2021 Hazardous Waste Scanning Project

File Form Naming Convention.

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Note 1: Each category is separated by a period "."
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Specific File Naming Convention Label:

report. HW. 932035. 1988- 10-26. Site_Investigation.pdf

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UNION CARBIDE CORPORATION
CARBON PRODUCTS DIVISION

SITE INVESTIGATION

AREA WEST OF SOLID WASTE MANAGEMENT FACILITY

Union Carbide Corporation
Republic Plant
Town of Niagara, New York

OCT 26 1988

UNION CARBIDE

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Union Carbide Corporation
Republic Plant
Town of Niagara, New York

October 1988
Ref. No. 2293

CONESTOGA-ROVERS & ASSOCIATES

EXECUTIVE SUMMARY

The Union Carbide Corporation (UCC) operated the Republic Plant located in Niagara Falls, New York from 1934 until 1987. Prior to UCC operations, the Republic Plant was operated and maintained by the Aluminum Corporation of America, Carborundum Corporation and Acheson Graphite. Historically, UCC waste from the facility was disposed in the area east of the building complex. During the last 40 years of the plant operation, waste was disposed in an isolated eastern area which in 1978 became an approved solid waste management facility (SWMF). Operations at the Republic Plant ceased in 1987 and the SWMF was closed in accordance with a NYSDEC approved closure plan. The plant facility was purchased by Niagara Vest and UCC retained title to 64 acres which included the SWMF.

In June 1987, UCC consented to the construction of a watermain by the Town of Niagara. The watermain was to cross the area west of the closed Solid Waste Management Facility (SWMF). During excavation for the watermain, waste was identified outside the SWMF and on property now owned by Niagara Vest. Hence, the watermain across the property was installed in a berm located above ground and a site investigation was undertaken to assess the areal extent of waste deposition west of the SWMF.

This executive summary presents a brief overview of the investigation conducted, the result obtained, and the recommendations and conclusions formulated. Further detail of the investigation and subsequent data evaluation is presented in the ensuing report.

The Site Investigation included:

1) Collection of water samples for chemical analysis from two locations along the newly installed watermain traversing the Site;

2) Excavation of test pits at eight locations along the newly constructed watermain and the collection of soil samples immediately underlying the bedding gravel for chemical analysis;

3) Completion of electromagnetic (EM) and magnetometer (MAG) geophysical surveys over the area west of the SWMF to identify potential locations for disposed waste and buried drums;

4) Excavation of a total of 22 test pits over the area west of the SWMF to confirm the presence or absence of potential buried drums based on the geophysical survey data;

5) Collection of samples for chemical analysis from the three drums encountered during the test pit excavations;

6) Collection of composite soil samples for chemical analysis in conjunction with test pit excavation; and

7) Installation of two shallow groundwater monitoring wells in areas of confirmed waste presence and subsequent sample collection and chemical analysis of groundwater samples.

Geology

The geological conditions beneath the site were determined based upon excavations and borehole data from this Investigation and from previous studies conducted at the SWMF and surrounding area.

The overburden materials encountered in this investigation are typical of those encountered in the previous test pit and monitoring well installation programs conducted at the SWMF and surrounding area. In general, the Site is underlain by four geologic units: Fill Material; Glaciolacustrine Clay; Glacial Till; and Bedrock.

The Fill Material consists of demolition debris, wood, ash, brick, glass and vegetation, intermixed with a black sand to cobble-size carbonaceous matrix and varies in thickness across the Site from 0 to 12 feet. The carbonaceous materials are believed to be from UCC and include graphite and other carbon products which are present in both dust and solid form. The Fill Material extends onto Niagara Vest and Niagara Mohawk property, to the west and north, respectively.

The Glaciolacustrine Clay underlying the Fill Material consists of very stiff gray to brown silty clay and extends almost to the top of Bedrock which is encountered at a depth of approximately 17 to 20 feet. A thin layer of Till material is usually present between the Clay and the top of Bedrock.

Hydrogeology

A perched water table condition exists in the Fill Material with the groundwater flowing in a northerly direction. The perched water table is generally confined vertically by the underlying clay aquitard. The groundwater flow direction in the underlying bedrock ranges from easterly to southeasterly towards the PASNY conduits located east of the site as presented on Figure 1.

Surface Water

Surface water runoff from the SWMF and the area west of the SWMF historically drained through the

Republic Plant in a southwesterly direction. Construction of the berm and newly installed watermain has resulted in surface water ponding recently in the southwest corner of the Site.

Chemical Data Assessment

The analytical data collected during the Site Investigation indicated that the test pit soil samples collected from the watermain berm at locations both upstream and downstream of the Site were not impacted by Site conditions. Similarly, the parameters reported present in watermain water samples collected from fire hydrants located upstream and downstream of the Site were essentially identical, also indicating no site impact.

Various semi-volatiles, pesticides, and metals were detected in the test pit composite soil samples collected over the Site. The parameters identified in the test composite soil samples generally correspond to the parameters detected during the 1987 SWMF Soil Investigation. Benzene was not detected in any of the composite soil samples or groundwater samples, however, benzene was detected in six of the eight test pit locations along the watermain berm. Contaminants present in the soils imported to construct the watermain are expected to be the result of contamination external to the Site.

The results of the geophysical surveys indicate that the EM Survey was not interpretable due to the large deviations in readings caused by the heterogeneity of the fill material. The MAG survey successfully pinpointed 22 areas of buried metal presence including one area containing 3 drums.

Samples were collected from the three drums encountered on site. The results for these samples indicate that the drum contents exhibit characteristics of an off-specification material and may be an altered form of the impregnating compound Code 88 formerly used at the UCC facilities.

The concentrations of chemicals detected in the perched groundwater system are relatively low and all are below applicable standards, with the exception of total recoverable phenols for which the standard is based on taste effects and not health effects. Alpha-BHC was also detected in one sample at 0.02 ppb above the detection limit, but was not detected in a duplicate sample.

Public and Environment Health Assessment

A public health assessment was conducted based on a set of indicator chemicals which included detected carcinogenic PAHs and pesticides.

The potential human exposure pathways and exposure points identified at the Site include exposure of surface soils to on-site workers through dermal contact, inhalation and inadvertent ingestion. Other potential exposure points off-site include exposure to nearby residents through dust inhalation and to the general population through consumption of fish and water from the PASNY reservoir and the Niagara River.

The only complete pathways of exposure were determined to be on-Site exposure of workers to surface soils and off-Site exposure of residents in surrounding areas to dust from surface soils. Using worst case estimates for exposure under either of these scenarios, results in a calculated risk estimate that is well within acceptable risk levels.

The limited and occasional presence of wildlife on the Site precludes concerns regarding environmental exposure.

Conclusions and Recommendations

Based upon the results of the Site Investigation, the following conclusions and recommendations have been formulated:

1) The site does not pose a significant current or potential future threat to public health or the environment.

2) Water quality in the Town watermain is unaffected by the fill material and/or berm construction material. Contaminants in the berm construction material are not Site related.

3) Groundwater is essentially unaffected by the site and is contained as a perched water zone. Discharge to surface water is not a problem (based on chemical analysis). Bedrock groundwater is protected by a relatively thick clay aquitard.

4) Three buried drums were located during the investigation. These drums have been removed and disposed at a permitted waste disposal facility.

5) On-site exposure of workers to surface soils and exposure of off-site areas to dust from surface soils are the only complete potential pathways of exposure resulting from on-site wastes. Using worst case estimates for exposure under either of these scenarios results in a calculated risk estimate that is well within acceptable levels.

6) Soils containing PAHs and pesticides are present on site and are consistent with results from the SWMF.

7) PAHs stay sorbed to soils and do not create an unacceptable risk to public health or the environment.

8) As no existing or potential risk was identified at the site, it is recommended that remedial measures are not required.

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1.0 INTRODUCTION

In June 1987, Union Carbide Corporation (UCC) completed the closure of the 16.5 acre Solid Waste Management Facility (SWMF) located on a parcel of property east of the former Republic Plant in Niagara Falls, New York. The SWMF had been used as a waste disposal site by UCC for approximately the past 40 years and was closed in accordance with a NYSDEC approved Closure Plan. In 1986, the Town of Niagara requested and received an easement to install a watermain through the Union Carbide property west of the SWMF. Later in June 1987, during the installation of this watermain, it was discovered that the areal extent of waste deposition on the area west of the SWMF and on property now owned by Niagara Vest was larger than had been expected. As a result, a plan of investigation to assess this discovery was prepared and submitted to the New York State Department of Environmental Conservation (NYSDEC) in the document entitled "Proposed Plan of Work, Area West of Solid Waste Management Facility".

The purpose of this report is to present the results of the investigation agreed upon with the NYSDEC along with the results of additional work undertaken by Union Carbide Corporation (UCC) in resolving this matter.

2.0 BACKGROUND

Union Carbide Corporation (UCC) operated a SWMF located east of its former Republic Plant (currently Niagara Vest) for approximately 40 years. The location of the SWMF is presented in Figures 1 and 2. In conjunction with the closure of UCC operations in Niagara Falls, use of the SWMF for waste disposal ended on (December 1, 1986). Final closure of the SWMF was completed in accordance with the NYSDEC approved closure plan entitled "Final Landfill Closure, Solid Waste Management Facility, Union Carbide Corporation, Republic Plant, Town of Niagara, New York", dated September 1987.

At the time of the SWMF closure it was believed, based on historical records, that waste disposal to the west of the SWMF was limited to a thin layer (0 to 2 feet in thickness) of carbonaceous materials and surficial debris consisting of wood, bricks, glass and vegetation. The carbonaceous materials are from Union Carbide and include graphite and other carbon products which are present in both dust and solid form. Some of the larger solid pieces are on the order of 10 feet in size.

In June 1987 the Town of Niagara proceeded with the installation of a 16-inch diameter watermain along an acquired easement through Union Carbide and Niagara Vest

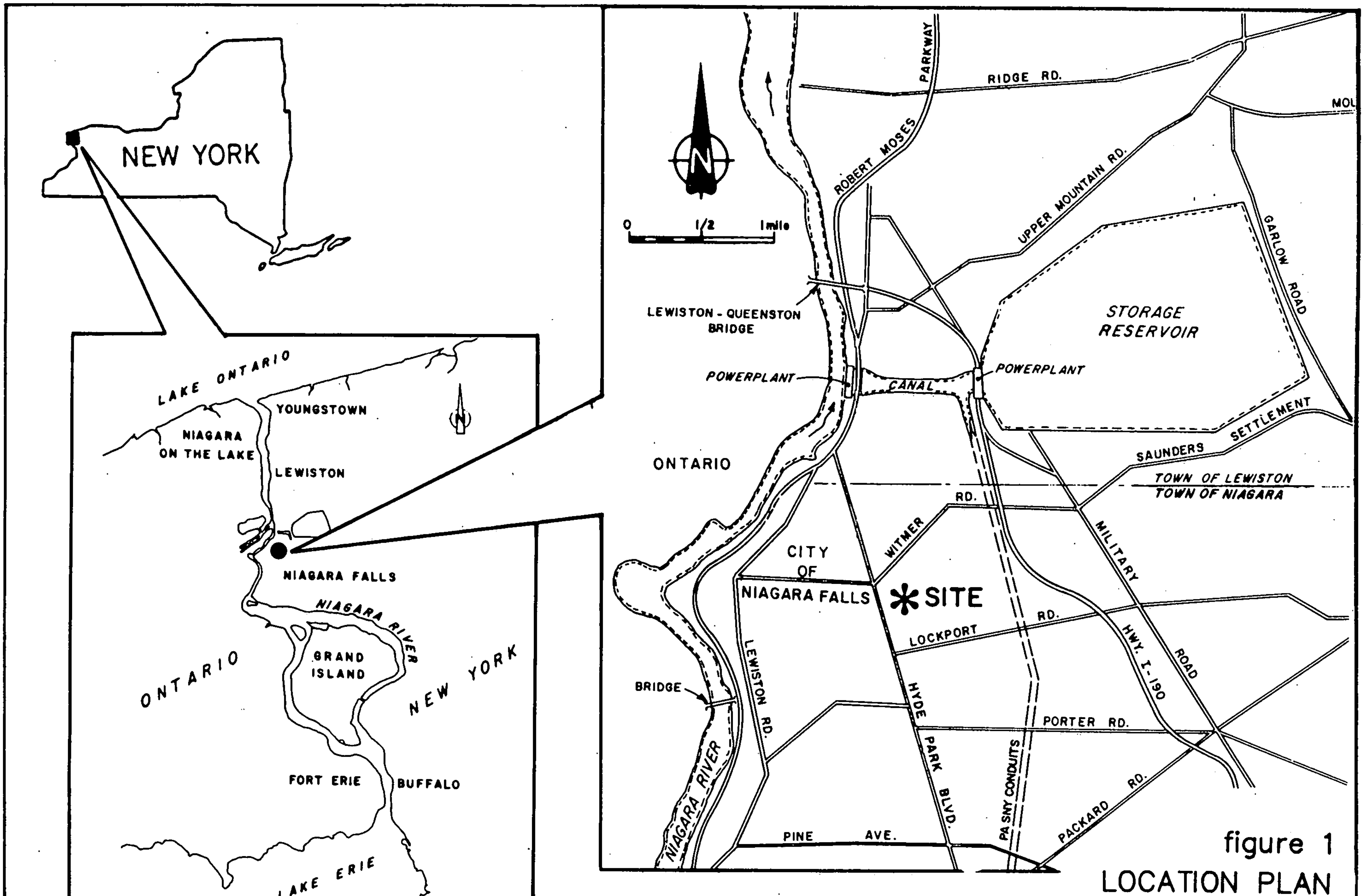

figure 1

LOCATION PLAN
REPUBLIC PLANT
Union Carbide Corporation

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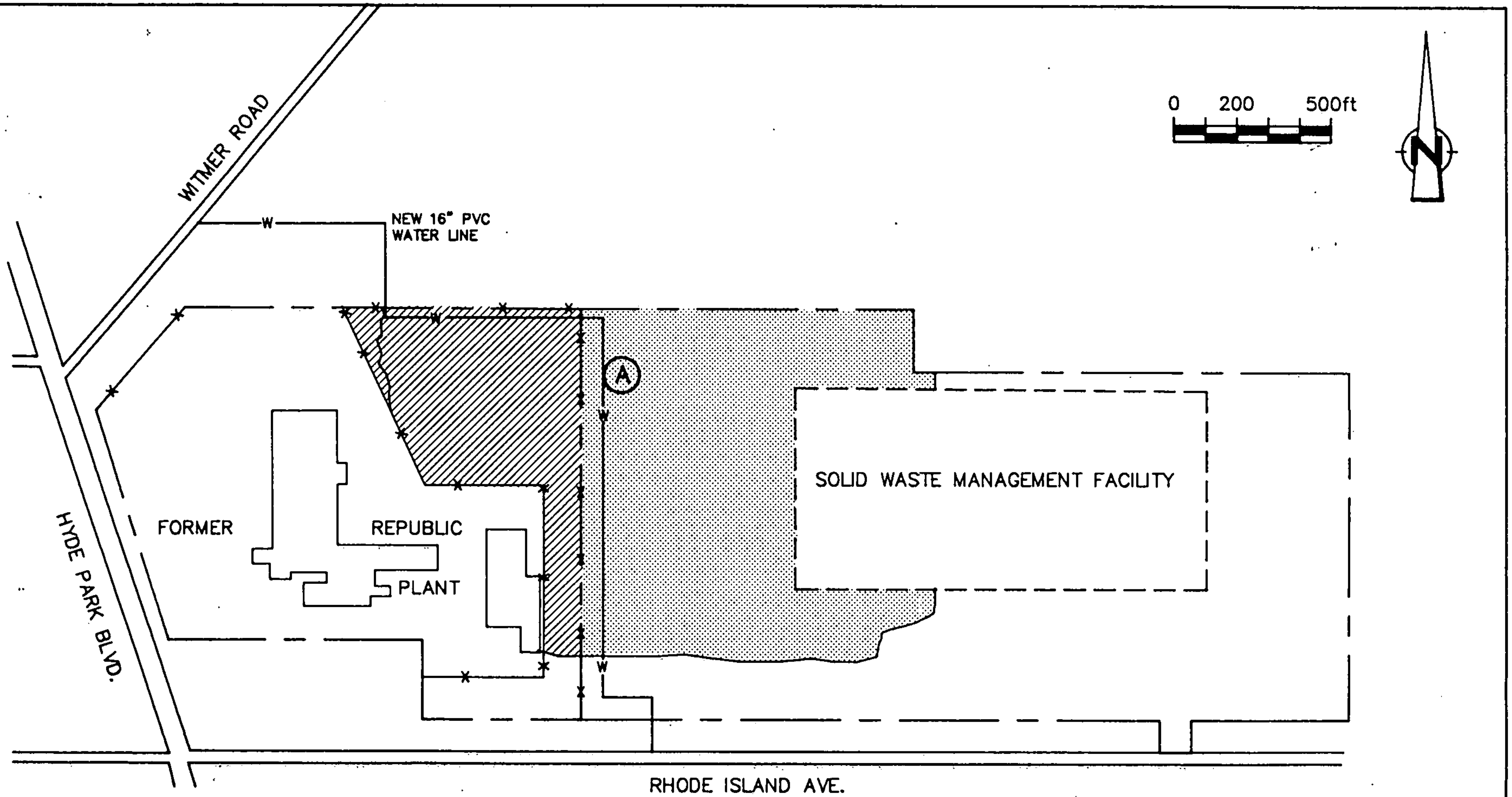

LEGEND

- PROPERTY LINE
- FENCE LINE
- PVC WATER LINE
- UCC PROPERTY CONTAINING WASTE (20± ACRES)
- NIAGARA VEST PROPERTY (FORMER REPUBLIC PLANT) CONTAINING WASTE (7± ACRES)
- (A) TAR-LIKE SUBSTANCE FOUND IN EXCAVATION

figure 2

SITE PLAN
NIAGARA PLANT-REPUBLIC LOCATION
Union Carbide Corporation

CRA

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properties. During excavation for the placement of this watermain, a tar-like substance was encountered which indicated that materials other than carbonaceous materials may have been disposed in this area.

After discovery of these possible waste materials along the proposed route of the watermain, it was decided that the watermain would be placed above, rather than below ground. This was accomplished by installing the watermain inside a berm constructed of imported clay.

Figure 2 shows the locations of the SWMF, watermain installation and the location of the original excavation where the "tar-like" substance was identified. (Denoted as location "A" on Figure 2.)

Subsequent to NYSDEC approval of the Plan of Work developed for the Site, the field investigation phase began. The field investigation included:

- Watermain Investigation, including soil and water sampling;
- Geophysical Survey;
- Test Pit Excavation and Sampling;
- Monitoring Well Installation; and
- Groundwater Sampling.

3.0 SITE INVESTIGATION

3.1 WATERMAIN INVESTIGATION

In order to determine whether the presence of UCC waste materials has impacted the quality of water supplied by the Town of Niagara watermain, samples of the bedding materials around the pipe were collected as well as samples of the water supply itself both upstream and downstream of the UCC Site. The locations of all watermain bedding test pits and the two watermain samples collected as part of this program are presented on Figure 3.

3.1.1 Watermain Soils Sampling

In February 1988, eight test pits were excavated along the newly installed watermain with the intent of sampling the pipe bedding material. The purpose of this sampling was to determine the chemical nature of the bedding material that is in contact with the water supply pipes. Upon excavation of the first test pit, it was confirmed that the bedding material was composed entirely of gravel. Consequently, the soils immediately surrounding the bedding gravel were sampled and submitted for analysis since the gravel itself cannot be analyzed.

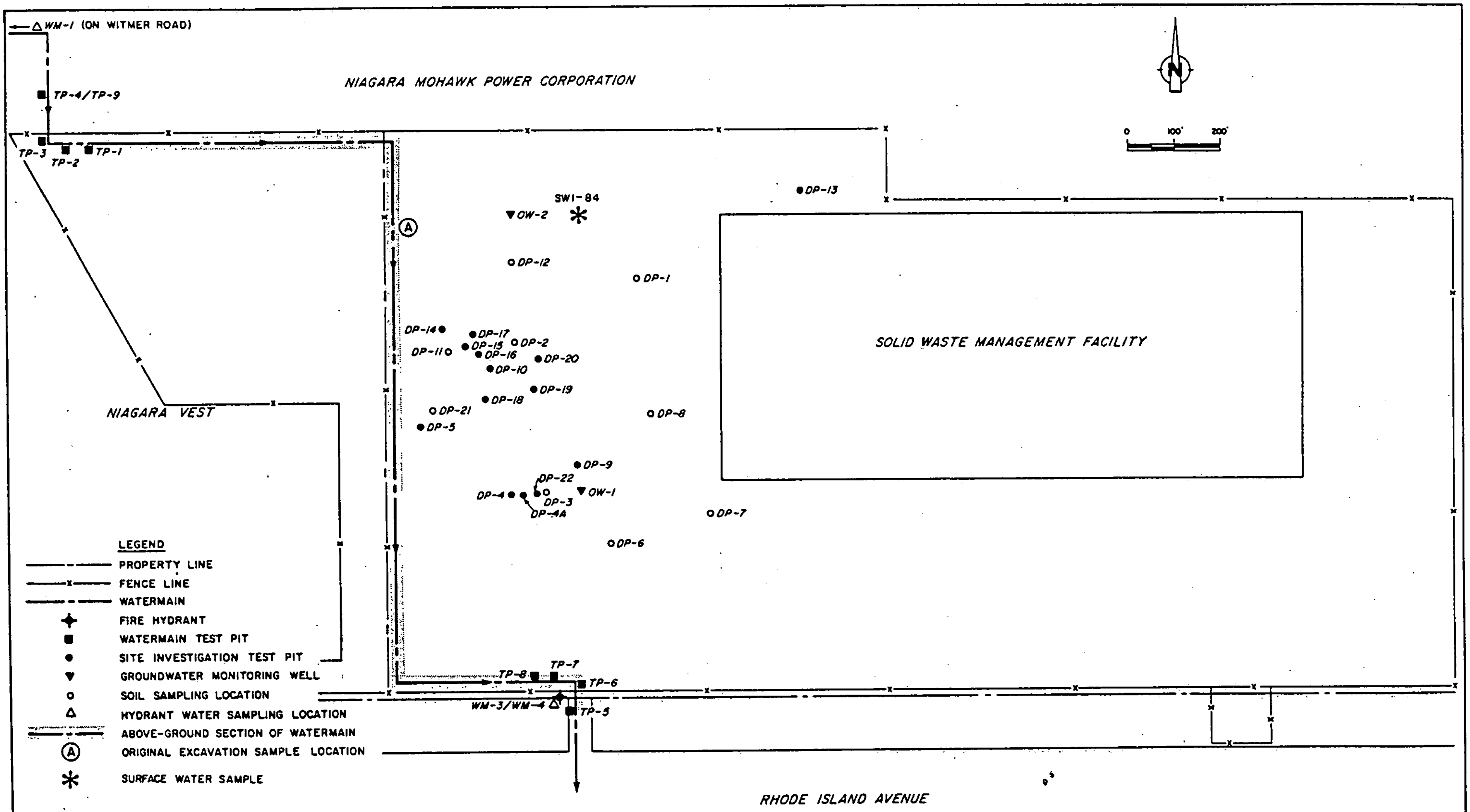

figure 3

TEST PIT & SAMPLING LOCATIONS
REPUBLIC PLANT
Union Carbide Corporation

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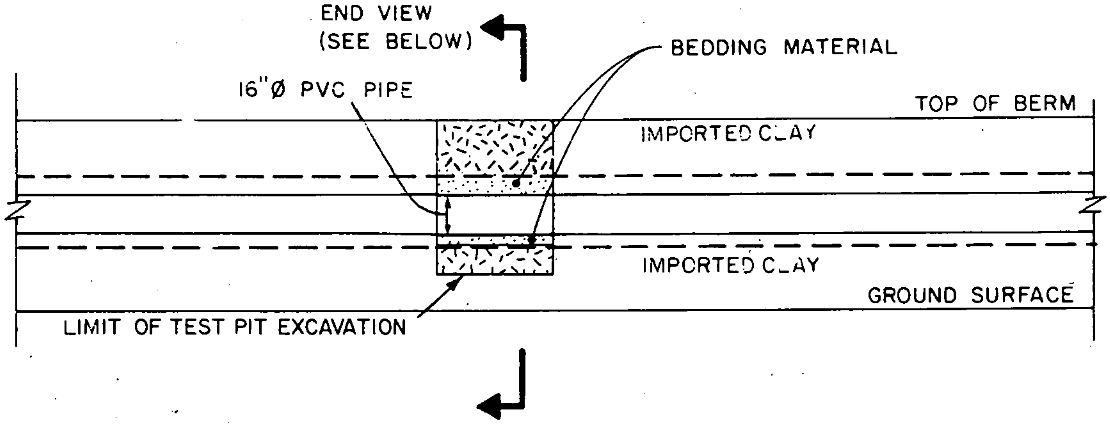
With the exception of Test Pits 3 and 4, the excavations were placed at 50-foot intervals along the pipe from a point at which the pipe is entirely above the surrounding ground elevation, (Test Pits 1 and 8), to a point at which the pipe is entirely below the elevation of the surrounding ground (Test Pits 4 and 5). The area between the original proposed location for Test Pit 3 and Test Pit 4 was flooded at the time of the sampling program. Consequently, Test Pit 3 was excavated at the location originally proposed for Test Pit 4 and Test Pit 4 was relocated to a drier location approximately 100 feet upstream from Test Pit 3.

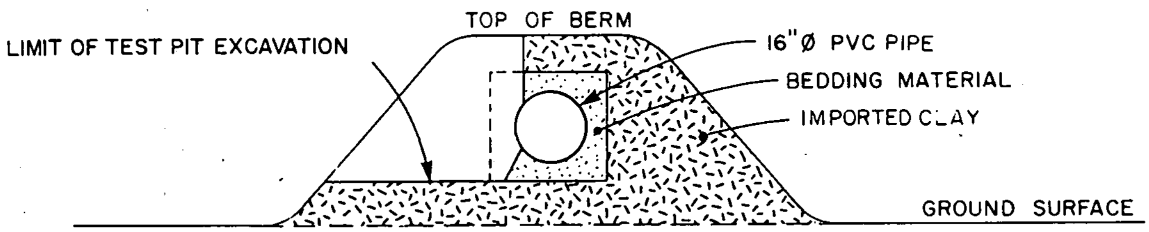
3.1.1.1 Sampling Methodology

Test pits were excavated using a backhoe with a precleaned bucket. The backhoe bucket was cleaned with fresh water before beginning the excavation of each pit. Wash water was allowed to drain onto the ground in the vicinity of the excavation.

Test pits were excavated perpendicular to the watermain in order that the bedding could be exposed as easily as possible. A typical schematic of a test pit excavation is presented on Figure 4.



SIDE VIEW



END VIEW

figure 4

TYPICAL ABOVEGROUND WATERMAIN TEST PIT EXCAVATION
REPUBLIC PLANT
Union Carbide Corporation

CRA

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At the locations where soil and groundwater conditions would permit sampling personnel to enter the excavation, samples were collected in the following manner:

- Exposed surfaces surrounding the bedding which had been contacted by the backhoe bucket were scraped "clean" using a precleaned sampling trowel. The sampling trowel was cleaned with soapy water, rinsed with a water, acetone, hexane, acetone, distilled water sequence and allowed to air dry before use at each location.

- Sample containers for chemical analyses were filled using the same trowel by collecting a composite of the soil material which was in immediate contact with the gravel bedding material under and alongside the watermain pipe.

- Sample containers were subsequently stored in a cooler and packed with ice for later transport to the laboratory.

At locations which were either too deep or too wet to permit safe entry of sampling personnel, the following procedures were followed:

- After the watermain had been located and exposed, the backhoe removed a bucket of material from around the bedding.

- After allowing water to drain from the bucket of soil, the exposed surfaces were scraped clean using a trowel precleaned using the above described rinse sequence.

- Composite samples were collected from the remaining material in the backhoe bucket using the same trowel and placed in sample containers.

- Sample containers were subsequently stored in a cooler and packed with ice for later transport to the laboratory.

After sampling was completed at each location, the displaced gravel bedding material was replaced using clean gravel of comparable size. The test pit was subsequently backfilled using all of the original berm soil and compacted using a backhoe compactor.

On June 8, 1988 three of the test pits (TP-2, TP-4 and TP-6) were re-excavated for confirmatory sampling. The new test pits were excavated adjacent to the original locations and samples were collected following the same protocols used during the original program.

An additional composite sample was also collected from the clay stockpile located at the Town of

Niagara garage as this was the source of the imported clay material used for the watermain berm construction onsite. Using a precleaned trowel, several aliquots of soil were collected from the areas where the watermain berm material had been removed from the stockpile.

A representative of the Town of Niagara was present at all times during test pit and stockpile sampling.

Table 1 summarizes the samples collected during the Watermain Soils Sampling Program.

3.1.2 Watermain Hydrant Sampling

In order to collect samples of the water within the watermain, it was necessary to use the fire hydrants as these are the only available access points. The fire hydrants sampled were situated immediately up and downstream of the UCC Site as shown on Figure 3. The upstream and downstream hydrant locations were selected based on information provided by the Town of Niagara. Because the watermain was installed, according to the Town of Niagara, to provide improved water service to the area south of the SWMF, the flow of water within the watermain traversing the Site is from the north along Witmer Road to the south along Rhode Island Avenue.

TABLE 1
SAMPLE SUMMARY
WATERMAIN SOILS SAMPLING PROGRAM
UNION CARBIDE - REPUBLIC PLANT

Location	Date	Sample No.	Comments
Test Pit 1	2/24/88	TP1	Sampled from bottom and side wall of watermain trench. Red-brown clay, moist.
Test Pit 2	2/24/88	TP2	Excavation filled with 1± foot water, sampled sidewall of watermain trench above water level. Red-brown clay, moist to wet.
	6/8/88	TP-2	Sampled from bottom of excavation. Red-brown clay.
Test Pit 3	2/24/88	TP3	Excavation filled with water. Cleared bedding around watermain pipe as much as possible. Removed one backhoe bucket of material from around the side and bottom of the bedding, sampled from bucket. Red-brown clay, moist to wet.
Test Pit 4	2/25/88	TP4	Excavation filled with water, could not see watermain pipe. Cleared away bedding, removed one backhoe bucket of material from around side and bottom of the bedding, sampled from bucket. Red-brown clay, moist to wet. Collected samples in duplicate (labelled TP9).
	6/8/88	TP-4	Sampled from bedding/trench interface above watermain pipe. Red-brown clay, moist.
Test Pit 5	2/25/88	TP5	Excavation filled with water. Cleared away bedding, removed one backhoe bucket of material from side and bottom of the bedding, sampled from bucket. Red-brown clay, moist.
Test Pit 6	2/26/88	TP6	Excavation filled rapidly with water to within 1 foot of ground surface. Could not locate pipe. Sampled from excavation sidewall above pipe, 1.5± feet below ground surface.
	6/8/88	TP-6	Sampled from bottom and sidewall of watermain trench. Brown clay.
Test Pit 7	2/26/88	TP7	Sampled from bedding/trench interface above watermain pipe. Red-brown clay, moist.
Test Pit 8	2/25/88	TP8	Sampled from sidewall of watermain pipe trench. Red-brown clay, moist.

Each fire hydrant was opened by a representative of the Town of Niagara and allowed to flush for two to three minutes before sampling. Water samples were collected directly from the fire hydrant stream in the appropriate sample containers. Collected samples were subsequently stored in coolers packed with ice for later transport to the laboratory.

Table 2 summarizes the watermain hydrant water samples collected.

3.2 GEOPHYSICAL SURVEY

Included in the field investigation were two geophysical surveys designed to detect and delineate, if possible, the potential locations of buried steel disposal containers (i.e. 55 gallon drums). Discussions with former employees indicated that drums may possibly have been disposed in the area. By performing these geophysical surveys over the entire area, this uncertainty could be addressed and appropriate action taken if necessary.

Because the effects, if any, of the carbonaceous (graphitic) materials at the Site on instrument performance were unknown, surveys were conducted using two types of instruments (electromagnetic (EM) and magnetometer

TABLE 2
SAMPLE SUMMARY
WATERMAIN HYDRANT SAMPLING PROGRAM
UNION CARBIDE - REPUBLIC PLANT

Sample No.	Location	Description
WM-1	Hydrant-1	North side of Witmer Road, upstream of UCC Site.
WM-3 WM-4	Hydrant-3	North side of Rhode Island Avenue, downstream of UCC Site.

(MAG)) over the same area. It was suspected that large pieces of carbonaceous waste may have conductivities similar to that of metallic deposits. The metallic deposits are readily identified by anomalous MAG readings. The carbonaceous waste, on the other hand, was expected to have no influence on the MAG readings. It was anticipated that using both the EM and MAG techniques would improve anomaly identification by making carbonaceous and metallic deposits distinguishable using the following identification criteria:

- An EM conductivity anomaly coupled with a MAG non-anomaly (i.e. no magnetic material detected) would be indicative of a deposit of carbonaceous waste.

- An EM conductivity anomaly coupled with a MAG anomaly would be more representative of buried ferrous wastes such as drums.

The surveys covered, in systematic fashion, the 20 acre area surrounding the SWMF which is owned by UCC.

3.2.1 Methodology

A 100 foot interval sample grid spacing was established by a licensed land surveyor prior to undertaking the geophysical surveys. Easting and northing coordinates were assigned to each location and marked by a wooden stake for future reference. The established grid was infilled at 25-foot intervals by pacing. The 25-foot station spacing was used for EM and MAG surveys over the entire 20 acres.

The shallow sensing Geonics EM31 electromagnetic instrument was chosen for the terrain conductivity survey to map the bulk conductivity of the earth materials to a depth of approximately 15 feet. The EM instrumentation is designed to detect terrain conductivity by utilizing a current flow induced in the subsurface materials by a surface transmitter. An alternating electric current produced in a transmitter coil generates an alternating magnetic field. The magnetic field penetrates the ground surface and induces current flow through the earth material which in turn induces a secondary magnetic field. The secondary magnetic field sensed at the receiver coil depends on the strength of the primary field, current frequency, distance between transmitter and receiver coils (factors considered constant for the EM31), and the presence of a conductive body. The EM31 is portable, permitting data to be gathered simply as the instrument is moved across the Site.

The Geonics EM31 instrument has transmitter and receiver coils separated by a rigid boom 3.6 meters (11.8 feet) in length. The device reads in milliSiemen per meter (mS/m). Generally, the conductivity readings obtained with the EM31 will vary smoothly from one region to another. In some cases however, an edge effect (due to fences, powerlines, etc.) may be seen in which the readings vary rapidly with position and are no longer a good indicator of terrain conductivity. The inphase component of the magnetic field is significantly more sensitive to large metallic objects than the quadrature-phase component. The Geonics EM31 is typically best suited for determining the location of buried steel containers. However, large pieces of carbonaceous waste may have conductivities similar to those expected from buried drums making data interpretation difficult if the EM31 is used alone.

Magnetometers can also be utilized to detect perturbations in the geomagnetic field created by buried ferromagnetic objects such as steel drums. The most common instruments currently in use are the gradiometric and the proton precession magnetometers. The proton precession magnetometer typically measures the magnetic susceptibility of the total field. That is to say that it is capable of sensing both the vertical and horizontal field components. The gradiometric magnetometer (MAG) has the advantage in being able to sense the vertical field while remaining relatively insensitive to the horizontal field component. This feature allows the instrument to sense subsurface targets in the presence of anthropogenic interferences such as steel fences.

Based upon this advantage, the McFar fluxgate MAG selected for use in the survey work at the Site. The MAG is portable, permitting data to be collected rapidly and continuously as the operator and the instrument move across the land surface. In soil with minimum interference, individual typical steel containers such as 55-gallon drums can easily be detected to a depth of 10 feet.

A computer aided "nearest neighbor" mapping package was used to store, manipulate and present the EM and MAG data. The nearest neighbor package is the simplest search method that finds the nearest neighboring data point, in an Euclidean distance sense, regardless of their angular distribution around the point being estimated. This method is fast and satisfactory if control points (instrument readings) are distributed in a comparatively uniform pattern and is based on the idea that a nearby observation point is a better estimate of the value of a point on a surface than a more distant one, and that a small number of nearest control points provide essentially all the information that is relevant to the estimate.

3.2.2 Results of the EM Survey

Plan 1 represents the EM inphase component values collected during the survey at the Site. Data obtained during the EM survey are presented in Appendix A.

Underground conductors are prevalent throughout the Site as evidenced by the large fluctuations in the data that occur over relatively short distances. Background readings obtained along the southern boundary of the Site (off the grid) averaged 30 mS/m. Due to the large and continuous degree of change over the Site, it is apparent that the EM Survey has been of limited value.

As discussed previously in Section 3.2.1, the inphase component of the magnetic field is typically significantly more sensitive to large metallic objects than the quadrature-phase component. However, no variation in the inphase and quadrature-phase component was observed in the field during the survey at the Site. This deviation has been attributed to the extensive deposits of carbonaceous wastes present which have masked the possible response of the EM31 to metal. Therefore, the locations of potential buried drums could not be identified under EM survey.

3.2.3 Results of the MAG Survey

The results of the MAG survey conducted at the Site are presented on Plan 2. Data obtained during the MAG survey are presented in Appendix B.

Typical background levels on the order of 10,500 gammas were obtained for the MAG survey. The results of the MAG survey indicated 29 areas of response, as shown on Plan 2. At each of these locations, the MAG survey crew collected additional readings in the field to pinpoint the location having the highest MAG reading in the vicinity of the area of response for future references.

These areas of magnetic highs could not be explained by anthropogenic sources such as steel cased observation wells, metal posts or bars and scrap metal noted during the survey. The presence of carbonaceous waste did not influence the MAG survey as was the case with the EM results. Ground truthing of the MAG results was conducted with a test pit excavation program. The results of this program are discussed in the following section of this report.

3.3 SITE INVESTIGATION TEST PITS

After the location of suspected metal areas were identified through the geophysical surveys described in Section 3.2, a test pit excavation program was conducted to pinpoint the locations of buried drums, if any. Test pits were excavated at 22 of the 29 locations which had shown MAG readings of 15,000 gammas or more or, in one case, a negative reading. Test pits were not excavated at the remaining seven locations with high MAG readings in an effort to avoid disturbance of the clay cap on the closed SWMF. The identified peak MAG reading location was used as the starting point for each excavation.

Test pits were excavated using a backhoe. The test pits extended through the fill material to the top of the native clay regime. Drums were encountered in only one of the 22 test pit locations (DP-21). The locations of all test pits are shown on Figure 3.

Materials of a metallic nature were found at each of the test pit locations. These materials generally consisted of large chunks of reinforced Acheson furnace sidewall block. However, objects such as fence posts, metal pails, wire mesh and pipe were also encountered. Appendix C presents a summary of the stratigraphic logs from the test pit excavation program.

Following documentation of the type of fill encountered and other conditions such as the presence or absence of groundwater, each test pit was backfilled with the original material. To the extent practicable, excavated material was replaced in the same order in which it had been removed.

At location DP-21, three intact 55-gallon drums containing waste materials were encountered. The drums appeared to be watertight and the primary substance contained in these drums was a solid, black, tar-like material. These drums also contained cloth, cardboard, wood, rope and miscellaneous trash. The test pit excavation was expanded in the immediate area, however, no other drums were located.

After exposing the buried drums, they were lifted out of the excavation using the backhoe. Three samples were collected, one from each drum, and subsequently submitted to the laboratory for selected chemical analysis. In addition, two random samples, one consisting of a solid black material and the other of a black tar-like material, were collected from the excavation and submitted to the laboratory for chemical analysis. The tar-like material was also submitted for selected physical analysis. The results of these analyses are discussed in detail in Section 5.4.

Following sampling of the drums, they were placed inside oversize salvage drums, tightly covered and labelled. These salvage drums were then placed in the open excavation and markers were placed next to them which extended above ground. The entire excavation was then backfilled with the original material in the same manner as the other excavations. Subsequent to receipt of analytical results, the drums were excavated and were disposed at a permitted disposal facility.

3.4 SOIL SAMPLING PROGRAM

A Soil Sampling Program was conducted in conjunction with the test pit excavation program. As outlined in the "Proposed Plan of Work", the Site was divided into four sub-areas of approximately equal size. In each sub-area, two test pits were chosen for soil sampling. (See Figure 5.)

The sample sites were picked with the following criteria in mind:

- Location
- Nature of the fill material
- Groundwater conditions

3.4.1 Methodology

Sampling of the test pits was conducted in a manner similar to the watermain soil (bedding) samples except that the backhoe was not cleaned between each excavation. The sampling tools, however, were precleaned at each location using the rinse sequence previously described in Section 3.1.1.1.

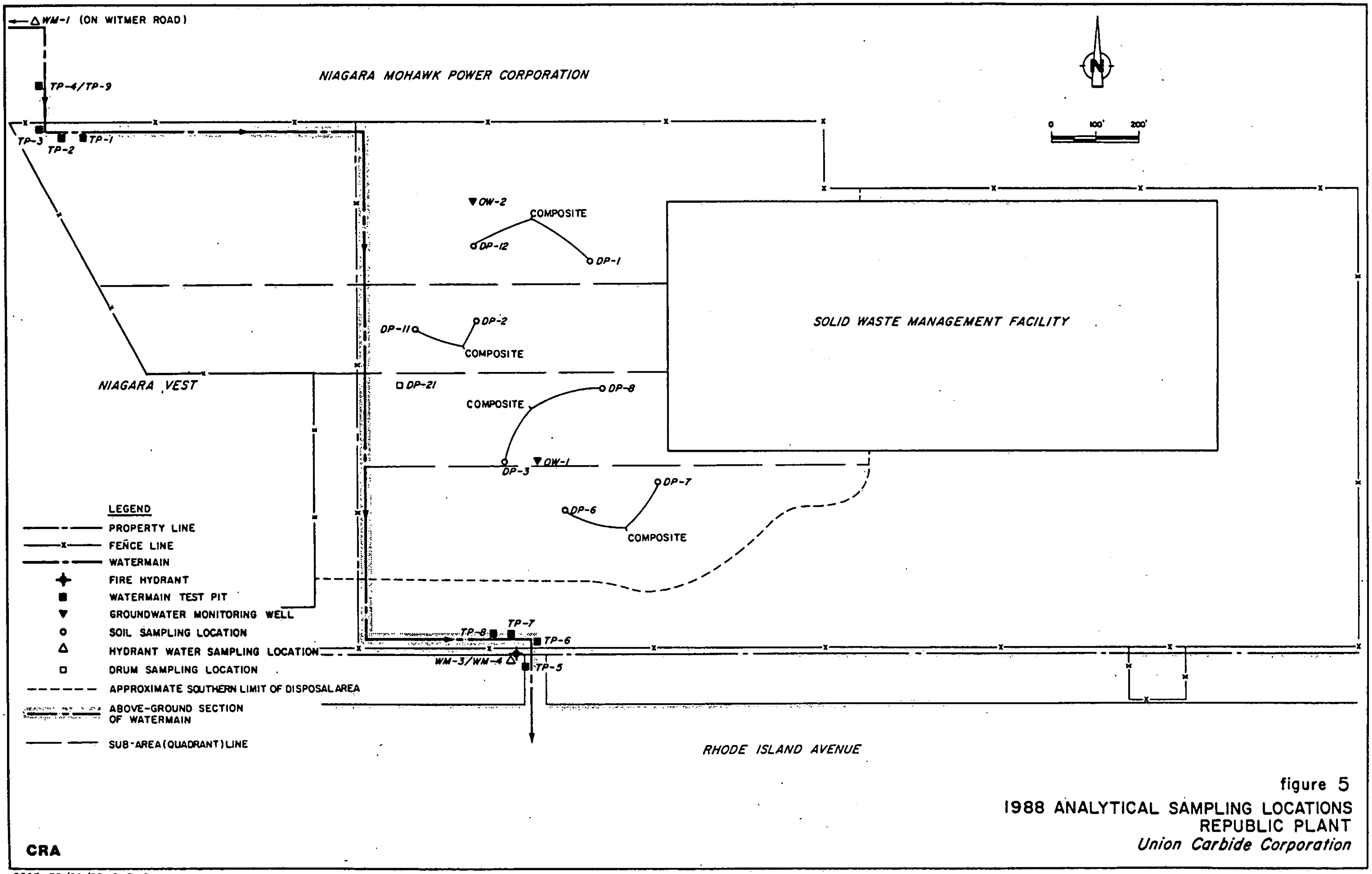

figure 5

1988 ANALYTICAL SAMPLING LOCATIONS
REPUBLIC PLANT
Union Carbide Corporation

2293-30/09/88-2-D-2

As discussed previously in Section 3.3, test pits were excavated through the fill material to the top of the native clay. Then, using a precleaned sampling trowel the exposed surface which had contacted the backhoe was scraped clean. Composite samples of the fill material over the entire depth of the excavation were then collected and placed in appropriate sample containers. Sample containers were subsequently stored in a cooler packed with ice for later transport to the laboratory.

Two samples from each sub-area were composited into one sample and homogenized at the laboratory prior to analysis.

3.5 MONITORING WELL INSTALLATION

After completion of the test pit excavation program, two locations were chosen for the installation of shallow groundwater monitoring wells. The principle factors of concern in the selection of well locations were:

- suitable depth of fill; and
- appreciable groundwater presence.

In general, the groundwater in the fill material was observed to be perched upon the top of the native clay strata.

Consequently, excavations were made through the fill and into the underlying clay to a depth which would ensure an adequate column of water within the well for the purpose of sampling.

The locations of the monitoring wells are presented on Figure 5.

3.5.1 Methodology

Using a backhoe which had been precleaned with clean water, a pit was excavated to a depth believed to be sufficient to provide at least three feet of groundwater in the well. After excavation, each monitoring well pit was allowed to stand for approximately two to three hours to reach a static, or near static water level.

Well materials were prepared and assembled in the following manner:

- A 2-foot long, #10-slot, 2-inch diameter stainless steel well screen was fitted to an appropriate length of 2-inch ID black steel riser pipe.

- The assembled well was then cleaned inside and out by rinsing with acetone, hexane, acetone and distilled water.

- A 3-foot long, 4- to 5-inch diameter geotextile filter fabric bag was placed around the well screen and filled with quartzite sand. This filter fabric bag was secured to the riser pipe above the well screen.

- The assembled well and sandpack was lowered into the excavated pit and held in a vertical position to a depth at which the static water level was at least one foot above the top of the well screen.

- The pit was then backfilled with the excavated fill and clay material. The fill material was placed first so it would be sure to be situated around the well screen. The clay was placed at the top of the well installation.

- The well was fitted with a lockable cap and lock.

Table 3 summarizes the well installation details. Stratigraphic and Instrumentation Logs are contained in Appendix D.

3.6 GROUNDWATER SAMPLING

After the groundwater monitoring wells had been allowed to stabilize for five days, they were developed and sampled.

TABLE 3
WELL INSTALLATION DETAILS
UNION CARBIDE - REPUBLIC PLANT

Well Number	Bottom of Screen (BGS)	Bottom of Fill (BGS)	Static Water Level (BGS)
OW-1-88	4.6 ft.	4.6 ft.	1.80 ft.
OW-2-88	6.0 ft.	4.9 ft.	1.95 ft.

3.6.1 Methodology

Each well was purged of a minimum of ten volumes of standing water before sampling. This was accomplished using a peristaltic pump fitted with clean, well-dedicated teflon tubing.

On March 22, 1988, after purging was complete, samples for volatile analysis were collected using a precleaned bottom-loading stainless steel bailer attached to a stainless steel lead and nylon rope. Other samples were collected using the same peristaltic pump and tubing which had been used for purging.

Sample containers were subsequently stored in a cooler packed with ice and immediately transported to the laboratory.

Table 4 summarizes the Well Sampling Program.

TABLE 4
GROUNDWATER SAMPLING SUMMARY
UNION CARBIDE - REPUBLIC PLANT

Well No.	Date	One Well Volume	Total Volume Purged	Comments
OW-1-88	3/22/88	.43 gal.	6.0 gal.	Final water quality slightly cloudy, colorless, trace suspended black sediment, no odor (initially water had a slight petroleum-like odor).
OW-2-88	3/22/88	0.75 gal.	7.5 gal.	Final water quality clear and colorless.

4.0 SITE CHARACTERIZATION

The overburden materials encountered during the investigation are typical of those encountered in previous test pit and monitoring well installation programs conducted at the SWMF and surrounding area. In general, the Site is underlain by four geologic units. These are: Fill Material, Glaciolacustrine Clay, Glacial Till and Bedrock. During this study, only the two uppermost geologic units were encountered as the study did not require penetration beyond the top of the clay strata. Descriptions of the fill and clay encountered during this study are presented in Appendix C and are further discussed in the following subsections.

4.1 FILL MATERIAL

The uppermost unit consists of Fill Material. The Fill Material typically consists of demolition debris, including Acheson furnace sidewall block fragments (large chunks of material resembling reinforced concrete), wood, ash, brick, glass and vegetation, intermixed in a black sand to cobble-size carbonaceous matrix. Also present in the fill matrix is gravel, sand, silt and clay. The thickness of the Fill Material varies across the Site from 0 to 12.0 feet and averages 5.4 feet (see Figure 6). The thickest fill deposits exist along the northeast corner and in the northwest portion

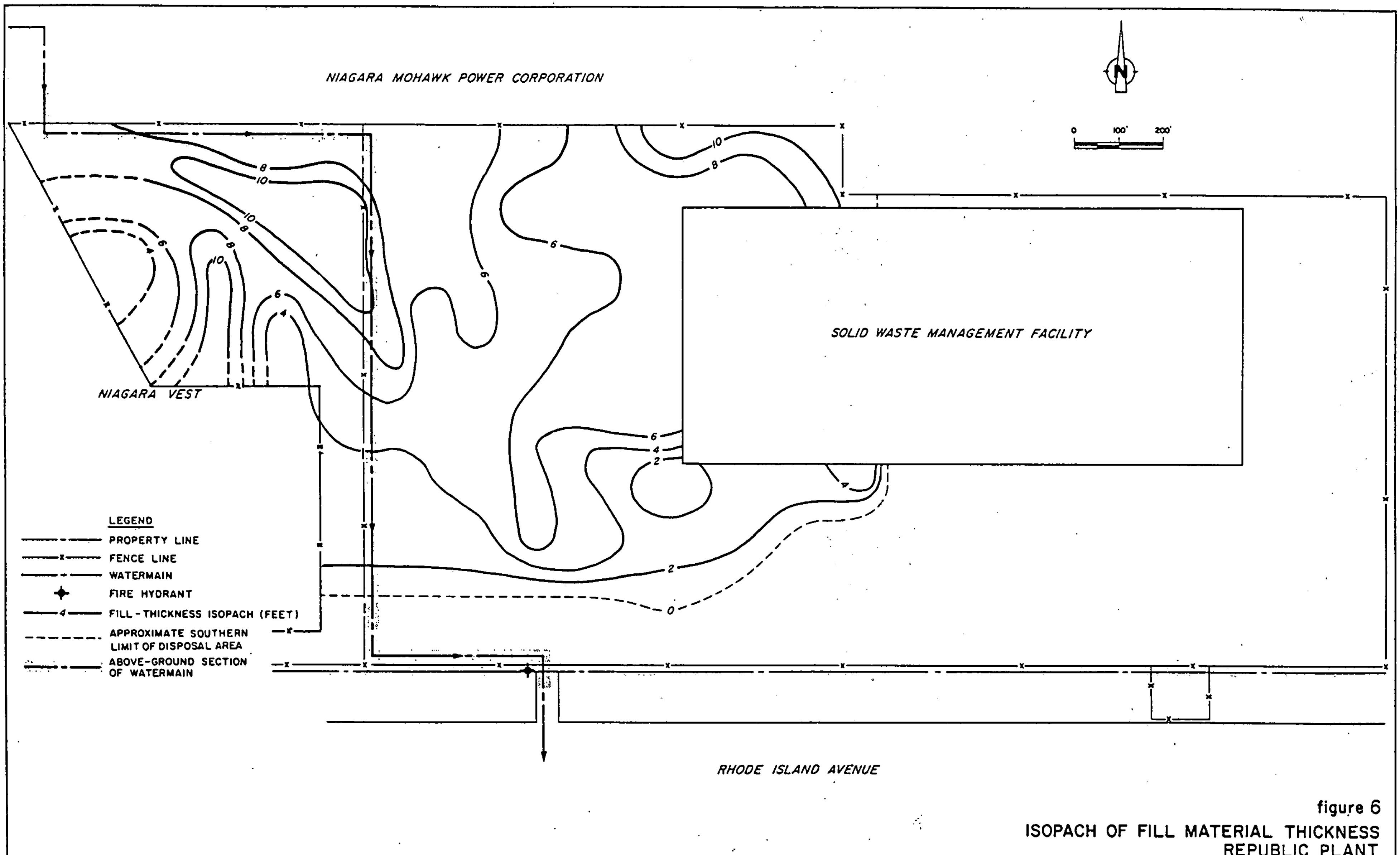

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figure 6
ISOPACH OF FILL MATERIAL THICKNESS
REPUBLIC PLANT
Union Carbide Corporation

2293-30/09/88-2-D-2

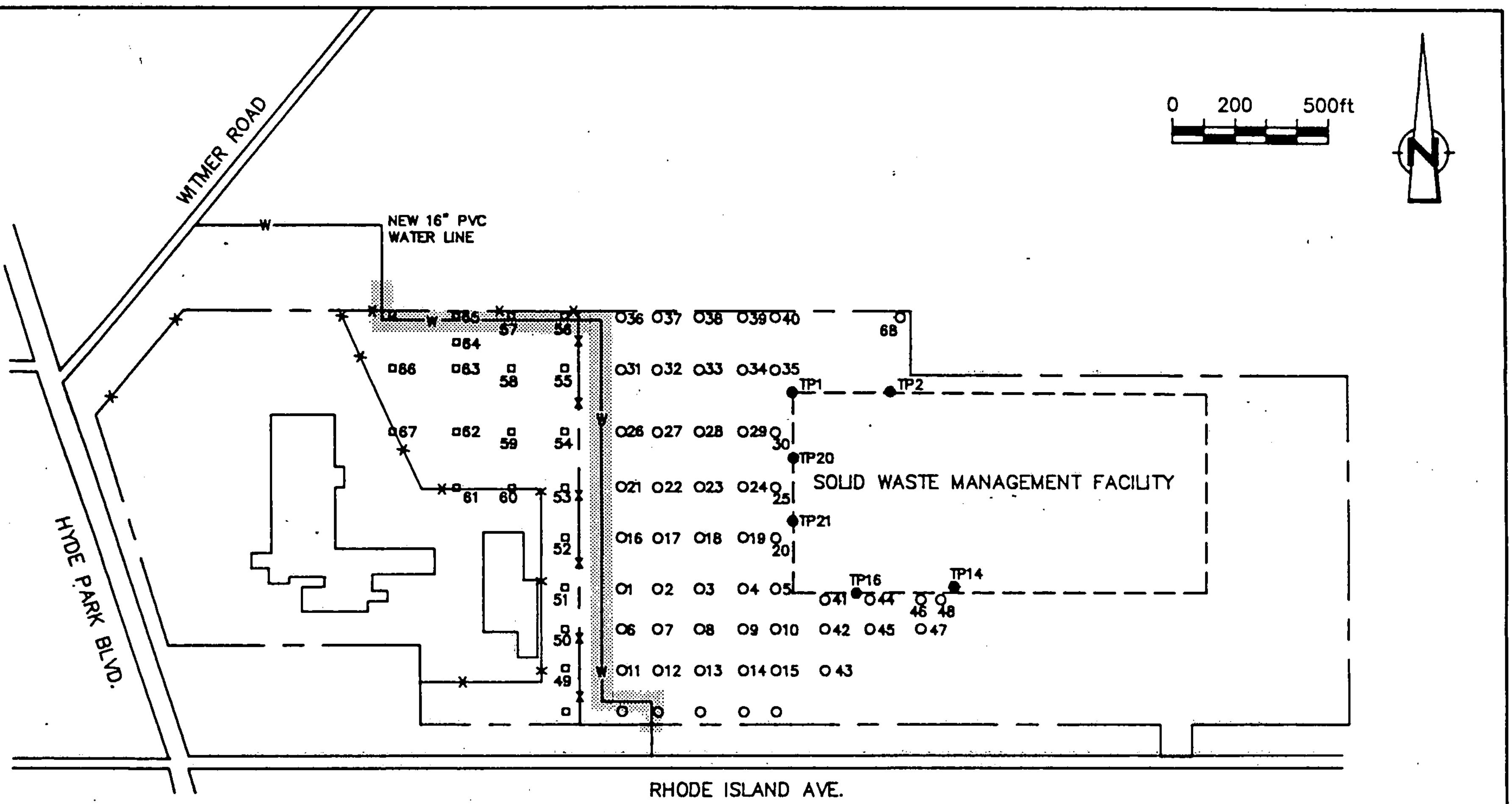
of the Site. No fill was encountered along the southern segment of the Site. Information pertaining to the thickness of fill material was generally obtained from the test pit survey performed by UCC in June 1987. This survey included the excavation of 75 test pits to determine the depth and areal extent of fill material presence at the Site. The location of the test pits are presented in Figure 7.

The northern and western limits of the fill were not defined since the presence of fill extends onto Niagara Mohawk and Niagara Vest property.

Generally the Fill Material is coarse and consequently is very conducive to infiltration and groundwater flow.

4.2 GLACIOLACUSTRINE CLAY

The Fill Material is underlain by Glaciolacustrine Clay which generally consists of very stiff gray to brown silty clay. Due to the fine grained nature of this unit, the clay is a low permeable strata which acts as an aquitard. The top of this unit is exposed along the southern boundary of the Site and gradually slopes downwards toward the north and northwest. During this study, the Glaciolacustrine Clay was excavated to a maximum depth of



LEGEND

- PROPERTY LINE
- FENCE LINE
- BELOW-GROUND PVC WATER LINE
- ABOVE-GROUND PVC WATER LINE
- UCC TEST HOLE
- NIAGARA VEST TEST HOLE
- CLAY KEY TEST HOLE (PART OF FINAL LANDFILL CLOSURE)

NOTE: NUMBERED TEST HOLES CONTAINED CARBONACEOUS WASTE MATERIALS; UNNUMBERED TEST HOLES WERE WASTE-FREE.

figure 7

TEST HOLE LOCATIONS
REPUBLIC PLANT
Union Carbide Corporation

CRA

2293-30/09/88-2-D-1

2.7 feet. However, the Glaciolacustrine Clay is known, from other borings on the Site, to extend almost to the top of the bedrock formation which lies 7 to 20 feet below grade around the SWMF. At the western end of the SWMF, the depth to bedrock was in the 17 to 20 foot range.

It is surmised that prior to the use of the area as a disposal facility, some of the native clay was excavated and used for fill in other areas of the plant. Thus, throughout the Site, pockets of clay may have been removed. As the clay under the western portion of the site extends to depths ranging from 17 to 20 feet deep, it is expected that at least 10 feet of clay remains beneath the entire western area. Thus, there is considerable separation between the Fill Material and Bedrock.

4.3 GLACIAL TILL

Immediately overlying the bedrock, between the clay and bedrock, there is usually a thin layer of till (0.5 to 6 feet thick) which is also of low permeability.

The till is generally silty but can range from clayey to sandy. Information obtained from other sites in Niagara Falls confirms that even the sandy tills generally contain sufficient fines (silt and clay) to maintain a low permeability.

4.4 BEDROCK

The bedrock beneath the Site is the Lockport Group of the Middle Silurian System. The Lockport Group is comprised of brownish to dark gray dolomite that is typically medium to thick bedded and medium grained.

The upper 30 to 45 feet of the Lockport Group is generally heavily fractured and consequently, a significant water bearing unit.

4.5 GROUNDWATER CONDITIONS

During the course of the Site Investigation, groundwater levels were measured periodically in the new Fill Material monitoring wells OW1 and OW2. Four rounds of groundwater level measurements were conducted in April and May (see Table 5). These rounds included measurement of water levels in the two newly installed wells and in all of the existing Site Monitoring wells. However, since the existing overburden wells on the Site (MW1, MW2 and MW3) are screened in native materials rather than fill, no correlation can be made between the new and existing overburden wells.

The water level elevations of the two newly installed fill wells reveal that the groundwater in the Fill

TABLE 5

WATER LEVEL ELEVATIONS
UNION CARBIDE CORPORATION - REPUBLIC PLANT

Well Number	Top of Casing Elevation (feet AMSL)	Date	Water Level Elevation (feet AMSL)
OW1-88	605.38	4/26/88	599.46
		4/29/88	599.56
		5/02/88	599.60
		5/09/88	599.38
OW2-88	599.21	4/26/88	592.71
		4/29/88	592.78
		5/02/88	593.04
		5/09/88	592.52

Material is lower in the northern portion of the Site around OW2 and higher in the southern portion around OW1. The difference in groundwater elevations between the wells is on the order of six to seven feet which is consistent with the change in ground surface elevation between the wells. Based on the difference in groundwater elevations between the wells, the groundwater gradient is approximately 0.01 foot/foot in a northerly direction. U.S. Department of the Interior Niagara Falls Quadrangle indicates a surface elevation in the range of 595± feet AMSL in the vicinity of the Niagara-Mohawk property, north of the UCC Site. This area has been observed to be in swampy condition with standing water and bullrushes. The measured water levels of OW-2 are in the range of 592 to 593 feet AMSL. It is thus possible that the swampy area may be an area of groundwater discharge to the surface.

4.6 SURFACE WATER CONDITIONS

Surface water ponding has occurred in the southwest corner of the Site as a result of the installation of the watermain berm. At the time of the closure of the SWMF it was assumed that some of the surface water runoff would continue to drain unabated to the southwest without problem. However, the watermain berm has effectively created a dam which retains the runoff in a relatively small area.

Once the overburden materials above the clay strata become saturated, water ponds on the surface in this area. At the time of the Site Investigation (April) the depth of surface water in this area was approximately 6-8 inches. It was noted that during the drier, warmer seasons of the year, surface water accumulation was considerably less however the ponded area never completely dried up.

5.0 ANALYTICAL RESULTS

Sampling procedures for the various programs conducted during this investigation have been described in Section 3.0. The locations of all monitoring points have been presented previously on Figure 3. The subsequent subsections present and discuss the analytical data collected under this investigation.

5.1 WATERMAIN INSTALLATION PROGRAM GRAB SAMPLES

Water, soil and tar samples were collected from an excavation during the June 1987 watermain installation program described in Section 2.0. During excavation, grab samples were taken at location "A", shown previously on Figure 2. The excavation had been open for an unknown amount of time before sampling. Volatile compounds may have volatilized from the excavation before samples were taken. Also, the collection protocols were not recorded. Due to these reasons, the samples taken at location "A" have been included for qualitative purposes only, but should not be assumed to be representative of in situ conditions.

The results of the soil, water and tar samples are contained in Appendix I. Soil sample results are from analyses of Toxicity Characteristic Leaching Procedure (TCLP) extracts.

No priority pollutant volatile organics, pesticides or PCBs were detected in the water or soil samples. Analyses for petroleum products detected tar primer in the water, soil and tar samples. Various metals were detected in the water and soil samples. The metals concentrations in the water were below the applicable New York State groundwater standards except for manganese which was reported at a concentration of 1.86 ppm. The New York State (NYS) Groundwater Quality Standard for manganese is 0.3 ppm, for Class GA waters (source of potable water supply).

Various Polynuclear Aromatic Hydrocarbons (PAHs) were also detected in water and soil samples. Of the PAHs detected, only fluoranthene (detected at 321 ppb) has an established standard (EPA Water Quality Criteria - 42 ppb). There is no NYS Groundwater Quality Standard established for fluoranthene.

5.2 WATERMAIN INVESTIGATION

As stated previously, soil and water samples were collected from in and around the watermain installation to determine what, if any, impact the presence of waste materials on the UCC Site has had on the city watermain.

Soil samples were collected from TP-1 to TP-4, upstream of the Site and from TP-5 to TP-8, downstream of the Site. One field duplicate sample (TP-9) was also collected from location TP-4. As summarized on Table 1, presented previously, material encountered in the test pit excavations consisted of pipe bedding and red-brown (imported) clay. The soil samples collected from each individual test pit were composites of the clays in direct contact with the pipe bedding.

Table 6 summarizes the compounds that were detected in the watermain soil samples. Appendix E presents the laboratory results for the soil samples and a summary of the analytical Quality Control (QC) review conducted on the data. On the basis of the reported data and QC review, the data presented on Table 6, with the exceptions noted below, are valid and acceptable for assessment purposes.

Analyses of the field duplicate samples (TP4/TP9) produced data that were generally comparable with the exception of a relatively small, acceptable deviation in nitrite concentrations and a significant deviation for benzene. Reported benzene concentrations for TP4 and TP9 were 53,000 ppb and 1,300 ppb, respectively. In order to confirm the presence or absence of benzene and investigate the duplicate data anomaly, Test Pits TP2, TP4 and TP6 were re-excavated and resampled as described previously in

TABLE 6
SUMMARY OF COMPOUNDS DETECTED
WATERMAIN SOILS SAMPLING, FEBRUARY 1988
UNION CARBIDE CORPORATION - REPUBLIC PLANT

Compound	Units	TP-1	TP-2	TP-3	TP-4 / TP-9*	TP-5	TP-6	TP-7	TP-8	TP-10 (Stockpile)	Lab Blank	Quantifiable Limit
Wet Chemistry												
Ammonia	ppm	0.07	0.04	0.04	0.06 / 0.08	0.02	0.22	0.04 (0.05)	0.02		BQL	0.01
TKN	ppm	BQL	BQL	BQL	0.1 / 0.1	BQL	0.1	0.1 (0.1)	0.1		BQL	0.1
Nitrite	ppm	0.07	0.02	0.04	0.15 / 0.06	0.10	0.02	0.04 (0.05)	0.05		BQL	0.01
Total Recoverable Phenols	ppm	0.060	BQL	0.008	0.010 / 0.008	0.006	0.006	0.006(0.006)	BQL		BQL	0.005
Diethyl Sulfate (As SO_4)	ppm	74	94	17	15 / 12	14	12	20	67		BQL	2.0
Volatile Organics												
Benzene	ppb	1,000(930)	2,000 [3,900]	BQL	53,000 / 1,300 [BQL(BQL)]	800	2,100 [500]	BQL	880	[BQL]	BQL	800 [100]
Semi-Volatiles												
Fluoranthene	ppb	BQL(BQL)	1,300	BQL	BQL / BQL	BQL	BQL	BQL	BQL		BQL	660
Pyrene	ppb	BQL(BQL)	1,300	BQL	BQL / BQL	BQL	BQL	BQL	BQL		BQL	660
Benzo(b)Fluoranthene	ppb	BQL(BQL)	2,500	BQL	BQL / BQL	BQL	BQL	BQL	BQL		BQL	660
Metals												
Total Potassium	ppm	1,570	1,798	1,241	1,708 / 2,548(2,554)	1,204	1,943	2,270	1,613		--	100
Total Iron	ppm	16,600	16,850	19,500	20,700 / 21,750(21,600)	17,250	24,600	22,300	19,750		--	30
Total Zinc	ppm	27.0	95.0	90.0	39.0 / 50(49)	39	55	50	76		--	5.0
Total Arsenic	ppm	2.3	1.4	3.0	2.6 / 2.3	2.6	3.0	3.0	2.8		--	0.5
Total Copper	ppm	21.0	BQL	24.0	23.0 / 21.0	21.0	24.0	22.0	23.0		--	20.0
Total Mercury	ppm	BQL	0.50	BQL	BQL / BQL	BQL	BQL	BQL	BQL		--	0.10
Total Nickel	ppm	34.0	44.0	36.0	32.0 / 39.0	39.0	31.0	46.0	42.0		--	30.0

BQL = Below Quantifiable Limits
* = Duplicate Sample
( ) = Duplicate Laboratory Sample
[ ] = Resampled 6/8/88

Section 3.1.1. As was also discussed in Section 3.1.1 a composite soil sample was collected (TP10) from the clay stockpile (source of imported clay) located at the Town of Niagara garage. The confirmatory test pit samples were analyzed for benzene and the results are summarized on Table 6. Complete analytical reports for these samples are presented in Appendix E.

A review of the data indicates that the presence of benzene was confirmed with consistent confirmatory data at locations TP2 and TP6. Benzene was not detected in the sample (TP10) from the clay stockpile, hence the source of the benzene cannot be confirmed. However, it should be noted that the samples collected from around the bedding material were not in contact with Site soils and therefore, it is concluded that the site is not the source of the benzene detected in these samples.

Benzene was not detected at a quantification limit of 100 ppb in the confirmatory sample from TP4 and the laboratory duplicate for this sample. The initial samples at this location were reported to have concentrations of 53,000 ppb and 1,300 ppb for benzene. This indicates that the soil matrix is not homogeneous, an observation that was substantiated during the collection of the composite stockpile soil sample, and may explain why benzene was not detected in the stockpile sample (TP10). The sample collected at the stockpile was also only taken from the remaining portion of the stockpile and not of the same material that was brought to the UCC Site and the results are therefore somewhat inconclusive.

The presence of benzene could be due to other factors such as fuel spillage from the equipment used to install the watermain or other such possibilities.

The maximum allowable holding period established for nitrite in water covered by USEPA and Standard Methods is 48 hours. The leachate from the soils were analyzed with 48 hours of leaching with deionized water, however, the analyses were conducted more than 48 hours after sample collection. The presence of oxidizing or reducing agents in the sample matrix could possibly affect conversion of nitrites to nitrate or ammonia, respectively. As the overall effects on nitrite concentrations cannot be adequately determined, it is recommended that the reported nitrite data be used for qualitative purposes only.

All test pit samples, including both upstream samples and downstream samples, exhibit similar characteristics (i.e. detected parameters exhibit comparable levels of concentrations) with two exceptions. In TP-4, fluoranthene, pyrene and benzo(b)fluoranthene were detected at concentrations of 1,300, 1,300 and 2,500 ppb, respectively. These parameters were not quantifiable (quantification limit of 660 ppb) in any of the other test pit samples. Benzene was detected in six of the eight test pits, at concentrations ranging from 880 ppb to 2,100 ppb (benzene concentration of 53,000 ppb at TP4 was previously discussed). Benzene was not quantifiable at a concentration of 800 ppb in the remaining two test pits (TP-3 and TP-7). A comparison of the data summarized on Table 6 to the data collected under the Soil Sampling Program is subsequently presented in Section 5.3.

5.2.2 Watermain Hydrant Sampling

Water samples were collected from two hydrants (No. 1 and No. 3) situated along the watermain which passes through the Site. Hydrant No. 1 is located upstream of the Site and hydrant No. 3 is located downstream of the Site (see Figure 3). One sample, WM-1, was collected from hydrant No. 1 and two samples WM-3 and WM-4 (duplicate sample) were collected from hydrant No. 3. These samples were analyzed for the same compounds as the watermain soil samples. In addition, analyses of soluble iron and soluble zinc were performed.

Table 7 summarizes the compounds that were detected in the watermain water samples. Complete laboratory results are contained in Appendix E.

TABLE 7

SUMMARY OF COMPOUNDS DETECTED
WATERMAIN HYDRANT SAMPLING, JANUARY 1988
UNION CARBIDE CORPORATION - REPUBLIC PLANT

Compound	Units	WM-1	WM-3 / WM-4*	Quantifiable Limit
Wet Chemistry				
TKN	ppm	0.33	0.14 / 0.19	0.01
Sulfate	ppm	15	16 / 15	2.0
Metals				
Total Potassium	ppm	1.36	1.83 / 1.26	1.00
Volatiles				
Chloroform	ppb	14	17 / 17	5
Bromodichloromethane	ppb	8	10 / 10	5

* = Duplicate Samples

A review of the detected compound concentrations summarized on Table 7, indicates that the water quality in the watermain downstream of the Site is essentially identical to the water quality measured upstream of the Site. There were only five compounds detected in the water samples: TKN, sulfate, total potassium, chloroform and bromodichloromethane. All five compounds were present in both the upstream sample and downstream sample at similar concentrations.

Of the five compounds detected, three of the compounds were present in watermain soil samples: TKN, sulfate and total potassium. Chloroform and bromodichloromethane which were present in the watermain water samples at maximum concentrations of 17 ppb and 10 ppb, respectively, were not detected in the watermain soil samples. The only volatile organic compound detected in the watermain soil samples was benzene.

Since the watermain water quality was essentially the same at both the upstream and downstream locations, and, the volatile organic compounds present in the watermain water samples were not detected in the watermain soil samples, it is concluded that the materials used to construct the watermain berm have not impacted the water quality within the watermain.

5.3 SOIL SAMPLING PROGRAM

As discussed in Section 3.4, eight soil samples were collected from selected test excavations, and composited into four analytical samples at the laboratory. (DP-1/DP-12, DP-2/DP-11, DP-3/DP-8 and DP-6/DP-7). Each of these composite samples represent a quadrant of the Site as shown on Figure 5.

As presented on Figure 5, the four quadrants are oriented in an east-west direction. The northernmost quadrant covers the area of maximum fill material thickness and the southernmost quadrant covers the area of minimum fill material thickness. The thickness of the fill material was presented previously on Figure 6.

The composite soil samples were analyzed for the following compounds:

- Ammonia
- Nitrite
- Total Kjeldahl Nitrogen (TKN)
- Total Recoverable Phenols
- Diethyl Sulfate
- HSL Volatile Organics
- HSL Semi-Volatiles
- HSL Pesticides and PCBs
- Priority Pollutant Metals
- Cyanide
- Total Potassium
- Total Iron

Table 8 summarizes the compounds that were detected in the composite soil samples. Complete laboratory results are contained in Appendix F.

Initially, the metals analyses for the composited soil samples included only total potassium, total iron and total zinc. These samples were subsequently analyzed for the complete list of priority pollutant metals. Consequently, duplicate results for total zinc appear on Table 8.

Ammonia, nitrite, TKN and diethyl sulfate were detected in all of the composite samples at maximum concentrations 2.3, 0.25, 3.3 and 62 ppm, respectively. Total recoverable phenols were detected in composite samples DP-2/DP-11 and DP-3/DP-8 at a concentration of 0.006 ppm but were not quantifiable at a concentration of 0.005 ppm in the other two composite samples.

Acetone was detected in composite samples DP2/DP11 and DP3/DP8 at concentrations of 190,000 ug/kg and 53,000 ppb, respectively. Acetone was not quantifiable at a concentration of 8,000 ppb in the other two composite samples or in the trip blank and lab blank. Acetone was not detected in any other sampling programs conducted during this investigation (i.e. watermain soil and water sampling, groundwater sampling and drum sampling). In order to confirm

TABLE 8

SUMMARY OF COMPOUNDS DETECTED
SOIL SAMPLING PROGRAM, MARCH 1988
UNION CARBIDE CORPORATION - REPUBLIC PLANT

Compound	Units	DP1/DP12 Composite	DP2/DP11 Composite	DP3/DP8 Composite	DP6/DP7 Composite	Trip Blank	Lab Blank	Quantifiable Limit
Wet Chemistry								
Ammonia (As N)	ppm	0.42	0.08	0.52	2.3 (2.3)	--	BQL	0.01
Nitrite (As N)	ppm	0.25	0.15	0.24	0.06 (0.06)	--	BQL	0.01
TKN	ppm	0.6	0.3	3.2	3.3 (3.2)	--	BQL	0.1
Total Recoverable Phenols	ppm	BQL	0.006	0.006	BQL (BQL)	--	BQL	0.005
Diethyl Sulfate (As SO_4)	ppm	25	22	24	62 (58)	--	BQL	2.0
Volatile Organics (HSL)								
Acetone	ppb	BQL	190,000 [BQL]	53,000 [BQL]	BQL	BQL	BQL	8000 [500]
Semi-Volatiles (HSL)								
2-Methylnaphthalene	ppb	11,000	3,600	3,300	5,800 (5,400)	--	BQL	660
Naphthalene	ppb	21,000	13,000	13,000	12,000 (10,000)	--	BQL	660
Acenaphthylene	ppb	BQL	7,000	BQL	BQL (BQL)	--	BQL	660
Acenaphthene	ppb	41,000	43,000	23,000	21,000 (22,000)	--	BQL	660
Fluorene	ppb	36,000	24,000	17,000	26,000 (23,000)	--	BQL	660
Phenanthrene	ppb	100,000	84,000	45,000	43,000 (44,000)	--	BQL	660
Anthracene	ppb	26,000	36,000	19,000	11,000 (11,000)	--	BQL	660
Fluoranthene	ppb	150,000	71,000	11,000	78,000 (72,000)	--	BQL	660
Pyrene	ppb	110,000	62,000	40,000	61,000 (59,000)	--	BQL	660
Benzo(a)Anthracene	ppb	750,000	260,000	150,000	99,000 (90,000)	--	BQL	660
Chrysene	ppb	9,600	230,000	110,000	49,000 (44,000)	--	BQL	660
Benzo(b)Fluoranthene	ppb	500,000	95,000	36,000	500,000(470,000)	--	BQL	660
Benzo(k)Fluoranthene	ppb	37,000	BQL	29,000	36,000 (37,000)	--	BQL	660
Benzo(a)Pyrene	ppb	550,000	640,000	BQL	17,000 (17,000)	--	BQL	660

continued....

TABLE 8

SUMMARY OF COMPOUNDS DETECTED
SOIL SAMPLING PROGRAM, MARCH 1988
UNION CARBIDE CORPORATION - REPUBLIC PLANT

Compound	Units	DP1/DP12 Composite	DP2/DP11 Composite	DP3/DP8 Composite	DP6/DP7 Composite	Trip Blank	Lab Blank	Quantifiable Limit
Wet Chemistry								
Pesticides and PCBs (HSL)								
Aldrin	ppm	BQL	0.146	0.121	0.282 (0.452)	--	BQL	0.010
Alpha-BHC	ppm	0.181	0.112	1.04	0.138 (0.256)	--	BQL	0.010
Beta-BHC	ppm	BQL	BQL	0.541	BQL (BQL)	--	BQL	0.010
Gamma-BHC	ppm	0.570	0.910	0.729	1.06 (1.54)	--	BQL	0.010
Heptachlor	ppm	BQL	0.215	0.274	0.264 (0.282)	--	BQL	0.010
Metals								
Total Potassium	ppm	595	339	823	711 (701)	--	--	100
Total Iron	ppm	15,800	6,000	12,250	19,500 (19,250)	--	--	30
Total Zinc	ppm	53/50	66/56	142/134	136/52 (47)	--	--	5
Total Arsenic	ppm	6.7	5.3	2.8	4.3 (4.4)	--	--	0.5
Total Chromium	ppm	54	67	90	300 (303)	--	--	50.0
Total Copper	ppm	79	85	53	83 (83)	--	--	20.0
Total Mercury	ppm	BQL(BQL)(BQL)	BQL(BQL)(BQL)	BQL(BQL)(BQL)	BQL(0.50)(BQL)	--	--	0.10
Total Nickel	ppm	34	35	46	59 (54)	--	--	30.0
Total Selenium	ppm	0.6	0.6	0.5	0.7 (0.7)	--	--	0.5

( ) = Indicates Laboratory Duplicate
BQL = Below Quantifiable Limits
[ ] = Resampled 6/8/88

the presence or absence of acetone, composite soil samples were recollected from locations DP2/DP11 and DP3/DP8 following the same protocols as described previously in Section 3.4.1 and analyzed for acetone. The confirmatory results are summarized on Table 8 and complete analytical reports are presented in Appendix E.

A review of the data indicates that acetone was not detected at a quantification limit of 500 ppb in the confirmatory composite soil sample DP2/DP11 or DP3/DP8. Since acetone was not detected in the confirmatory samples or in any other sampling programs conducted during this investigation, the initial presence of acetone is probably attributable to field and/or laboratory contamination.

There were a total of 14 semi-volatiles detected in the composite soil samples ranging in concentrations from 3,300 ppb to 750,000 ppb. Of the 14 compounds detected, nine compounds corresponded with compounds detected in the leachate from the sample collected at location "A" and seven compounds corresponded with compounds detected in surface soil samples collected from the slopes of the SWMF as part of the SWMF Site Investigation[1]. A summary of the corresponding parameters between the three sets of samples is presented below:

Corresponding Semi-Volatiles

Parameters	Composite Soil Samples	1987 SWMF Soil Samples Site Investigation	Sample "A" Leachate
Acenaphthylene	X		X
Phenanthrene	X	X	X
Anthracene	X		X
Fluoranthene	X	X	X
Pyrene	X	X	X
Benzo(a)anthracene	X	X	X
Chrysene	X	X	X
Benzo(b)fluoranthene	X		X
Benzo(k)fluoranthene	X	X	X
Benzo(a)pyrene	X	X	X
Indeno(1,2,3-CD)pyrene		X	X
Benzo(g,h,i)perylene		X	X

In addition to the semi-volatiles, a majority of the metals detected in the composite soil samples also correspond to the metals detected in the leachate from the sample collected at location "A" and the surface soil samples collected from the slopes of the SWMF as part of the SWMF Site Investigation(1). A summary of the corresponding parameters between the three sets of samples is presented as follows:

Corresponding Metals

Parameters	Composite Soil Samples	1987 SWMF Soil Samples Site Investigation	Sample "A" Leachate
Arsenic	X	X	
Chromium	X	X	X
Copper	X	X	X
Nickel	X	X	X
Zinc	X	X	X
Lead		X	X

Based upon the above comparisons and the data presented on Table 8, it is concluded that the fill material (composite samples) sampled under this investigation exhibits levels of PAHs that are above background levels and consistent with the material disposed of within the SWMF.

There were a total of five pesticides detected in the composite soil samples: aldrin; alpha-BHC; beta-BHC; gamma-BHC; and, heptachlor. Concentrations ranged from 0.112 ppm to 1.54 ppm. Of the five compounds detected, only heptachlor and gamma-BHC were analyzed in the leachate from the sample collected at location"A". Heptachlor was not detected at a quantification limit of 0.50 ppb and gamma-BHC was not detected at a quantification limit of 0.10 ppb. Of the five compounds detected, only beta-BHC was detected in surface soil samples collected from the slopes of the SWMF as part of the SWMF Site Investigation(1).

A comparison of the data summarized on Table 8 to that summarized previously on Table 6 yields the following observations.

Ammonia, nitrite, TKN, total recoverable phenols and diethyl sulfate were detected in both the watermain soil samples and the composite soil samples. Also, with the exception of chromium and selenium, similar metals were detected in both the watermain soil samples and the composite soil samples.

Fluoranthene, pyrene and benzo(b)fluoranthene were the only semi-volatiles detected in the watermain soil samples at location TP-2. A total of 14 semi-volatiles, including the three discussed above, were detected in the composite soil samples. The concentrations of fluoranthene, pyrene and benzo(b)fluoranthene in the composite samples are approximately one to two orders of magnitude higher than in the watermain soil samples. It should be noted that during the watermain soil sample collection in TP-2 the excavation filled with water, thus the presence of these three parameters may be attributed to the sloughing of residual waste contamination from the sidewalls of the excavation into the test pit.

Benzene was detected in the watermain soil samples at a maximum concentration of 53,000 ppb. Benzene was not detected in any of the composite soil samples or in any other sample ever collected at the UCC Site.

Based on the above comparisons, it can be concluded that the waste material has not impacted the imported clay material used to construct the berm for the watermain. It is further concluded that contaminants present in the clay berm material, especially benzene, are not site related.

5.4 WASTE DRUM SAMPLE

At site investigation test pit DP-21, three drums of waste materials were encountered. Materials within the drums and the soils in the surrounding excavation consisted of a black, tar-like solid. It was suspected that this waste material was an altered form of an impregnating compound (Code 88) formerly used at the UCC facilities.

One sample from each drum plus two random samples from the excavation, one consisting of a solid black material and the other of a black tar-like material, were collected and were analyzed for the following parameters using EP Toxicity extraction procedures:

- Components of tar pitch
- Diethyl sulfate
- Furfural

The tar-like material was also submitted for the following physical testing:

- softening point
- percent quinolline insoluble
- percent toluene insoluble
- percent coking value

Table 9 summarizes the results of these analyses and also previous analyses of Code 88 material. Complete laboratory reports for all waste material analyses are contained in Appendix G.

The previous analyses of Code 88 material were conducted on November 20, 1987. This material contained toluene, m/p-xylene and o-xylene at concentrations of 8.48, 28.2 and 27.8 ppb, respectively. Total recoverable phenol, ammonia, diethyl sulfate and furfural were also detected at concentrations of 0.009, 0.12, 89 and 22.7 ppm, respectively.

The three drum samples contained m/p-xylene, o-xylene, naphthalene and anthracene at maximum concentrations of 5.11, 5.11, 23.5 and 426 ppb, respectively. Total recoverable phenol, ammonia and diethyl sulfate were also detected at maximum concentrations of 0.179, 60 and 186 ppm, respectively. Similar results were also recorded for the tar-like and solid materials.

The above comparison indicates that the material encountered in the drums and in the soils surrounding the drums is an off-specification material which may be an altered form of the impregnating compound Code 88.

TABLE 9

SUMMARY OF ANALYTICAL RESULTS
WASTE DRUM SAMPLING

	Units	Code 88	DP21 Drum #1	DP21 Drum #2	DP21 Drum #3	Tar Material	Solid Material	Quantifiable Limit
Compounds								
- Benzene	ppb	BQL	BQL	BQL	BQL	BQL	BQL(BQL)	2.00
- toluene	ppb	8.48	BQL	BQL	BQL	BQL	BQL(BQL)	2.00
- m/p-xylene	ppb	28.2	3.82	5.11	4.97	BQL	4.53(4.42)	2.00
- o-xylene	ppb	27.8	5.11	2.46	2.21	BQL	2.81(2.74)	2.00
- naphthalene	ppb	BQL	16.4	23.5	22.7	125	21.7(23.7)	3.00
- anthracene	ppb	BQL	71.4	15.3	426	19.4	415(436)	3.00
- thiophene	ppm	BQL	BQL	BQL	BQL	BQL	BQL(BQL)	2.00
- total recoverable phenol	ppm	0.009	0.084	0.179	0.150(0.150)	0.046	0.124	0.005
- ammonia	ppm	0.12	46	60	27	BQL(BQL)	60	0.01
Diethyl sulfate	ppm	89	186	130	26(30)	4.2	198	2.0
Furfural	ppm	22.7	BQL	BQL	BQL	BQL	BQL(BQL)	2.0
Softening Point	°C					58		
Quinolline Insoluble	%					11.22		
Toluene Insoluble	%					22.97		
Coking Value	%					61.46		

BQL = Below Quantifiable Limits
( ) = indicates laboratory duplicate

5.5 SITE GROUNDWATER

Two monitoring wells, OW-1 and OW-2, were installed in test pits that encountered the perched water table system. The pits were backfilled with the same material that had been excavated. These wells were installed at locations that, by visual inspection, contained larger than average quantities of waste in the soil. The wells were developed and sampled five days after installation.

Sampling results for the groundwater samples are summarized in Table 10, and complete laboratory results are contained in Appendix H.

Total recoverable phenols were detected in well OW1-88 at a concentration of 0.044 ppm but not detected in well OW2-88 at a quantifiable limit of 0.005 ppm. The New York State (NYS) Groundwater Quality Standard, for Class GA waters (source of potable water supply), for total recoverable phenols is 0.001 ppm. This level is based upon the prevention of organoleptic (taste) effects. Total recoverable phenols were detected in two of the four composite soil samples. Total recoverable phenols were also detected in the groundwater during the SWMF Site Investigation(1) at levels that exceeded the standard of 0.001 ppm. The other wet chemistry parameters, ammonia, nitrite, TKN or diethyl sulfate, which were detected in the

TABLE 10

SUMMARY OF COMPOUNDS DETECTED
GROUNDWATER MONITORING PROGRAM
MARCH 1988
UNION CARBIDE CORPORATION - REPUBLIC PLANT

Compound	Units	OW1-88	OW2-88	Field Blank	Quantifiable Limit
Wet Chemistry					
Total Recoverable Phenols	ppm	0.044	BQL(BQL)	--	0.005
PCBs and Pesticides					
Alpha-BHC	ppb	0.52(BQL)	BQL	--	0.50
Base/Neutral Extractables					
Phenanthrene	ppb	14 (14)	BQL	BQL	10
Fluoranthene	ppb	13 (10)	BQL	BQL	10
Pyrene	ppb	12 (BQL)	BQL	BQL	10
Metals					
Soluble Arsenic	ppm	0.013(0.014)	BQL	BQL	0.005
Soluble Zinc	ppm	0.06	0.12(0.12)	BQL	0.05

BQL = Below Quantifiable Limits
( ) = Indicates Laboratory Duplicate

composite soil samples, were not analyzed for in the groundwater.

Alpha-BHC was detected in well OW1-88 at a concentration of 0.52 ppb but was not detected in well OW2-88 at a quantifiable limit of 0.50 ppb. The NYS Groundwater Quality Standard, for Class GA waters (source of potable water supply), for alpha-BHC is not detectable by analytical determination. Alpha-BHC was detected in the one groundwater sample at only 0.02 ppb greater than the detection limit making its presence suspect particularly in view of the fact that it was not detected in the duplicate. Alpha-BHC was detected in the four composite samples collected during this investigation. The other pesticides, aldrin, beta-BHC, gamma-BHC and heptachlor, which were detected in the composite soil samples, were not detected in the groundwater.

Phenanthrene, fluoranthene and pyrene were detected in well OW1-88 at maximum concentrations of 14, 13 and 12 ppb, respectively. These compounds were not detected in well OW2-88 at quantifiable limits of 10 ppb. There are no NYS Groundwater Quality Standards available for these three compounds. Phenanthrene, fluoranthene and pyrene were all detected in the composite soil samples. None of these parameters were detected in any of the groundwater samples collected from the existing wells sampled as part of the SWMF Site Investigation[1].

Soluble arsenic was detected in well OW1-88 at a concentration of 0.013 ppm but was not detected in well OW2-88 at a quantifiable limit of 0.005 ppm. The NYS Groundwater Quality Standard for arsenic is 0.025 ppm for Class GA waters (source of potable water supply). The level of arsenic detected is below this standard. Total arsenic was detected in all of the soil composite samples. Arsenic was not detected in any of the existing wells sampled as part of the SWMF Site Investigation(1).

Soluble zinc was detected in wells OW1-88 and OW2-88 at concentrations of 0.06 and 0.12 ppm, respectively. The NYS Groundwater Quality Standard for zinc is 5 ppm for Class GA waters (source of potable water supply). The levels of zinc detected are significantly less than the standard. Total zinc was detected in all of the composite soil samples and in various existing wells sampled as part of the SWMF Site Investigation(1).

Based on the analytical data collected, it is concluded that the waste material is the probable source of contaminants in the groundwater. However, the concentrations of chemicals detected in the groundwater are relatively low and are all below applicable standards, with the exception of total recoverable phenols (standard based on taste effects) and possibly alpha-BHC (0.02 ppb above the detection limit and standard is set at less than detection limit). It is further noted that the groundwater quality in the area of OW2-88, which is located in fill material and is downgradient of OW1-88, is essentially free of impact. Both wells monitor groundwater in direct contact with the waste material. It can be reasonably concluded, therefore, that groundwater downgradient of the Site will be of better quality than at OW2-88, due to attenuation and dilution, and will also be essentially free of impact.

6.0 PUBLIC AND ENVIRONMENTAL HEALTH ASSESSMENT

To evaluate the potential chemical impact on public health and the environment it is necessary to identify the Site related chemicals present at significant concentrations, the media contaminated and the potential exposure of receptor organisms. The Public Health Assessment evaluation will generally follow the EPA "Superfund Public Health Evaluation Manual" (the Manual)[2]. Because the small size and industrial nature of the Site severely limits potential wildlife exposure, the Environmental Assessment will be limited to a brief comment on potential effects on wildlife.

6.1 PUBLIC HEALTH ASSESSMENT

6.1.1 Selection of Indicator Chemicals

A limited number of chemicals were reported in media at the Site, therefore it was not necessary to apply the selection process described in the Manual.

The metals concentrations reported in soils were within the normal range of concentrations of metals in soil as published by Baker, et al[3]. Since metal concentrations are within natural ranges, metals in soils will not be further evaluated.

Benzene, polynuclear aromatic hydrocarbons (PAHs), and pesticides are the only organic chemicals of concern, the presence of which are reported consistently in soil samples from the Site.

Benzene was reported in the soil samples collected along the watermain. Benzene was not reported in samples of water from the monitoring wells on Site or in any of the composite soil samples collected. The presence of benzene was concluded to be the result of contamination external to the Site (see Section 5.3). Consequently, benzene will not be assessed as an indicator chemical.

Acetone was reported in two of the four original composite soil samples. Acetone was not detected in confirmatory samples of the two composites nor was it detected in any other sampling programs conducted during this investigation. The presence of acetone in the initial two composite samples was concluded to be attributed to field and/or laboratory contamination (see Section 5.3). Consequently, acetone will not be assessed as an indicator chemical.

6.1.2 Exposure Pathways and Exposure Point Concentrations

The Site is a controlled access (fenced) industrial property. The Site could continue to be used for industrial purposes. On-Site exposure would therefore be limited to industrial workers. Since the groundwater within the Fill material is not available for contact, the only on-Site point of contact is contaminated soil.

The chemicals of concern in the surface soil are PAHs and pesticides. None of the chemicals are volatile, therefore vapor exposure is not a concern on or off-Site. However, dust can be carried off-Site.

Off-Site migration of contaminants could potentially occur through surface water runoff, groundwater migration and airborne vapor or dusts. The Site Fill material is comparatively permeable and groundwater will move laterally through the Fill toward the north; possibly discharging to the surface water exposure along the Niagara Mohawk property.

Surface water from this northerly area historically drained through the Republic Plant by way of a drainage swale. The drainage swale water was sampled in 1984 and was determined to be clean, except for

1,2-dichlorobenzene which was present at a concentration of 8.44 ppb. This concentration is approximately 2 orders of magnitude lower than the EPA proposed Recommended Maximum Contaminant Level (RMCL) of 620 ppb. The sampling point was located approximately 300 feet west of the SWMF boundary at the intersection of the access road and the swale as shown on Figure 2 (SW-1-84). Since 1,2-dichlorobenzene has not been detected in any of the site soil or water samples, it was probably not site related. Since the Republic Plant site compounds were not detected in the surface water sample, any groundwater discharge to the north has had no impact on the surface water in that area. The complete surface water sample results are contained in Appendix J. It should be noted, as discussed in Section 4.4, that the construction of the watermain across the UCC property has effectively created a dam which retains runoff from the UCC property in a relatively small area.

The vertical movement of groundwater from the perched water table downward toward the bedrock is severely limited by the Glaciolacustrine Clay layer. In any case, if the perched water in the Fill enters the main groundwater flow in the bedrock formation, the ultimate exposure point for groundwater would be the PASNY reservoir and Niagara River because groundwater from the bedrock formation enters the PASNY conduits near the Site. As discussed previously in Section 5.5, the concentrations of chemicals detected in the groundwater are relatively low and all are below applicable standards, with the exception of total recoverable phenols for which the standard is based on taste effects.

In summary, the potential human exposure pathways are:

On-Site Worker: Surface soil (contact, dust inhalation and inadvertent ingestion)

Off-Site: Nearby Residents: Dust inhalation

General Population: Consumption of fish and water from the PASNY reservoir and Niagara River

A special concern was the possible contamination of the water in the City watermain that traverses the Site. Chemical levels in upstream and downstream water samples were essentially the same which confirms that the above ground placement of the watermain precludes any impact from the on-Site chemicals.

An on-Site worker could be exposed to surface soil due to dermal contact, inhalation of dust and/or inadvertent ingestion due to hand to mouth contact, cigarettes, food, etc. Using the adult soil exposure estimate published by Kimbrough et al[4] of 0.1 gm per day and assuming: 1) a worker would spend a significant part of an 8-hour work day in this area once every two weeks for 20 years, and 2) that conditions exist 50% of the time which allow significant soil exposure (frozen ground, snow cover and other weather conditions prevent soil exposure in cold months), a worker weighing 70 kg (155 lbs) would be exposed to an average 0.3 gm of soil per day. This soil exposure and the resulting chemical exposures are summarized in Table 11. Because the carcinogenic PAHs account for the preponderance of the potential risks from PAH exposure, only the carcinogenic PAHs and pesticides are evaluated in Table 11.

Off-Site exposure to indicator chemicals in groundwater is judged to be insignificant for the following reasons. The migration of the water through soil would result in significant attenuation due to adsorption. The resulting low (to non-detectable) concentrations, when combined with the fact that only a small volume of water would reach the PASNY conduit, would be diluted by many orders of magnitude. The resulting concentration would be of no health consequences. The potential for groundwater discharge into the surface water pond area north of the Site is also not of concern due to the fact that the groundwater is essentially clean and sampling of the surface water has shown it also to be essentially clean.

TABLE 11

WORKER EXPOSURE TO SURFACE SOILS
AND INDICATOR CHEMICALS

Indicator Chemical	Concentration[1] in Soil mg/kg	Worker's Daily Exposure		Cancer[4] Risk
		Soil mg[2]	Chemicals mg[3]	
Benzo(a)anthracene	315	0.3	4.5×10^{-5}	1.1×10^{-5}
Chrysene	100	0.3	3.0×10^{-5}	4.8×10^{-6}
Benzo(b)fluoranthene	283	0.3	8.5×10^{-5}	1.9×10^{-5}
Benzo(k)fluoranthene	26	0.3	7.8×10^{-6}	1.1×10^{-5}
Benzo(a)pyrene	302	0.3	9.1×10^{-5}	1.4×10^{-5}
Aldrin	0.161	0.3	4.8×10^{-8}	5.5×10^{-7}
Alpha-BHC	0.382	0.3	1.1×10^{-7}	1.2×10^{-7}
Beta-BHC	0.135	0.3	4.1×10^{-8}	7.3×10^{-8}
Gamma-BHC	0.877	0.3	2.6×10^{-7}	3.4×10^{-7}
Heptachlor	0.193	0.3	5.8×10^{-8}	2.0×10^{-7}
			Total	6.6×10^{-5}

NOTES:

(1) Average of four composites.

(2) Based in assumption in text.

(3) Concentration on soil x Daily Exposure to soil.

(4) Based on Potency Factor (oral route). Exhibit C-4 in the Manual. Oral route is used because the inadvertent ingestion accounts for the major exposure to soil at all ages.

The off-Site exposure to dust can be estimated by assuming the average dust concentration in the air to be 0.0525 mg/m^3. This is the annual geometric mean for 1976 - 1986 of suspended particulate level in the Niagara Falls area. Using a conservative estimate that half the dust in a near off-Site area originates on Site and that any home is downwind 10 percent of the time, the average concentration of dust from the Site in off-Site air would be 0.0026 mg/m^3. Assuming: 1) an individual inhales 20 m^3 per day, 2) lives in the area 35 years, 3) spends 12 hours at home each day, and 4) that 50 percent of the PAH on the inhaled dust is absorbed, the effective soil exposure for an individual is 0.0065 mg. For a 70 kg adult, the daily soil exposure would be 0.000093 mg/kg. Table 12 summarizes this soil exposure and the resulting exposure to carcinogenic PAHs and pesticides.

It should be noted that there are only a limited number of houses (estimated 70) within 1000 feet of the identified waste deposition area.

6.1.3 Risk Assessment

When developing maximum contaminant levels (MCL) for drinking water, EPA stated "the target reference risk range for carcinogens is 10^{-4} to 10^{-6}", and further states "EPA considers these to be safe levels and protective of public health"(5). Since this acceptable risk range is applied to the drinking water for the general population, it is considered a very conservative range for the assessment of the potential risks to a comparatively small population of workers or neighbors which are the potential receptors for this Site assessment.

Tables 11 and 12 present the estimated cancer risk based on the EPA Potency Factors presented in the Manual. The risk levels are based on worst case assumptions and provide a very conservative evaluation. Since these worst case estimates are all below a 1×10^{-6} risk level for neighbors and within the acceptable range of 10^{-4} to 10^{-6} for the workers, the estimated risks are considered acceptable with a wide margin of safety for the small populations potentially exposed.

6.1.4 Summary and Conclusion

On-Site exposure of workers to surface soils and off-Site exposure to neighbors to dust from surface soils are the only complete pathways of exposure. Using worst case estimates for exposure, the estimated exposure will result in a calculated risk estimate that is well within levels of acceptable risk.

TABLE 12

ESTIMATED EXPOSURE OF OFF-SITE RESIDENTS TO ON-SITE SURFACE SOIL

Indicator Chemical	Concentration[1] in Soil mg/kg	Resident's Daily Daily Exposure		Cancer[4] Risk
		Soil mg[2]	Chemicals mg[3]	
Benzo(a)anthracene	315	0.0065	2.9×10^{-8}	3.2×10^{-7}
Chrysene	100	0.0065	9.3×10^{-9}	1.0×10^{-8}
Benzo(b)fluoranthene	283	0.0065	2.6×10^{-8}	2.9×10^{-7}
Benzo(k)fluoranthene	26	0.0065	2.2×10^{-9}	2.4×10^{-8}
Benzo(a)pyrene	302	0.0065	2.8×10^{-8}	3.1×10^{-7}
Aldrin	0.161	0.0065	1.0×10^{-9}	1.1×10^{-8}
Alpha-BHC	0.382	0.0065	2.5×10^{-9}	2.8×10^{-8}
Beta-BHC	0.135	0.0065	8.8×10^{-10}	1.6×10^{-9}
Gamma-BHC	0.877	0.0065	5.7×10^{-9}	7.7×10^{-9}
Heptachlor	0.193	0.0065	1.3×10^{-9}	4.4×10^{-9}
			Total	1.0×10^{-6}

NOTES:

(1) Average of four composites.

(2) Based in assumption in text.

(3) Concentration on soil x Daily Exposure and assumes individual weighs 70 kg.

(4) Based on Potency Factor (oral route). Exhibit C-4 in the Manual. Oral route is used because the inadvertant ingestion accounts for the major exposure to soil at all ages.

6.2 ENVIRONMENTAL EXPOSURE

The Site is in an urban area essentially surrounded by industrial plants and residential areas. Although wildlife, such as upland birds, ducks and deer have been observed to enter the Site, it is not well suited as a wildlife habitat. Cover and food sources are limited and the ponded water is shallow, especially in drier periods.

Regardless of the number of animals and/or birds that would frequent the Site, the acute and subchronic toxicity levels, the comparatively low concentrations of Site related chemicals to which the wildlife could be exposed, and the limited time that the wildlife would spend on the Site preclude any potential adverse impacts on health.

The prohibition of hunting within city boundaries and the limited area involved limits the potential for using exposed wildlife for food. The limited exposure to wildlife containing Site-related chemical residues precludes the human consumption of unacceptable dose levels of Site-related chemicals.

In summary, the available information would indicate that wildlife would not be impacted by on-Site chemical residues in surface soils and surface water. The potential for human consumption of meat from wildlife precludes unacceptable exposure to Site-related chemicals due to consumption of game birds or animals from the Site area.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of the Site Investigation, the following conclusions and recommendations have been formulated:

1) The site does not pose a significant current or potential future threat to public health or the environment.

2) Water quality in the Town watermain is unaffected by the fill material and/or berm construction material. Contaminants in the berm construction material are not site related.

3) Groundwater is essentially unaffected by the site and is contained as a perched water zone. Discharge to surface water is not a problem (based on chemical analysis). Bedrock groundwater is protected by a relatively thick clay aquitard.

4) Three buried drums were located during the investigation. These drums have been removed and disposed off Site at a permitted waste disposal facility.

5) On-site exposure of workers to surface soils and exposure to off-site areas to dust from surface soils are the only complete potential pathways of exposure resulting from

on-site wastes. Using worst case estimates for exposure resulted in a calculated risk estimate that is well within the published levels of acceptable risk for the public.

6) Soils containing PAHs and pesticides are present on site. The PAHs and pesticides detected are consistent with results from the SWMF. S

7) PAHs stay sorbed to soils and do not create an unacceptable risk to public health or the environment.

8) As no existing or potential risk was identified at the Site, it is recommended that remedial measures are not required.

Solid Waste Mgmt Facility

REFERENCES

(1) Conestoga-Rovers & Associates. Site Investigation, Solid Waste Management Facility, Union Carbide Corporation, Republic Plant, Town of Niagara, New York, July 1987.

(2) Superfund Public Health Evaluation Manual. EPA 540/1-86/060 (OSWER Directive 9285.4-1) October 1986.

(3) Baker, Dale E. and Chesnin, Leon. Chemical Monitoring of Soils for Environmental Quality and Animal and Human Health.

(4) Kimbrough, Renata, D. et al. Health implications of 2,3,7,8-Tetrachlorodibenzo-dioxin (TCDD) contamination of residential soil. J. Fox Environmental Health 14:47-93.

(4) Federal Register (40 CFR Parts 141 & 142) Wednesday, July 8, 1987 pages 25700 - 25701.

APPENDIX A

APPENDIX A

EM SURVEY DATA

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-800	-700	46		
-800	-675	80		
-800	-650	96		
-800	-625	200		
-800	-600	32		
-800	-575	NR**	NR	
-800	-550	54		
-800	-525	64		
-800	-500	57		
-800	-475	42		
-800	-450	42		
-800	-425	67		
-800	-400	58		
-800	-375	22		
-800	-350	OS*		48 E-W (OFFSCALE N-S)
-800	-325	110		
-800	-300	68		
-800	-275	78		
-800	-250	54		
-800	-225	40		
-800	-200	42		
-800	-175	36		
-800	-150	37		
-800	-125	25		
-800	-100	42		
-800	-75	165		
-800	-50	65		
-800	-25	32		
-800	0	10		
-800	25	40		
-800	50	24		
-800	75	10		
-800	100	37		
-800	125	12		
-800	150	34		
-800	175	32		
-800	200	23		
-800	225	21		
-800	250	23		
-800	275	23		
-800	300	21		
-775	-700	62		
-775	-675	48		
-775	-650	110		
-775	-625	360		
-775	-600	320		
-775	-575	240		
-775	-550	72		
-775	-525	100		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-775	-500	64		
-775	-475	64		
-775	-450	74		
-775	-425	120		
-775	-400	130		
-775	-375	210		
-775	-350	210		
-775	-325	220		
-775	-300	64		
-775	-275	94		
-775	-250	170		
-775	-225	OS*		110 E-W
-775	-200	160		
-775	-175	90		
-775	-150	52		
-775	-125	90		
-775	-100	OS*		135 E-W
-775	-75	NR**	NR	
-775	-50	OS*		35 E-W
-775	-25	90		
-775	0	52		
-775	25	105		
-775	50	40		
-775	75	30		
-775	100	43		
-775	125	25		
-775	150	36		
-775	175	24		
-775	200	29		
-775	225	23		
-775	250	24		
-775	275	20		
-775	300	26		
-750	-700	110		
-750	-675	26		
-750	-650	310		
-750	-625	130		
-750	-600	44		
-750	-575	200		
-750	-550	240		
-750	-525	230		
-750	-500	90		
-750	-475	120		
-750	-450	130		
-750	-425	230		
-750	-400	250		
-750	-375	300		
-750	-350	300		
-750	-325	220		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-750	-300	NR**	NR	
-750	-275	200		
-750	-250	160		
-750	-225	210		
-750	-200	250		
-750	-175	140		
-750	-150	165		
-750	-125	370		
-750	-100	NR**	NR	
-750	-75	400		
-750	-50	290		
-750	-25	190		
-750	0	430		
-750	25	110		
-750	50	90		
-750	75	110		
-750	100	94		
-750	125	90		
-750	150	62		
-750	175	9		
-750	200	58		
-750	225	31		
-750	250	27		
-750	275	29		
-750	300	30		
-725	-700	140		
-725	-675	64		
-725	-650	OS*		19 E-W
-725	-625	200		
-725	-600	199		
-725	-575	140		
-725	-550	140		
-725	-525	180		
-725	-500	300		
-725	-475	56		
-725	-450	680		
-725	-425	320		
-725	-400	300		
-725	-375	320		
-725	-350	76		
-725	-325	66		
-725	-300	280		
-725	-275	160		
-725	-250	260		
-725	-225	340		
-725	-200	160		
-725	-175	100		
-725	-150	130		
-725	-125	OS*		100 E-W

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-725	-100	280		
-725	-75	150		
-725	-50	560		
-725	-25	315		
-725	0	27		
-725	25	340		
-725	50	20		
-725	75	110		
-725	100	250		
-725	125	155		
-725	150	56		
-725	175	130		
-725	200	76		
-725	225	NR**	NR	
-725	250	39		
-725	275	72		
-725	300	14		
-700	-700	85		
-700	-675	195		
-700	-650	NR**	NR	
-700	-625	245		
-700	-600	545		
-700	-575	200		
-700	-550	180		
-700	-525	185		
-700	-500	320		
-700	-475	330		
-700	-450	600		
-700	-425	560		
-700	-400	360		
-700	-375	320		
-700	-350	480		
-700	-325	NR**	NR	
-700	-300	530		
-700	-275	780		
-700	-250	440		
-700	-225	510		
-700	-200	265		
-700	-175	240		
-700	-150	180		
-700	-125	90		
-700	-100	110		
-700	-75	290		
-700	-50	300		
-700	-25	230		
-700	0	500		
-700	25	220		
-700	50	240		
-700	75	450		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-700	100	280		
-700	125	240		
-700	150	260		
-700	175	210		
-700	200	220		
-700	225	400		
-700	250	370		
-700	275	220		
-700	300	100		
-700	325	18		
-700	350	84		
-675	-700	58		
-675	-675	6		
-675	-650	720		
-675	-625	160		
-675	-600	560		
-675	-575	260		
-675	-550	240		
-675	-525	160		
-675	-500	540		
-675	-475	420		
-675	-450	420		
-675	-425	280		
-675	-400	560		
-675	-375	290		
-675	-350	130		
-675	-325	440		
-675	-300	380		
-675	-275	70		
-675	-250	400		
-675	-225	420		
-675	-200	300		
-675	-175	440		
-675	-150	290		
-675	-125	295		
-675	-100	185		
-675	-75	240		
-675	-50	54		
-675	-25	320		
-675	0	290		
-675	25	160		
-675	50	220		
-675	75	165		
-675	100	300		
-675	125	300		
-675	150	280		
-675	175	560		
-675	200	370		
-675	225	400		

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EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-675	250	650		
-675	275	460		
-675	300	420		
-675	325	OS*		300 E-W
-675	350	150		
-650	-700	32		
-650	-675	48		
-650	-650	680		
-650	-625	13		
-650	-600	680		
-650	-575	OS*		1 E-W
-650	-550	200		
-650	-525	110		
-650	-500	320		
-650	-475	440		
-650	-450	660		
-650	-425	640		
-650	-400	400		
-650	-375	290		
-650	-350	310		
-650	-325	NR**	NR	
-650	-300	475		
-650	-275	360		
-650	-250	340		
-650	-225	900		
-650	-200	620		
-650	-175	210		
-650	-150	235		
-650	-125	50		
-650	-100	205		
-650	-75	110		
-650	-50	240		
-650	-25	240		
-650	0	325		
-650	25	420		
-650	50	220		
-650	75	240		
-650	100	610		
-650	125	330		
-650	150	195		
-650	175	230		
-650	200	480		
-650	225	220		
-650	250	560		
-650	275	280		
-650	300	510		
-650	325	600		
-650	350	610		
-625	-700	46		

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EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-625	-675	34		
-625	-650	NR**	NR	
-625	-625	OS*		300 E-W
-625	-600	440		
-625	-575	78		
-625	-550	240		
-625	-525	280		
-625	-500	560		
-625	-475	230		
-625	-450	830		
-625	-425	270		
-625	-400	340		
-625	-375	300		
-625	-350	230		
-625	-325	480		
-625	-300	400		
-625	-275	715		
-625	-250	740		
-625	-225	390		
-625	-200	360		
-625	-175	640		
-625	-150	39		
-625	-125	340		
-625	-100	170		
-625	-75	NR**	NR	
-625	-50	NR**	NR	
-625	-25	420		
-625	0	255		
-625	25	250		
-625	50	170		
-625	75	520		
-625	100	300		
-625	125	470		
-625	150	385		
-625	175	320		
-625	200	410		
-625	225	220		
-625	250	400		
-625	275	220		
-625	300	750		
-625	325	945		
-625	350	390		
-600	-700	270		
-600	-675	200		
-600	-650	130		
-600	-625	360		
-600	-600	520		
-600	-575	150		
-600	-550	NR**	NR	

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EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-600	-525	50		
-600	-500	400		
-600	-475	270		
-600	-450	420		
-600	-425	370		
-600	-400	230		
-600	-375	220		
-600	-350	500		
-600	-325	340		
-600	-300	290		
-600	-275	200		
-600	-250	500		
-600	-225	360		
-600	-200	250		
-600	-175	190		
-600	-150	1000		
-600	-125	740		
-600	-100	320		
-600	-75	390		
-600	-50	300		
-600	-25	480		
-600	0	340		
-600	25	500		
-600	50	370		
-600	75	560		
-600	100	230		
-600	125	210		
-600	150	250		
-600	175	290		
-600	200	420		
-600	225	420		
-600	250	190		
-600	275	NR**	NR	
-600	300	400		
-600	325	360		
-600	350	110		
-600	375	560		
-600	400	340		
-600	425	480		
-575	-700	140		
-575	-675	600		
-575	-650	260		
-575	-625	490		
-575	-600	120		
-575	-575	64		
-575	-550	230		
-575	-525	255		
-575	-500	250		
-575	-475	420		

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EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-575	-450	420		
-575	-425	930		
-575	-400	820		
-575	-375	550		
-575	-350	500		
-575	-325	580		
-575	-300	390		
-575	-275	300		
-575	-250	600		
-575	-225	60		
-575	-200	380		
-575	-175	420		
-575	-150	350		
-575	-125	560		
-575	-100	680		
-575	-75	300		
-575	-50	270		
-575	-25	160		
-575	0	300		
-575	25	380		
-575	50	340		
-575	75	450		
-575	100	220		
-575	125	480		
-575	150	580		
-575	175	280		
-575	200	20		
-575	225	700		
-575	250	100		
-575	275	210		
-575	300	26		
-575	325	500		
-575	350	NR**	NR	
-575	375	190		
-575	400	380		
-575	425	250		
-550	-700	120		
-550	-675	180		
-550	-650	300		
-550	-625	450		
-550	-600	300		
-550	-575	240		
-550	-550	185		
-550	-525	185		
-550	-500	420		
-550	-475	410		
-550	-450	470		
-550	-425	270		
-550	-400	295		

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EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-550	-375	480		
-550	-350	58		
-550	-325	510		
-550	-300	500		
-550	-275	430		
-550	-250	OS*		25 E-W
-550	-225	240		
-550	-200	300		
-550	-175	800		
-550	-150	425		
-550	-125	OS*		OS E-W
-550	-100	220		
-550	-75	68		
-550	-50	620		
-550	-25	320		
-550	0	400		
-550	25	320		
-550	50	460		
-550	75	580		
-550	100	440		
-550	125	230		
-550	150	530		
-550	175	360		
-550	200	440		
-550	225	500		
-550	250	490		
-550	275	270		
-550	300	225		
-550	325	300		
-550	350	520		
-550	375	340		
-550	400	400		
-550	425	200		
-525	-700	125		
-525	-675	120		
-525	-650	160		
-525	-625	630		
-525	-600	460		
-525	-575	365		
-525	-550	320		
-525	-525	480		
-525	-500	400		
-525	-475	260		
-525	-450	220		
-525	-425	OS*		OS E-W
-525	-400	50		
-525	-375	280		
-525	-350	440		
-525	-325	400		

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EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-525	-300	360		
-525	-275	520		
-525	-250	420		
-525	-225	560		
-525	-200	400		
-525	-175	600		
-525	-150	OS*		OS E-W
-525	-125	NR**	NR	
-525	-100	150		
-525	-75	400		
-525	-50	480		
-525	-25	560		
-525	0	380		
-525	25	520		
-525	50	480		
-525	75	380		
-525	100	680		
-525	125	420		
-525	150	200		
-525	175	450		
-525	200	440		
-525	225	510		
-525	250	500		
-525	275	440		
-525	300	460		
-525	325	510		
-525	350	280		
-500	-700	190		
-500	-675	380		
-500	-650	360		
-500	-625	350		
-500	-600	240		
-500	-575	740		
-500	-550	460		
-500	-525	560		
-500	-500	590		
-500	-475	790		
-500	-450	420		
-500	-425	175		
-500	-400	520		
-500	-375	500		
-500	-350	360		
-500	-325	450		
-500	-300	620		
-500	-275	110		
-500	-250	390		
-500	-225	390		
-500	-200	420		
-500	-175	360		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-500	-150	620		
-500	-125	640		
-500	-100	410		
-500	-75	440		
-500	-50	260		
-500	-25	840		
-500	0	440		
-500	25	540		
-500	50	510		
-500	75	330		
-500	100	380		
-500	125	250		
-500	150	240		
-500	175	260		
-500	200	300		
-500	225	460		
-500	250	480		
-500	275	460		
-500	300	490		
-475	-700	140		
-475	-675	320		
-475	-650	310		
-475	-625	38		
-475	-600	446		
-475	-575	220		
-475	-550	440		
-475	-525	630		
-475	-500	48		
-475	-475	650		
-475	-450	0.5		
-475	-425	NR**	26	
-475	-400	260		
-475	-375	260		
-475	-350	275		
-475	-325	380		
-475	-300	235		
-475	-275	280		
-475	-250	860		
-475	-225	400		
-475	-200	380		
-475	-175	310		
-475	-150	630		
-475	-125	22		
-475	-100	OS*		74 E-W
-475	-75	370		
-475	-50	730		
-475	-25	220		
-475	0	58		
-475	25	480		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-475	50	340		
-475	75	415		
-475	100	360		
-475	125	440		
-475	150	190		
-475	175	280		
-475	200	220		
-475	225	340		
-475	250	450		
-475	275	460		
-475	300	400		
-450	-700	235		
-450	-675	440		
-450	-650	236		
-450	-625	145		
-450	-600	440		
-450	-575	430		
-450	-550	76		
-450	-525	465		
-450	-500	OS*	35	E-W
-450	-475	490		
-450	-450	NR**	NR	
-450	-425	700		
-450	-400	OS*	1.5	E-W
-450	-375	220		
-450	-350	NR**	NR	
-450	-325	NR**	NR	
-450	-300	640		
-450	-275	390		
-450	-250	320		
-450	-225	430		
-450	-200	350		
-450	-175	290		
-450	-150	200		
-450	-125	NR**	35	E-W
-450	-100	330		
-450	-75	41		
-450	-50	290		
-450	-25	NR**	NR	
-450	0	NR**	30	
-450	25	96		
-450	50	58		
-450	75	110		
-450	100	250		
-450	125	84		
-450	150	25		
-450	175	315		
-450	200	360		
-450	225	340		

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EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-450	250	350		
-450	275	380		
-450	300	380		
-425	-700	270		
-425	-675	496		
-425	-650	880		
-425	-625	480		
-425	-600	480		
-425	-575	550		
-425	-550	360		
-425	-525	OS*	OS	
-425	-500	120		
-425	-475	880		
-425	-450	0.4		
-425	-425	165		
-425	-400	NR**	NR	
-425	-375	14		
-425	-350	380		
-425	-325	65		
-425	-300	290		
-425	-275	380		
-425	-250	300		
-425	-225	120		
-425	-200	330		
-425	-175	890		
-425	-150	360		
-425	-125	205		
-425	-100	100		
-425	-75	170		
-425	-50	580		
-425	-25	260		
-425	0	NR**	1.8	
-425	25	310		
-425	50	NR**	66	
-425	75	180		
-425	100	130		
-425	125	76		
-425	150	195		
-425	175	315		
-425	200	260		
-425	225	290		
-425	250	320		
-425	275	360		
-425	300	315		
-400	-675	750		
-400	-650	460		
-400	-625	570		
-400	-600	560		
-400	-575	500		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-400	-550	630		
-400	-525	OS*		760 E-W (OFFSCALE N-S)
-400	-500	660		
-400	-475	500		
-400	-450	320		
-400	-425	175		
-400	-400	44		
-400	-375	OS*	NR	E-W (OFFSCALE N-S)
-400	-350	OS*	NR	E-W (OFFSCALE N-S)
-400	-325	NR**	NR	
-400	-300	90		
-400	-275	410		
-400	-250	215		
-400	-225	110		
-400	-200	120		
-400	-175	140		
-400	-150	96		
-400	-125	32		
-400	-100	NR**	NR	
-400	-75	OS*		55 E-W (OFFSCALE N-S)
-400	-50	NR**	NR	
-400	-25	170		
-400	0	85		
-400	25	440		
-400	50	64		
-400	75	130		
-400	100	24		
-400	125	NR**	89	
-400	150	320		
-400	175	200		
-400	200	320		
-400	225	110		
-400	250	320		
-400	275	320		
-400	300	300		
-375	-700	230		
-375	-675	600		
-375	-650	540		
-375	-625	580		
-375	-600	440		
-375	-575	580		
-375	-550	380		
-375	-525	320		
-375	-500	340		
-375	-475	560		
-375	-450	240		
-375	-425	480		
-375	-400	900		
-375	-375	7		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-375	-350	NR**	NR	
-375	-325	NR**	30	
-375	-300	NR**	NR	
-375	-275	150		
-375	-250	NR**	NR	
-375	-225	190		
-375	-200	52		
-375	-175	NR**	NR	
-375	-150	120		
-375	-125	560		
-375	-100	NR**	NR	
-375	-75	NR**	NR	
-375	-50	NR**	NR	
-375	-25	680		
-375	0	340		
-375	25	570		
-375	50	280		
-375	75	NR**	60	
-375	100	52		
-375	125	82		
-375	150	330		
-375	175	265		
-375	200	320		
-375	225	360		
-375	250	300		
-375	275	290		
-375	300	250		
-350	-700	210		
-350	-675	620		
-350	-650	660		
-350	-625	540		
-350	-600	500		
-350	-575	560		
-350	-550	480		
-350	-525	640		
-350	-500	690		
-350	-475	680		
-350	-450	300		
-350	-425	900		
-350	-400	880		
-350	-375	260		
-350	-350	580		
-350	-325	300		
-350	-300	OS*		60 E-W
-350	-275	NR**	12	
-350	-250	140		
-350	-225	100		
-350	-200	NR**	50	
-350	-175	NR**	NR	

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EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-350	-150	110		
-350	-125	300		
-350	-100	300		
-350	-75	160		
-350	-50	360		
-350	-25	300		
-350	0	110		
-350	25	78		
-350	50	42		
-350	75	NR**	16	
-350	100	NR**	NR	
-350	125	NR**	NR	
-350	150	260		
-350	175	225		
-350	200	320		
-350	225	360		
-350	250	340		
-350	275	250		
-350	300	370		
-325	-700	210		
-325	-675	580		
-325	-650	440		
-325	-625	560		
-325	-600	520		
-325	-575	520		
-325	-550	180		
-325	-525	660		
-325	-500	300		
-325	-475	420		
-325	-450	490		
-325	-425	520		
-325	-400	760		
-325	-375	800		
-325	-350	720		
-325	-325	320		
-325	-300	NR**	12	E-W
-325	-275	20		
-325	-250	110		
-325	-225	32		
-325	-200	70		
-325	-175	NR**	64	
-325	-150	NR**	10	
-325	-125	NR**	24	E-W
-325	-100	560		
-325	-75	300		
-325	-50	20		
-325	-25	880		
-325	0	NR**	NR	
-325	25	OS*		28 E-W

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EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-325	50	NR**	NR	
-325	75	NR**	NR	
-325	100	NR**	70	E-W
-325	125	NR**	42	
-325	150	260		
-325	175	420		
-325	200	420		
-325	225	470		
-325	250	295		
-325	275	290		
-325	300	300		
-300	-700	145		
-300	-675	620		
-300	-650	420		
-300	-625	640		
-300	-600	450		
-300	-575	420		
-300	-550	OS*	640	E-W (OFF-SCALE N-S
-300	-525	940		
-300	-500	260		
-300	-475	110		
-300	-450	640		
-300	-425	520		
-300	-400	460		
-300	-375	500		
-300	-350	250		
-300	-325	NR**	NR	
-300	-300	84		
-300	-275	380		
-300	-250	OS*	56	E-W (OFF-SCALE N-S
-300	-225	NR**	NR	
-300	-200	54		
-300	-175	NR**	NR	
-300	-150	NR**	NR	
-300	-125	NR**	NR	
-300	-100	NR**	53	
-300	-75	NR**	NR	
-300	-50	230		
-300	-25	140		
-300	0	280		
-300	25	62		62 E-W (OFF-SCALE N-S
-300	50	OS*		28 E-W (OFF-SCALE N-S
-300	75	OS*		64 E-W (OFF-SCALE N-S
-300	100	OS*	40	
-300	125	OS*	50	
-300	150	340		
-300	175	500		
-300	200	400		
-300	225	480		

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EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-300	250	360		
-300	275	220		
-300	300	240		
-275	-700	230		
-275	-675	620		
-275	-650	310		
-275	-625	630		
-275	-600	510		
-275	-575	OS*		
-275	-550	340		
-275	-525	440		
-275	-500	110		
-275	-475	440		
-275	-450	740		
-275	-425	200		
-275	-400	520		
-275	-375	600		
-275	-350	NR**	NR	
-275	-325	280		
-275	-300	200		
-275	-275	NR**	10	
-275	-250	NR**	NR	
-275	-225	NR**	NR	
-275	-200	NR**	54	
-275	-175	NR**	30	
-275	-150	105		
-275	-125	NR**	NR	
-275	-100	100		
-275	-75	NR**	NR	
-275	-50	480		
-275	-25	180		
-275	0	300		
-275	25	98		
-275	50	76		
-275	75	90		
-275	100	110		
-275	125	210		
-275	150	440		
-275	175	450		
-275	200	270		
-275	225	415		
-275	250	240		
-275	275	225		
-275	300	210		
-250	-700	180		
-250	-675	280		
-250	-650	400		
-250	-625	620		
-250	-600	540		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-250	-575	440		
-250	-550	680		
-250	-525	680		
-250	-500	440		
-250	-475	560		
-250	-450	880		
-250	-425	790		
-250	-400	140		
-250	-375	700		
-250	-350	NR**	NR	
-250	-325	NR**	NR	
-250	-300	60		
-250	-275	26		
-250	-250	135		
-250	-225	NR**	NR	
-250	-200	135		
-250	-175	50		
-250	-150	5		
-250	-125	NR**	1.2	
-250	-100	16		
-250	-75	540		
-250	-50	NR**	NR	
-250	-25	NR**	50	
-250	0	NR**	NR	
-250	25	260		
-250	50	34		
-250	75	38		
-250	100	110		
-250	125	150		
-250	150	380		
-250	175	480		
-250	200	310		
-250	225	340		
-250	250	460		
-250	275	360		
-250	300	300		
-225	-700	150		
-225	-675	390		
-225	-650	500		
-225	-625	750		
-225	-600	580		
-225	-575	440		
-225	-550	130		
-225	-525	290		
-225	-500	740		
-225	-475	250		
-225	-450	440		
-225	-425	550		
-225	-400	750		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-225	-375	640		
-225	-350	NR**	15	E-W
-225	-325	NR**	NR	
-225	-300	110		
-225	-275	NR**	NR	
-225	-250	NR**	53	
-225	-225	NR**	75	
-225	-200	135		
-225	-175	70		
-225	-150	NR**	NR	
-225	-125	52		
-225	-100	NR**	0.3	
-225	-75	NR**	NR	
-225	-50	25		
-225	-25	NR**	NR	
-225	0	36		
-225	25	130		
-225	50	20		
-225	75	260		
-225	100	230		
-225	125	300		
-225	150	365		
-225	175	360		
-225	200	380		
-225	225	460		
-225	250	520		
-225	275	340		
-225	300	340		
-200	-700	190		
-200	-675	650		
-200	-650	600		
-200	-625	600		
-200	-600	180		
-200	-575	540		
-200	-550	680		
-200	-525	280		
-200	-500	160		
-200	-475	21		
-200	-450	540		
-200	-425	560		
-200	-400	720		
-200	-375	200		
-200	-350	460		
-200	-325	110		
-200	-300	NR**	120	
-200	-275	NR**	30	
-200	-250	190		
-200	-225	220		
-200	-200	130		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-200	-175	OS*		0.6 E-W (OFF-SCALE N-S
-200	-150	NR**	64	
-200	-125	NR**	20	
-200	-100	NR**	23	
-200	-75	700		
-200	-50	330		
-200	-25	420		
-200	0	110		
-200	25	NR**	20	
-200	50	NR**	50	
-200	75	130		
-200	100	240		
-200	125	340		
-200	150	340		
-200	175	340		
-200	200	490		
-200	225	460		
-200	250	430		
-200	275	400		
-200	300	330		
-175	-700	165		
-175	-675	360		
-175	-650	540		
-175	-625	640		
-175	-600	400		
-175	-575	360		
-175	-550	380		
-175	-525	540		
-175	-500	38		
-175	-475	56		
-175	-450	300		
-175	-425	600		
-175	-400	540		
-175	-375	NR**	19	
-175	-350	NR**	NR	
-175	-325	800		
-175	-300	NR**	NR	
-175	-275	NR**	NR	
-175	-250	NR**	NR	
-175	-225	255		
-175	-200	NR**	NR	
-175	-175	NR**	NR	
-175	-150	NR**	24	
-175	-125	NR**	82	
-175	-100	260		
-175	-75	230		
-175	-50	540		
-175	-25	250		
-175	0	160		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-175	25	190		
-175	50	44		
-175	75	110		
-175	100	190		
-175	125	340		
-175	150	320		
-175	175	320		
-175	200	410		
-175	225	420		
-175	250	440		
-175	275	320		
-175	300	360		
-150	-700	170		
-150	-675	470		
-150	-650	440		
-150	-625	360		
-150	-600	360		
-150	-575	370		
-150	-550	700		
-150	-525	NR**	NR	
-150	-500	38		
-150	-475	NR**	30	
-150	-450	230		
-150	-425	NR**	68	
-150	-400	OS*		38 E-W (OFF-SCALE N-S
-150	-375	870		
-150	-350	NR**	NR	
-150	-325	NR**	26	
-150	-300	480		
-150	-275	380		
-150	-250	195		
-150	-225	NR**	15	E-W
-150	-200	760		
-150	-175	50		
-150	-150	NR**	NR	
-150	-125	640		
-150	-100	240		
-150	-75	600		
-150	-50	500		
-150	-25	100		
-150	0	300		
-150	25	100		
-150	50	48		
-150	75	420		
-150	100	300		
-150	125	340		
-150	150	300		
-150	175	210		
-150	200	320		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-150	225	380		
-150	250	280		
-150	275	170		
-150	300	190		
-125	-700	170		
-125	-675	480		
-125	-650	700		
-125	-625	590		
-125	-600	300		
-125	-575	280		
-125	-550	550		
-125	-525	NR**	46	
-125	-500	130		
-125	-475	64		
-125	-450	290		
-125	-425	NR**	31	
-125	-400	NR**	50	
-125	-375	500		
-125	-350	NR**	1.0	E-W
-125	-325	710		
-125	-300	460		
-125	-275	480		
-125	-250	50		
-125	-225	80		
-125	-200	200		
-125	-175	380		
-125	-150	480		
-125	-125	920		
-125	-100	220		
-125	-75	540		
-125	-50	380		
-125	-25	NR**	NR	
-125	0	48		
-125	25	18		
-125	50	160		
-125	75	380		
-125	100	360		
-125	125	370		
-125	150	340		
-125	175	320		
-125	200	360		
-125	225	360		
-125	250	250		
-125	275	90		
-125	300	170		
-100	-700	190		
-100	-675	450		
-100	-650	740		
-100	-625	860		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-100	-600	320		
-100	-575	520		
-100	-550	80		
-100	-525	51		
-100	-500	190		
-100	-475	200		
-100	-450	420		
-100	-425	60		
-100	-400	90		
-100	-375	NR**	NR	
-100	-350	NR**	NR	
-100	-325	NR**	NR	
-100	-300	480		
-100	-275	420		
-100	-250	80		
-100	-225	230		
-100	-200	NR**	NR	
-100	-175	440		
-100	-150	780		
-100	-125	NR**	NR	
-100	-100	NR**	NR	
-100	-75	230		
-100	-50	480		
-100	-25	NR**	NR	
-100	0	NR**	NR	
-100	25	11		
-100	50	120		
-100	75	370		
-100	100	280		
-100	125	400		
-100	150	410		
-100	175	420		
-100	200	440		
-100	225	320		
-100	250	120		
-100	275	110		
-100	300	170		
-75	-700	160		
-75	-675	420		
-75	-650	460		
-75	-625	540		
-75	-600	200		
-75	-575	300		
-75	-550	270		
-75	-525	640		
-75	-500	430		
-75	-475	250		
-75	-450	220		
-75	-425	NR**	NR	

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-75	-400	290		
-75	-375	400		
-75	-350	NR**	100	
-75	-325	NR**	10	E-W
-75	-300	580		
-75	-275	OS*		>1000 OFF SCALE
-75	-250	360		
-75	-225	NR**	NR	
-75	-200	NR**	NR	
-75	-175	NR**	NR	
-75	-150	460		
-75	-125	98		
-75	-100	OS*		42 E-W (OFF-SCALE N-S
-75	-75	3		
-75	-50	320		
-75	-25	800		
-75	0	180		
-75	25	28		
-75	50	NR**	34	
-75	75	180		
-75	100	270		
-75	125	210		
-75	150	460		
-75	175	400		
-75	200	340		
-75	225	230		
-75	250	200		
-75	275	80		
-75	300	140		
-50	-700	140		
-50	-675	460		
-50	-650	380		
-50	-625	560		
-50	-600	680		
-50	-575	290		
-50	-550	520		
-50	-525	680		
-50	-500	280		
-50	-475	79		
-50	-450	2		
-50	-425	115		
-50	-400	560		
-50	-375	380		
-50	-350	700		
-50	-325	NR**	10	
-50	-300	510		
-50	-275	330		
-50	-250	NR**	NR	
-50	-225	NR**	NR	

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-50	-200	100		
-50	-175	NR**	50	
-50	-150	NR**	1.4	
-50	-125	300		
-50	-100	205		
-50	-75	460		
-50	-50	320		
-50	-25	52		
-50	0	110		
-50	25	59		
-50	50	30		
-50	75	200		
-50	100	220		
-50	125	360		
-50	150	380		
-50	175	420		
-50	200	400		
-50	225	240		
-50	250	280		
-50	275	160		
-50	300	270		
-25	-700	140		
-25	-675	320		
-25	-650	415		
-25	-625	340		
-25	-600	150		
-25	-575	330		
-25	-550	280		
-25	-525	600		
-25	-500	38		
-25	-475	380		
-25	-450	NR**	80	
-25	-425	50		
-25	-400	270		
-25	-375	320		
-25	-350	320		
-25	-325	200		
-25	-300	810		
-25	-275	580		
-25	-250	NR**	110	E-W
-25	-225	NR**	0.4	
-25	-200	72		
-25	-175	NR**	NR	
-25	-150	NR**	NR	
-25	-125	NR**	28	
-25	-100	300		
-25	-75	225		
-25	-50	300		
-25	-25	38		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
-25	0	NR**	NR	
-25	25	120		
-25	50	200		
-25	75	420		
-25	100	340		
-25	125	380		
-25	150	560		
-25	175	470		
-25	200	250		
-25	225	340		
-25	250	380		
-25	275	360		
-25	300	170		
0	-700	170		
0	-675	240		
0	-650	220		
0	-625	260		
0	-600	660		
0	-575	280		
0	-550	19		
0	-525	175		
0	-500	360		
0	-475	440		
0	-450	190		
0	-425	580		
0	-400	300		
0	-375	26		
0	-350	440		
0	-325	800		
0	-300	380		
0	-275	65		
0	-250	OS*		62 E-W (OFF-SCALE N-S
0	-225	OS*		300 E-W (OFF-SCALE N-S
0	-200	400		
0	-175	190		
0	-150	320		
0	-125	280		
0	-100	200		
0	-75	440		
0	-50	150		
0	-25	OS*		980 E-W (OFF-SCALE N-S
0	0	48		
0	25	170		
0	50	205		
0	75	400		
0	100	300		
0	125	60		
0	150	280		
0	175	260		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
0	200	230		
0	225	220		
0	250	220		
0	275	175		
0	300	210		
0	325	420		
0	350	300		
0	375	270		
0	400	280		
0	425	300		
25	-700	150		
25	-675	210		
25	-650	NR**	31	
25	-625	90		
25	-600	390		
25	-575	300		
25	-550	44		
25	-525	155		
25	-500	30		
25	-475	11		
25	-450	220		
25	-425	760		
25	-400	390		
25	-375	470		
25	-350	140		
25	-325	560		
25	-300	640		
25	-275	300		
25	-250	150		
25	-225	360		
25	-200	320		
25	-175	52		
25	-150	290		
25	-125	185		
25	-100	65		
25	-75	400		
25	-50	670		
25	-25	460		
25	0	460		
25	25	620		
25	50	380		
25	75	350		
25	100	520		
25	125	620		
25	150	210		
25	175	320		
25	200	300		
25	225	340		
25	250	320		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
25	275	340		
25	300	380		
25	325	160		
25	350	165		
25	350	180		
50	-700	150		
50	-675	195		
50	-650	380		
50	-625	570		
50	-600	200		
50	-575	340		
50	-550	NR**	11	
50	-525	170		
50	-500	140		
50	-475	NR**	NR	
50	-450	500		
50	-425	880		
50	-400	680		
50	-375	560		
50	-350	330		
50	-325	365		
50	-300	410		
50	-275	145		
50	-250	110		
50	-225	340		
50	-200	400		
50	-175	250		
50	-150	NR**	780	E-W
50	-125	90		
50	-100	OS*	30	E-W (OFF-SCALE N-S
50	-75	NR**	70	E-W
50	-50	NR**	130	E-W
50	-25	335		
50	0	NR**	NR	
50	25	10		
50	50	410		
50	75	400		
50	100	400		
50	125	400		
50	150	300		
50	175	415		
50	200	300		
50	225	195		
50	250	190		
50	275	280		
50	300	320		
50	325	145		
50	350	100		
75	-700	200		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
75	-675	380		
75	-650	520		
75	-625	530		
75	-600	550		
75	-575	440		
75	-550	540		
75	-525	380		
75	-500	420		
75	-475	300		
75	-450	130		
75	-425	300		
75	-400	195		
75	-375	400		
75	-350	560		
75	-325	620		
75	-300	340		
75	-275	215		
75	-250	520		
75	-225	48		
75	-200	240		
75	-175	540		
75	-150	360		
75	-125	520		
75	-100	400		
75	-75	NR**	12	
75	-50	270		
75	-25	260		
75	0	NR**	2	
75	25	300		
75	50	430		
75	75	610		
75	100	475		
75	125	280		
75	150	480		
75	175	500		
75	200	180		
75	225	160		
75	250	210		
75	275	340		
75	300	400		
75	325	220		
75	350	150		
100	-700	200		
100	-675	260		
100	-650	370		
100	-625	420		
100	-600	370		
100	-575	480		
100	-550	250		

APPENDIX A

EM-31 GROUND CONDUCTIVITY

Northing	Easting	Oper(mS)	Phase(mS)	Comments
100	-525	710		
100	-500	340		
100	-475	270		
100	-450	380		
100	-425	260		
100	-400	420		
100	-375	340		
100	-350	300		
100	-325	400		
100	-300	OS*		120 E-W (OFF-SCALE N-S
100	-275	420		
100	-250	410		
100	-225	700		
100	-200	17		
100	-175	OS*		80 E-W (OFF-SCALE N-S
100	-150	220		
100	-125	260		
100	-100	245		
100	-75	NR**	NR	
100	-50	180		
100	-25	240		
100	0	280		
100	25	410		
100	50	460		
100	75	100		
100	100	200		
100	125	300		
100	150	360		
100	175	180		
100	200	190		
100	225	260		
100	250	280		
100	275	290		
100	300	400		
100	325	63		
100	350	100		

NOTES: * - Reading was off scale.
** - No reading.

APPENDIX B

APPENDIX B

MAG SURVEY DATA

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-800	-700	10000	
-800	-675	9500	
-800	-650	10000	
-800	-625	10000	
-800	-600	10000	
-800	-575	9500	
-800	-550	10000	
-800	-525	10000	
-800	-500	10000	
-800	-475	10000	
-800	-450	10000	
-800	-425	10000	
-800	-400	10000	
-800	-375	10000	
-800	-350	10000	
-800	-325	10000	
-800	-300	10000	
-800	-275	10000	
-800	-250	10000	
-800	-225	10500	
-800	-200	10000	
-800	-175	10000	
-800	-150	10000	
-800	-125	10000	
-800	-100	10000	
-800	-75	10000	
-800	-50	10500	
-800	-25	10000	
-800	0	9500	
-800	25	9500	
-800	50	11500	
-800	75	10000	
-800	100	10000	
-800	125	10000	
-800	150	10000	
-800	175	10000	
-800	200	10000	
-800	225	10000	
-800	250	10000	
-800	275	10000	
-800	300	10000	
-775	-700	10000	
-775	-675	9500	
-775	-650	9500	
-775	-625	10000	
-775	-600	10000	
-775	-575	9500	
-775	-550	10000	
-775	-525	9500	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-775	-500	10000	
-775	-475	10000	
-775	-450	10500	
-775	-425	10000	
-775	-400	10000	
-775	-375	10000	
-775	-350	10000	
-775	-325	10000	
-775	-300	10000	
-775	-275	10000	
-775	-250	10000	
-775	-225	10000	
-775	-200	10500	
-775	-175	10000	
-775	-150	10000	
-775	-125	10500	
-775	-100	10000	
-775	-75	10000	
-775	-50	10000	
-775	-25	10000	
-775	0	10000	
-775	25	10000	
-775	50	10000	
-775	75	10500	
-775	100	10000	
-775	125	10000	
-775	150	10000	
-775	175	10000	
-775	200	10000	
-775	225	10000	
-775	250	10000	
-775	275	10000	
-775	300	10000	
-750	-700	10000	
-750	-675	9500	
-750	-650	10000	
-750	-625	9500	
-750	-600	10000	
-750	-575	10000	
-750	-550	10000	
-750	-525	10000	
-750	-500	10500	
-750	-475	10000	
-750	-450	9500	
-750	-425	10000	
-750	-400	10000	
-750	-375	10000	
-750	-350	10000	
-750	-325	10000	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-750	-300	10000	
-750	-275	10000	
-750	-250	10000	
-750	-225	10000	
-750	-200	10000	
-750	-175	10000	
-750	-150	10000	
-750	-125	10000	
-750	-100	10000	
-750	-75	10000	
-750	-50	10500	
-750	-25	10000	
-750	0	10000	
-750	25	10000	
-750	50	10000	
-750	75	10000	
-750	100	10000	
-750	125	11000	
-750	150	10000	
-750	175	10000	
-750	200	10000	
-750	225	10000	
-750	250	10000	
-750	275	10000	
-750	300	10000	
-725	-700	9500	
-725	-675	10000	
-725	-650	10000	
-725	-625	10000	
-725	-600	10000	
-725	-575	10000	
-725	-550	10000	
-725	-525	10000	
-725	-500	10000	
-725	-475	10000	
-725	-450	10500	
-725	-425	10000	
-725	-400	10500	
-725	-375	10500	
-725	-350	10000	
-725	-325	10000	
-725	-300	10000	
-725	-275	10000	
-725	-250	10500	
-725	-225	10000	
-725	-200	10000	
-725	-175	10000	
-725	-150	10000	
-725	-125	10000	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-725	-100	10000	
-725	-75	10000	
-725	-50	10000	
-725	-25	10000	
-725	0	10000	
-725	25	10000	
-725	50	10000	
-725	75	10000	
-725	100	10000	
-725	125	10000	
-725	150	10000	
-725	175	10000	
-725	200	10000	
-725	225	10000	
-725	250	10500	
-725	275	10000	
-725	300	10000	
-709	-246	19500	STAKED
-700	-700	9200	
-700	-675	9000	
-700	-650	9200	
-700	-625	9900	
-700	-600	9200	
-700	-575	9600	
-700	-550	9200	
-700	-525	9400	
-700	-500	9800	
-700	-475	9600	
-700	-450	9400	
-700	-425	9800	
-700	-400	9200	
-700	-375	9600	
-700	-350	9400	
-700	-325	9800	
-700	-300	9800	
-700	-275	14000	
-700	-250	8600	
-700	-225	11500	
-700	-200	10500	
-700	-175	10500	
-700	-150	9000	
-700	-125	9600	
-700	-100	9400	
-700	-75	9800	
-700	-50	9200	
-700	-25	9800	
-700	0	10500	
-700	25	9600	
-700	50	9600	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-700	75	9800	
-700	100	9400	
-700	125	9800	
-700	150	9800	
-700	175	9800	
-700	200	9400	
-700	225	9600	
-700	250	10000	
-700	275	10000	
-700	300	10000	
-700	325	10000	
-700	350	10000	
-675	-700	8600	
-675	-675	9000	
-675	-650	9200	
-675	-625	9400	
-675	-600	9400	
-675	-575	9500	
-675	-550	9000	
-675	-525	9400	
-675	-500	9200	
-675	-475	9400	
-675	-450	9600	
-675	-425	9600	
-675	-400	9400	
-675	-375	9800	
-675	-350	9600	
-675	-325	9400	
-675	-300	9800	
-675	-275	7800	
-675	-250	9000	
-675	-225	11500	
-675	-200	11000	
-675	-175	11000	
-675	-150	10500	
-675	-125	9800	
-675	-100	9400	
-675	-75	10000	
-675	-50	9400	
-675	-25	9800	
-675	0	9600	
-675	25	9800	
-675	50	9600	
-675	75	9800	
-675	100	9600	
-675	125	9800	
-675	150	9800	
-675	175	9800	
-675	200	9400	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-675	225	9800	
-675	250	9800	
-675	275	10000	
-675	300	9600	
-675	325	10000	
-675	350	10000	
-650	-700	6400	
-650	-675	8000	-8000 METAL POST
-650	-650	8800	
-650	-625	9400	
-650	-600	9400	
-650	-575	9600	
-650	-550	9400	
-650	-525	9400	
-650	-500	9200	
-650	-475	9400	
-650	-450	9200	
-650	-425	9600	
-650	-400	9200	
-650	-375	9600	
-650	-350	9800	
-650	-325	8800	
-650	-300	9800	
-650	-275	8600	
-650	-250	9600	
-650	-225	11000	
-650	-200	10500	
-650	-175	10500	
-650	-150	10500	
-650	-125	10000	
-650	-100	10000	
-650	-75	9600	
-650	-50	9600	
-650	-25	9800	
-650	0	9600	
-650	25	13500	
-650	28	1600	STAKED
-650	50	9400	
-650	75	9600	
-650	100	10000	
-650	125	9600	
-650	150	9600	
-650	175	10500	
-650	200	9800	
-650	225	10000	
-650	250	8200	
-650	275	10000	
-650	300	10000	
-650	325	10000	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-650	350	9200	
-625	-700	6500	
-625	-675	8800	
-625	-650	8600	
-625	-625	9400	
-625	-600	9200	
-625	-575	9800	
-625	-550	9200	
-625	-525	10000	
-625	-500	9200	
-625	-475	9400	
-625	-450	9400	
-625	-425	9400	
-625	-400	8400	
-625	-375	9400	
-625	-350	9000	
-625	-325	9600	
-625	-300	9200	
-625	-275	9600	
-625	-250	9600	
-625	-225	11500	
-625	-200	11000	
-625	-175	10500	
-625	-150	10500	
-625	-125	9200	
-625	-100	9400	
-625	-75	9800	
-625	-50	9600	
-625	-25	9800	
-625	0	9800	
-625	25	9800	
-625	50	9800	
-625	75	9200	
-625	100	9600	
-625	125	9800	
-625	150	9600	
-625	175	9800	
-625	200	10000	
-625	225	10000	
-625	250	9600	
-625	275	9600	
-625	300	8000	
-625	325	10000	
-625	350	10000	
-613	-350	14500	
-602	-455	16500	STAKED
-601	-380	24500	STAKED
-600	-700	10000	
-600	-675	10000	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-600	-650	10000	
-600	-625	10500	
-600	-600	11000	
-600	-575	10500	
-600	-550	10500	
-600	-525	10500	
-600	-500	10500	
-600	-475	10500	
-600	-450	12500	
-600	-425	10500	
-600	-400	10500	
-600	-375	14500	
-600	-350	10000	
-600	-325	10500	
-600	-300	14500	
-600	-275	10500	
-600	-250	10500	
-600	-225	10500	
-600	-200	10500	
-600	-175	10500	
-600	-150	10500	
-600	-125	10500	
-600	-100	10500	
-600	-75	10500	
-600	-50	10500	
-600	-25	10500	
-600	0	10500	
-600	25	10500	
-600	50	10500	
-600	75	10500	
-600	100	10500	
-600	125	10500	
-600	150	10500	
-600	175	10500	
-600	200	10500	
-600	225	10500	
-600	250	10500	
-600	275	11000	
-600	300	11000	
-600	325	11000	
-600	350	10500	
-600	375	6800	
-600	400	11000	
-600	425	7400	OS WELL,value
-599	-302	15500	STAKED
-594	-394	19500	STAKED
-580	-400	2000	
-575	-700	10000	
-575	-675	10000	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-575	-650	10500	
-575	-625	10500	
-575	-600	10500	
-575	-575	10500	
-575	-550	10500	
-575	-525	11000	
-575	-500	10500	
-575	-475	10500	
-575	-450	10500	
-575	-425	10500	
-575	-400	7000	
-575	-375	10500	
-575	-350	10000	
-575	-325	10000	
-575	-300	9500	
-575	-275	10500	
-575	-250	10500	
-575	-225	10500	
-575	-200	10500	
-575	-175	10500	
-575	-150	10500	
-575	-125	10500	
-575	-100	10500	
-575	-75	10500	
-575	-50	10500	
-575	-25	10500	
-575	0	7400	-7400 WELL CASING
-575	25	10500	
-575	50	10500	
-575	75	10500	
-575	100	10500	
-575	125	10500	
-575	150	10500	
-575	175	10500	
-575	200	10500	
-575	225	10500	
-575	250	10500	
-575	275	10500	
-575	300	11000	
-575	325	10500	
-575	350	10500	
-575	375	11000	
-575	400	10500	
-575	425	9500	
-550	-700	10000	
-550	-675	10000	
-550	-650	10500	
-550	-625	10000	
-550	-600	10500	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-550	-575	10500	
-550	-550	10500	
-550	-525	10500	
-550	-500	10500	
-550	-475	10500	
-550	-450	11000	
-550	-425	10500	
-550	-400	10500	
-550	-375	10500	
-550	-350	10500	
-550	-325	12000	
-550	-300	10500	
-550	-275	10500	
-550	-250	9500	
-550	-225	10500	
-550	-200	10500	
-550	-175	10500	
-550	-150	10500	
-550	-125	10500	
-550	-100	10500	
-550	-75	10500	
-550	-50	10500	
-550	-25	10500	
-550	0	10500	
-550	25	10500	
-550	50	10500	
-550	75	10500	
-550	100	10500	
-550	125	10500	
-550	150	10500	
-550	175	10500	
-550	200	11000	
-550	225	10500	
-550	250	10500	
-550	275	10500	
-550	300	10500	
-550	325	10500	
-550	350	10500	
-550	375	10500	
-550	400	10500	
-550	425	9500	
-544	-318	25500	STAKED
-537	-314	5000	-5000
-532	-44	16500	STAKED
-525	-700	10000	
-525	-675	10500	
-525	-650	11000	
-525	-625	10500	
-525	-600	10500	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-525	-575	10000	
-525	-550	10500	
-525	-525	10500	
-525	-500	10500	
-525	-475	11000	
-525	-450	10500	
-525	-425	10500	
-525	-400	10500	
-525	-375	10500	
-525	-350	10500	
-525	-325	10000	
-525	-300	10500	
-525	-275	10500	
-525	-250	10500	
-525	-225	10500	
-525	-200	10500	
-525	-175	10500	
-525	-150	10500	
-525	-125	10500	
-525	-100	10500	
-525	-75	10500	
-525	-50	11000	
-525	-25	8200	
-525	0	10500	
-525	25	10500	
-525	50	10500	
-525	75	10500	
-525	100	10500	
-525	125	10500	
-525	150	10500	
-525	175	10500	
-525	200	10500	
-525	225	10500	
-525	250	10500	
-525	275	10500	
-525	300	10500	
-525	325	10500	
-525	350	10500	
-500	-700	9500	
-500	-675	10000	
-500	-650	10000	
-500	-625	10000	
-500	-600	9500	
-500	-575	10500	
-500	-550	10000	
-500	-525	10000	
-500	-500	10000	
-500	-475	10000	
-500	-450	10000	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-500	-425	10000	
-500	-400	10000	
-500	-375	10000	
-500	-350	10000	
-500	-325	10000	
-500	-300	10000	
-500	-275	10000	
-500	-250	10000	
-500	-225	10000	
-500	-200	10000	
-500	-175	10000	
-500	-150	10000	
-500	-125	10000	
-500	-100	10000	
-500	-75	10000	
-500	-50	10000	
-500	-25	10000	
-500	0	10000	
-500	25	10500	
-500	50	10000	
-500	75	9500	
-500	100	10000	
-500	125	10000	
-500	150	10000	
-500	175	10000	
-500	200	10500	
-500	225	10000	
-500	250	10000	
-500	275	11000	
-500	300	10000	
-475	-700	10000	
-475	-675	10500	
-475	-650	9000	
-475	-625	10000	
-475	-600	9500	
-475	-575	9500	
-475	-550	10000	
-475	-525	10000	
-475	-500	10000	
-475	-475	10000	
-475	-450	10500	
-475	-425	10000	
-475	-400	10000	
-475	-375	10000	
-475	-350	10000	
-475	-325	10000	
-475	-300	10000	
-475	-275	10000	
-475	-250	10000	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-475	-225	10000	
-475	-200	10500	
-475	-175	10000	
-475	-150	10000	
-475	-125	10000	
-475	-100	10000	
-475	-75	10000	
-475	-50	10500	ON GROUND
-475	-25	10000	
-475	0	10000	
-475	25	10500	
-475	50	10000	
-475	75	10000	
-475	100	10000	
-475	125	10500	
-475	150	10500	
-475	175	10500	
-475	200	9500	
-475	225	10000	
-475	250	10000	
-475	275	10500	
-475	300	10500	
-459	-650	16000	STAKED
-450	-700	10000	
-450	-675	9500	
-450	-650	12500	
-450	-625	10000	
-450	-600	10000	
-450	-575	10500	
-450	-550	10000	
-450	-525	10000	
-450	-500	10500	
-450	-475	10000	
-450	-450	10500	
-450	-425	10000	
-450	-400	10500	
-450	-375	10000	
-450	-350	10000	
-450	-325	10000	
-450	-300	10000	
-450	-275	10000	
-450	-250	10500	
-450	-225	10000	
-450	-200	10000	
-450	-175	10000	
-450	-150	9500	
-450	-125	9000	
-450	-100	10000	
-450	-75	10000	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-450	-50	14000	-14000 SCRAP METAL
-450	-25	10500	
-450	0	10000	
-450	25	10000	
-450	50	9500	
-450	75	10000	
-450	100	10000	
-450	125	10500	
-450	150	9500	
-450	175	10500	
-450	200	10000	
-450	225	10000	
-450	250	10000	
-450	275	10500	
-450	300	10000	
-435	-152	17500	STAKED
-425	-700	10000	
-425	-675	10000	
-425	-650	8500	
-425	-625	18000	STAKED
-425	-600	9500	
-425	-575	9500	
-425	-550	10000	
-425	-525	10000	
-425	-500	10500	
-425	-475	10000	
-425	-450	10000	
-425	-425	9500	
-425	-400	10500	
-425	-375	10000	
-425	-350	10500	
-425	-325	9500	
-425	-300	10000	
-425	-275	10000	
-425	-250	10500	
-425	-225	10000	
-425	-200	10000	
-425	-175	10000	
-425	-150	10000	
-425	-125	10000	
-425	-100	9000	
-425	-75	9500	
-425	-50	7000	
-425	-25	11500	
-425	0	10000	
-425	25	10000	
-425	50	10000	
-425	75	10000	
-425	100	10000	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-425	125	10500	
-425	150	10000	
-425	175	10000	
-425	200	10000	
-425	225	10500	
-425	250	10000	
-425	275	10500	
-425	300	10000	
-401	-40	20000	
-400	-700	10000	
-400	-675	9500	
-400	-650	8500	
-400	-625	10500	
-400	-600	10500	
-400	-575	10500	
-400	-550	10500	
-400	-525	11000	
-400	-513	21000	STAKED
-400	-500	10500	
-400	-475	11000	
-400	-450	10500	
-400	-425	10500	
-400	-400	10500	
-400	-375	10500	
-400	-350	10500	
-400	-325	10500	
-400	-300	10500	
-400	-275	10500	
-400	-250	11000	
-400	-225	10500	
-400	-200	10500	
-400	-175	10500	
-400	-150	10500	
-400	-125	10000	
-400	-100	11500	
-400	-75	9500	
-400	-50	12000	
-400	-25	10500	
-400	0	10500	
-400	25	10500	
-400	50	10500	
-400	75	9500	
-400	100	10500	
-400	125	10500	
-400	150	10500	
-400	175	10500	
-400	200	10500	
-400	225	10500	
-400	250	10500	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
-400	275	10500	
-400	300	10500	
-386	-408	19500	STAKED
-375	-700	10000	
-375	-675	10500	
-375	-650	10500	
-375	-625	10500	
-375	-600	10500	
-375	-575	10500	
-375	-550	10500	
-375	-525	10500	
-375	-500	10500	
-375	-475	10500	
-375	-450	10500	
-375	-425	10000	
-375	-400	10000	
-375	-375	10500	
-375	-350	10500	
-375	-325	10500	
-375	-300	10500	
-375	-275	10500	
-375	-250	10000	
-375	-225	10000	
-375	-200	10500	
-375	-175	10500	
-375	-150	11000	
-375	-125	11000	
-375	-100	10500	
-375	-75	10500	
-375	-50	10500	
-375	-25	10500	
-375	0	10500	
-375	25	10500	
-375	50	10500	
-375	75	10000	
-375	100	11000	
-375	125	10500	
-375	150	10500	
-375	175	10500	
-375	200	10500	
-375	225	10500	
-375	250	10500	
-375	275	10500	
-375	300	10500	
-350	-700	10000	
-350	-675	10500	
-350	-650	10500	
-350	-625	10500	
-350	-600	11000	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
-350	-575	10000	
-350	-550	10500	
-350	-525	10500	
-350	-500	10500	
-350	-475	10500	
-350	-450	10500	
-350	-425	10500	
-350	-400	10500	
-350	-375	10500	
-350	-350	10500	
-350	-325	10500	
-350	-300	10500	
-350	-275	10500	
-350	-250	10500	
-350	-225	11000	
-350	-200	10500	
-350	-175	10500	
-350	-150	10000	
-350	-125	10500	
-350	-100	11000	
-350	-75	10500	
-350	-50	10500	
-350	-25	10000	
-350	0	11000	
-350	25	10500	
-350	50	10500	
-350	75	10000	
-350	100	11000	
-350	125	10500	
-350	150	10500	
-350	175	10500	
-350	200	10500	
-350	225	10500	
-350	250	10500	
-350	275	10500	
-350	300	10500	
-342	-3	19000	STAKED
-332	-500	19500	STAKED
-325	-700	10500	
-325	-675	10500	
-325	-650	10500	
-325	-625	10500	
-325	-600	11000	
-325	-575	10500	
-325	-550	11000	
-325	-525	10500	
-325	-500	19000	
-325	-475	10500	
-325	-450	10500	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
-325	-425	10000	
-325	-400	10500	
-325	-375	10500	
-325	-350	10500	
-325	-325	10500	
-325	-300	10500	
-325	-275	10500	
-325	-250	10500	
-325	-225	12000	
-325	-200	10500	
-325	-175	10500	
-325	-150	10500	
-325	-125	10500	
-325	-100	10500	
-325	-75	10500	
-325	-50	10500	
-325	-25	10500	
-325	0	10000	
-325	25	10500	
-325	50	10500	
-325	75	10500	
-325	100	10500	
-325	125	10500	
-325	150	11000	
-325	175	9000	
-325	200	10500	
-325	225	10500	
-325	250	10500	
-325	275	10500	
-325	300	10000	
-321	0	15000	STAKED
-311	-397	22000	STAKED
-300	-700	10500	
-300	-675	10500	
-300	-650	10500	
-300	-625	10500	
-300	-600	9000	
-300	-590	19000	STAKED
-300	-575	11500	
-300	-550	10500	
-300	-525	1600	-1600 STAKED
-300	-500	10000	
-300	-475	11500	
-300	-450	10500	
-300	-425	9500	
-300	-400	9500	
-300	-375	10500	
-300	-350	10500	
-300	-325	11000	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
-300	-300	10500	
-300	-275	11000	
-300	-250	10500	
-300	-225	11000	
-300	-200	10500	
-300	-175	11000	
-300	-150	10500	
-300	-125	11000	
-300	-100	10500	
-300	-75	10500	
-300	-50	11000	
-300	-25	11000	
-300	0	10500	
-300	25	11000	
-300	50	11000	
-300	75	11000	
-300	100	10500	
-300	125	11000	
-300	150	10500	
-300	175	11000	
-300	200	11500	
-300	225	11000	
-300	250	11000	
-300	275	11000	
-300	300	11000	
-286	-550	20000	STAKED
-275	-700	10500	
-275	-675	10500	
-275	-650	10500	
-275	-625	10500	
-275	-600	10000	
-275	-575	11000	
-275	-550	8500	
-275	-525	12000	
-275	-500	10500	
-275	-475	11000	
-275	-450	20500	
-275	-445	28000	STAKED
-275	-425	11000	
-275	-400	11000	
-275	-375	10500	
-275	-350	10500	
-275	-325	11000	
-275	-300	10500	
-275	-275	10500	
-275	-250	11000	
-275	-225	10500	
-275	-200	10500	
-275	-175	11000	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
-275	-150	10500	
-275	-125	11000	
-275	-100	10500	
-275	-75	11500	
-275	-50	10500	
-275	-25	10500	
-275	0	11500	
-275	25	11000	
-275	50	10500	
-275	75	11000	
-275	100	10500	
-275	125	11000	
-275	150	11000	
-275	175	11000	
-275	200	10500	
-275	225	11500	
-275	250	6800	
-275	275	11000	
-275	300	10500	
-265	-535	22500	STAKED
-250	-700	10500	
-250	-675	11500	
-250	-650	12500	
-250	-625	10500	
-250	-601.33	25000	STAKED
-250	-600	23000	
-250	-575	11000	
-250	-550	11000	
-250	-525	8500	
-250	-500	11000	
-250	-475	11000	
-250	-450	10500	
-250	-425	10000	
-250	-400	10500	
-250	-375	10500	
-250	-350	11000	
-250	-325	11000	
-250	-300	10500	
-250	-275	11000	
-250	-250	10500	
-250	-225	10500	
-250	-200	10500	
-250	-175	11000	
-250	-150	10500	
-250	-125	11000	
-250	-100	10500	
-250	-75	11500	
-250	-50	11000	
-250	-25	11000	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
-250	0	11000	
-250	25	11000	
-250	50	11000	
-250	75	11000	
-250	100	11000	
-250	125	11000	
-250	150	10500	
-250	175	11000	
-250	200	10500	
-250	225	11000	
-250	250	11000	
-250	275	11000	
-250	300	10500	
-225	-700	10500	
-225	-675	10000	
-225	-650	9200	
-225	-625	10500	
-225	-600	10500	
-225	-575	11000	
-225	-550	8000	
-225	-525	10500	
-225	-500	10500	
-225	-475	11000	
-225	-450	10500	
-225	-425	10500	
-225	-400	10500	
-225	-375	10500	
-225	-350	10500	
-225	-325	11000	
-225	-300	11000	
-225	-275	11000	
-225	-250	10500	
-225	-225	10500	
-225	-200	11000	
-225	-175	10500	
-225	-150	11500	
-225	-125	11000	
-225	-100	11000	
-225	-75	11000	
-225	-50	11000	
-225	-25	10500	
-225	0	10500	
-225	25	11000	
-225	50	10500	
-225	75	11000	
-225	100	10500	
-225	125	11000	
-225	150	10500	
-225	175	11000	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
-225	200	11000	
-225	225	11000	
-225	250	11000	
-225	275	11000	
-225	300	10500	
-200	-700	10500	
-200	-675	8000	
-200	-650	9500	
-200	-625	10000	
-200	-600	10000	
-200	-575	11000	
-200	-550	11000	
-200	-525	7500	
-200	-500	11500	
-200	-475	10500	
-200	-450	10500	
-200	-425	11000	
-200	-400	10500	
-200	-375	10500	
-200	-350	10500	
-200	-325	10500	
-200	-300	10500	
-200	-275	11000	
-200	-250	10500	
-200	-225	10500	
-200	-200	10500	
-200	-175	10000	
-200	-150	10500	
-200	-125	10500	
-200	-100	10500	
-200	-75	10500	
-200	-50	10500	
-200	-25	10500	
-200	0	10500	
-200	25	10500	
-200	50	10500	
-200	75	10500	
-200	100	10500	
-200	125	10500	
-200	150	10500	
-200	175	11000	
-200	200	10500	
-200	225	11000	
-200	250	11000	
-200	275	10500	
-200	300	10500	
-175	-700	10500	
-175	-675	11500	
-175	-650	9500	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
-175	-625	10500	
-175	-600	10500	
-175	-575	10500	
-175	-550	10500	
-175	-525	10000	
-175	-500	10000	
-175	-475	11000	
-175	-450	10500	
-175	-425	11000	
-175	-400	10500	
-175	-375	10500	
-175	-350	10500	
-175	-325	10500	
-175	-300	11000	
-175	-275	10500	
-175	-250	10500	
-175	-225	10000	
-175	-200	10000	
-175	-175	10500	
-175	-150	10500	
-175	-125	10500	
-175	-100	10500	
-175	-75	10500	
-175	-50	10500	
-175	-25	10500	
-175	0	10500	
-175	25	10500	
-175	50	10000	
-175	75	10500	
-175	100	10500	
-175	125	10500	
-175	150	10500	
-175	175	11000	
-175	200	10500	
-175	225	11000	
-175	250	10500	
-175	275	10500	
-175	300	10500	
-155	-200	19500	
-150	-700	10500	
-150	-675	10500	
-150	-650	10000	
-150	-625	10000	
-150	-600	10000	
-150	-575	10500	
-150	-550	10000	
-150	-525	10000	
-150	-500	10000	
-150	-475	10000	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
-150	-450	10000	
-150	-425	11000	
-150	-400	10500	
-150	-375	8000	
-150	-350	10500	
-150	-325	11000	
-150	-300	10500	
-150	-275	10500	
-150	-250	10000	
-150	-225	11000	
-150	-200	11500	
-150	-175	10500	
-150	-150	10500	
-150	-125	10500	
-150	-100	10000	
-150	-75	10500	
-150	-50	10500	
-150	-25	10500	
-150	0	10000	
-150	25	10500	
-150	50	10500	
-150	75	10500	
-150	100	10500	
-150	125	10500	
-150	150	10500	
-150	175	10500	
-150	200	10500	
-150	225	11000	
-150	250	10500	
-150	275	10500	
-150	300	10000	
-125	-700	10500	
-125	-675	10000	
-125	-650	10000	
-125	-625	10500	
-125	-600	10000	
-125	-575	10500	
-125	-550	10000	
-125	-525	10500	
-125	-500	10500	
-125	-475	10500	
-125	-450	12000	
-125	-425	11000	
-125	-400	10500	
-125	-375	11500	
-125	-350	10500	
-125	-325	10500	
-125	-300	10500	
-125	-275	11000	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
-125	-250	10500	
-125	-225	10500	
-125	-200	11000	
-125	-175	11000	
-125	-150	10500	
-125	-125	10500	
-125	-100	10500	
-125	-75	10500	
-125	-50	10500	
-125	-25	10500	
-125	0	10500	
-125	25	10500	
-125	50	10500	
-125	75	10500	
-125	100	10500	
-125	125	10500	
-125	150	10500	
-125	175	10500	
-125	200	10500	
-125	225	11000	
-125	250	10500	
-125	275	10500	
-125	300	10500	
-100	-700	10500	
-100	-675	12500	
-100	-650	11000	
-100	-625	10500	
-100	-600	10000	
-100	-575	11000	
-100	-550	11000	
-100	-525	10500	
-100	-500	11000	
-100	-475	10500	
-100	-450	16000	STAKED
-100	-425	11000	
-100	-400	10500	
-100	-375	10500	
-100	-350	10500	
-100	-325	10500	
-100	-300	10500	
-100	-275	11000	
-100	-250	10500	
-100	-225	11500	
-100	-200	11000	
-100	-175	11000	
-100	-150	11000	
-100	-125	10500	
-100	-100	11000	
-100	-75	14500	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
-100	-50	11000	
-100	-25	10500	
-100	0	11000	
-100	25	10500	
-100	50	11000	
-100	75	10500	
-100	100	11000	
-100	125	10500	
-100	150	10500	
-100	175	10500	
-100	200	10500	
-100	225	10500	
-100	250	10500	
-100	275	10500	
-100	300	10500	
-75	-700	10500	
-75	-675	10500	
-75	-650	10500	
-75	-625	10500	
-75	-600	10500	
-75	-575	10500	
-75	-550	10500	
-75	-525	10500	
-75	-500	11000	
-75	-475	10500	
-75	-450	10500	
-75	-425	11000	
-75	-400	11000	
-75	-375	10500	
-75	-350	11000	
-75	-325	11000	
-75	-300	10500	
-75	-275	10500	
-75	-250	11000	
-75	-225	10500	
-75	-200	11000	
-75	-175	11000	
-75	-150	11000	
-75	-125	10500	
-75	-100	11000	
-75	-75	11000	
-75	-50	10500	
-75	-25	10500	
-75	0	11000	
-75	25	11000	
-75	50	11000	
-75	75	10500	
-75	100	11000	
-75	125	11000	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
-75	150	11000	
-75	175	10500	
-75	200	10500	
-75	225	10500	
-75	250	10500	
-75	275	10500	
-75	300	10500	
-50	-700	10500	
-50	-675	10500	
-50	-650	11000	
-50	-625	10500	
-50	-600	10500	
-50	-575	10500	
-50	-550	11000	
-50	-525	11000	
-50	-500	11000	
-50	-475	10500	
-50	-450	11000	
-50	-425	11000	
-50	-400	11000	
-50	-375	10500	
-50	-350	11000	
-50	-325	10500	
-50	-300	11000	
-50	-275	11000	
-50	-250	10500	
-50	-225	10500	
-50	-200	11000	
-50	-175	10500	
-50	-150	11000	
-50	-125	11000	
-50	-100	11000	
-50	-75	10500	
-50	-50	11000	
-50	-25	11000	
-50	0	11000	
-50	25	11000	
-50	50	11000	
-50	75	10500	
-50	100	10500	
-50	125	10500	
-50	150	10500	
-50	175	10500	
-50	200	10500	
-50	225	10500	
-50	250	11000	
-50	275	11500	
-50	300	10500	
-25	-700	10500	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
-25	-675	11000	
-25	-650	10500	
-25	-625	11000	
-25	-600	11000	
-25	-575	11000	
-25	-550	11000	
-25	-525	10500	
-25	-500	10500	
-25	-475	11000	
-25	-450	11000	
-25	-425	11000	
-25	-400	11000	
-25	-375	10500	
-25	-350	11000	
-25	-325	11000	
-25	-300	11000	
-25	-275	10500	
-25	-250	11000	
-25	-225	11000	
-25	-200	11000	
-25	-175	10500	
-25	-150	10500	
-25	-125	11000	
-25	-100	11000	
-25	-75	10500	
-25	-50	11000	
-25	-25	11000	
-25	0	11000	
-25	25	11000	
-25	50	11000	
-25	75	10500	
-25	100	11000	
-25	125	10500	
-25	150	10500	
-25	175	10500	
-25	200	10500	
-25	225	10500	
-25	250	11000	
-25	275	10500	
-25	300	10500	
0	-700	7200	
0	-675	7600	
0	-650	7400	
0	-625	7000	
0	-600	7200	
0	-575	7200	
0	-550	7000	
0	-525	7200	
0	-500	7200	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
0	-475	6800	
0	-450	7000	
0	-425	7000	
0	-400	7000	
0	-375	7000	
0	-350	7000	
0	-325	7000	
0	-300	6800	
0	-275	10500	
0	-250	10500	
0	-225	10500	
0	-200	10500	
0	-175	10500	
0	-150	10500	
0	-125	10500	
0	-100	10000	
0	-75	10500	
0	-50	10500	
0	-25	10500	
0	0	26500	WELL
0	25	10500	
0	50	10000	
0	75	10000	
0	100	10500	
0	125	10500	
0	150	10500	
0	175	10000	
0	200	10000	
0	225	12000	
0	250	17000	
0	275	10000	
0	300	10500	
0	325	10500	
0	350	10500	
0	375	10000	
0	400	10000	
0	425	10500	
25	-700	7000	
25	-675	7000	
25	-650	7000	
25	-625	7000	
25	-600	6800	
25	-575	7000	
25	-550	7000	
25	-525	7200	
25	-500	7000	
25	-475	7000	
25	-450	7000	
25	-425	7000	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
25	-400	7000	
25	-375	7400	
25	-350	7000	
25	-325	7000	
25	-300	7000	
25	-275	10500	
25	-250	10500	
25	-225	11000	
25	-200	10500	
25	-175	10500	
25	-150	10500	
25	-125	10500	
25	-100	10500	
25	-75	10500	
25	-50	10500	
25	-25	10500	
25	0	10500	
25	25	10500	
25	50	11000	
25	75	10500	
25	100	11000	
25	125	10000	
25	150	12000	
25	175	10500	
25	200	10000	
25	225	11500	
25	250	10500	
25	275	10000	
25	300	11000	
25	325	11500	
25	350	10000	
45	247.5	19000	STAKED
50	-700	11000	
50	-675	12000	
50	-650	6800	
50	-625	7000	
50	-600	7800	
50	-575	6800	
50	-550	7000	
50	-525	7000	
50	-500	7000	
50	-475	6800	
50	-450	7000	
50	-425	7000	
50	-400	7200	
50	-375	7000	
50	-350	6800	
50	-325	6800	
50	-300	7000	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
50	-275	8000	
50	-250	8400	
50	-225	10500	
50	-200	10500	
50	-175	10500	
50	-150	10500	
50	-125	10000	
50	-100	10500	
50	-75	10500	
50	-50	10000	
50	-25	10000	
50	0	11000	
50	25	10500	
50	50	10500	
50	75	11000	
50	100	10500	
50	125	10500	
50	150	10500	
50	175	18500	
50	200	11500	
50	225	10500	
50	250	10000	
50	275	10000	
50	300	10500	
50	325	10000	
50	350	10000	
75	-700	8000	
75	-675	7400	
75	-650	7250	
75	-625	7500	
75	-600	10800	
75	-575	7000	
75	-550	7200	
75	-525	7000	
75	-500	7000	
75	-475	7000	
75	-450	7000	
75	-425	7200	
75	-400	6800	
75	-375	7000	
75	-350	7200	
75	-325	7000	
75	-300	7000	
75	-275	7600	
75	-250	7000	
75	-225	5200	
75	-200	7000	
75	-175	10500	
75	-150	10500	

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MAGNETICS DATA

Northing	Easting	Reading	Comments
75	-125	10500	
75	-100	10500	
75	-75	10500	
75	-50	10500	
75	-25	10500	
75	0	10000	
75	25	10000	
75	50	10000	
75	75	11000	
75	100	9500	
75	125	10500	
75	150	10500	
75	175	11000	
75	200	10500	
75	225	11500	
75	250	10500	
75	275	10000	
75	300	10500	
75	325	10500	
75	350	9500	
100	-700	7500	
100	-675	7500	
100	-650	7500	
100	-625	7000	
100	-600	7250	
100	-575	6800	
100	-550	7000	
100	-525	7200	
100	-500	6800	
100	-475	6800	
100	-450	7000	
100	-425	7000	
100	-400	6800	
100	-375	7000	
100	-350	7200	
100	-325	7000	
100	-300	7800	
100	-275	6800	
100	-250	5800	
100	-225	7000	
100	-200	7800	
100	-175	11000	
100	-150	10500	
100	-125	11000	
100	-100	10500	
100	-75	10000	
100	-50	10500	
100	-25	10000	
100	0	9500	

APPENDIX B

MAGNETICS DATA

Northing	Easting	Reading	Comments
100	25	10000	
100	50	10000	
100	75	9500	
100	100	10000	
100	125	11000	
100	150	10500	
100	175	11000	
100	200	10500	
100	225	10500	
100	250	10500	
100	275	10500	
100	300	10000	
100	325	10000	
100	350	9500	

APPENDIX C

APPENDIX C

TEST PIT SAMPLING AND DRUM

EXCAVATION SUMMARY

APPENDIX C

SITE INVESTIGATION TEST PIT, SAMPLING AND DRUM EXCAVATION SUMMARY

UNION CARBIDE - REPUBLIC PLANT

Site No.	Coordinates	Sampled	Depth (ft. BGS)	Description
DP-1	155S & 200W	Yes	0 - 5.4	Black fine sand-size carbon material, carbon forms (1.5± ft.) and vegetation; some Acheson* sidewall block fragments (3± ft.), wood, fire brick and red-brown sandy clay; trace transite, oily sheen on water surface. (FILL) (Dry to Wet) W/L = 5.0 ft.
			5.4 - 6.4	Red-brown silty clay. (NATIVE) (Wet)
DP-2	275S & 445W	Yes	0 - 6.0	Black fine sand-size carbon material, carbon forms (1.5± ft.), vegetation, Acheson sidewall block fragments (1± ft.), brick and coarse angular gravel; trace firebrick, tar-like material, blue-gray sheen on water surface. (FILL) (Dry to Wet) W/L = 5.5 ft.
			6.0 - 6.6	Gray-brown silty clay. (NATIVE) (Wet)
DP-3	601S & 380W	Yes	0 - 6.0	Black fine sand-size carbon material, Acheson sidewall block fragments (1± ft.); trace vegetation, firebrick, wood, carbon forms, glass (amber glass bottle), gray sandy clay, oily sheen on water surface, moderate chemical odor (mothball) dissipating with depth. (FILL) (Dry to Wet) W/L = 6.0 ft.
			6.0 - 7.0	Brown silty clay. (NATIVE) (Wet)
DP-4	602S & 455W	No	0 - 5.7	Black fine sand-size carbon material, Acheson sidewall block fragments (4.5 ft.), vegetation, carbon forms (1.5± ft.); trace firebrick; brown sandy clay layer with slight chemical odor (2± ft.). (FILL) (Dry to Wet) W/L = 5.0 ft.
			5.7 - 6.3	Gray-brown silty clay, some sand. (NATIVE) (Wet)

*large chunks of material resembling reinforced concrete.

Site No.	Coordinates	Sampled	Depth (ft. BGS)	Description
DP-4a	600S & 425W	No	0 - 4.9	Black fine sand-size carbon material; trace Acheson sidewall block fragments, coarse angular gravel, carbon forms, firebrick, brick, wood, vegetation, fragments of a 5-gallon bucket with material resembling coal tar pitch (3.8 ft.), brown sandy clay layer with slight chemical odor (1.3-2.0 ft.), metal pipe. (FILL) (Dry to Moist)
			4.9 - 6.6	Gray-brown silty clay, some sand. (NATIVE) (Wet)
DP-5	459S & 650W	No	0 - 4.2	Brown to black fine sand-size carbon material; some coarse angular gravel; trace vegetation, Acheson sidewall block fragments, carbon forms (1.5± ft.), metal pipe (0.5 ft.), firebrick, brick, wood, transite, metal fencepost and gray-brown sandy clay. (FILL) (Dry to Wet) W/L = 5.0 ft.
			4.2 - 5.3	Brown silty clay. (NATIVE) (Wet)
DP-6	709S & 246W	Yes	0 - 5.0	Black fine sand-size carbon material, carbon forms (1.5± ft.) and metal banding; some gray-brown sandy clay; trace vegetation, wood, firebrick, glove, boot, oily sheen on water surface. (FILL) (Dry to Wet) W/L = 2.8 ft.
			5.0 - 6.3	Red-brown silty clay. (NATIVE) (Wet)
DP-7	650S & 28E	Yes	0 - 2.0	Black fine sand-size carbon material; trace Acheson sidewall block fragments (0.5 ft.), carbon forms, vegetation, wood, firebrick, wire mesh, corrugated fiberglass and fiber drum fragments containing material resembling coal tar pitch. (FILL) (Dry to Wet) W/L = 2.7 ft.
			2.0 - 4.0	Gray-brown silty clay. (NATIVE) (Wet)

APPENDIX C
SITE INVESTIGATION TEST PIT, SAMPLING AND DRUM EXCAVATION SUMMARY
UNION CARBIDE - REPUBLIC PLANT

Site No.	Coordinates	Sampled	Depth (ft. BGS)	Description
DP-8	435S & 152W	Yes	0 - 6.5	Black fine sand-size carbon material and wood; some Acheson sidewall block fragments; trace carbon forms (1.5± ft.), vegetation, metal banding, truck tire, metal pipe, firebrick, fiberglass, plastic bag, oily sheen on water surface. (FILL) (Dry to Wet)
				W/L = 6.4 ft.
				Gray-brown silty clay. (NATIVE) (Wet)
DP-9	544S & 318W	No	0 - 5.7	Black fine sand-size carbon material; some Acheson sidewall block fragments (0.5 ft.) and carbon forms (1.5± ft.); trace vegetation, firebrick, wood, red-brown sandy silt, blue-gray oily sheen. (FILL) (Dry to Wet) W/L = 3.6 ft.
			5.7	Gray-brown silty clay. (NATIVE) (Wet)
DP-10	332S & 500W	No	0 - 4.2	Black fine sand-size carbon material; some coarse angular gravel and carbon forms; trace vegetation, Acheson sidewall block fragments (1.0 ft.), large metal ring and nut, firebrick, brick, cloth, oily sheen on water surface. (FILL) (Dry to Wet)
				W/L = 3.7 ft.
			4.2 - 5.8	Gray-brown silty clay. (NATIVE) (Wet)
DP-11	300S & 590W	Yes	0 - 5.0	Black fine sand-size carbon material; some carbon forms and Acheson sidewall block fragments (1.0 ft.); trace coarse angular gravel, vegetation, wood, firebrick, brick, oily sheen on water surface. (FILL) (Dry to Wet)
				W/L = 4.0 ft.
			5.0 - 6.0	Gray-brown silty clay. (NATIVE) (Wet)

Site No.	Coordinates	Sampled	Depth (ft. BGS)	Description
DP-12	100S & 450W	Yes	0 - 4.7	Black fine sand-size carbon material and Acheson sidewall block fragments (1.0 ft. and 3± ft.); trace carbon forms (1.5± ft.), vegetation, wood, firebrick, oily sheen on water surface. (FILL) (Dry to Wet) W/L = 4.0 ft.
			4.7 - 6.0	Brown-gray silty clay. (NATIVE) (Wet)
DP-13	50N & 175E	No	0 - 6.2	Black fine sand-size carbon material; some red-brown sandy clay (0.5-1.7 ft.); trace vegetation, Acheson sidewall block fragments, firebrick, brick, cinder block, wood, carbon forms, gray ash, wire mesh, metal banding, metal pipe, plastic bag, oily sheen on water surface. (FILL) (Dry to Wet) W/L = 4.4 ft. Excavation filled with water, could not see native clay.
DP-14	250S & 601W	No	0 - 5.5	Black and gray fine sand-size carbon material; some coarse angular gravel and carbon forms; trace Acheson sidewall block fragments (1.0 ft.), firebrick, brick, vegetation and wood. (FILL) (Dry to Wet) W/L = 1.6 ft.
			5.5 - 6.8	Gray silty clay. (NATIVE) (Wet)
DP-15	286S & 550W	No	0 - 4.7	Black fine sand-size carbon material; trace Acheson sidewall block fragments (0.5 ft.), vegetation, carbon forms, firebrick, brick, wood, carbon electrode butt, and rubber. (FILL) (Dry to Wet) W/L = 4.0 ft.
			4.7 - 5.0	Gray silty clay. (NATIVE) (Wet)

Site No.	Coordinates	Sampled	Depth (ft. BGS)	Description
DP-16	300S & 525W	No	0 - 4.0	Black fine sand-size carbon material; some carbon forms and Acheson sidewall blocks; trace coarse angular gravel, vegetation, brick and wood. (FILL) (Dry to Wet) W/L = 2.0 ft.
			4.0 - 4.2	Gray silty clay. (NATIVE) (Wet)
DP-17	265S & 535W	No	0 - 4.2	Black fine sand-size carbon material, carbon forms and Acheson sidewall block fragments (0.5 ft.); trace coarse angular gravel, vegetation, firebrick and wood. (FILL) (Dry to Wet) W/L = 2.5 ft.
			4.2 - 4.6	Gray silty clay. (NATIVE) (Wet)
DP-18	400S & 513W	No	0 - 4.5	Black fine sand-size carbon material; some carbon forms, Acheson sidewall block fragments (1.0 ft.) and wood; trace coarse angular gravel, firebrick, sintering tray, oily sheen on water surface. (FILL) (Dry to Wet) W/L = 4.5 ft.
			4.5 - 5.8	Gray silty clay. (NATIVE) (Wet)
DP-19	386S & 408W	No	0 - 4.3	Black fine sand-size carbon material; trace carbon forms, Acheson sidewall block fragments, coarse angular gravel, wood, firebrick, brick, glass bottle. (FILL) (Dry to Wet) W/L = 3.7 ft.
			4.3 - 5.5	Gray silty clay. (NATIVE) (Wet)

Site No.	Coordinates	Sampled	Depth (ft. BGS)	Description
DP-20	311S & 397W	No	0 - 4.8	Black fine sand-size carbon material; some Acheson sidewall block fragments (0.3 ft.); trace vegetation, coarse angular gravel, firebrick, wood and rubber. (FILL) (Dry to Wet) W/L = 3.3 ft.
			4.8 - 6.0	Gray silty clay. (NATIVE) (Wet)
DP-21	425S & 625W	Yes	0 - 4.5	Black fine sand-size carbon material, coarse angular gravel, firebrick and brick; some carbon forms, Acheson sidewall blocks and fragments, impregnating pitch (1.5± ft.) and roofing material; trace wood, glass bottle, iron hooks, light bulbs, metal pipe, oily sheen on water surface. (FILL) Note: Three 55-gallon drum remains, with contents, were found at 4.5 ft. Drum No. 1 - metal drum with black solid material resembling coal tar pitch, cardboard, cloth and light bulb stem. Drum No. 2 - metal drum with black solid material resembling coal tar pitch, cardboard, three metal 1-gallon buckets, wood and newspaper. Drum No. 3 - metal drum with black solid material resembling coal tar pitch, cardboard, wood, rope and green grease. Drums with contents were placed in salvage drums and buried in the excavated pit. Samples of the black material were collected and submitted for analysis. W/L = 3.0 ft.
			4.5	Gray silty clay. (NATIVE) (Wet)
DP-22	594S & 394W	No	0 - 5.3	Black fine sand-size carbon material and Acheson sidewall block (1.0 ft.); some carbon forms; trace vegetation, coarse angular gravel, tar-like material, wood and firebrick; brown sandy clay layer with chemical (mothball) odor (1.5± ft.). (FILL) (Dry to Wet) W/L = 4.0 ft.
			5.3 - 5.7	Brown silty clay. (NATIVE) (Wet)

Site No.	Coordinates	Sampled	Depth (ft. BGS)	Description
OW-1	599S & 302W	No	0 - 4.6	Black fine sand-size carbon material; trace coarse angular gravel, carbon forms, Acheson sidewall block fragments, wood, rubber hose and fuel oil. (FILL) (Dry to Wet) Static W/L = 3.0 ft.
			4.6 - 5.9	Gray silty clay. (NATIVE) (Wet) Note: Monitoring well installed. Screen bottom at 4.6 ft.
OW-2	0 & 450W	No	0 - 4.9	Black fine sand-size carbon material; trace carbon forms (1.5± ft.), Acheson sidewall block fragments, vegetation, firebrick, brick, metal pipe, ceramics, shoe, glass, gloves and oily sheen on water surface. (FILL) Static W/L = 2.6 ft.
			4.9 - 6.5	Brown silty clay. (NATIVE) (WET) Note: Monitoring well installed. Screen bottom at 6.0 ft.

APPENDIX D

APPENDIX D

STRATIGRAPHIC AND INSTRUMENTATION LOGS

STRATIGRAPHIC AND INSTRUMENTATION LOG

(OVERBURDEN)

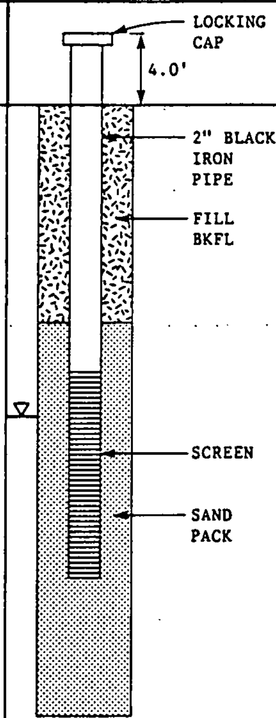
PROJECT NAME: UNION CARBIDE CORPORATION - RUPUBLIC
HOLE DESIGNATION: OW-1

PROJECT NO.: 2293
DATE COMPLETED: MARCH 17, 1988

CLIENT: UNION CARBIDE CORPORATION
DRILLING METHOD: BACKHOE

LOCATION: 599S + 302W
CRA SUPERVISOR: N.W. THOMPSON

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft/m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
0						
	Fill, black-fine sand size carbon material; trace coarse angular gravel, carbon forms, Acheson sidewall block fragments, wood, rubber hose and fuel oil; dry to wet.					
3						
	Gray silty clay; native; wet					
6	NOTES: No samples collected. Monitoring well installed.					
9						



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ∇ WATER FOUND STATIC WATER LEVEL 3.0 FT.

STRATIGRAPHIC AND INSTRUMENTATION LOG

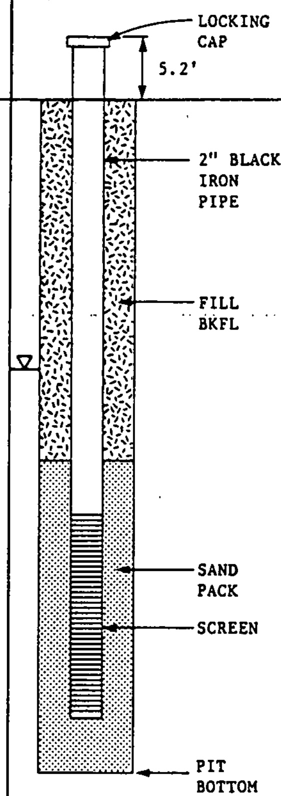
(OVERBURDEN)

PROJECT NAME: UNION CARBIDE CORPORATION - RUPUBLIC HOLE DESIGNATION: OW-2

PROJECT NO.: 2293 DATE COMPLETED: MARCH 16, 1988

CLIENT: UNION CARBIDE CORPORATION DRILLING METHOD: BACKHOE

LOCATION: 0 + 450 W CRA SUPERVISOR: N.W. THOMPSON

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft/m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
0						
	Fill, black-fine sand size carbon material; trace Acheson sidewall block fragments, vegetation, firebrick, brick, metal pipe, ceramics, shoe, glass, gloves and oily sheen on water surface. Trace carbon forms @ 1.5					
3						
	Brown silty clay; native; wet					
6						
	NOTES: No samples collected. Monitoring well installed.					
9						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ∇ WATER FOUND STATIC WATER LEVEL 2.5 FT.

APPENDIX E

APPENDIX E

ANALYTICAL RESULTS

WATERMAIN SAMPLING PROGRAM

M E M O

TO: File/Jim Kay

FROM: Bruce Clegg/cd

DATE: March 28, 1988

REFERENCE NO. 2293

RE: ANALYTICAL Q.C. REVIEW AES DATA
UNION CARBIDE SOIL SAMPLING PROGRAM

The following comments are based on review of analytical data generated from the analyses of nine soil samples collected between February 24 and February 26, 1988 from the above-captioned Site.

Details are as follows:

Holding Times

On the basis of maximum allowable holding times established for analytes covered by USEPA and Standard Methods, all samples analyzed for nitrite exceeded the established 48 hour holding time. As reported by Advanced Environmental Services (AES), however, samples were analyzed within 48 hours of leaching with deionized water. The presence of oxidizing or reducing agents in the sample matrix could effect conversion of nitrites to nitrate or ammonia, respectively. However, on the basis of the available data, the overall effects on nitrite concentrations cannot be adequately determined. From this reported nitrite data should be used for qualitative purposes only. All other analytes were determined within an acceptable time period. Tables 1-6 present relevant dates and time elapsed to analyses.

Blank Analyses

No detectable analytes were found in method blanks run for VOCs, BNAs, thiophene or furfural. Method blank data for the remaining analytes were not reported.

Matrix, Surrogate and Q.C. Check Sample Recoveries

Matrix, surrogate and Q.C. check sample recoveries were acceptable for all analytes with the exception of 2,4-dimethylphenol (recovery = 49%) and phenol (recovery = 153%) in sample TP-1. Although recovery of 2,4-dimethylphenol is typical of acid extractable compounds, in general, the cause for high recovery of phenol from sources other than contamination is not readily apparent.

continued....

Analytical Precision

i) Laboratory Duplicates

Analytical precision was acceptable for all analyses. The poorest precision (as determined by high relative percent difference) did not exceed 25%. For both cases in which poor precision was observed analytical concentrations were low (<0.06 mg/L).

ii) Field Duplicates

Analyses of blind field duplicate samples (TP-4/TP-9) produced data that were generally comparable with the exception of relatively small, acceptable deviations in nitrite concentrations and significant deviations for benzene. Reported benzene concentrations for TP-4 and TP-9 were 53,000 ug/kg and 1,300 ug/kg, respectively: a variation in duplicate concentrations by a factor of 40. As other reported analyte concentrations did not vary significantly, it is apparent the samples were likely homogeneous with respect to these compounds and differences in benzene concentrations may have been due to poor analytical precision. Detailed evaluation of raw data and sample appearance by AES subsequent to our notification (March 29, 1988) indicated no apparent errors in raw data but visual differences between the duplicate samples.

Discussion

On the basis of the reported data and Q.C. information, these data, with the exceptions noted above, are valid and acceptable for assessment purposes.

TABLE 1

UNION CARBIDE SOIL SAMPLES
VOC - HOLDING TIMES

SAMPLE I.D.	COLLECTION DATE	ANALYSIS DATE	ELAPSED TIME (DAYS)
TP-1	02/24/88	03/08/88	13
TP-2	02/24/88	03/09/88	14
TP-3	02/24/88	03/08/88	13
TP-4	02/25/88	03/08/88	12
TP-5	02/25/88	03/09/88	13
TP-6	02/26/88	03/08/88	11
TP-7	02/26/88	03/08/88	11
TP-8	02/25/88	03/09/88	13
TP-9	02/25/88	03/09/88	13

TABLE 2

UNION CARBIDE SOIL SAMPLES
B/N/A - HOLDING TIMES

SAMPLE I.D.	COLLECTION DATE	EXTRACTION DATE	ANALYSES RATE	ELAPSED TIME (DAYS) (EXTRACTION/ ANALYSES)
TP-1	02/24/88	03/04/88	03/16/88	9/12
TP-2	02/24/88	03/04/88	03/16/88	9/12
TP-3	02/24/88	03/04/88	03/16/88	9/12
TP-4	02/25/88	03/04/88	03/16/88	8/12
TP-5	02/25/88	03/04/88	03/16/88	8/12
TP-6	02/26/88	03/04/88	03/16/88	7/12
TP-7	02/26/88	03/04/88	03/16/88	7/12
TP-8	02/25/88	03/04/88	03/16/88	8/12
TP-9	02/25/88	03/04/88	03/16/88	8/12

TABLE 3

UNION CARBIDE SOIL SAMPLES
GENERAL CHEMISTRY - TKN
HOLDING TIMES

SAMPLE I.D.	COLLECTION DATE	ANALYSES DATE	ELAPSED TIME (DAYS)
TP-1	02/24/88	02/29/88	5
TP-2	02/24/88	02/29/88	5
TP-3	02/24/88	02/29/88	5
TP-4	02/25/88	02/29/88	4
TP-5	02/25/88	02/29/88	4
TP-6	02/26/88	02/29/88	3
TP-7	02/26/88	02/29/88	3
TP-8	02/25/88	02/29/88	4
TP-9	02/25/88	02/29/88	4

TABLE 4

UNION CARBIDE SOIL SAMPLES
GENERAL CHEMISTRY - NITRITE
HOLDING TIMES

SAMPLE I.D.	COLLECTION DATE	ANALYSES DATE	ELAPSED TIME (DAYS)
TP-1	02/24/88	03/10/88	15
TP-2	02/24/88	03/10/88	15
TP-3	02/24/88	03/10/88	15
TP-4	02/25/88	03/10/88	14
TP-5	02/25/88	03/10/88	14
TP-6	02/26/88	03/10/88	13
TP-7	02/26/88	03/10/88	13
TP-8	02/25/88	03/10/88	14
TP-9	02/25/88	03/10/88	14

TABLE 5

UNION CARBIDE SOIL SAMPLES
GENERAL CHEMISTRY - PHENOLS
HOLDING TIMES

SAMPLE I.D.	COLLECTION DATE	ANALYSES DATE	ELAPSED TIME (DAYS)
TP-1	02/24/88	03/09/88	14
TP-2	02/24/88	03/09/88	14
TP-3	02/24/88	03/09/88	14
TP-4	02/25/88	03/09/88	13
TP-5	02/25/88	03/09/88	13
TP-6	02/26/88	03/09/88	12
TP-7	02/26/88	03/09/88	12
TP-8	02/25/88	03/09/88	13
TP-9	02/25/88	03/09/88	13

TABLE 6

UNION CARBIDE SOIL SAMPLES
GENERAL CHEMISTRY - AMMONIA-N
HOLDING TIMES

SAMPLE I.D.	COLLECTION DATE	ANALYSES DATE	ELAPSED TIME (DAYS)
TP-1	02/24/88	03/03/88	8
TP-2	02/24/88	03/03/88	8
TP-3	02/24/88	03/03/88	8
TP-4	02/25/88	03/03/88	7
TP-5	02/25/88	03/03/88	7
TP-6	02/26/88	03/03/88	6
TP-7	02/26/88	03/03/88	6
TP-8	02/25/88	03/03/88	7
TP-9	02/25/88	03/03/88	7

LABORATORY REPORT
RESULTS

Analytical Parameter	17642 WM-1 GRAB 1/26/88	17643 WM-3 GRAB 1/26/88	17644 WM-4 GRAB 1/26/88	METHOD BLANK	Units	Method Number	Quantifiabl Limits
AES Lab Number >	17642	17643	17644				
Customer I.D. >	WM-1 GRAB	WM-3 GRAB	WM-4 GRAB	METHOD BLANK			
Date of Sample >	1/26/88	1/26/88	1/26/88				
Ammonia (As N)	BQL*	BQL	BQL	BQL	mg/l	350.1	0.01
Total Kjeldahl Nitrogen	0.33	0.14	0.19	BQL	mg/l	351.2	0.1
Nitrite (As N)	BQL	BQL	BQL	BQL	mg/l	353.3	0.01
Total Recoverable Phenols	BQL	BQL	BQL	BQL	mg/l	420.2	0.001
Sulfate	15	16	15	BQL	mg/l	375.2	2.0
Total Potassium (K)	1.36	1.83	1.26	BQL	mg/l	7610	1.00
Total Iron (Fe)	BQL	BQL	BQL	BQL	mg/l	7380	0.30
Total Zinc (Zn)	BQL	BQL	BQL	BQL	mg/l	7950	0.05
Soluble Iron (Fe)	BQL	BQL	BQL	BQL	mg/l	7380	0.30
Soluble Zinc (Zn)	BQL	BQL	BQL	BQL	mg/l	7950	0.05

Margaret L. Skowron
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Manager
Wet Chemistry Department

Janette Bingert
Janette Bingert
Manager
Atomic Spectroscopy Department

LABORATORY REPORT
RESULTS

AES Lab Number >	17642	17643	17644	
Customer I.D. >	WM-1 GRAB	WM-3 GRAB	WM-4 GRAB	METHOD BLANK
Date of Sample >	1/26/88	1/26/88	1/26/88	

Analytical Parameter	17642 WM-1 GRAB	17643 WM-3 GRAB	17644 WM-4 GRAB	METHOD BLANK	Units	Method Number	Quantifiable Limits
Chloromethane	BQL	BQL	BQL	BQL	ug/l	8240	10
Vinyl Chloride	BQL	BQL	BQL	BQL	ug/l	"	10
Chloroethane	BQL	BQL	BQL	BQL	ug/l	"	10
Bromomethane	BQL	BQL	BQL	BQL	ug/l	"	10
2-Chloroethyl Vinyl Ether	BQL	BQL	BQL	BQL	ug/l	"	10
Ethylbenzene	BQL	BQL	BQL	BQL	ug/l	"	5
Methylene Chloride	BQL	BQL	BQL	BQL	ug/l	"	5
Chlorobenzene	BQL	BQL	BQL	BQL	ug/l	"	5
1,1-Dichloroethylene	BQL	BQL	BQL	BQL	ug/l	"	5
1,1-Dichloroethane	BQL	BQL	BQL	BQL	ug/l	"	5
trans-1,2-Dichloroethylene	BQL	BQL	BQL	BQL	ug/l	"	5
Chloroform	14	17	17	BQL	ug/l	"	5
1,2-Dichloroethane	BQL	BQL	BQL	BQL	ug/l	"	5
1,1,1-Trichloroethane	BQL	BQL	BQL	BQL	ug/l	"	5
Carbon Tetrachloride	BQL	BQL	BQL	BQL	ug/l	"	5
Bromodichloromethane	8	10	10	BQL	ug/l	"	5
1,2-Dichloropropane	BQL	BQL	BQL	BQL	ug/l	"	5
trans-1,3-Dichloropropane	BQL	BQL	BQL	BQL	ug/l	"	5
Trichloroethylene	BQL	BQL	BQL	BQL	ug/l	"	5
Benzene	BQL	BQL	BQL	BQL	ug/l	"	5
cis-1,3-Dichloropropene	BQL	BQL	BQL	BQL	ug/l	"	5
1,1,2-Trichloroethane	BQL	BQL	BQL	BQL	ug/l	"	5
Dibromochloromethane	BQL	BQL	BQL	BQL	ug/l	"	5
Bromoform	BQL	BQL	BQL	BQL	ug/l	"	5

Susan C. Scrocchi

Susan C. Scrocchi
Manager

LABORATORY REPORT
RESULTS

AES Lab Number >	17642	17643	17644				
Customer I.D. >	WM-1 GRAB	WM-3 GRAB	WM-4 GRAB	METHOD BLANK			
Date of Sample >	1/26/88	1/26/88	1/26/88				
Analytical Parameter					Units	Method Number	Quantifiable Limits
1,1,2,2-Tetrachloroethylene	BQL	BQL	BQL	BQL	ug/l	8240	5
1,1,2,2-Tetrachloroethane	BQL	BQL	BQL	BQL	ug/l	"	5
Toluene	BQL	BQL	BQL	BQL	ug/l	"	5
Acetone	BQL	BQL	BQL	BQL	ug/l	"	50
Carbon Disulfide	BQL	BQL	BQL	BQL	ug/l	"	5
2-Butanone	BQL	BQL	BQL	BQL	ug/l	"	50
Vinyl Acetate	BQL	BQL	BQL	BQL	ug/l	"	50
2-Hexanone	BQL	BQL	BQL	BQL	ug/l	"	50
4-Methyl-2-Pentanone	BQL	BQL	BQL	BQL	ug/l	"	50
Styrene	BQL	BQL	BQL	BQL	ug/l	"	5
Xylenes (Total)	BQL	BQL	BQL	BQL	ug/l	"	5
Trichlorofluoromethane	BQL	BQL	BQL	BQL	ug/l	"	5

Susan C Scrocchi

Susan C. Scrocchi
Manager

LABORATORY REPORT
RESULTS

AES Lab Number >	17642	17643	17644				
Customer I.D. >	WM-1 GRAB	WM-3 GRAB	WM-4 GRAB	METHOD BLANK			
Date of Sample >	1/26/88	1/26/88	1/26/88				
Analytical Parameter					Units	Method Number	Quantifiable Limits
2-Methylnaphthalene	BQL	BQL	BQL	BQL	ug/l	8270	10
Bis(2-Chloroethyl)Ether	BQL	BQL	BQL	BQL	ug/l	"	10
1,3-Dichlorobenzene	BQL	BQL	BQL	BQL	ug/l	"	10
1,4-Dichlorobenzene	BQL	BQL	BQL	BQL	ug/l	"	10
1,2-Dichlorobenzene	BQL	BQL	BQL	BQL	ug/l	"	10
Bis(2-Chloroisopropyl)Ether	BQL	BQL	BQL	BQL	ug/l	"	10
Hexachloroethane	BQL	BQL	BQL	BQL	ug/l	"	10
N-Nitrosodi-N-Propylamine	BQL	BQL	BQL	BQL	ug/l	"	10
Nitrobenzene	BQL	BQL	BQL	BQL	ug/l	"	10
Isophorone	BQL	BQL	BQL	BQL	ug/l	"	10
Bis(2-Chloroethoxy)Methane	BQL	BQL	BQL	BQL	ug/l	"	10
1,2,4-Trichlorobenzene	BQL	BQL	BQL	BQL	ug/l	"	10
Naphthalene	BQL	BQL	BQL	BQL	ug/l	"	10
Hexachlorobutadiene	BQL	BQL	BQL	BQL	ug/l	"	10
Hexachlorocyclopentadiene	BQL	BQL	BQL	BQL	ug/l	"	10
2-Chloronaphthalene	BQL	BQL	BQL	BQL	ug/l	"	10
Dimethylphthalate	BQL	BQL	BQL	BQL	ug/l	"	10
Acenaphthylene	BQL	BQL	BQL	BQL	ug/l	"	10
2,6-Dinitrotoluene	BQL	BQL	BQL	BQL	ug/l	"	10
Acenaphthene	BQL	BQL	BQL	BQL	ug/l	"	10
2,4-Dinitrotoluene	BQL	BQL	BQL	BQL	ug/l	"	10
Diethylphthalate	BQL	BQL	BQL	BQL	ug/l	"	10

Susan C. Scrocchi

Susan C. Scrocchi
Manager

LABORATORY REPORT
RESULTS

Analytical Parameter	17642	17643	17644		Units	Method Number	Quantifiable Limits
AES Lab Number >	17642	17643	17644				
Customer I.D. >	WM-1 GRAB	WM-3 GRAB	WM-4 GRAB	METHOD BLANK			
Date of Sample >	1/26/88	1/26/88	1/26/88				
Fluorene	BQL	BQL	BQL	BQL	ug/l	8240	10
4-Chlorophenylphenylether	BQL	BQL	BQL	BQL	ug/l	"	10
Diphenylamine(N-Nitroso)	BQL	BQL	BQL	BQL	ug/l	"	10
Benzylalcohol	BQL	BQL	BQL	BQL	ug/l	"	10
4-Chloroaniline	BQL	BQL	BQL	BQL	ug/l	"	10
4-Bromophenylphenylether	BQL	BQL	BQL	BQL	ug/l	"	10
Hexachlorobenzene	BQL	BQL	BQL	BQL	ug/l	"	10
Phenanthrene	BQL	BQL	BQL	BQL	ug/l	"	10
Anthracene	BQL	BQL	BQL	BQL	ug/l	"	10
Di-N-Butylphthalate	BQL	BQL	BQL	BQL	ug/l	"	10
Fluoranthene	BQL	BQL	BQL	BQL	ug/l	"	10
2-Nitroaniline	BQL	BQL	BQL	BQL	ug/l	"	10
Pyrene	BQL	BQL	BQL	BQL	ug/l	"	10
Butylbenzylphthalate	BQL	BQL	BQL	BQL	ug/l	"	10
Benzo(a)Anthracene	BQL	BQL	BQL	BQL	ug/l	"	10
3,3'-Dichlorobenzidine	BQL	BQL	BQL	BQL	ug/l	"	30
Chrysene	BQL	BQL	BQL	BQL	ug/l	"	10
Bis(2-Ethylhexyl)Phthalate	BQL	BQL	BQL	BQL	ug/l	"	10
Di-N_Octylphthalate	BQL	BQL	BQL	BQL	ug/l	"	10
Benzo(b)Fluoranthene	BQL	BQL	BQL	BQL	ug/l	"	10
Benzo(k)Fluoranthene	BQL	BQL	BQL	BQL	ug/l	"	10
Benzo(a)Pyrene	BQL	BQL	BQL	BQL	ug/l	"	10
Indeno(1,2,3-C,D)Pyrene	BQL	BQL	BQL	BQL	ug/l	"	10
Dibenzo(a,h)Anthracene	BQL	BQL	BQL	BQL	ug/l	"	10
Benzo(g,h,i)Perylene	BQL	BQL	BQL	BQL	ug/l	"	10

Susan C. Scrocchi

Susan C. Scrocchi
Manager

LABORATORY REPORT
RESULTS

Analytical Parameter	17642	17643	17644		Units	Method Number	Quantifiable Limits
AES Lab Number >	17642	17643	17644				
Customer I.D. >	WM-1 GRAB	WM-3 GRAB	WM-4 GRAB	METHOD BLANK			
Date of Sample >	1/26/88	1/26/88	1/26/88				
Phenol	BQL	BQL	BQL	BQL	ug/l	8270	10
2-Chlorophenol	BQL	BQL	BQL	BQL	ug/l	"	10
2-Nitrophenol	BQL	BQL	BQL	BQL	ug/l	"	10
2,4-Dimethylphenol	BQL	BQL	BQL	BQL	ug/l	"	10
p-Chloro-m-Chesol	BQL	BQL	BQL	BQL	ug/l	"	10
2,4,6-Trichlorophenol	BQL	BQL	BQL	BQL	ug/l	"	10
2,4-Dinitrophenol	BQL	BQL	BQL	BQL	ug/l	"	50
4-Nitrophenol	BQL	BQL	BQL	BQL	ug/l	"	50
4,6-Dinitro-O-Cresol	BQL	BQL	BQL	BQL	ug/l	"	50
Pentachlorophenol	BQL	BQL	BQL	BQL	ug/l	"	50
2,4-Dichlorophenol	BQL	BQL	BQL	BQL	ug/l	"	10
4-Methylphenol	BQL	BQL	BQL	BQL	ug/l	"	10
Benzoic Acid	BQL	BQL	BQL	BQL	ug/l	"	30
2,4,5-Trichlorophenol	BQL	BQL	BQL	BQL	ug/l	"	10
3-Nitroaniline	BQL	BQL	BQL	BQL	ug/l	"	10
Dibenzofuran	BQL	BQL	BQL	BQL	ug/l	"	10
4-Nitroaniline	BQL	BQL	BQL	BQL	ug/l	"	10
2-Methylphenol	BQL	BQL	BQL	BQL	ug/l	"	10
Benzidine	BQL	BQL	BQL	BQL	ug/l	"	50

Susan C. Scrocchi

Susan C. Scrocchi
Manager
Gas Chromatography Department

LABORATORY REPORT
RESULTS

AES Lab Number >	17642	17643	17644				
Customer I.D. >	WM-1 GRAB	WM-3 GRAB	WM-4 GRAB	METHOD BLANK			
Date of Sample >	1/26/88	1/26/88	1/26/88				
Analytical Parameter					Units	Method Number	Quantifiable Limits
Furfural	BQL	BQL	BQL	BQL	mg/l	790	2.00
Thiophene	BQL	BQL	BQL	BQL	mg/l	7225	2.00

Susan C Scrocchi

Susan C. Scrocchi
Manager
Gas Chromatography Department

cc: NF files

ADVANCED ENVIRONMENTAL SERVICES INC.

CRA PROJECT #2293
(FOR UNION CARBIDE)
PRIORITY POLLUTANT METALS AND CYANIDE

Report Prepared For

CONESTOGA ROVERS & ASSOCIATES, INC.

Catherine Mocniak

Catherine Mocniak
Project Manager

Janette Bingert

Janette Bingert
Quality Control Manager

April 14, 1988
AES Report CRF

COMMITMENT
TO
HONESTY - QUALITY - SERVICE

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: RESULTS - WET CHEMISTRY

Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. -	18231	18232	18233	18234
			Sample ID -	TP-1 GRAB	TP-2 GRAB	TP-3 GRAB	TP-4 GRAB
			Sample Date-	2/24/88	2/24/88	2/24/88	2/24/88
Total Cyanide (mg/l)	9010/335.3	0.01		BQL*	BQL	BQL	BQL

* Below quantifiable limits.

S.Donovan For M.S.
Margaret L. Skowron
Wet Chemistry Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: RESULTS - WET CHEMISTRY

Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. -	18235	18236	18237	18243
			Sample ID -	TP-5 GRAB	TP-8 GRAB	TP-9 GRAB	TP-6 GRAB
			Sample Date-	2/25/88	2/25/88	2/25/88	2/26/88
Total Cyanide (mg/l)	9010/335.3	0.01		BQL*	BQL	BQL	BQL

* Below quantifiable limits.

SKowron EOLMS
Margaret L. Skowron
Wet Chemistry Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: RESULTS - WET CHEMISTRY

Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. -	18244	18630	18631
			Sample ID -	TP-7 GRAB	DP-1 & DP-12 LAB COMP	DP-2 & DP-11 LAB COMP
			Sample Date-	2/26/88	3/15-16/88	3/15-16/88
Total Cyanide (mg/l)	9010/335.3	0.01		BQL*	BQL	BQL

* Below quantifiable limits.

SDonovan For MS.
Margaret L. Skowron
Wet Chemistry Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: RESULTS - WET CHEMISTRY

Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. -	18632	18633	
			Sample ID -	DP-3 & DP-8 LAB COMP	DP-6 & DP-7 LAB COMP	LAB BLANK
			Sample Date-	3/15/88	3/15/88	
Total Cyanide (mg/l)	9010/335.3	0.01		BQL*	BQL	BQL

* Below quantifiable limits.

A Doneucin For M.S.
Margaret L. Skowron
Wet Chemistry Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: METALS

Client: CRA A.E.S. Job Code CRF

(All results are in mg/kg)

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. - / Sample ID - / Sample Date-	18231 TP-1 GRAB 2/24/88	18232 TP-2 GRAB 2/24/88	18233 TP-3 GRAB 2/24/88	18234 TP-4 GRAB 2/24/88
Total Antimony (Sb)	7041	2.0		BQL*	BQL	BQL	BQL
Total Arsenic (As)	7060	0.5		2.3	1.4	3.0	2.6
Total Beryllium (Be)	7090	5.0		BQL	BQL	BQL	BQL
Total Cadmium (Cd)	7130	4.0		BQL	BQL	BQL	BQL
Total Chromium (Cr)	7190	50.0		BQL	BQL	BQL	BQL
Total Copper (Cu)	7210	20.0		21.0	BQL	24.0	23.0
Total Lead (Pb)	7420	100		BQL	BQL	BQL	BQL
Total Mercury (Hg)	7471	0.10		BQL	0.50	BQL	BQL
Total Mercury (Hg)	7471	0.10		BQL	BQL	BQL	BQL
Total Mercury (Hg)	7471	0.10		BQL	0.50	BQL	BQL
Total Nickel (Ni)	7520	30.0		34.0	44.0	36.0	32.0
Total Selenium (Se)	7740	0.5		BQL	BQL	BQL	BQL
Total Silver (Ag)	7760	10.0		BQL	BQL	BQL	BQL
Total Thallium (Tl)	7840	100		BQL	BQL	BQL	BQL
Total Zinc (Zn)	7950	5.0		27.0	95.0	90.0	39.0

Janette Bingert
Janette Bingert
Atomic Spectroscopy Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: METALS

Client: CRA A.E.S. Job Code CRF

(All results are in mg/kg)

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. -	18235	18236	18237
			Sample ID -	TP-5 GRAB	TP-8 GRAB	TP-9 GRAB
			Sample Date-	2/25/88	2/25/88	2/25/88
Total Antimony (Sb)	7041	2.0		BQL*	BQL	BQL
Total Arsenic (As)	7060	0.5		2.6	2.8	2.3
Total Beryllium (Be)	7090	5.0		BQL	BQL	BQL
Total Cadmium (Cd)	7130	4.0		BQL	BQL	BQL
Total Chromium (Cr)	7190	50.0		BQL	BQL	BQL
Total Copper (Cu)	7210	20.0		21.0	23.0	21.0
Total Lead (Pb)	7420	100		BQL	BQL	BQL
Total Mercury (Hg)	7471	0.10		BQL	BQL	BQL
Total Mercury (Hg)	7471	0.10		BQL	BQL	BQL
Total Mercury (Hg)	7471	0.10		BQL	BQL	BQL
Total Nickel (Ni)	7520	30.0		39.0	42.0	48.0
Total Selenium (Se)	7740	0.5		BQL	BQL	BQL
Total Silver (Ag)	7760	10.0		BQL	BQL	BQL
Total Thallium (Tl)	7840	100		BQL	BQL	BQL
Total Zinc (Zn)	7950	5.0		39.0	76.0	50.0

Janette Bingert

Janette Bingert
Atomic Spectroscopy Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: METALS

Client: CRA A.E.S. Job Code CRF

(All results are in mg/kg)

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. -	18631	18632	18633
			Sample ID -	DP-2 & DP-11 LAB COMP	DP-3 & DP-8 LAB COMP	DP-6 & DP-7 LAB COMP
			Sample Date-	3/15-16/88	3/15/88	3/15/88
Total Antimony (Sb)	7041	2.0		BQL*	BQL	BQL
Total Arsenic (As)	7060	0.5		5.3	2.8	4.4
Total Beryllium (Be)	7090	5.0		BQL	BQL	BQL
Total Cadmium (Cd)	7130	4.0		BQL	BQL	BQL
Total Chromium (Cr)	7190	50.0		67.0	90.0	302
Total Copper (Cu)	7210	20.0		85.0	53.0	83.0
Total Lead (Pb)	7420	100		BQL	BQL	BQL
Total Mercury (Hg)	7471	0.10		BQL	BQL	BQL
Total Mercury (Hg)	7471	0.10		BQL	BQL	0.50
Total Mercury (Hg)	7471	0.10		BQL	BQL	BQL
Total Nickel (Ni)	7520	30.0		35.0	46.0	56.5
Total Selenium (Se)	7740	0.5		0.6	0.5	0.7
Total Silver (Ag)	7760	10.0		BQL	BQL	BQL
Total Thallium (Tl)	7840	100		BQL	BQL	BQL
Total Zinc (Zn)	7950	5.0		66.0	142	136

Janette Bingert
Janette Bingert
Atomic Spectroscopy Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: METALS

Client: CRA A.E.S. Job Code CRF

(All results are in mg/kg)

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. - / Sample ID - / Sample Date-	18243 TP-6 GRAB 2/26/88	18244 TP-7 GRAB 2/26/88	18630 DP-1 & DP-12 LAB COMP 3/15-16/88
Total Antimony (Sb)	7041	2.0		BQL*	BQL	BQL
Total Arsenic (As)	7060	0.5		3.0	3.0	6.7
Total Beryllium (Be)	7090	5.0		BQL	BQL	BQL
Total Cadmium (Cd)	7130	4.0		BQL	BQL	BQL
Total Chromium (Cr)	7190	50.0		BQL	BQL	54.0
Total Copper (Cu)	7210	20.0		24.0	22.0	79.0
Total Lead (Pb)	7420	100		BQL	BQL	BQL
Total Mercury (Hg)	7471	0.10		BQL	BQL	BQL
Total Mercury (Hg)	7471	0.10		BQL	BQL	BQL
Total Mercury (Hg)	7471	0.10		BQL	BQL	BQL
Total Nickel (Ni)	7520	30.0		31.0	46.0	34.0
Total Selenium (Se)	7740	0.5		BQL	BQL	0.6
Total Silver (Ag)	7760	10.0		BQL	BQL	BQL
Total Thallium (Tl)	7840	100		BQL	BQL	BQL
Total Zinc (Zn)	7950	5.0		56.0	52.0	53.0

Janette Bingert
Janette Bingert
Atomic Spectroscopy Supervisor

* Below quantifiable limits.

APPENDIX A

QUALITY CONTROL PRECISION AND ACCURACY DATA

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Analysis: Milligrams/Liter or ppm
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample No.	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Cyanide	18243	BQL*	BQL	BQL	None	None
Cyanide	18633	BQL	BQL	BQL	None	None

Relative Percent Difference =
Range/Average X 100
* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units:mg/l or ppm)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Cyanide	18243	**SPK	0.26	BQL***	0.25	104
Cyanide	18633	**SPK	0.24	BQL	0.25	96
Cyanide		STD	0.11	0.10	---	110

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)
** Spiked after distillation.
*** Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
WET CHEMISTRY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
S Donovan	335.3	18230,->37,43,44	4/8/88	1130
S Donovan	335.3	18630->39	4/12/88	1500

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Analysis: Milligram/Kilogram, or ppm
Client: CRA A.E.S. Job Code: CRF

Analytical Parameters	Sample No.	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Antimony (Sb)	18633	BQL*	BQL	BQL	None	None
Arsenic (As)	18633	4.3	4.4	4.4	0.1	2
Beryllium (Be)	18633	BQL	BQL	BQL	None	None
Cadmium (Cd)	18633	BQL	BQL	BQL	None	None
Chromium (Cr)	18633	300	303	302	3	1
Copper (Cu)	18633	83.0	83.0	83.0	None	None
Lead (Pb)	18633	BQL	BQL	BQL	None	None
Nickel (Ni)	18633	59.0	54.0	56.5	5	9
Selenium (Se)	18633	0.70	0.70	0.70	None	None
Silver (Ag)	18633	BQL	BQL	BQL	None	None
Thallium (Tl)	18633	BQL	BQL	BQL	None	None
Zinc (Zn)	18633	1.36	1.36	1.36	None	None

Relative Percent Difference =
Range/Average X 100
* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units:mg/l or ppm)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Antimony (Sb)	18633	SPK	0.326	BQL**	0.300	109
EPA (Sb) std.	581	EPA	0.083	0.086	---	96
Arsenic (As)	18633	SPK	0.132	0.044	0.100	88
EPA (As) std.	386	EPA	0.032	0.030	---	107
Beryllium (Be)	18633	SPK	2.00	BQL	2.00	100
EPA (Be) std.	386	EPA	1.00	0.98	---	102
Cadmium (Cd)	18633	SPK	2.06	BQL	2.00	103
EPA (Cd) std.	1085	EPA	1.06	1.01	---	105
Chromium (Cr)	18633	SPK	12.38	3.02	10.00	94
EPA (Cr) std.	1085	EPA	4.70	5.06	---	93
Copper (Cu)	18633	SPK	5.86	0.83	5.00	101
EPA (Cu) std.	386	EPA	1.02	0.99	---	103
Lead (Pb)	18633	SPK	21.74	BQL	20.00	109
EPA (Pb) std.	1085	EPA	5.42	5.12	---	106
Mercury (Hg)	18633	SPK	0.0107	BQL	0.0100	107
Independent (Hg) std.		STD	0.0039	0.0040	---	98
Nickel (Ni)	18633	SPK	4.92	0.56	5.00	88
EPA (Ni) std.	386	EPA	0.94	0.99	---	95
Selenium (Se)	18633	SPK	0.100	0.007	0.100	93
EPA (Se) std.	386	EPA	0.007	0.007	---	100
Silver (Ag)	18633	SPK	3.70	BQL	4.00	92
EPA (Ag) std.	1085	EPA	2.53	2.50	---	101
Thallium (Tl)	18633	SPK	20.90	BQL	20.00	104
Independent (Tl) std.		STD	10.42	10.00	---	104
Zinc (Zn)	18633	***SPK	1.60	0.68	1.00	92
EPA (Zn) std.	386	EPA	0.46	0.50	---	92

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)
** Below quantifiable limits.
*** Spike on sample dilution factor of two.

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
ATOMIC SPECTROSCOPY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
P. McMahon	7041	18630-33 18243-44 18231-37	4-7-88	1000
	7060	18630-33 18243-44 18231-37	4-7-88	1200
	7740	18630-33 18243-44 18231-37	4-7-88	1300
F. Serrano	7760	18630-33 18243-44 18231-37	3-31-88	2100
	7520	18630-33 18243-44 18231-37	3-31-88	2000
	7420	18630-33 18243-44 18231-37	3-31-88	1900
	7210	18630-33 18243-44 18231-37	3-31-88	1700
	7190	18630-33 18243-44 18231-37	3-31-88	1600

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
ATOMIC SPECTROSCOPY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
F. Scurano	7130	18630-33 18243-44 18231-37	3-31-88	1500
	7090	18630-33 18243-44 18231-37	3-31-88	2300
	7840	18630-33 18243-44 18231-37	3-31-88	2400
	7950	18630-33 18243-44 18231-37	3-31-88	1800
	7471	18630-33 18243-47 18231-37	4-12-88	0700

APPENDIX B

CHAIN OF CUSTODY RECORDS

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): AES

CHAIN OF CUSTODY RECORD

PROJECT №: 2293

PROJECT NAME: UCC - Republic Watermain Test Pits

SAMPLER'S SIGNATURE C. Dunnigan (SIGN)

SEQ. №	SAMPLE №	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	№ OF CONTAINERS	REMARKS
	TP1	2/24/88		Test Pit 1	Soil	2	VOA vial
					"	1	1pt. glass
	TP2	"		Test Pit 2	Soil	2	VOA vial
					"	1	1pt glass
	TP3	"		Test Pit 3	Soil	2	VOA vial
					"	1	1pt. glass
				TOTAL NUMBER OF CONTAINERS		9	

ANTICIPATED CHEMICAL HAZARDS: Unknown

RELINQUISHED BY: 1 C. Dunnigan (SIGN)	DATE/TIME 2/24/88 1430	RECEIVED BY: 2 Steven Sugrue (SIGN)
RELINQUISHED BY: 2 Steven Sugrue (SIGN)	DATE/TIME [illegible] 3:00pm	RECEIVED BY: 3 [illegible] (SIGN)
RELINQUISHED BY: 3 (SIGN)	DATE/TIME	RECEIVED BY: 4 (SIGN)
ADDITIONAL SIGNATURE SHEET REQUIRED ☐		

METHOD OF SHIPMENT:	SHIPPED BY:	RECEIVED FOR LABORATORY BY: (SIGN) [illegible]	DATE/TIME [illegible] 3:00
CONDITION OF SEAL UPON RECEIPT: GENERAL CONDITION OF COOLER:		COOLER OPENED BY: (SIGN)	DATE/TIME

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

№ 4739

ADVANCED
ENVIRONMENTAL SERVICES INC.

2186 LIBERTY DRIVE
NIAGARA FALLS, NY 14304
(716) 283-3120

CHAIN OF CUSTODY RECORD	JOB CODE	PROJECT NAME,
	CRF	UCC - Republic Watermain Test Pits

SAMPLER'S SIGNATURE

SAMPLE NO.	SEQ. NO.	DATE	TIME	SAMPLE LOCATION	GRAB	COMP	SAMPLE TYPE	NO. OF CONTAINERS	REMARKS
	1	2/24/88		TEST PIT 1	X		SOIL	3	2 VOAS, 1-502
	2	2/24/88		TEST PIT 2	X		"	3	" "
	3	2/24/88		TEST PIT 3	X		SOIL	3	" "
							TOTAL CONTAINERS	9	

RELINQUISHED BY (Sign)	DATE	TIME	RECEIVED BY (Sign)
1 Steve Surprenant	2/24/88	5:00 p.m.	2 [illegible]
RELINQUISHED BY (Sign) 2	DATE	TIME	RECEIVED BY (Sign) 3
RELINQUISHED BY (Sign) 3	DATE	TIME	RECEIVED BY (Sign) 4
RELINQUISHED BY (Sign) 4	DATE	TIME	RECEIVED BY (Sign) 5

REMARKS:

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): AES

CHAIN OF CUSTODY RECORD

PROJECT Nº: 2293

PROJECT NAME: Union Carbide Watermain Bedding

SAMPLER'S SIGNATURE C. Dummigs (SIGN)

SEQ. Nº.	SAMPLE Nº.	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	Nº OF CONTAINERS	REMARKS
	TP4	2/25/88		Test Pit 4	Soil	1	VOA
	TP4	"		" " "	"	1	1pt glass
	TP8	"		" " 8	"	1	VOA
	TP8	"		" " 8	"	1	1pt glass
	TP9	"		" " 9	"	1	VOA
	TP9	"		" " 9	"	1	1pt glass
	TP5	"		" " 5	"	1	VOA
	TP5	"		" " 5	"	1	1pt glass
				TOTAL NUMBER OF CONTAINERS		8	

ANTICIPATED CHEMICAL HAZARDS: Unknown

RELINQUISHED BY:	DATE/TIME	RECEIVED BY:
1 C. Dummigs (SIGN)	[illegible]	2 [illegible] (SIGN)
2 (SIGN)		3 (SIGN)
3 (SIGN)		4 (SIGN)
ADDITIONAL SIGNATURE SHEET REQUIRED ☐		

METHOD OF SHIPMENT:	SHIPPED BY:	RECEIVED FOR LABORATORY BY: (SIGN)	DATE/TIME
CONDITION OF SEAL UPON RECEIPT: GENERAL CONDITION OF COOLER:		COOLER OPENED BY: (SIGN)	DATE/TIME

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

Nº 4738

ADVANCED ENVIRONMENTAL SERVICES INC.

2186 LIBERTY DRIVE
NIAGARA FALLS, NY 14304
(716) 283-3120

CHAIN OF CUSTODY RECORD

JOB CODE: CAF

PROJECT NAME: UNION CARBIDE Watermain Bedding.

SAMPLER'S SIGNATURE ______

SAMPLE NO.	SEQ. NO.	DATE	TIME	SAMPLE LOCATION	GRAB	COMP	SAMPLE TYPE	NO. OF CONTAINERS	REMARKS
TP4		2-25-88		Test P.T 4			SOIL	1	
TP4		"		" "				1	
TP8		"		" "				1	
TP5		"		" "				1	
TP9		"		" "				1	
TP9		"		" "				1	
				"					
TP5		"		" "				1	
TP5		"		" "				1	
							TOTAL CONTAINERS		

RELINQUISHED BY (Sign)	DATE	TIME	RECEIVED BY (Sign)
1 C. Dunnigan	2/25/88	4:43	2 Frank J. Sorrano
2			3
3			4
4			5

REMARKS:

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): AES

CHAIN OF CUSTODY RECORD

PROJECT Nº: 2293

PROJECT NAME: UCC-Republic Watermain Test Pits

SAMPLER'S SIGNATURE: C Dunnige (SIGN)

SEQ. Nº	SAMPLE Nº	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	Nº OF CONTAINERS	REMARKS
	TP6	2/26/88		Test Pit 6	Soil	1	VOA
	TP6			" " 6	"	1	1 pt. glass
	TP7	2/26/88		" " 7	"	1	VOA
	TP7			" " 7	"	1	1 pt. glass
				TOTAL NUMBER OF CONTAINERS		4	

20

ANTICIPATED CHEMICAL HAZARDS: Unknown

RELINQUISHED BY:	DATE/TIME	RECEIVED BY:
1 C Dunnige (SIGN)	2/26/88 1330	2 Diana Thompson (SIGN)
2 Dana Thompson (SIGN)	2/26/88 2:40	3 Judy Ostrowsk (SIGN)
3 (SIGN)		4 (SIGN)
ADDITIONAL SIGNATURE SHEET REQUIRED ☐		

METHOD OF SHIPMENT:	SHIPPED BY:	RECEIVED FOR LABORATORY BY:	DATE/TIME
Courier (CRA)	D. Thompson	(SIGN) Judy Ostrowsk	2/26 2:40

CONDITION OF SEAL UPON RECEIPT:
GENERAL CONDITION OF COOLER:

COOLER OPENED BY: (SIGN)
DATE/TIME

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

Nº 4802

ADVANCED ENVIRONMENTAL SERVICES INC.

2186 LIBERTY DRIVE
NIAGARA FALLS, NY 14304
(716) 283-3120

CHAIN OF CUSTODY RECORD

JOB CODE: CRF

PROJECT NAME: UCC-Republic Watermain Test Pits

SAMPLER'S SIGNATURE

SAMPLE NO.	SEQ. NO.	DATE	TIME	SAMPLE LOCATION	GRAB	COMP	SAMPLE TYPE	NO. OF CONTAINERS	REMARKS
		2/26/88		Test Pit 6	X		soil	2	containers
		2/26/88		Test Pit 7	X		soil	2	"
							TOTAL CONTAINERS	4	

RELINQUISHED BY (Sign)	DATE	TIME	RECEIVED BY (Sign)
1 Diana Thompson	2/26/88	2:40 pm	2 [illegible]
2			3
3			4
4			5

REMARKS:

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): AES

CHAIN OF CUSTODY RECORD

PROJECT №: 2293

PROJECT NAME: UCC-REPUBLIC

SAMPLER'S SIGNATURE Nib W. Thompson (SIGN)

SEQ. №	SAMPLE №	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	№ OF CONTAINERS	REMARKS
	DP-1	3/15/88	9:20	200W + 155S	FILL	2	1 VOA, 1 500ml
	DP-2	3/15/88	10:20	275S + 445W	FILL	2	1 VOA, 1 500ml
	DP-3	3/15/88	11:30	601S + 380W	FILL	2	1 VOA, 1 500ml
	~~DP-5~~	~~3/15/88~~	~~12:00~~	~~[illegible]~~	~~FILL~~	~~2~~	~~1 VOA, 1 500ml~~
	DP-6	3/15/88	1:55	709S + 246W	FILL	2	1 VOA, 1 500ml
	DP-7	3/15/88	2:10	650S + 28E	FILL	2	1 VOA, 1 500ml
	DP-8	3/15/88	2:45	152W + 435S	FILL	2	1 VOA, 1 500ml
	DP-11	3/16/88	9:10	300S + 590W	FILL	2	1 VOA, 1 500ml
	DP-12	3/16/88	10:10	100S + 450W	FILL	2	1 VOA, 1 500ml

NOTE: THE ABOVE WILL BE COMPOSITED AS FOLLOWS—

DP-1 AND DP-12
DP-2 AND DP-11
DP-3 AND DP-8
DP-6 AND DP-7

TOTAL NUMBER OF CONTAINERS

ANTICIPATED CHEMICAL HAZARDS:

RELINQUISHED BY	DATE/TIME	RECEIVED BY
1 Nib W. Thompson (SIGN)	3/16/88 1300	2 Diana Thompson (SIGN)
2 Diana Thompson (SIGN)	3/16/88 2:00	3 Judy Ostrowsk (SIGN)
3 (SIGN)		4 (SIGN)

ADDITIONAL SIGNATURE SHEET REQUIRED ☐

METHOD OF SHIPMENT:	SHIPPED BY:	RECEIVED FOR LABORATORY BY:	DATE/TIME
CRA Carrier	D. Thompson	(SIGN) Judy Ostrowsk-	3/16 2:00

CONDITION OF SEAL UPON RECEIPT:
GENERAL CONDITION OF COOLER:

COOLER OPENED BY: (SIGN)
DATE/TIME

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

№ 4529

ADVANCED ENVIRONMENTAL SERVICES INC.

2186 LIBERTY DRIVE
NIAGARA FALLS, NY 14304
(716) 283-3120

CHAIN OF CUSTODY RECORD

CHAIN OF CUSTODY RECORD	JOB CODE	PROJECT NAME
	3RF	UNION CARBIDE

SAMPLER'S SIGNATURE

SAMPLE NO.	SEQ. NO.	DATE	TIME	SAMPLE LOCATION	GRAB	COMP	SAMPLE TYPE	NO. OF CONTAINERS	REMARKS
	1	3/15/88		DP-1	X		SOIL	2	1-VOA 1-500 ml.
	2			DP-2	X			2	
	3			DP-3	X			2	
	~~4~~			~~DP-4~~	~~X~~			~~2~~	
	5			DP-6	X			2	
	6			DP-7	X			2	
	7			DP-8	X			2	
	8	3/16/88		DP-11	X			2	
	9	3/16/88		DP-12	X			2	
	10	3/14/88		TRIP BLANK			WATER	1	VOA
							TOTAL CONTAINERS	17	

RELINQUISHED BY (Sign)	DATE	TIME	RECEIVED BY (Sign)
1 Diana Thompson	3/16/88	2:00 p.m.	2 Judy Petrowski
RELINQUISHED BY (Sign)	DATE	TIME	RECEIVED BY (Sign)
			3
RELINQUISHED BY (Sign)	DATE	TIME	RECEIVED BY (Sign)
			4
RELINQUISHED BY (Sign)	DATE	TIME	RECEIVED BY (Sign)
			5

REMARKS:

23

2293

ADVANCED
ENVIRONMENTAL SERVICES INC.

GROUNDWATER MONITORING PROGRAM
CRA PROJECT #2293
(FOR UNION CARBIDE)

Report Prepared For

CONESTOGA ROVERS & ASSOCIATES, INC.

Catherine Mocniak

Catherine Mocniak
Project Manager

W. Joseph McDougall

W. Joseph McDougall, Ph.D.
Technical Evaluation

March 18, 1988
AES Report CRF

COMMITMENT
TO
HONESTY - QUALITY - SERVICE

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: RESULTS - WET CHEMISTRY

Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. -	18231	18232	18233
			Sample ID -	TP-1 GRAB	TP-2 GRAB	TP-3 GRAB
			Sample Date-	2/24/88	2/24/88	2/24/88
Ammonia (As N) (mg/l)*	350.1	0.01		0.07	0.04	0.04
Total Kjeldahl Nitrogen(mg/l)	351.2	0.1		BQL**	BQL	BQL
Nitrite (mg/l)*	353.2	0.01		0.07	0.02	0.04
Total Rec. Phenols (mg/l)	420.2	0.005		0.060	BQL	0.008
Diethyl Sulfate (As SO_4)*	375.2	2.0		74	94	17

* In 20% solution.
** Below quantifiable limits.

Margaret L. Skowron
Margaret L. Skowron
Wet Chemistry Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: RESULTS - WET CHEMISTRY

Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. - / Sample ID - / Sample Date-	18234 TP-4 GRAB 2/25/88	18235 TP-5 GRAB 2/25/88	18236 TP-8 GRAB 2/25/88
Ammonia (As N) (mg/l)*	350.1	0.01		0.06	0.02	0.02
Total Kjeldahl Nitrogen(mg/l)	351.2	0.1		0.1	BQL**	0.1
Nitrite (mg/l)*	353.2	0.01		0.15	0.10	0.05
Total Rec. Phenols (mg/l)	420.2	0.005		0.010	0.006	BQL
Diethyl Sulfate (As SO_4)*	375.2	2.0		15	14	67

* In 20% solution.
** Below quantifiable limits.

Margaret L. Skowron
Margaret L. Skowron
Wet Chemistry Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: RESULTS - WET CHEMISTRY

Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. -	18237	18243	18244
			Sample ID -	TP-9 GRAB	TP-6 SOIL	TP-7 SOIL
			Sample Date-	2/25/88	2/26/88	2/26/88
Ammonia (As N) (mg/l)*	350.1	0.01		0.08	0.22	0.04
Total Kjeldahl Nitrogen(mg/l)	351.2	0.1		0.1	0.1	0.1
Nitrite (mg/l)*	353.2	0.01		0.06	0.02	0.04
Total Rec. Phenols (mg/l)	420.2	0.005		0.008	0.006	0.006
Diethyl Sulfate (As SO_4)*	375.2	2.0		12	12	20

* In 20% solution.

Margaret L. Skowron

Margaret L. Skowron
Wet Chemistry Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Analysis: Milligrams/Liter or ppm
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample No.	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Sulfate	18232	94	93	94	1	1.1
Total Kjeldahl Nitrogen	18244	0.1	0.1	0.1	None	None
Ammonia	18244	0.04	0.05	0.04	0.01	25
Total Recoverable Phenols	18244	0.006	0.006	0.006	None	None
Nitrite	18244	0.05	0.04	0.04	0.01	25

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units:mg/l or ppm)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Sulfate	18232	SPK	160	94	72	92
Sulfate	384-2	EPA	7.4	7.2	---	103
Total Kjeldahl Nitrogen	18244	SPK	3.0	0.1	---	97
Total Kjeldahl Nitrogen	486-2	EPA	5.0	5.0	---	100
Ammonia	18244	SPK	0.62	0.04	0.50	116
Ammonia	9916	EPA	9.0	8.0	---	112
Total Recoverable Phenols	18244	SPK	0.220	0.006	0.200	107
Total Recoverable Phenols	694	STD	0.121	0.150	---	81
Nitrite	18244	SPK	0.28	0.04	0.25	96

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
WET CHEMISTRY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
Donovan	375.2	18231,32,33,34,35,36,37 18243,44	2/29/88	1600
Donovan	351.2	18231→18237 18243,18244	3/2/88	1600
Donovan	350.1	18231→18237,18243,44	3/3/88	1230
Donovan	420.2	18231→37,18243→44	3/9/88	1000
Donovan	353.2	18231→37,43,44	3/10/88	1300

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

			AES Lab No.-	18231	18232	18233
			Sample ID -	TP-1	TP-2	TP-3
Analytical Parameter(s)	Method No.	Quant. Limits	Sample Date-	2/24/88	2/24/88	2/24/88
Chloromethane	8240	1600		BQL*	BQL	BQL
Vinyl Chloride	"	1600		BQL	BQL	BQL
Chloroethane	"	1600		BQL	BQL	BQL
Bromomethane	"	1600		BQL	BQL	BQL
2-Chloroethyl Vinyl Ether	"	1600		BQL	BQL	BQL
Ethylbenzene	"	800		BQL	BQL	BQL
Methylene Chloride	"	800		BQL	BQL	BQL
Chlorobenzene	"	800		BQL	BQL	BQL
1,1-Dichloroethylene	"	800		BQL	BQL	BQL
1,1-Dichloroethane	"	800		BQL	BQL	BQL
trans-1,2-Dichloroethylene	"	800		BQL	BQL	BQL
Chloroform	"	800		BQL	BQL	BQL
1,2-Dichloroethane	"	800		BQL	BQL	BQL
1,1,1-Trichloroethane	"	800		BQL	BQL	BQL
Carbon Tetrachloride	"	800		BQL	BQL	BQL
Bromodichloromethane	"	800		BQL	BQL	BQL
1,2-Dichloropropane	"	800		BQL	BQL	BQL
trans-1,3-Dichloropropene	"	800		BQL	BQL	BQL
Trichloroethylene	"	800		BQL	BQL	BQL
Benzene	"	800		1,000	2,000	BQL
cis-1,3-Dichloropropene	"	800		BQL	BQL	BQL
1,1,2-Trichloroethane	"	800		BQL	BQL	BQL
Dibromochloromethane	"	800		BQL	BQL	BQL
Bromoform	"	800		BQL	BQL	BQL

Susan C. Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.-	18234	18235	18236
			Sample ID -	TP-4	TP-5	TP-8
			Sample Date-	2/25/88	2/25/88	2/25/88
Chloromethane	8240	1600		BQL*	BQL	BQL
Vinyl Chloride	"	1600		BQL	BQL	BQL
Chloroethane	"	1600		BQL	BQL	BQL
Bromomethane	"	1600		BQL	BQL	BQL
2-Chloroethyl Vinyl Ether	"	1600		BQL	BQL	BQL
Ethylbenzene	"	800		BQL	BQL	BQL
Methylene Chloride	"	800		BQL	BQL	BQL
Chlorobenzene	"	800		BQL	BQL	BQL
1,1-Dichloroethylene	"	800		BQL	BQL	BQL
1,1-Dichloroethane	"	800		BQL	BQL	BQL
trans-1,2-Dichloroethylene	"	800		BQL	BQL	BQL
Chloroform	"	800		BQL	BQL	BQL
1,2-Dichloroethane	"	800		BQL	BQL	BQL
1,1,1-Trichloroethane	"	800		BQL	BQL	BQL
Carbon Tetrachloride	"	800		BQL	BQL	BQL
Bromodichloromethane	"	800		BQL	BQL	BQL
1,2-Dichloropropane	"	800		BQL	BQL	BQL
trans-1,3-Dichloropropene	"	800		BQL	BQL	BQL
Trichloroethylene	"	800		BQL	BQL	BQL
Benzene	"	800		53,000	800	880
cis-1,3-Dichloropropene	"	800		BQL	BQL	BQL
1,1,2-Trichloroethane	"	800		BQL	BQL	BQL
Dibromochloromethane	"	800		BQL	BQL	BQL
Bromoform	"	800		BQL	BQL	BQL

Susan C. Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.-	18237	18243
			Sample ID -	TP-9	TP-6
			Sample Date-	2/25/88	2/26/88
Chloromethane	8240	1600		BQL*	BQL
Vinyl Chloride	"	1600		BQL	BQL
Chloroethane	"	1600		BQL	BQL
Bromomethane	"	1600		BQL	BQL
2-Chloroethyl Vinyl Ether	"	1600		BQL	BQL
Ethylbenzene	"	800		BQL	BQL
Methylene Chloride	"	800		BQL	BQL
Chlorobenzene	"	800		BQL	BQL
1,1-Dichloroethylene	"	800		BQL	BQL
1,1-Dichloroethane	"	800		BQL	BQL
trans-1,2-Dichloroethylene	"	800		BQL	BQL
Chloroform	"	800		BQL	BQL
1,2-Dichloroethane	"	800		BQL	BQL
1,1,1-Trichloroethane	"	800		BQL	BQL
Carbon Tetrachloride	"	800		BQL	BQL
Bromodichloromethane	"	800		BQL	BQL
1,2-Dichloropropane	"	800		BQL	BQL
trans-1,3-Dichloropropene	"	800		BQL	BQL
Trichloroethylene	"	800		BQL	BQL
Benzene	"	800		1,300	2,100
cis-1,3-Dichloropropene	"	800		BQL	BQL
1,1,2-Trichloroethane	"	800		BQL	BQL
Dibromochloromethane	"	800		BQL	BQL
Bromoform	"	800		BQL	BQL

Susan C Scrocchi
Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- 18244 / Sample ID - TP-7 / Sample Date- 2/26/88	METHOD * BLANK
Chloromethane	8240	1600	BQL**	<10
Vinyl Chloride	"	1600	BQL	<10
Chloroethane	"	1600	BQL	<10
Bromomethane	"	1600	BQL	<10
2-Chloroethyl Vinyl Ether	"	1600	BQL	<10
Ethylbenzene	"	800	BQL	<5.0
Methylene Chloride	"	800	BQL	<5.0
Chlorobenzene	"	800	BQL	<5.0
1,1-Dichloroethylene	"	800	BQL	<5.0
1,1-Dichloroethane	"	800	BQL	<5.0
trans-1,2-Dichloroethylene	"	800	BQL	<5.0
Chloroform	"	800	BQL	<5.0
1,2-Dichloroethane	"	800	BQL	<5.0
1,1,1-Trichloroethane	"	800	BQL	<5.0
Carbon Tetrachloride	"	800	BQL	<5.0
Bromodichloromethane	"	800	BQL	<5.0
1,2-Dichloropropane	"	800	BQL	<5.0
trans-1,3-Dichloropropene	"	800	BQL	<5.0
Trichloroethylene	"	800	BQL	<5.0
Benzene	"	800	BQL	<5.0
cis-1,3-Dichloropropene	"	800	BQL	<5.0
1,1,2-Trichloroethane	"	800	BQL	<5.0
Dibromochloromethane	"	800	BQL	<5.0
Bromoform	"	800	BQL	<5.0

Susan C. Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Unit of measure are µg/l, ppb.
* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.-	18231	18232	18233
			Sample ID -	TP-1	TP-2	TP-3
			Sample Date-	2/24/88	2/24/88	2/24/88
Fluorene	8240	660		BQL*	BQL	BQL
4-Chlorophenylphenylether	"	660		BQL	BQL	BQL
Diphenylamine(N-Nitroso)	"	660		BQL	BQL	BQL
Benzyl Alcohol	"	660		BQL	BQL	BQL
4-Chloroaniline	"	660		BQL	BQL	BQL
4-Bromophenylphenylether	"	660		BQL	BQL	BQL
Hexachlorobenzene	"	660		BQL	BQL	BQL
Phenanthrene	"	660		BQL	BQL	BQL
Anthracene	"	660		BQL	BQL	BQL
Di-N-Butylphthalate	"	660		BQL	BQL	BQL
Fluoranthene	"	660		BQL	1,300	BQL
2-Nitroaniline	"	660		BQL	BQL	BQL
Pyrene	"	660		BQL	1,300	BQL
Butylbenzylphthalate	"	660		BQL	BQL	BQL
Benzo(a)Anthracene	"	660		BQL	BQL	BQL
3,3′-Dichlorobenzidine	"	1980		BQL	BQL	BQL
Chrysene	"	660		BQL	BQL	BQL
Bis(2-Ethylhexyl)Phthalate	"	660		BQL	BQL	BQL
Di-N-Octylphthalate	"	660		BQL	BQL	BQL
Benzo(b)Fluoranthene	"	660		BQL	2,500	BQL
Benzo(k)Fluoranthene	"	660		BQL	BQL	BQL
Benzo(a)Pyrene	"	660		BQL	BQL	BQL
Indeno(1,2,3-C,D)Pyrene	"	660		BQL	BQL	BQL
Dibenzo(a,h)Anthracene	"	660		BQL	BQL	BQL
Benzo(g,h,i)Perylene	"	660		BQL	BQL	BQL

Susan C. Scrocchi

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Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	18234 TP-4 2/25/88	18235 TP-5 2/25/88	18236 TP-8 2/25/88
Fluorene	8240	660		BQL*	BQL	BQL
4-Chlorophenylphenylether	"	660		BQL	BQL	BQL
Diphenylamine(N-Nitroso)	"	660		BQL	BQL	BQL
Benzyl Alcohol	"	660		BQL	BQL	BQL
4-Chloroaniline	"	660		BQL	BQL	BQL
4-Bromophenylphenylether	"	660		BQL	BQL	BQL
Hexachlorobenzene	"	660		BQL	BQL	BQL
Phenanthrene	"	660		BQL	BQL	BQL
Anthracene	"	660		BQL	BQL	BQL
Di-N-Butylphthalate	"	660		BQL	BQL	BQL
Fluoranthene	"	660		BQL	BQL	BQL
2-Nitroaniline	"	660		BQL	BQL	BQL
Pyrene	"	660		BQL	BQL	BQL
Butylbenzylphthalate	"	660		BQL	BQL	BQL
Benzo(a)Anthracene	"	660		BQL	BQL	BQL
3,3´-Dichlorobenzidine	"	1980		BQL	BQL	BQL
Chrysene	"	660		BQL	BQL	BQL
Bis(2-Ethylhexyl)Phthalate	"	660		BQL	BQL	BQL
Di-N-Octylphthalate	"	660		BQL	BQL	BQL
Benzo(b)Fluoranthene	"	660		BQL	BQL	BQL
Benzo(k)Fluoranthene	"	660		BQL	BQL	BQL
Benzo(a)Pyrene	"	660		BQL	BQL	BQL
Indeno(1,2,3-C,D)Pyrene	"	660		BQL	BQL	BQL
Dibenzo(a,h)Anthracene	"	660		BQL	BQL	BQL
Benzo(g,h,i)Perylene	"	660		BQL	BQL	BQL

Susan C. Scrocchi

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Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

			AES Lab No.-	18237	18243
			Sample ID -	TP-9	TP-6
Analytical Parameter(s)	Method No.	Quant. Limits	Sample Date-	2/25/88	2/26/88
Fluorene	8240	660		BQL*	BQL
4-Chlorophenylphenylether	"	660		BQL	BQL
Diphenylamine(N-Nitroso)	"	660		BQL	BQL
Benzyl Alcohol	"	660		BQL	BQL
4-Chloroaniline	"	660		BQL	BQL
4-Bromophenylphenylether	"	660		BQL	BQL
Hexachlorobenzene	"	660		BQL	BQL
Phenanthrene	"	660		BQL	BQL
Anthracene	"	660		BQL	BQL
Di-N-Butylphthalate	"	660		BQL	BQL
Fluoranthene	"	660		BQL	BQL
2-Nitroaniline	"	660		BQL	BQL
Pyrene	"	660		BQL	BQL
Butylbenzylphthalate	"	660		BQL	BQL
Benzo(a)Anthracene	"	660		BQL	BQL
3,3´-Dichlorobenzidine	"	1980		BQL	BQL
Chrysene	"	660		BQL	BQL
Bis(2-Ethylhexyl)Phthalate	"	660		BQL	BQL
Di-N-Octylphthalate	"	660		BQL	BQL
Benzo(b)Fluoranthene	"	660		BQL	BQL
Benzo(k)Fluoranthene	"	660		BQL	BQL
Benzo(a)Pyrene	"	660		BQL	BQL
Indeno(1,2,3-C,D)Pyrene	"	660		BQL	BQL
Dibenzo(a,h)Anthracene	"	660		BQL	BQL
Benzo(g,h,i)Perylene	"	660		BQL	BQL

Susan C. Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- 18244 Sample ID - TP-7 Sample Date- 2/26/88	METHOD* BLANK
Fluorene	8240	660	BQL**	<10
4-Chlorophenylphenylether	"	660	BQL	<10
Diphenylamine(N-Nitroso)	"	660	BQL	<10
Benzyl Alcohol	"	660	BQL	<10
4-Chloroaniline	"	660	BQL	<10
4-Bromophenylphenylether	"	660	BQL	<10
Hexachlorobenzene	"	660	BQL	<10
Phenanthrene	"	660	BQL	<10
Anthracene	"	660	BQL	<10
Di-N-Butylphthalate	"	660	BQL	<10
Fluoranthene	"	660	BQL	<10
2-Nitroaniline	"	660	BQL	<10
Pyrene	"	660	BQL	<10
Butylbenzylphthalate	"	660	BQL	<10
Benzo(a)Anthracene	"	660	BQL	<10
3,3´-Dichlorobenzidine	"	1980	BQL	<30
Chrysene	"	660	BQL	<10
Bis(2-Ethylhexyl)Phthalate	"	660	BQL	<10
Di-N-Octylphthalate	"	660	BQL	<10
Benzo(b)Fluoranthene	"	660	BQL	<10
Benzo(k)Fluoranthene	"	660	BQL	<10
Benzo(a)Pyrene	"	660	BQL	<10
Indeno(1,2,3-C,D)Pyrene	"	660	BQL	<10
Dibenzo(a,h)Anthracene	"	660	BQL	<10
Benzo(g,h,i)Perylene	"	660	BQL	<10

Susan C. Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Units of measure are μg/l, ppb.
** Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.-	18231	18232	18233
			Sample ID -	TP-1	TP-2	TP-3
			Sample Date-	2/24/88	2/24/88	2/24/88
1,1,2,2-Tetrachloroethylene	8240	800		BQL*	BQL	BQL
1,1,2,2-Tetrachloroethane	"	800		BQL	BQL	BQL
Toluene	"	800		BQL	BQL	BQL
Acetone	"	8000		BQL	BQL	BQL
Carbon Disulfide	"	800		BQL	BQL	BQL
2-Butanone	"	8000		BQL	BQL	BQL
Vinyl Acetate	"	800		BQL	BQL	BQL
2-Hexanone	"	8000		BQL	BQL	BQL
4-Methyl-2-Pentanone	"	8000		BQL	BQL	BQL
Styrene	"	800		BQL	BQL	BQL
Xylenes (Total)	"	800		BQL	BQL	BQL
Trichlorofluoromethane	"	800		BQL	BQL	BQL

Susan C Scrocchi
Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	18234 TP-4 2/25/88	18235 TP-5 2/25/88	18236 TP-8 2/25/88
1,1,2,2-Tetrachloroethylene	8240	800		BQL*	BQL	BQL
1,1,2,2-Tetrachloroethane	"	800		BQL	BQL	BQL
Toluene	"	800		BQL	BQL	BQL
Acetone	"	8000		BQL	BQL	BQL
Carbon Disulfide	"	800		BQL	BQL	BQL
2-Butanone	"	8000		BQL	BQL	BQL
Vinyl Acetate	"	800		BQL	BQL	BQL
2-Hexanone	"	8000		BQL	BQL	BQL
4-Methyl-2-Pentanone	"	8000		BQL	BQL	BQL
Styrene	"	800		BQL	BQL	BQL
Xylenes (Total)	"	800		BQL	BQL	BQL
Trichlorofluoromethane	"	800		BQL	BQL	BQL

Susan C Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

			AES Lab No.-	18237	18243
			Sample ID -	TP-9	TP-6
Analytical Parameter(s)	Method No.	Quant. Limits	Sample Date-	2/25/88	2/26/88
1,1,2,2-Tetrachloroethylene	8240	800		BQL*	BQL
1,1,2,2-Tetrachloroethane	"	800		BQL	BQL
Toluene	"	800		BQL	BQL
Acetone	"	8000		BQL	BQL
Carbon Disulfide	"	800		BQL	BQL
2-Butanone	"	8000		BQL	BQL
Vinyl Acetate	"	800		BQL	BQL
2-Hexanone	"	8000		BQL	BQL
4-Methyl-2-Pentanone	"	8000		BQL	BQL
Styrene	"	800		BQL	BQL
Xylenes (Total)	"	800		BQL	BQL
Trichlorofluoromethane	"	800		BQL	BQL

Susan C. Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA   A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- 18244 Sample ID - TP-7 Sample Date- 2/26/88	METHOD* BLANK
1,1,2,2-Tetrachloroethylene	8240	800	BQL**	<5.0
1,1,2,2-Tetrachloroethane	"	800	BQL	<5.0
Toluene	"	800	BQL	<5.0
Acetone	"	8000	BQL	<50
Carbon Disulfide	"	800	BQL	<5.0
2-Butanone	"	8000	BQL	<50
Vinyl Acetate	"	800	BQL	<5.0
2-Hexanone	"	8000	BQL	<50
4-Methyl-2-Pentanone	"	8000	BQL	<50
Styrene	"	800	BQL	<5.0
Xylenes (Total)	"	800	BQL	<5.0
Trichlorofluoromethane	"	800	BQL	<5.0

Susan C. Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Units of measure are µg/l, ppb.
* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Kilogram, ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Chloromethane	18231	<1600	<1600	<1600	None	None
Vinyl Chloride	18231	<1600	<1600	<1600	None	None
Chloroethane	18231	<1600	<1600	<1600	None	None
Bromomethane	18231	<1600	<1600	<1600	None	None
2-Chloroethyl Vinyl Ether	18231	<1600	<1600	<1600	None	None
Ethylbenzene	18231	<800	<800	<800	None	None
Methylene Chloride	18231	<800	<800	<800	None	None
Chlorobenzene	18231	<800	<800	<800	None	None
1,1-Dichloroethylene	18231	<800	<800	<800	None	None
1,1-Dichloroethane	18231	<800	<800	<800	None	None
trans-1,2-Dichloroethylene	18231	<800	<800	<800	None	None
Chloroform	18231	<800	<800	<800	None	None
1,2-Dichloroethane	18231	<800	<800	<800	None	None
1,1,1-Trichloroethane	18231	<800	<800	<800	None	None
Carbon Tetrachloride	18231	<800	<800	<800	None	None
Bromodichloromethane	18231	<800	<800	<800	None	None
1,2-Dichloropropane	18231	<800	<800	<800	None	None
trans-1,3-Dichloropropene	18231	<800	<800	<800	None	None
Trichloroethylene	18231	<800	<800	<800	None	None
Benzene	18231	1,000	930	965	70	7
cis-1,3-Dichloropropene	18231	<800	<800	<800	None	None
1,1,2-Trichloroethane	18231	<800	<800	<800	None	None
Dibromochloromethane	18231	<800	<800	<800	None	None
Bromoform	18231	<800	<800	<800	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Kilogram, ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
1,1,2,2-Tetrachloroethylene	18231	<800	<800	<800	None	None
1,1,2,2-Tetrachloroethane	18231	<800	<800	<800	None	None
Toluene	18231	<800	<800	<800	None	None
Acetone	18231	<8000	<8000	<8000	None	None
Carbon Disulfide	18231	<800	<800	<800	None	None
2-Butanone	18231	<8000	<8000	<8000	None	None
Vinyl Acetate	18231	<800	<800	<800	None	None
2-Hexanone	18231	<8000	<8000	<8000	None	None
4-Methyl-2-Pentanone	18231	<8000	<8000	<8000	None	None
Styrene	18231	<800	<800	<800	None	None
Xylenes (Total)	18231	<800	<800	<800	None	None
Trichlorofluoromethane	18231	<800	<800	<800	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units: µg/l or ppb)*

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery**
Toluene	18243	SPK	38	<5.0	36	106
Ethylbenzene	18243	SPK	25	<5.0	31	81
o-Xylene	18243	SPK	43	<5.0	36	119
Chloroform		EPA	208	---	150	139
Carbon Tetrachloride		EPA	44	---	56	79
1,1,1-Trichloroethane		EPA	13	---	19	68
1,2-Dichloroethane		EPA	38	---	31	123
Dichlorobromomethane		EPA	9.7	---	15	65
Bromoform		EPA	26	---	39	67
1,2-Dichloroethane	18233	Surrogate	10	---	10	100
Toluene d_8	18236	Surrogate	10	---	10	100
Toluene d_8	18244	Surrogate	7.0	---	10	70

** % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)
* Spike was performed on the sample extract.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	18231 TP-1 2/24/88	18232 TP-2 2/24/88	18233 TP-3 2/24/88
2-Methylnaphthalene	8270	660		BQL*	BQL	BQL
Bis(2-Chloroethyl)Ether	"	660		BQL	BQL	BQL
1,3-Dichlorobenzene	"	660		BQL	BQL	BQL
1,4-Dichlorobenzene	"	660		BQL	BQL	BQL
1,2-Dichlorobenzene	"	660		BQL	BQL	BQL
Bis(2-Chloroisopropyl) Ether	"	660		BQL	BQL	BQL
Hexachloroethane	"	660		BQL	BQL	BQL
N-Nitrosodi-N-Propylamine	"	660		BQL	BQL	BQL
Nitrobenzene	"	660		BQL	BQL	BQL
Isophorone	"	660		BQL	BQL	BQL
Bis(2-Chloroethoxy)Methane	"	660		BQL	BQL	BQL
1,2,4-Trichlorobenzene	"	660		BQL	BQL	BQL
Naphthalene	"	660		BQL	BQL	BQL
Hexachlorobutadiene	"	660		BQL	BQL	BQL
Hexachlorocylopentadiene	"	660		BQL	BQL	BQL
2-Chloronaphthalene	"	660		BQL	BQL	BQL
Dimethylphthalate	"	660		BQL	BQL	BQL
Acenaphthylene	"	660		BQL	BQL	BQL
2,6-Dinitrotoluene	"	660		BQL	BQL	BQL
Acenaphthene	"	660		BQL	BQL	BQL
2,4-Dinitrotoluene	"	660		BQL	BQL	BQL
Diethylphthalate	"	660		BQL	BQL	BQL

Susan C. Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits				
			AES Lab No.-	18234	18235	18236
			Sample ID -	TP-4	TP-5	TP-8
			Sample Date-	2/25/88	2/25/88	2/25/88
2-Methylnaphthalene	8270	660		BQL*	BQL	BQL
Bis(2-Chloroethyl)Ether	"	660		BQL	BQL	BQL
1,3-Dichlorobenzene	"	660		BQL	BQL	BQL
1,4-Dichlorobenzene	"	660		BQL	BQL	BQL
1,2-Dichlorobenzene	"	660		BQL	BQL	BQL
Bis(2-Chloroisopropyl) Ether	"	660		BQL	BQL	BQL
Hexachloroethane	"	660		BQL	BQL	BQL
N-Nitrosodi-N-Propylamine	"	660		BQL	BQL	BQL
Nitrobenzene	"	660		BQL	BQL	BQL
Isophorone	"	660		BQL	BQL	BQL
Bis(2-Chloroethoxy)Methane	"	660		BQL	BQL	BQL
1,2,4-Trichlorobenzene	"	660		BQL	BQL	BQL
Naphthalene	"	660		BQL	BQL	BQL
Hexachlorobutadiene	"	660		BQL	BQL	BQL
Hexachlorocylopentadiene	"	660		BQL	BQL	BQL
2-Chloronaphthalene	"	660		BQL	BQL	BQL
Dimethylphthalate	"	660		BQL	BQL	BQL
Acenaphthylene	"	660		BQL	BQL	BQL
2,6-Dinitrotoluene	"	660		BQL	BQL	BQL
Acenaphthene	"	660		BQL	BQL	BQL
2,4-Dinitrotoluene	"	660		BQL	BQL	BQL
Diethylphthalate	"	660		BQL	BQL	BQL

Susan C Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

nalytical arameter(s)	Method No.	Quant. Limits	AES Lab No.- Sample ID - Sample Date-	18237 TP-9 2/25/88	18243 TP-6 2/26/88
?-Methylnaphthalene	8270	660		BQL*	BQL
3is(2-Chloroethyl)Ether	"	660		BQL	BQL
l,3-Dichlorobenzene	"	660		BQL	BQL
l,4-Dichlorobenzene	"	660		BQL	BQL
l,2-Dichlorobenzene	"	660		BQL	BQL
3is(2-Chloroisopropyl) Ether	"	660		BQL	BQL
Iexachloroethane	"	660		BQL	BQL
N-Nitrosodi-N-Propylamine	"	660		BQL	BQL
Nitrobenzene	"	660		BQL	BQL
Isophorone	"	660		BQL	BQL
3is(2-Chloroethoxy)Methane	"	660		BQL	BQL
l,2,4-Trichlorobenzene	"	660		BQL	BQL
Naphthalene	"	660		BQL	BQL
Iexachlorobutadiene	"	660		BQL	BQL
Iexachlorocylopentadiene	"	660		BQL	BQL
2-Chloronaphthalene	"	660		BQL	BQL
Dimethylphthalate	"	660		BQL	BQL
Acenaphthylene	"	660		BQL	BQL
2,6-Dinitrotoluene	"	660		BQL	BQL
Acenaphthene	"	660		BQL	BQL
2,4-Dinitrotoluene	"	660		BQL	BQL
Diethylphthalate	"	660		BQL	BQL

Susan C. Scrocchi

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Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA   A.E.S. Job Code CRF

			AES Lab No.-	METHOD*
			18244	
			Sample ID - TP-7	BLANK
Analytical Parameter(s)	Method No.	Quant. Limits	Sample Date- 2/26/88	
2-Methylnaphthalene	8270	660	BQL**	<10
Bis(2-Chloroethyl)Ether	"	660	BQL	<10
1,3-Dichlorobenzene	"	660	BQL	<10
1,4-Dichlorobenzene	"	660	BQL	<10
1,2-Dichlorobenzene	"	660	BQL	<10
Bis(2-Chloroisopropyl) Ether	"	660	BQL	<10
Hexachloroethane	"	660	BQL	<10
N-Nitrosodi-N-Propylamine	"	660	BQL	<10
Nitrobenzene	"	660	BQL	<10
Isophorone	"	660	BQL	<10
Bis(2-Chloroethoxy)Methane	"	660	BQL	<10
1,2,4-Trichlorobenzene	"	660	BQL	<10
Naphthalene	"	660	BQL	<10
Hexachlorobutadiene	"	660	BQL	<10
Hexachlorocylopentadiene	"	660	BQL	<10
2-Chloronaphthalene	"	660	BQL	<10
Dimethylphthalate	"	660	BQL	<10
Acenaphthylene	"	660	BQL	<10
2,6-Dinitrotoluene	"	660	BQL	<10
Acenaphthene	"	660	BQL	<10
2,4-Dinitrotoluene	"	660	BQL	<10
Diethylphthalate	"	660	BQL	<10

Susan C. Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Units of measure are µg/l, ppb.
** Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

			AES Lab No.-	18231	18232	18233
			Sample ID -	TP-1	TP-2	TP-3
Analytical Parameter(s)	Method No.	Quant. Limits	Sample Date-	2/24/88	2/24/88	2/24/88
Phenol	8720	660		BQL*	BQL	BQL
2-Chlorophenol	"	660		BQL	BQL	BQL
2-Nitrophenol	"	660		BQL	BQL	BQL
2,4-Dimethylphenol	"	660		BQL	BQL	BQL
p-Chloro-m-Chesol	"	660		BQL	BQL	BQL
2,4,6-Trichlorophenol	"	660		BQL	BQL	BQL
2,4-Dinitrophenol	"	1320		BQL	BQL	BQL
4-Nitrophenol	"	1320		BQL	BQL	BQL
4,6-Dinitro-O-Cresol	"	1320		BQL	BQL	BQL
Pentachlorophenol	"	1320		BQL	BQL	BQL
2,4-Dichlorophenol	"	660		BQL	BQL	BQL
4-Methylphenol	"	660		BQL	BQL	BQL
Benzoic Acid	"	1320		BQL	BQL	BQL
2,4,5-Trichlorophenol	"	660		BQL	BQL	BQL
3-Nitroaniline	"	660		BQL	BQL	BQL
Dibenzofuran	"	660		BQL	BQL	BQL
4-Nitroaniline	"	660		BQL	BQL	BQL
2-Methylphenol	"	660		BQL	BQL	BQL
Benzidine	"	3300		BQL	BQL	BQL

Susan C. Scrocchi

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Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA   A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- 18234 Sample ID - TP-4 Sample Date- 2/25/88	18235 TP-5 2/25/88	18236 TP-8 2/25/88
Phenol	8720	660	BQL*	BQL	BQL
2-Chlorophenol	"	660	BQL	BQL	BQL
2-Nitrophenol	"	660	BQL	BQL	BQL
2,4-Dimethylphenol	"	660	BQL	BQL	BQL
p-Chloro-m-Chesol	"	660	BQL	BQL	BQL
2,4,6-Trichlorophenol	"	660	BQL	BQL	BQL
2,4-Dinitrophenol	"	1320	BQL	BQL	BQL
4-Nitrophenol	"	1320	BQL	BQL	BQL
4,6-Dinitro-O-Cresol	"	1320	BQL	BQL	BQL
Pentachlorophenol	"	1320	BQL	BQL	BQL
2,4-Dichlorophenol	"	660	BQL	BQL	BQL
4-Methylphenol	"	660	BQL	BQL	BQL
Benzoic Acid	"	1320	BQL	BQL	BQL
2,4,5-Trichlorophenol	"	660	BQL	BQL	BQL
3-Nitroaniline	"	660	BQL	BQL	BQL
Dibenzofuran	"	660	BQL	BQL	BQL
4-Nitroaniline	"	660	BQL	BQL	BQL
2-Methylphenol	"	660	BQL	BQL	BQL
Benzidine	"	3300	BQL	BQL	BQL

Susan C. Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

			AES Lab No.-	18237	18243
			Sample ID -	TP-9	TP-6
Analytical Parameter(s)	Method No.	Quant. Limits	Sample Date-	2/25/88	2/26/88
Phenol	8720	660		BQL*	BQL
2-Chlorophenol	"	660		BQL	BQL
2-Nitrophenol	"	660		BQL	BQL
2,4-Dimethylphenol	"	660		BQL	BQL
p-Chloro-m-Chesol	"	660		BQL	BQL
2,4,6-Trichlorophenol	"	660		BQL	BQL
2,4-Dinitrophenol	"	1320		BQL	BQL
4-Nitrophenol	"	1320		BQL	BQL
4,6-Dinitro-O-Cresol	"	1320		BQL	BQL
Pentachlorophenol	"	1320		BQL	BQL
2,4-Dichlorophenol	"	660		BQL	BQL
4-Methylphenol	"	660		BQL	BQL
Benzoic Acid	"	1320		BQL	BQL
2,4,5-Trichlorophenol	"	660		BQL	BQL
3-Nitroaniline	"	660		BQL	BQL
Dibenzofuran	"	660		BQL	BQL
4-Nitroaniline	"	660		BQL	BQL
2-Methylphenol	"	660		BQL	BQL
Benzidine	"	3300		BQL	BQL

Susan C Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- 18244 Sample ID - TP-7 Sample Date- 2/26/88	METHOD* BLANK
Phenol	8720	660	BQL**	<10
2-Chlorophenol	"	660	BQL	<10
2-Nitrophenol	"	660	BQL	<10
2,4-Dimethylphenol	"	660	BQL	<10
p-Chloro-m-Chesol	"	660	BQL	<10
2,4,6-Trichlorophenol	"	660	BQL	<10
2,4-Dinitrophenol	"	1320	BQL	<20
4-Nitrophenol	"	1320	BQL	<20
4,6-Dinitro-O-Cresol	"	1320	BQL	<20
Pentachlorophenol	"	1320	BQL	<20
2,4-Dichlorophenol	"	660	BQL	<10
4-Methylphenol	"	660	BQL	<10
Benzoic Acid	"	1320	BQL	<20
2,4,5-Trichlorophenol	"	660	BQL	<10
3-Nitroaniline	"	660	BQL	<10
Dibenzofuran	"	660	BQL	<10
4-Nitroaniline	"	660	BQL	<10
2-Methylphenol	"	660	BQL	<10
Benzidine	"	3300	BQL	<50

Susan C. Serocchi

Susan C. Serocchi
Gas Chromatography Supervi

* Units of measure are μg/l, ppb.
** Below quantifiable limits

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Kilogram, ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
2-Methylnaphthalene	18231	<660	<660	<660	None	None
Bis(2-Chloroethyl)Ether	18231	<660	<660	<660	None	None
1,3-Dichlorobenzene	18231	<660	<660	<660	None	None
1,4-Dichlorobenzene	18231	<660	<660	<660	None	None
1,2-Dichlorobenzene	18231	<660	<660	<660	None	None
Bis(2-Chloroisopropyl)Ether	18231	<660	<660	<660	None	None
Hexachloroethane	18231	<660	<660	<660	None	None
N-Nitrosodi-N-Propylamine	18231	<660	<660	<660	None	None
Nitrobenzene	18231	<660	<660	<660	None	None
Isophorone	18231	<660	<660	<660	None	None
Bis(2-Chloroethoxy)Methane	18231	<660	<660	<660	None	None
1,2,4-Trichlorobenzene	18231	<660	<660	<660	None	None
Naphthalene	18231	<660	<660	<660	None	None
Hexachlorobutadiene	18231	<660	<660	<660	None	None
Hexachlorocylopentadiene	18231	<660	<660	<660	None	None
2-Chloronaphthalene	18231	<660	<660	<660	None	None
Dimethylphthalate	18231	<660	<660	<660	None	None
Acenaphthylene	18231	<660	<660	<660	None	None
2,6-Dinitrotoluene	18231	<660	<660	<660	None	None
Acenaphthene	18231	<660	<660	<660	None	None
2,4-Dinitrotoluene	18231	<660	<660	<660	None	None
Diethylphthalate	18231	<660	<660	<660	None	None
Fluorene	18231	<660	<660	<660	None	None
4-Chlorophenylphenylether	18231	<660	<660	<660	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Kilogram, ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Diphenylamine(N-Nitroso)	18231	<660	<660	<660	None	None
Benzyl Alcohol	18231	<660	<660	<660	None	None
4-Chloroaniline	18231	<660	<660	<660	None	None
4-Bromophenylphenylether	18231	<660	<660	<660	None	None
Hexachlorobenzene	18231	<660	<660	<660	None	None
Phenanthrene	18231	<660	<660	<660	None	None
Anthracene	18231	<660	<660	<660	None	None
Di-n-Butylphthalate	18231	<660	<660	<660	None	None
Fluoranthene	18231	<660	<660	<660	None	None
2-Nitroaniline	18231	<660	<660	<660	None	None
Pyrene	18231	<660	<660	<660	None	None
Butylbenzylphthalate	18231	<660	<660	<660	None	None
Benzo(a)Anthracene	18231	<660	<660	<660	None	None
3,3´-Dichlorobenzidine	18231	<1980	<1980	<1980	None	None
Chrysene	18231	<660	<660	<660	None	None
Bis(2-Ethylhexyl)Phthalate	18231	<660	<660	<660	None	None
Di-N-Octylphthalate	18231	<660	<660	<660	None	None
Benzo(b)Fluoranthene	18231	<660	<660	<660	None	None
Benzo(k)Fluoranthene	18231	<660	<660	<660	None	None
Benzo(a)Pyrene	18231	<660	<660	<660	None	None
Indeno(1,2,3-c,d)Pyrene	18231	<660	<660	<660	None	None
Debenzo(a,h)Anthracene	18231	<660	<660	<660	None	None
Benzo(g,h,i)Perylene	18231	<660	<660	<660	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Kilogram, ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Phenol	18231	<660	<660	<660	None	None
2-Chlorophenol	18231	<660	<660	<660	None	None
2-Nitrophenol	18231	<660	<660	<660	None	None
2,4-Dimethyphenol	18231	<660	<660	<660	None	None
p-Chloro-M-Cresol	18231	<660	<660	<660	None	None
2,4,6-Trichlorophenol	18231	<660	<660	<660	None	None
2,4-Dinitrophenol	18231	<1320	<1320	<1320	None	None
4-Nitrophenol	18231	<1320	<1320	<1320	None	None
4,6-Dinitro-o-Cresol	18231	<1320	<1320	<1320	None	None
Pentachlorophenol	18231	<1320	<1320	<1320	None	None
2,4-Dichlorophenol	18231	<660	<660	<660	None	None
4-Methylphenol	18231	<660	<660	<660	None	None
Benzoic Acid	18231	<1320	<1320	<1320	None	None
2,4,5-Trichlorophenol	18231	<660	<660	<660	None	None
3-Nitroaniline	18231	<660	<660	<660	None	None
Dibenzofuran	18231	<660	<660	<660	None	None
4-Nitroaniline	18231	<660	<660	<660	None	None
2-Methylphenol	18231	<660	<660	<660	None	None
Benzidene	18231	<3300	<3300	<3300	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units: ug/l or ppb)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Dimethylphthalate	18231	SPK	883	<660	1000	88
Diethylphthalate	18231	SPK	1220	<660	1100	111
Di-n-Butylphthalate	18231	SPK	1280	<660	1250	103
Butlybenzylphthalate	18231	SPK	1330	<660	1200	111
Bis(2-ethylhexyl)phthalate	18231	SPK	1600	<660	130	123
Di-n-octylphthalate	18231	SPK	1880	<660	1890	99
Phenol	18231	SPK	460	<660	300	153
2-Chlorophenol	18231	SPK	171	<660	164	104
4-Chloro-3-Methylphenol	18231	SPK	297	<660	400	75
2,4-Dichlorophenol	18231	SPK	173	<660	200	87
2,4,6-Trichlorophenol	18231	SPK	187	<660	250	75
Pentachlorophenol	18231	SPK	126	<660	200	63
2-Nitrophenol	18231	SPK	344	<660	400	86
4-Nitrophenol	18231	SPK	410	<660	300	137
2,4-Dimethylphenol	18231	SPK	121	<660	250	49
Acenaphthylene	18231	EPA	726	---	1000	73
Benzo(a)pyrene	18231	EPA	724	---	1000	72
Benzo(b)fluoranthene	18231	EPA	681	---	1000	68
Benzo(g,h,i)perylene	18231	EPA	695	---	1000	70

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: ORGANICS

Units Of Measure: Milligrams/Kilogram, ppm (dry wt. basis)
Client: CRA A.E.S. Job Code CRF

			AES Lab No.-	18231	18232	18233
			Sample ID -	TP-1	TP-2	TP-3
Analytical Parameter(s)	Method No.	Quant. Limits	Sample Date-	2/24/88	2/24/88	2/24/88
Thiophene	722J	10.0		BQL*	BQL	BQL
Furfural	790	10.0		BQL	BQL	BQL

Susan C. Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: ORGANICS

Units Of Measure: Milligrams/Kilogram, ppm (dry wt. basis)
Client: CRA A.E.S. Job Code CRF

			AES Lab No.-	18234	18235	18236
			Sample ID -	TP-4	TP-5	TP-8
Analytical Parameter(s)	Method No.	Quant. Limits	Sample Date-	2/25/88	2/25/88	2/25/88
Thiophene	722J	10.0		BQL*	BQL	BQL
Furfural	790	10.0		BQL	BQL	BQL

Susan C. Scrocchi

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Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: ORGANICS

Units Of Measure: Milligrams/Kilogram, ppm (dry wt. basis)
Client: CRA A.E.S. Job Code CRF

			AES Lab No.-	18237	18243
			Sample ID -	TP-9	TP-6
Analytical Parameter(s)	Method No.	Quant. Limits	Sample Date-	2/25/88	2/26/88
Thiophene	722J	10.0		BQL*	BQL
Furfural	790	10.0		BQL	BQL

* Below quantifiable limits.

Susan C. Scrocchi
Susan C. Scrocchi
Gas Chromatography Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: ORGANICS

Units Of Measure: Milligrams/Kilogram, ppm (dry wt. basis)
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- 18244 Sample ID - TP-7 Sample Date- 2/26/88	METHOD BLANK
Thiophene	722J	10.0	BQL*	<2.00**
Furfural	790	10.0	BQL	<2.00**

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.
** Units of measure are mg/l,ppm

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Milligrams/Kilogram, ppm
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Thiophene	18244	<10.0	<10.0	<10.0	None	None
Furfural	18244	<10.0	<10.0	<10.0	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units: mg/kg or ppm)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Furfural	18244	SPK	13.4	<10.0	12.6	106
Furfural (mg/l)		EPA	52	---	50	104
Thiophene	18244	SPK	39.1	<10.0	38.1	103
Thiophene (mg/l)		EPA	50	---	50	100

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
GAS CHROMATOGRAPHY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF EXTRACTION
[signature]	8240	18231-37,43,44	3/1/88
Joseph Novera	8270	18231-37,43,44	3/4/88

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
GAS CHROMATOGRAPHY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
S Scroccki for P Fama	722J	18231-37,43,44	3/14/88	1815-2400
	790	18231,33,36	3/8/88	2100 - 2230
	790	18232,34,35,37,43 44	3/9/88	1545 - 2200
Jim Feigl	8270	18231-18237,18243,44	3/16/88	9:30 - 22:00
Jim Feigl	8240	18244,33,31,43,34	3/8/88	16:00 - 24:00
Jim Feigl	8240	18232,35,37,36	3/9/88	9:30 - 16:00

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: METALS

Client: CRA   A.E.S. Job Code CRF

(All results are in mg/kg)

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. -	18231	18232	18233
			Sample ID -	TP-1 SOIL GRAB	TP-2 SOIL GRAB	TP-3 SOIL GRAB
			Sample Date-	2/24/88	2/24/88	2/24/88
Total Potassium (K)	7610	100		1,570	1,798	1,241
Total Iron (Fe)	7380	30		16,600	16,850	19,500
Total Zinc (Zn)	7950	5		95	91	39

Janette Bingert
Janette Bingert
Atomic Spectroscopy Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: METALS

Client: CRA A.E.S. Job Code CRF

(All results are in mg/kg)

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. -	18234	18235	18236
			Sample ID -	TP-4 SOIL GRAB	TP-5 SOIL GRAB	TP-8 SOIL GRAB
			Sample Date-	2/25/88	2/25/88	2/25/88
Total Potassium (K)	7610	100		1,708	1,204	1,613
Total Iron (Fe)	7380	30		20,700	17,250	19,750
Total Zinc (Zn)	7950	5		49	39	76

Janette Bingert
Janette Bingert
Atomic Spectroscopy Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: METALS

Client: CRA A.E.S. Job Code CRF

(All results are in mg/kg)

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. - / Sample ID - / Sample Date-	18237 TP-9 SOIL GRAB 2/25/88	18243 TP-6 SOIL GRAB 2/26/88	18244 TP-7 SOIL GRAB 2/26/88
Total Potassium (K)	7610	100		2,552	1,943	2,270
Total Iron (Fe)	7380	30		21,700	24,600	22,300
Total Zinc (Zn)	7950	5		50	55	50

Janette Bingert

Janette Bingert
Atomic Spectroscopy Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Milligrams/Kilogram
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Potassium (K)	18237	2,548	2,554	2,551	6	0.2
Iron (Fe)	18237	21,750	21,600	21,700	150	1
Zinc (Zn)	18237	49	50	50	1	2

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units: mg/l, or ppm)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Potassium (K)	18237	**SPK	32.20	12.76	20.00	97
Independent (K) std.		STD	10.48	10.00	---	105
Iron (Fe)	18237	***SPK	9.20	4.34	5.00	97
EPA (Fe) std.	386	EPA	1.06	0.99	---	107
Zinc (Zn)	18237	SPK	1.44	0.50	1.00	94
Independent (Zn) std.		STD	0.49	0.50	---	98

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)
** Spike on sample dilution factor of two.
*** Spike on sample dilution factor of fifty.

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
ATOMIC SPECTROSCOPY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
P. McMahon	7610	18243-44 18231-37	2-29-88	1700
	7380	18243-44 18231-37	2-29-88	1500
	7950	18243-44 18231-37	2-29-88	1900

APPENDIX A

CHAIN OF CUSTODY RECORDS

ADVANCED ENVIRONMENTAL SERVICES INC.

2186 LIBERTY DRIVE
NIAGARA FALLS, NY 14304
(716) 283-3120

CHAIN OF CUSTODY RECORD

JOB CODE CRF

PROJECT NAME UNION CARBIDE Watermain Bedding.

SAMPLER'S SIGNATURE

SAMPLE NO.	SEQ. NO.	DATE	TIME	SAMPLE LOCATION	GRAB	COMP	SAMPLE TYPE	NO. OF CONTAINERS	REMARKS
TP4		2-25-88		Test Pit 4			SOIL	1	
P4		"		" "				1	
TP8		"		" "				1	
P8		"		" "				1	
TP9		"		" "				1	
P9		"		" "				1	
				"					
TP5		"		" "				1	
P5		"		" "				1	
							TOTAL CONTAINERS		

RELINQUISHED BY (Sign)	DATE	TIME	RECEIVED BY (Sign)
1 C. Dunnigan	2/25/88	4:43	2 Frank J. Servo
2			3
3			4
4			5

REMARKS:

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): AES

CHAIN OF CUSTODY RECORD

PROJECT Nº: 2293

PROJECT NAME: Union Carbide Watermain Bedding

SAMPLER'S SIGNATURE C. Dunnigan (SIGN)

SEQ. Nº	SAMPLE Nº	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	Nº OF CONTAINERS	REMARKS
	TP4	2/25/88		Test Pit 4	Soil	1	VOA
	TP4	"		" " "	"	1	1 pt glass
	TP8	"		" " 8	"	1	VOA
	TP8	"		" " 8	"	1	1 pt glass
	TP9	"		" " 9	"	1	VOA
	TP9	"		" " 9	"	1	1 pt glass
	TP5	"		" " 5	"	1	VOA
	TP5	"		" " 5	"	1	1 pt glass
				TOTAL NUMBER OF CONTAINERS		8	

ANTICIPATED CHEMICAL HAZARDS: Unknown

RELINQUISHED BY:	DATE/TIME	RECEIVED BY:
1 C. Dunnigan (SIGN)	[illegible]	2 [illegible] (SIGN)
2 (SIGN)		3 (SIGN)
3 (SIGN)		4 (SIGN)
ADDITIONAL SIGNATURE SHEET REQUIRED ☐		

METHOD OF SHIPMENT:	SHIPPED BY:	RECEIVED FOR LABORATORY BY: (SIGN)	DATE/TIME
CONDITION OF SEAL UPON RECEIPT: GENERAL CONDITION OF COOLER:		COOLER OPENED BY: (SIGN)	DATE/TIME

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

Nº 4738

ADVANCED
ENVIRONMENTAL SERVICES INC.

2186 LIBERTY DRIVE
NIAGARA FALLS, NY 14304
(716) 283-3120

CHAIN OF CUSTODY RECORD	JOB CODE	PROJECT NAME
	CRF	UCC - Republic Watermain Test Pits

SAMPLER'S SIGNATURE

SAMPLE NO.	SEQ. NO.	DATE	TIME	SAMPLE LOCATION	GRAB	COMP	SAMPLE TYPE	NO. OF CONTAINERS	REMARKS
	1	2/24/88		TEST PIT 1	X		SOIL	3	2 VOAS, 1-500
	2	2/24/88		TEST PIT 2	X		"	3	" "
	3	2/24/88		TEST PIT 3	X		SOIL	3	" "
							TOTAL CONTAINERS	9	

RELINQUISHED BY (Sign)	DATE	TIME	RECEIVED BY (Sign)
1 Steven [illegible]	2/24/88	3:00 p.m.	2 [illegible]
2			3
3			4
4			5

REMARKS:

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): AES

CHAIN OF CUSTODY RECORD

PROJECT Nº: 2293

PROJECT NAME: UCC - Republic Watermain Test Pits

SAMPLER'S SIGNATURE C. Dunnige (SIGN)

SEQ. Nº	SAMPLE Nº	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	Nº OF CONTAINERS	REMARKS
	TP1	2/24/88		Test Pit 1	Soil	2	VOA vial
					"	1	1pt. glass
	TP2	"		Test Pit 2	Soil	2	VOA vial
					"	1	1pt glass
	TP3	"		Test Pit 3	Soil	2	VOA vial
					"	1	1pt. glass
				TOTAL NUMBER OF CONTAINERS		9	

ANTICIPATED CHEMICAL HAZARDS: Unknown

RELINQUISHED BY: 1 C. Dunnige (SIGN)	DATE/TIME 2/24/88 1430	RECEIVED BY: 2 Steven [illegible] (SIGN)
RELINQUISHED BY: 2 Steven [illegible] (SIGN)	DATE/TIME [illegible]	RECEIVED BY: 3 [illegible] (SIGN)
RELINQUISHED BY: 3 (SIGN)	DATE/TIME	RECEIVED BY: 4 (SIGN)
ADDITIONAL SIGNATURE SHEET REQUIRED ☐		

METHOD OF SHIPMENT:	SHIPPED BY:	RECEIVED FOR LABORATORY BY: (SIGN) [illegible]	DATE/TIME [illegible] 3:00
CONDITION OF SEAL UPON RECEIPT: GENERAL CONDITION OF COOLER:		COOLER OPENED BY: (SIGN)	DATE/TIME

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

Nº 4739

ADVANCED ENVIRONMENTAL SERVICES INC.

2186 LIBERTY DRIVE
NIAGARA FALLS, NY 14304
(716) 283-3120

CHAIN OF CUSTODY RECORD	JOB CODE	PROJECT NAME
	CRF	UCC - Republic Watermain Test Pits

SAMPLER'S SIGNATURE

SAMPLE NO.	SEQ. NO.	DATE	TIME	SAMPLE LOCATION	GRAB	COMP	SAMPLE TYPE	NO. OF CONTAINERS	REMARKS
		2/26/88		Test Pit 6	X		soil	2	containers
		2/26/88		Test Pit 7	X		soil	2	"
							TOTAL CONTAINERS	4	

RELINQUISHED BY (Sign)	DATE	TIME	RECEIVED BY (Sign)
1 Diana Thompson	2/26/88	2:40 p.m.	2 Judy Ostrowski
2			3
3			4
4			5

REMARKS:

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): AES

CHAIN OF CUSTODY RECORD

PROJECT №: 2293

PROJECT NAME: UCC- Republic Watermain Test Pits

SAMPLER'S SIGNATURE C. Dunnigan (SIGN)

SEQ. №	SAMPLE №	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	№ OF CONTAINERS	REMARKS
	TP6	2/26/88		Test Pit 6	Soil	1	VOA
	TP6			" " 6	"	1	1 pt. glass
	TP7	2/26/88		" " 7	"	1	VOA
	TP7			" " 7	"	1	1 pt glass
				TOTAL NUMBER OF CONTAINERS		4	

ANTICIPATED CHEMICAL HAZARDS: Unknown

RELINQUISHED BY:	DATE/TIME	RECEIVED BY:
1 C. Dunnigan (SIGN)	2/26/88 1330	2 Diana Thompson (SIGN)
2 Diana Thompson (SIGN)	2/26/88 2:40 pm	3 Judy Ostrowsh (SIGN)
3 (SIGN)		4 (SIGN)
ADDITIONAL SIGNATURE SHEET REQUIRED ☐		

METHOD OF SHIPMENT:	SHIPPED BY:	RECEIVED FOR LABORATORY BY:	DATE/TIME
courier (CRA)	D. Thompson	(SIGN) Judy Ostrowsh	2/26 2:40

CONDITION OF SEAL UPON RECEIPT:
GENERAL CONDITION OF COOLER:

COOLER OPENED BY: (SIGN)
DATE/TIME

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

№ 4802

APPENDIX F

APPENDIX F

ANALYTICAL RESULTS

SITE SOILS

cc. NF File

ADVANCED
ENVIRONMENTAL SERVICES INC.

CRA PROJECT #2293
(FOR UNION CARBIDE)

Report Prepared For

CONESTOGA ROVERS & ASSOCIATES, INC.

Catherine Mocniak
Project Manager

Janette Bingert
Quality Control Manager

April 14, 1988
AES Report CRF

COMMITMENT
TO
HONESTY - QUALITY - SERVICE

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: RESULTS - WET CHEMISTRY

Client: CRA   A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. -	18630	18631	18632
			Sample ID -	DP-1 DP-12 LAB COMP	DP-2 DP-11 LAB COMP	DP-3 DP-8 LAB COMP
			Sample Date-	3/15-16/88	3/15-16/99	3/15/88
Ammonia (As N) (mg/l)	350.1	0.01		0.42	0.08	0.52
Nitrite (As N) (mg/l)	353.2	0.01		0.25	0.15	0.24
Total Kjeldahl Nitrogen(mg/l)	351.2	0.1		0.6	0.3	3.2
Total Rec. Phenols (mg/l)	420.2	0.005		BQL*	0.006	0.006
Diethyl Sulfate (As S04)**	375.2	2.0		25	22	24

All analysis run on 20% solution of sample.

* Below quantifiable limits.
** Presumptive test.

Margaret L. Skowron
Margaret L. Skowron
Wet Chemistry Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: RESULTS - WET CHEMISTRY

Client: CRA   A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. - 18633 Sample ID - DP-6 DP-7 LAB COMP Sample Date- 3/15/88	LAB BLANK
Ammonia (As N) (mg/l)	350.1	0.01	2.2	BQL*
Nitrite (As N) (mg/l)	353.2	0.01	0.06	BQL
Total Kjeldahl Nitrogen(mg/l)	351.2	0.1	3.2	BQL
Total Rec. Phenols (mg/l)	420.2	0.005	BQL	BQL
Diethyl Sulfate (As S04)**	375.2	2.0	60	BQL

* Below quantifiable limits.
** Presumptive test.

Margaret L. Skowron

Margaret L. Skowron
Wet Chemistry Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: ORGANICS

Units Of Measure: Milligrams/Kilogram, ppm (dry wt. basis)
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.-	18630	18631	18632
			Sample ID -	DP-1 DP-12 LAB COMP	DP-2 DP-11 LAB COMP	DP-3 DP-8 LAB COMP
			Sample Date-	3/15-16/88	3/15-16/88	3/15-16/88
Furfural	Supelco 790	10		BQL*	BQL	BQL
Thiophene	Supelco 722J	10		BQL	BQL	BQL

* Below quantifiable limits.

Susan C. Scrocchi
Susan C. Scrocchi
Gas Chromatography Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: ORGANICS

Units Of Measure: Milligrams/Kilogram, ppm (dry wt. basis)
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- 18633 / Sample ID - DP-6 DP-7 LAB COMP / Sample Date- 3/15-16/88	METHOD BLANK*
Furfural	Supelco 790	10	BQL**	<1.0
Thiophene	Supelco 722J	10	BQL	<1.0

* Units of measure are: mg/l,ppm
** Below quantifiable limits.

Susan C. Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	18630 DP-1 DP-12 LAB COMP 3/15-16/88	18631 DP-2 DP-11 LAB COMP 3/15-16/88	18632 DP-3 DP-8 LAB COMP 3/15/88
Chloromethane	8240	1600		BQL*	BQL	BQL
Vinyl Chloride	"	1600		BQL	BQL	BQL
Chloroethane	"	1600		BQL	BQL	BQL
Bromomethane	"	1600		BQL	BQL	BQL
2-Chloroethyl Vinyl Ether	"	1600		BQL	BQL	BQL
Ethylbenzene	"	800		BQL	BQL	BQL
Methylene Chloride	"	800		BQL	BQL	BQL
Chlorobenzene	"	800		BQL	BQL	BQL
1,1-Dichloroethylene	"	800		BQL	BQL	BQL
1,1-Dichloroethane	"	800		BQL	BQL	BQL
trans-1,2-Dichloroethylene	"	800		BQL	BQL	BQL
Chloroform	"	800		BQL	BQL	BQL
1,2-Dichloroethane	"	800		BQL	BQL	BQL
1,1,1-Trichloroethane	"	800		BQL	BQL	BQL
Carbon Tetrachloride	"	800		BQL	BQL	BQL
Bromodichloromethane	"	800		BQL	BQL	BQL
1,2-Dichloropropane	"	800		BQL	BQL	BQL
trans-1,3-Dichloropropene	"	800		BQL	BQL	BQL
Trichloroethylene	"	800		BQL	BQL	BQL
Benzene	"	800		BQL	BQL	BQL
cis-1,3-Dichloropropene	"	800		BQL	BQL	BQL
1,1,2-Trichloroethane	"	800		BQL	BQL	BQL
Dibromochloromethane	"	800		BQL	BQL	BQL
Bromoform	"	800		BQL	BQL	BQL

Jim Fogl for
Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	18633 DP-6 DP-7 LAB COMP 3/15/88	18634 FIELD BLANK 3/14/88	LAB BLANK
:hloromethane	8240	1600		BQL*	BQL	BQL
/inyl Chloride	"	1600		BQL	BQL	BQL
:hloroethane	"	1600		BQL	BQL	BQL
3romomethane	"	1600		BQL	BQL	BQL
!-Chloroethyl Vinyl Ether	"	1600		BQL	BQL	BQL
:thylbenzene	"	800		BQL	BQL	BQL
1ethylene Chloride	"	800		BQL	BQL	BQL
:hlorobenzene	"	800		BQL	BQL	BQL
:,1-Dichloroethylene	"	800		BQL	BQL	BQL
l,1-Dichloroethane	"	800		BQL	BQL	BQL
:rans-1,2-Dichloroethylene	"	800		BQL	BQL	BQL
:hloroform	"	800		BQL	BQL	BQL
l,2-Dichloroethane	"	800		BQL	BQL	BQL
l,1,1-Trichloroethane	"	800		BQL	BQL	BQL
:arbon Tetrachloride	"	800		BQL	BQL	BQL
3romodichloromethane	"	800		BQL	BQL	BQL
:,2-Dichloropropane	"	800		BQL	BQL	BQL
:rans-1,3-Dichloropropene	"	800		BQL	BQL	BQL
'richloroethylene	"	800		BQL	BQL	BQL
3enzene	"	800		BQL	BQL	BQL
:is-1,3-Dichloropropene	"	800		BQL	BQL	BQL
l,1,2-Trichloroethane	"	800		BQL	BQL	BQL
)ibromochloromethane	"	800		BQL	BQL	BQL
3romoform	"	800		BQL	BQL	BQL

* Below quantifiable limits.

[signature] for
Susan C. Scrocchi
Gas Chromatography Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.-	18630	18631	18632
			Sample ID -	DP-1 DP-12 LAB COMP	DP-2 DP-11 LAB COMP	DP-3 DP-8 LAB COMP
			Sample Date-	3/15-16/88	3/15-16/88	3/15/88
1,1,2,2-Tetrachloroethylene	8240	800		BQL*	BQL	BQL
1,1,2,2-Tetrachloroethane	"	800		BQL	BQL	BQL
Toluene	"	800		BQL	BQL	BQL
Acetone	"	8000		BQL	190,000	53,000
Carbon Disulfide	"	800		BQL	BQL	BQL
2-Butanone	"	8000		BQL	BQL	BQL
Vinyl Acetate	"	800		BQL	BQL	BQL
2-Hexanone	"	8000		BQL	BQL	BQL
4-Methyl-2-Pentanone	"	8000		BQL	BQL	BQL
Styrene	"	800		BQL	BQL	BQL
Xylenes (Total)	"	800		BQL	BQL	BQL
Trichlorofluoromethane	"	800		BQL	BQL	BQL

Jim Tugl for
Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	18633 DP-6 DP-7 LAB COMP 3/15/88	18634 FIELD BLANK 3/14/88	LAB BLANK
1,1,2,2-Tetrachloroethylene	8240	800		BQL*	BQL	BQL
1,1,2,2-Tetrachloroethane	"	800		BQL	BQL	BQL
Toluene	"	800		BQL	BQL	BQL
Acetone	"	8000		BQL	BQL	BQL
Carbon Disulfide	"	800		BQL	BQL	BQL
2-Butanone	"	8000		BQL	BQL	BQL
Vinyl Acetate	"	800		BQL	BQL	BQL
2-Hexanone	"	8000		BQL	BQL	BQL
4-Methyl-2-Pentanone	"	8000		BQL	BQL	BQL
Styrene	"	800		BQL	BQL	BQL
Xylenes (Total)	"	800		BQL	BQL	BQL
Trichlorofluoromethane	"	800		BQL	BQL	BQL

Jim Tyle for
Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	18630 DP-1 DP-12 LAB COMP 3/15-16/88	18631 DP-2 DP-11 LAB COMP 3/15-16/88	18632 DP-3 DP-8 LAB COMP 3/15/88
2-Methylnaphthalene	8270	660		11,000	3,600	3,300
Bis(2-Chloroethyl)Ether	"	660		BQL*	BQL	BQL
1,3-Dichlorobenzene	"	660		BQL	BQL	BQL
1,4-Dichlorobenzene	"	660		BQL	BQL	BQL
1,2-Dichlorobenzene	"	660		BQL	BQL	BQL
Bis(2-Chloroisopropyl) Ether	"	660		BQL	BQL	BQL
Hexachloroethane	"	660		BQL	BQL	BQL
N-Nitrosodi-N-Propylamine	"	660		BQL	BQL	BQL
Nitrobenzene	"	660		BQL	BQL	BQL
Isophorone	"	660		BQL	BQL	BQL
Bis(2-Chloroethoxy)Methane	"	660		BQL	BQL	BQL
1,2,4-Trichlorobenzene	"	660		BQL	BQL	BQL
Naphthalene	"	660		21,000	13,000	13,000
Hexachlorobutadiene	"	660		BQL	BQL	BQL
Hexachlorocylopentadiene	"	660		BQL	BQL	BQL
2-Chloronaphthalene	"	660		BQL	BQL	BQL
Dimethylphthalate	"	660		BQL	BQL	BQL
Acenaphthylene	"	660		BQL	7,000	BQL
2,6-Dinitrotoluene	"	660		BQL	BQL	BQL
Acenaphthene	"	660		41,000	43,000	23,000
2,4-Dinitrotoluene	"	660		BQL	BQL	BQL
Diethylphthalate	"	660		BQL	BQL	BQL

Jim Tigh for

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	18633 DP-6 DP-7 LAB COMP 3/15/88	LAB BLANK
2-Methylnaphthalene	8270	660		5,800	BQL*
Bis(2-Chloroethyl)Ether	"	660		BQL	BQL
1,3-Dichlorobenzene	"	660		BQL	BQL
1,4-Dichlorobenzene	"	660		BQL	BQL
1,2-Dichlorobenzene	"	660		BQL	BQL
Bis(2-Chloroisopropyl) Ether	"	660		BQL	BQL
Hexachloroethane	"	660		BQL	BQL
N-Nitrosodi-N-Propylamine	"	660		BQL	BQL
Nitrobenzene	"	660		BQL	BQL
Isophorone	"	660		BQL	BQL
Bis(2-Chloroethoxy)Methane	"	660		BQL	BQL
1,2,4-Trichlorobenzene	"	660		BQL	BQL
Naphthalene	"	660		12,000	BQL
Hexachlorobutadiene	"	660		BQL	BQL
Hexachlorocylopentadiene	"	660		BQL	BQL
2-Chloronaphthalene	"	660		BQL	BQL
Dimethylphthalate	"	660		BQL	BQL
Acenaphthylene	"	660		BQL	BQL
2,6-Dinitrotoluene	"	660		BQL	BQL
Acenaphthene	"	660		21,000	BQL
2,4-Dinitrotoluene	"	660		BQL	BQL
Diethylphthalate	"	660		BQL	BQL

* Below quantifiable limits.

Susan C. Scrocchi
Gas Chromatography Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

ınalytical ·arameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	18630 DP-1 DP-12 LAB COMP 3/15-16/88	18631 DP-2 DP-11 LAB COMP 3/15-16/88	18632 DP-3 DP-8 LAB COMP 3/15/88
'luorene	8270	660		36,000	24,000	17,000
:-Chlorophenylphenylether	"	660		BQL*	BQL	BQL
›iphenylamine(N-Nitroso)	"	660		BQL	BQL	BQL
›enzyl Alcohol	"	660		BQL	BQL	BQL
.-Chloraniline	"	660		BQL	BQL	BQL
·-Bromophenylphenylether	"	660		BQL	BQL	BQL
iexachlorobenzene	"	660		BQL	BQL	BQL
'henanthrene	"	660		100,000	84,000	45,000
.nthracene	"	660		26,000	36,000	19,000
›i-N-Butylphthalate	"	660		BQL	BQL	BQL
'luoranthene	"	660		150,000	71,000	11,000
-Nitroaniline	"	660		BQL	BQL	BQL
'yrene	"	660		110,000	62,000	40,000
.utylbenzylphthalate	"	660		BQL	BQL	BQL
.enzo(a)Anthracene	"	660		750,000	260,000	150,000
,3´-Dichlorobenzidine	"	1980		BQL	BQL	BQL
'hrysene	"	660		9,600	230,000	110,000
:is(2-Ethylhexyl)Phthalate	"	660		BQL	BQL	BQL
›i-N-Octylphthalate	"	660		BQL	BQL	BQL
.enzo(b)Fluoranthene	"	660		500,000	95,000	36,000
enzo(k)Fluoranthene	"	660		37,000	BQL	29,000
enzo(a)Pyrene	"	660		550,000	640,000	BQL
ndeno(1,2,3-C,D)Pyrene	"	660		BQL	BQL	BQL
ibenzo(a,h)Anthracene	"	660		BQL	BQL	BQL
enzo(g,h,i)Perylene	"	660		BQL	BQL	BQL

Below quantifiable limits.

Jim Fagl
Susan C. Scrocchi
Gas Chromatography Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES (HSL)

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	18633 DP-6 DP-7 LAB COMP 3/15/88	LAB BLANK
Fluorene	8270	660		26,000	BQL*
4-Chlorophenylphenylether	"	660		BQL	BQL
Diphenylamine(N-Nitroso)	"	660		BQL	BQL
Benzyl Alcohol	"	660		BQL	BQL
4-Chloraniline	"	660		BQL	BQL
4-Bromophenylphenylether	"	660		BQL	BQL
Hexachlorobenzene	"	660		BQL	BQL
Phenanthrene	"	660		43,000	BQL
Anthracene	"	660		11,000	BQL
Di-N-Butylphthalate	"	660		BQL	BQL
Fluoranthene	"	660		78,000	BQL
2-Nitroaniline	"	660		BQL	BQL
Pyrene	"	660		61,000	BQL
Butylbenzylphthalate	"	660		BQL	BQL
Benzo(a)Anthracene	"	660		99,000	BQL
3,3´-Dichlorobenzidine	"	1980		BQL	BQL
Chrysene	"	660		49,000	BQL
Bis(2-Ethylhexyl)Phthalate	"	660		BQL	BQL
Di-N-Octylphthalate	"	660		BQL	BQL
Benzo(b)Fluoranthene	"	660		500,000	BQL
Benzo(k)Fluoranthene	"	660		36,000	BQL
Benzo(a)Pyrene	"	660		17,000	BQL
Indeno(1,2,3-C,D)Pyrene	"	660		BQL	BQL
Dibenzo(a,h)Anthracene	"	660		BQL	BQL
Benzo(g,h,i)Perylene	"	660		BQL	BQL

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES

Units Of Measure: Micrograms/Kilogram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	18630 DP-1 DP-12 LAB COMP 3/15-16/88	18631 DP-2 DP-11 LAB COMP 3/15-16/88	18632 DP-3 DP-8 LAB COMP 3/15/88
Phenol	8270	660		BQL*	BQL	BQL
2-Chlorophenol	"	660		BQL	BQL	BQL
2-Nitrophenol	"	660		BQL	BQL	BQL
2,4-Dimethylphenol	"	660		BQL	BQL	BQL
p-Chloro-m-Chesol	"	660		BQL	BQL	BQL
2,4,6-Trichlorophenol	"	660		BQL	BQL	BQL
2,4-Dinitrophenol	"	1320		BQL	BQL	BQL
4-Nitrophenol	"	1320		BQL	BQL	BQL
4,6-Dinitro-O-Cresol	"	1320		BQL	BQL	BQL
Pentachlorophenol	"	1320		BQL	BQL	BQL
2,4-Dichlorophenol	"	660		BQL	BQL	BQL
4-Methylphenol	"	660		BQL	BQL	BQL
Benzoic Acid	"	1320		BQL	BQL	BQL
2,4,5-Trichlorophenol	"	660		BQL	BQL	BQL
3-Nitroaniline	"	660		BQL	BQL	BQL
Dibenzofuran	"	660		BQL	BQL	BQL
4-Nitroaniline	"	660		BQL	BQL	BQL
2-Methylphenol	"	660		BQL	BQL	BQL
Benzidine	"	3300		BQL	BQL	BQL

Jim Tyl for
Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: SEMI-VOLATILES

Units Of Measure: Micrograms/Kiloggram, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	18633 DP-6 DP-7 LAB COMP 3/15/88	LAB BLANK
Phenol	8270	660		BQL*	BQL
2-Chlorophenol	"	660		BQL	BQL
2-Nitrophenol	"	660		BQL	BQL
2,4-Dimethylphenol	"	660		BQL	BQL
p-Chloro-m-Chesol	"	660		BQL	BQL
2,4,6-Trichlorophenol	"	660		BQL	BQL
2,4-Dinitrophenol	"	1320		BQL	BQL
4-Nitrophenol	"	1320		BQL	BQL
4,6-Dinitro-O-Cresol	"	1320		BQL	BQL
Pentachlorophenol	"	1320		BQL	BQL
2,4-Dichlorophenol	"	660		BQL	BQL
4-Methylphenol	"	660		BQL	BQL
Benzoic Acid	"	1320		BQL	BQL
2,4,5-Trichlorophenol	"	660		BQL	BQL
3-Nitroaniline	"	660		BQL	BQL
Dibenzofuran	"	660		BQL	BQL
4-Nitroaniline	"	660		BQL	BQL
2-Methylphenol	"	660		BQL	BQL
Benzidine	"	3300		BQL	BQL

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: METALS

Client: CRA A.E.S. Job Code CRF

(All results are in mg/kg)

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. - Sample ID - Sample Date-	18630 DP-1 DP-12 LAB COMP 3/15-16/88	18631 DP-2 DP-11 LAB COMP 3/15-16/88	18632 DP-3 DP-8 LAB COMP 3/15/88	18633 DP-6 DP-7 LAB COMP 3/15/88
Total Potassium (K)	7610	100		595	339	823	706
Total Iron (Fe)	7380	30		15,800	6,000	12,250	19,375
Total Zinc (Zn)	7950	5		50	56	134	50

Janette Bingert
Janette Bingert
Atomic Spectroscopy Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: METALS

Client: CRA A.E.S. Job Code CRF

(All results are in mg/kg)

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. - Sample ID - / Sample Date-	METHOD BLANK
Total Potassium (K)	7610	100		BQL*
Total Iron (Fe)	7380	30		BQL
Total Zinc (Zn)	7950	5		BQL

* Below quantifiable limits.

Janette Bingert
Janette Bingert
Atomic Spectroscopy Supervisor

APPENDIX A

QUALITY CONTROL PRECISION AND ACCURACY DATA

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Analysis: Milligrams/Liter or ppm
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample No.	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Ammonia	18633	2.3	2.2	2.2	0.1	4
Total Recoverable Phenols	18633	BQL*	BQL	BQL	None	None
Total Kjeldahl Nitrogen	18633	3.3	3.2	3.2	0.1	3
Sulfate	18633	62	58	60	4.0	7
Nitrite	18633	0.06	0.06	0.06	None	None

Relative Percent Difference =
Range/Average X 100
* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units:mg/l or ppm)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Ammonia	18633	SPK	4.9	2.2	2.5	108
Ammonia	9916	EPA	10	8.0	---	125
Total Recoverable Phenols	18633	SPK	0.284	BQL**	0.300	95
Total Recoverable Phenols	728	STD	0.298	0.300	---	99
Total Kjeldahl Nitrogen	18633	SPK	6.4	3.2	3.0	107
Total Kjeldahl Nitrogen	486-2	EPA	5.4	5.0	---	108
Sulfate	18633	SPK	172	60	100	112
Sulfate	384-2	EPA	6.8	7.2	---	94
Nitrite	18633	SPK	0.56	0.06	0.50	100

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)
** Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
WET CHEMISTRY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
SDonovan	350.1	18630,31,32,33	3/24/88	1200
SDonovan	420.2	18630,31,32,33	3/28/88	1500
SDonovan	351.2	18630,31,32,33	3/30/88	1330
SDonovan	375.2	18630,31,32,33	4/4/88	1500
SDonovan	353.2	18630,31,32,33	4/1/88	1600

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Milligrams/Kilogram, ppm
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Furfural	18633	<10	<10	<10	None	None
Thiophene	18633	<10	<10	<10	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF)

(Units: ppm)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Furfural (mg/l)	---	EPA	12.2	---	12.6	97
Furfural (mg/kg)	18633	SPK	63	<10	63	100
Thiophene (mg/l)	---	EPA	9.42	---	9.64	98
Thiophene (mg/kg)	18633	SPK	83	<10	96	86

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
GAS CHROMATOGRAPHY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
Patrick a Fama	722J	18630-33	3/31/88	1730 - 2400
Patrick a Fama	790	18630-33	3/31/88-4/1/88	2000 - 0030

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
GAS CHROMATOGRAPHY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF EXTRACTION
Joe Najera	722J/790	18630-33	3/25/88

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Kilogram, ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Chloromethane	18633	<1600	<1600	<1600	None	None
Vinyl Chloride	18633	<1600	<1600	<1600	None	None
Chloroethane	18633	<1600	<1600	<1600	None	None
Bromomethane	18633	<1600	<1600	<1600	None	None
2-Chloroethylvinylether	18633	<1600	<1600	<1600	None	None
Ethylbenzene	18633	<800	<800	<800	None	None
Methylene Chloride	18633	<800	<800	<800	None	None
Chlorobenzene	18633	<800	<800	<800	None	None
1,1-Dichloroethylene	18633	<800	<800	<800	None	None
1,1-Dichloroethane	18633	<800	<800	<800	None	None
trans-1,2-Dichloroethylene	18633	<800	<800	<800	None	None
Chloroform	18633	<800	<800	<800	None	None
1,2-Dichloroethane	18633	<800	<800	<800	None	None
1,1,1-Trichloroethane	18633	<800	<800	<800	None	None
Carbon Tetrachloride	18633	<800	<800	<800	None	None
Bromodichloromethane	18633	<800	<800	<800	None	None
1,2-Dichloropropane	18633	<800	<800	<800	None	None
trans-1,3-Dichloropropene	18633	<800	<800	<800	None	None
Trichloroethylene	18633	<800	<800	<800	None	None
Benzene	18633	<800	<800	<800	None	None
cis-1,3-Dichloropropene	18633	<800	<800	<800	None	None
1,1,2-Trichloroethane	18633	<800	<800	<800	None	None
Dibromochloromethane	18633	<800	<800	<800	None	None
Bromoform	18633	<800	<800	<800	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Kilogram, ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
1,1,2,2-Tetrachloroethylene	18633	<800	<800	<800	None	None
1,1,2,2-Tetrachloroethane	18633	<800	<800	<800	None	None
Toluene	18633	<800	<800	<800	None	None
Acetone	18633	<8000	<8000	<8000	None	None
Carbon Disulfide	18633	<800	<800	<800	None	None
2-Butanone	18633	<8000	<8000	<8000	None	None
Vinyl Acetate	18633	<800	<800	<800	None	None
2-Hexanone	18633	<8000	<8000	<8000	None	None
4-Methyl-2-Pentanone	18633	<8000	<8000	<8000	None	None
Styrene	18633	<800	<800	<800	None	None
Xylenes (Total)	18633	<800	<800	<800	None	None
Trichlorofluoromethane	18633	<800	<800	<800	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units: ng/ul or ppl)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Dimethylphthalate	18630	SPK	114	<10	100	114
Diethylphthalate	18630	SPK	130	<10	110	118
Di-n-Butylphthalate	18630	SPK	109	<10	125	87
Butylbenzylphthalate	18630	SPK	89	<10	120	74
Bis(2-ethylhexyl)phthalate	18630	SPK	157	<10	130	121
Di-n-Octylphthalate	18630	SPK	151	<10	189	80
Naphalene	18630	SPK	215	136	100	79
Acenaphthene	18630	SPK	354	266	100	88
Anthracene	18630	SPK	274	164	100	110
Nitrobenzene-d5	18630	Surrogate	81	---	100	81
4-Terphenyl-d14	18630	Surrogate	68	---	100	68
2-Fluorobiphenyl	18630	Surrogate	79	---	100	79
Phenol-d6	18630	Surrogate	80	---	100	80
2-Fluorophenol	18630	Surrogate	74	---	100	74
2,4,6-Tribromophenol	18630	Surrogate	75	---	199	75

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units: ug/kg or ppb)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
1,1-Dichloroethane	18630	SPK	41	<5.0	50	82
Dibromochloromethane	18630	SPK	38	<5.0	40	95
Trichloroethylene	18630	SPK	30	<5.0	32	94
Carbon Tetrachloride	18630	SPK	51	<5.0	60	85
1,1,2,2-Tetrachloroethane	18630	SPK	31	<5.0	36	86
1,2-Dichloroethane-d4	18630	Surrogate	49	---	50	98
Toluene-d8	18630	Surrogate	47	---	50	94
1,2-Dichloroethane-d4	18631	Surrogate	27	---	50	54
Toluene-d8	18631	Surrogate	41	---	50	82
1,2-Dichloroethane	18632	Surrogate	31	---	50	62
Toluene	18632	Surrogate	37	---	50	74

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Kilogram, ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
2-Methylnaphthalene	18633	5,800	5,400	5,600	400	7
Bis(2-chloroethyl)ether	18633	<660	<660	<660	None	None
1,3-Dichlorobenzene	18633	<660	<660	<660	None	None
1,4-Dichlorobenzene	18633	<660	<660	<660	None	None
1,2-Dichlorobenzene	18633	<660	<660	<660	None	None
Bis(2-chloroisopropyl)ether	18633	<660	<660	<660	None	None
Hexachloroethane	18633	<660	<660	<660	None	None
N-Nitrosodi-N-Propylamine	18633	<660	<660	<660	None	None
Nitrobenzene	18633	<660	<660	<660	None	None
Isophorone	18633	<660	<660	<660	None	None
Bis(20Chloroethoxy)Methane	18633	<660	<660	<660	None	None
1,2,4-Trichlorobenzene	18633	<660	<660	<660	None	None
Naphthalene	18633	12,000	10,000	11,000	2,000	18
Hexachlorobutadiene	18633	<660	<660	<660	None	None
Hexachlorocylopentadiene	18633	<660	<660	<660	None	None
2-Chloronaphthalene	18633	<660	<660	<660	None	None
Dimethylphthalate	18633	<660	<660	<660	None	None
Acenaphthylene	18633	<660	<660	<660	None	None
2,6-Dinitrotoluene	18633	<660	<660	<660	None	None
Acenaphthene	18633	21,000	22,000	21,500	1,000	5
2,4-Dinitrotoluene	18633	<660	<660	<660	None	None
Diethylphthalate	18633	<660	<660	<660	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Kilogram, ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Fluorene	18633	26,000	23,000	24,500	3,000	12
4-Chlorophenylphenylether	18633	<660	<660	<660	None	None
Diphenylamine(N-Nitroso)	18633	<660	<660	<660	None	None
Benzyl Alcohol	18633	<660	<660	<660	None	None
4-Chloroaniline	18633	<660	<660	<660	None	None
4-Bromophenylphenylether	18633	<660	<660	<660	None	None
Hexachlorobenzene	18633	<660	<660	<660	None	None
Phenanthrene	18633	43,000	44,000	43,500	1,000	2
Anthracene	18633	11,000	11,000	11,000	0	0
Di-N-Butylphthalate	18633	<660	<660	<660	None	None
Fluoranthene	18633	78,000	72,000	75,000	6,000	8
2-Nitroaniline	18633	<660	<660	<660	None	None
Pyrene	18633	61,000	59,000	60,000	2,000	3
Butylbenzylphthalate	18633	<660	<660	<660	None	None
Benzo(a)Anthracene	18633	99,000	90,000	94,500	9,000	10
3,3´-Dichlorobenzidine	18633	<1980	<1980	<1980	None	None
Chrysene	18633	49,000	44,000	46,500	5,000	11
Bis(2-Ethylhexyl)Phthalate	18633	<660	<660	<660	None	None
Di-N-Octylphthalate	18633	<660	<660	<660	None	None
Benzo(b)Fluoranthene	18633	500,000	470,000	485,000	30,000	6
Benzo(k)Fluoranthene	18633	36,000	37,000	36,500	1,000	3
Benzo(a)Pyrene	18633	17,000	17,000	17,000	0	0
Indeno(1,2,3-c,d)Pyrene	18633	<660	<660	<660	None	None
Dibenzo(a,h)Anthracene	18633	<660	<660	<660	None	None
Benzo(g,h,i)Perylene	18633	<660	<660	<660	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Kilogram, ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Phenol	18633	<660	<660	<660	None	None
2-Chlorophenol	18633	<660	<660	<660	None	None
2-Nitrophenol	18633	<660	<660	<660	None	None
2,4-Dimethyphenol	18633	<660	<660	<660	None	None
p-Chloro-m-Cresol	18633	<660	<660	<660	None	None
2,4,6-Trichlorophenol	18633	<660	<660	<660	None	None
2,4-Dinitrophenol	18633	<1320	<1320	<1320	None	None
4-Nitrophenol	18633	<1320	<1320	<1320	None	None
4,6-Dinitro-o-Cresol	18633	<1320	<1320	<1320	None	None
Pentachlorophenol	18633	<1320	<1320	<1320	None	None
2,4-Dichlorophenol	18633	<660	<660	<660	None	None
4-Methylphenol	18633	<660	<660	<660	None	None
Benzoic Acid	18633	<1320	<1320	<1320	None	None
2,4,5-Trichlorophenol	18633	<660	<660	<660	None	None
3-Nitroaniline	18633	<660	<660	<660	None	None
Dibenzofuran	18633	<660	<660	<660	None	None
4-Nitroaniline	18633	<660	<660	<660	None	None
2-Methylphenol	18633	<660	<660	<660	None	None
Benzidine	18633	<3300	<3300	<3300	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
GAS CHROMATOGRAPHY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
Jim Fugh	8240	18630-18633	4/5/88	12:00 - 18:00
Jim Fugh	8270	18630-18633	4/1, 4/88	10:00-14:00, 12:00-19:00

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Analysis: Milligrams/Kilogram, or ppm
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample No.	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Potassium (K)	18633	711	701	706	10	1
Iron (Fe)	18633	19,500	19,250	19,375	250	1
Zinc (Zn)	18633	52	47	50	5	10

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units:mg/l or ppm)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Potassium (K)	18633	SPK	29.38	7.06	20.00	112
Independent (K) std.		STD	11.06	10.00	---	111
Iron (Fe)	18633	**SPK	8.90	3.90	5.00	100
EPA (Fe) std.	386	EPA	1.05	0.99	---	106
Zinc (Zn)	18633	SPK	1.66	0.50	1.00	116
EPA (Zn) std.	386	EPA	0.46	0.50	---	92

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)
** Spike on sample dilution factor of fifty.

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
ATOMIC SPECTROSCOPY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
F. Scrivano	7160	18630-33	3/22/88	1900
	7380	18630-33	3/22/88	2100
	7950	18630-33	3/22/88	2400

APPENDIX B

CHAIN OF CUSTODY RECORDS

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): AES

CHAIN OF CUSTODY RECORD

PROJECT Nº: 2293

PROJECT NAME: UCC-REPUBLIC

SAMPLER'S SIGNATURE Nils W. Thompson (SIGN)

SEQ. Nº	SAMPLE Nº	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	Nº OF CONTAINERS	REMARKS
	DP-1	3/15/88	9:20	200W + 155S	FILL	2	1 VOA, 1 500ml
	DP-2	3/15/88	10:20	275S + 445W	FILL	2	1 VOA, 1 500ml
	DP-3	3/15/88	11:30	601S + 380W	FILL	2	1 VOA, 1 500ml
	~~DP-5~~	~~3/15/88~~	~~[illegible]~~	~~[illegible]~~	~~FILL~~	~~2~~	~~1 VOA, 1 500ml~~
	DP-6	3/15/88	1:55	709S + 246W	FILL	2	1 VOA, 1 500ml
	DP-7	3/15/88	2:10	650S + 28E	FILL	2	1 VOA, 1 500ml
	DP-8	3/15/88	2:45	152W + 435S	FILL	2	1 VOA, 1 500ml
	DP-11	3/16/88	9:10	300S + 590W	FILL	2	1 VOA, 1 500ml
	DP-12	3/16/88	10:10	100S + 450W	FILL	2	1 VOA, 1 500ml
NOTE: THE ABOVE WILL BE COMPOSITED AS FOLLOWS—							
	DP-1	AND	DP-12				
	DP-2	AND	DP-11				
	DP-3	AND	DP-8				
	DP-6	AND	DP-7				
				TOTAL NUMBER OF CONTAINERS			

ANTICIPATED CHEMICAL HAZARDS:

RELINQUISHED BY	DATE/TIME	RECEIVED BY
1 Nils W. Thompson (SIGN)	3/16/88 | 1300	2 Diana Thompson (SIGN)
2 Diana Thompson (SIGN)	3/16/88 | 2:00	3 Judy Ostrowski (SIGN)
3 (SIGN)	|	4 (SIGN)

ADDITIONAL SIGNATURE SHEET REQUIRED ☐

METHOD OF SHIPMENT:	SHIPPED BY:	RECEIVED FOR LABORATORY BY:	DATE/TIME
CRA Carrier	D. Thompson	(SIGN) Judy Ostrowski	3/16 | 2:00

CONDITION OF SEAL UPON RECEIPT:
GENERAL CONDITION OF COOLER:

COOLER OPENED BY: (SIGN)

DATE/TIME |

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

Nº 4529

35

ADVANCED ENVIRONMENTAL SERVICES INC.

2186 LIBERTY DRIVE
NIAGARA FALLS, NY 14304
(716) 283-3120

CHAIN OF CUSTODY RECORD	JOB CODE	PROJECT NAME
	CRF	UNION CARBIDE

SAMPLER'S SIGNATURE

SAMPLE ID.	SEQ. NO.	DATE	TIME	SAMPLE LOCATION	GRAB	COMP	SAMPLE TYPE	NO. OF CONTAINERS	REMARKS
	1	3/15/88		DP-1	X		SOIL	2	1-VOA 1-500 ml.
	2			DP-2	X			2	
	3			DP-3	X			2	
	~~4~~			~~DP-4~~	~~X~~			~~2~~	
	5			DP-6	X			2	
	6			DP-7	X			2	
	7			DP-8	X			2	
	8	3/16/88		DP-11	X			2	
	9	3/16/88		DP-12	X			2	
	10	3/14/88		TRIP BLANK			WATER	1	VOA
							TOTAL CONTAINERS	17	

RELINQUISHED BY (Sign)	DATE	TIME	RECEIVED BY (Sign)
[ ] Diana Thompson	3/16/88	2:00 p.m.	② Jody Petrowski
RELINQUISHED BY (Sign) [ ]	DATE	TIME	RECEIVED BY (Sign) ③
RELINQUISHED BY (Sign) [ ]	DATE	TIME	RECEIVED BY (Sign) ④
RELINQUISHED BY (Sign) [ ]	DATE	TIME	RECEIVED BY (Sign) ⑤

REMARKS:

ADVANCED
ENVIRONMENTAL SERVICES INC.

ANALYSIS OF FOUR SOIL COMPOSITES FOR PRIORITY POLLUTANT PESTICIDES AND PCB'S (CRA PROJECT #2293)

Report Prepared For

CONESTOGA ROVERS & ASSOCIATES, INC.

Catherine Mocniak
Catherine Mocniak
Project Manager

Janette Bingert
Janette Bingert
Quality Control Manager

April 28, 1988
AES Report CRF

COMMITMENT
TO
HONESTY - QUALITY - SERVICE

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: PCBs AND PESTICIDES

Units Of Measure: Milligrams/Kilogram, ppm (dry wt. basis)
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	19324 DP-1 & DP-12 LAB COMP 4/7/88	19325 DP-2 & DP-11 LAB COMP 4/7/88
Aldrin	8080	0.010		BQL*	0.146
alpha-BHC	"	0.010		0.181	0.112
beta-BHC	"	0.010		BQL	BQL
gamma-BHC	"	0.010		0.570	0.910
delta-BHC	"	0.010		BQL	BQL
Chlordane	"	0.100		BQL	BQL
4,4´-DDT	"	0.010		BQL	BQL
4,4´-DDE	"	0.010		BQL	BQL
4,4´-DDD	"	0.010		BQL	BQL
Dieldrin	"	0.010		BQL	BQL
alpha-Endosulfan	"	0.010		BQL	BQL
beta-Endosulfan	"	0.010		BQL	BQL
Endosulfan Sulfate	"	0.010		BQL	BQL
Endrin	"	0.010		BQL	BQL
Endrin Aldehyde	"	0.010		BQL	BQL
Heptachlor	"	0.010		BQL	0.215
Heptachlor Epoxide	"	0.010		BQL	BQL
PCB-1242	"	0.010		BQL	BQL
PCB-1254	"	0.010		BQL	BQL
PCB-1221	"	0.010		BQL	BQL
PCB-1232	"	0.010		BQL	BQL
PCB-1248	"	0.010		BQL	BQL
PCB-1260	"	0.010		BQL	BQL
PCB-1016	"	0.010		BQL	BQL
Toxaphene	"	0.100		BQL	BQL

Susan C Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits

Rec'd CRA

AUG 5 1988

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: PCBs AND PESTICIDES

Units Of Measure: Milligrams/Kilogram, ppm (dry wt. basis)
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	19326 DP-3 & DP-8 LAB COMP 4/7/88	19327 DP-6 & DP-7 LAB COMP 4/7/88
Aldrin	8080	0.010		0.121	0.367
alpha-BHC	"	0.010		1.04	0.197
beta-BHC	"	0.010		0.541	BQL*
gamma-BHC	"	0.010		0.729	1.30
delta-BHC	"	0.010		BQL	BQL
Chlordane	"	0.100		BQL	BQL
4,4´-DDT	"	0.010		BQL	BQL
4,4´-DDE	"	0.010		BQL	BQL
4,4´-DDD	"	0.010		BQL	BQL
Dieldrin	"	0.010		BQL	BQL
alpha-Endosulfan	"	0.010		BQL	BQL
beta-Endosulfan	"	0.010		BQL	BQL
Endosulfan Sulfate	"	0.010		BQL	BQL
Endrin	"	0.010		BQL	BQL
Endrin Aldehyde	"	0.010		BQL	BQL
Heptachlor	"	0.010		0.274	0.273
Heptachlor Epoxide	"	0.010		BQL	BQL
PCB-1242	"	0.010		BQL	BQL
PCB-1254	"	0.010		BQL	BQL
PCB-1221	"	0.010		BQL	BQL
PCB-1232	"	0.010		BQL	BQL
PCB-1248	"	0.010		BQL	BQL
PCB-1260	"	0.010		BQL	BQL
PCB-1016	"	0.010		BQL	BQL
Toxaphene	"	0.100		BQL	BQL

Susan C Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: PCBs AND PESTICIDES

Units Of Measure: Micrograms/Liter, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- Sample ID - Sample Date-	METHOD BLANK
Aldrin	8080	0.50		BQL*
alpha-BHC	"	0.50		BQL
beta-BHC	"	0.50		BQL
gamma-BHC	"	0.50		BQL
delta-BHC	"	0.50		BQL
Chlordane	"	5.00		BQL
4,4´-DDT	"	0.50		BQL
4,4´-DDE	"	0.50		BQL
4,4´-DDD	"	0.50		BQL
Dieldrin	"	0.50		BQL
alpha-Endosulfan	"	0.50		BQL
beta-Endosulfan	"	0.50		BQL
Endosulfan Sulfate	"	0.50		BQL
Endrin	"	0.50		BQL
Endrin Aldehyde	"	0.50		BQL
Heptachlor	"	0.50		BQL
Heptachlor Epoxide	"	0.50		BQL
PCB-1242	"	0.50		BQL
PCB-1254	"	0.50		BQL
PCB-1221	"	0.50		BQL
PCB-1232	"	0.50		BQL
PCB-1248	"	0.50		BQL
PCB-1260	"	0.50		BQL
PCB-1016	"	0.50		BQL
Toxaphene	"	5.00		BQL

Susan C Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits

APPENDIX A

QUALITY CONTROL PRECISION AND ACCURACY DATA

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: mg/kg, ppm
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Aldrin	19327	0.282	0.452	0.367	0.170	46
alpha-BHC	19327	0.138	0.256	0.197	0.118	60
beta-BHC	19327	<0.010	<0.010	<0.010	None	None
gamma-BHC	19327	1.06	1.54	1.30	0.48	37
delta-BHC	19327	<0.010	<0.010	<0.010	None	None
Chlordane	19327	<0.100	<0.100	<0.100	None	None
4,4´-DDT	19327	<0.010	<0.010	<0.010	None	None
4,4´-DDE	19327	<0.010	<0.010	<0.010	None	None
4,4´-DDD	19327	<0.010	<0.010	<0.010	None	None
Dieldrin	19327	<0.010	<0.010	<0.010	None	None
alpha-Endosulfan	19327	<0.010	<0.010	<0.010	None	None
beta-Endosulfan	19327	<0.010	<0.010	<0.010	None	None
Endosulfan Sulfate	19327	<0.010	<0.010	<0.010	None	None
Endrin	19327	<0.010	<0.010	<0.010	None	None
Endrin Aldehyde	19327	<0.010	<0.010	<0.010	None	None
Heptachlor	19327	0.264	0.282	0.273	0.018	6
Heptachlor Epoxide	19327	<0.010	<0.010	<0.010	None	None
PCB-1242	19327	<0.010	<0.010	<0.010	None	None
PCB-1254	19327	<0.010	<0.010	<0.010	None	None
PCB-1221	19327	<0.010	<0.010	<0.010	None	None
PCB-1232	19327	<0.010	<0.010	<0.010	None	None
PCB-1248	19327	<0.010	<0.010	<0.010	None	None
PCB-1260	19327	<0.010	<0.010	<0.010	None	None
PCB-1016	19327	<0.010	<0.010	<0.010	None	None
Toxaphene	19327	<0.100	<0.100	<0.100	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units: mg/kg or ppm)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
alpha-BHC	19327	SPK	0.334	0.197	0.124	110
Heptachlor	19327	SPK	0.388	0.273	0.156	74
Heptachlor Epoxide	19327	SPK	0.433	<0.010	0.499	87
Endrin	19327	SPK	1.58	<0.010	1.25	126
Endrin (ug/l)	---	EPA	11.9	---	10.0	119
gamma-BHC (ug/l)	---	EPA	166	---	200	83

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
GAS CHROMATOGRAPHY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
Patricia a. Fama	8080	19324-27	4/19/88	1730 - 2400

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
GAS CHROMATOGRAPHY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF EXTRACTION
Joe Nocera	8080	19324-27	4/14/88

APPENDIX B

CHAIN OF CUSTODY RECORDS

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): AES

CHAIN OF CUSTODY RECORD

PROJECT Nº: 2293

PROJECT NAME: UCC-REPUBLIC

SAMPLER'S SIGNATURE Nick W. Thompson (SIGN)

	SEQ. Nº	SAMPLE Nº	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	Nº OF CONTAINERS	REMARKS
LAB COMPOSITE		DP-1	4-7-88	09:19	155S + 200W	FILL	2	Pesticides, PCBs
		DP-12	4-7-88	07:50	100S + 450W	FILL	2	Pesticides, PCBs
LAB COMPOSITE		DP-2	4-7-88	11:10	275S + 445W	FILL	2	Pesticides, PCBs
		DP-11	4-7-88	09:51	300S + 590W	FILL	2	Pesticides, PCBs
LAB COMPOSITE		DP-3	4-7-88	14:35	601S + 380W	FILL	2	Pesticides, PCBs
		DP-8	4-7-88	13:48	435S + 152W	FILL	2	Pesticides, PCBs
LAB COMPOSITE		DP-6	4-7-88	15:28	709S + 246W	FILL	2	Pesticides, PCBs
		DP-7	4-7-88	16:18	650S + 28E	FILL	2	Pesticides, PCBs
					TOTAL NUMBER OF CONTAINERS		16	

ANTICIPATED CHEMICAL HAZARDS:

RELINQUISHED BY	DATE/TIME	RECEIVED BY
1 Nick W. Thompson (SIGN)	4/7/88 18:20	2 Pat Fama (SIGN)
2 (SIGN)		3 (SIGN)
3 (SIGN)		4 (SIGN)

ADDITIONAL SIGNATURE SHEET REQUIRED ☐

METHOD OF SHIPMENT	SHIPPED BY	RECEIVED FOR LABORATORY BY	DATE/TIME
AUTO	N.W. THOMPSON	(SIGN) Pat Fama	4/7/88 18:20

CONDITION OF SEAL UPON RECEIPT:
GENERAL CONDITION OF COOLER:

COOLER OPENED BY: (SIGN) Pat Fama — DATE/TIME 4/7/88 18:20

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

Nº 4532

ADVANCED ENVIRONMENTAL SERVICES INC.

2186 LIBERTY DRIVE
NIAGARA FALLS, NY 14304
(716) 283-3120

CHAIN OF CUSTODY RECORD	JOB CODE	PROJECT NAME
	CRF	CRA

SAMPLER'S SIGNATURE

SAMPLE NO.	SEQ. NO.	DATE	TIME	SAMPLE LOCATION	GRAB	COMP	SAMPLE TYPE	NO. OF CONTAINERS	REMARKS
							Soil	16	
							TOTAL CONTAINERS	16	

RELINQUISHED BY (Sign)	DATE	TIME	RECEIVED BY (Sign)
1 Nik W. Thompson	4/7/88	18:20	2 Pat Fama
2			3
3			4
4			5

REMARKS:

N.F. FILE COPY

ADVANCED
ENVIRONMENTAL SERVICES INC.

CRA PROJECT #2293

Report Prepared For

CONESTOGA-ROVERS & ASSOCIATES, INC.

Karen E. Kuklis

Karen E. Kuklis
Project Manager

Catherine C. Mocniak for

W. Joseph McDougall, Ph.D.
Technical Evaluation

June 22, 1988
AES Report CRF

COMMITMENT
TO
HONESTY - QUALITY - SERVICE

Rec'd CRA
JUN 22 1988

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS

Units Of Measure: Milligrams/Kilogram, or ppm (dry wt. basis)
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.-	20677	20678	20679
			Sample ID -	TP-2 GRAB	TP-4 GRAB	TP-6 GRAB
			Sample Date-	6/8/88	6/8/88	6/8/88
Benzene	8020	0.10		3.90	BQL*	0.50

Susan C. Scrocchi

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS

Units Of Measure: Milligrams/Kilogram, or ppm (dry wt. basis)
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.-	20680	20681	20694
			Sample ID -	DP-2,11 LAB COMP	DP-3,8 LAB COMP	TP-10 GRAB
			Sample Date-	6/8/88	6/8/88	6/9/88
Acetone	8020	0.50		BQL*	BQL	N/R**
Benzene	"	0.10		N/R	N/R	BQL

Susan C. Scroechi
Susan C. Scroechi
Gas Chromatography Supervisor

* Below quantifiable limits.
** Not required.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Milligrams/Kilogram, ppm
Client: CRA   A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Benzene	20678	<0.10	<0.10	<0.10	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units: mg/kg or ppm)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Benzene	20679	SPK	1.63	0.50	1.13	100

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
GAS CHROMATOGRAPHY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
Patrika Fama	8020	20677-79	6/13/88	2000-2300
Patrika Fama	8020	20680, 81, 94	6/14/88	1530-1715

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): AES

CHAIN OF CUSTODY RECORD

PROJECT Nº: 2293

PROJECT NAME: UCC - Republic Plant

SAMPLER'S SIGNATURE Nils W. Thompson (SIGN)

	SEQ. Nº.	SAMPLE Nº.	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	Nº OF CONTAINERS	REMARKS
COMPOSITE		DP - 2	6/8/88	2:23	275S + 445W	FILL	1	ACETONE
		DP - 11	"	2:48	300S + 590W	"	1	"
COMPOSITE		DP - 3	"	1:10	601S + 380W	"	1	"
		DP - 8	"	1:44	435S + 152W	"	1	"
	NOTE: COMPOSITE DP-2 WITH DP-11 AND DP-3 WITH DP-8							
		TP - 2	6/8/88	10:55	WATERMAIN PIT 2	SOIL	1	BENZENE
		TP - 4	"	9:30	" " 4	"	1	"
		TP - 6	"	11:45	" " 6	"	1	"
					TOTAL NUMBER OF CONTAINERS		7	

ANTICIPATED CHEMICAL HAZARDS:

RELINQUISHED BY: 1 Nils Thompson (SIGN)	DATE/TIME 6/8/88 | 3:47	RECEIVED BY: 2 Judy Ostrowski (SIGN)
RELINQUISHED BY: 2 (SIGN)	DATE/TIME	RECEIVED BY: 3 (SIGN)
RELINQUISHED BY: 3 (SIGN)	DATE/TIME	RECEIVED BY: 4 (SIGN)
ADDITIONAL SIGNATURE SHEET REQUIRED ☐		

METHOD OF SHIPMENT: AUTO	SHIPPED BY: NILS THOMPSON	RECEIVED FOR LABORATORY BY: (SIGN) Judy Ostrowski	DATE/TIME 6/8/88 | 3:47
CONDITION OF SEAL UPON RECEIPT: GENERAL CONDITION OF COOLER:		COOLER OPENED BY: (SIGN) Judy Ostrowski	DATE/TIME 6/8/88 | 3:47

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

Nº 4571

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): AES

CHAIN OF CUSTODY RECORD

PROJECT №: 2293

PROJECT NAME: UCC - Republic Watermain Inves.

SAMPLER'S SIGNATURE C. Dunniga (SIGN)

SEQ. №	SAMPLE №	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	№ OF CONTAINERS	REMARKS
	TP10	6/9/88		Stockpile	Soil	1	Benzene
				TOTAL NUMBER OF CONTAINERS		1	

ANTICIPATED CHEMICAL HAZARDS: Unknown

RELINQUISHED BY	DATE/TIME	RECEIVED BY
1 C. Dunniga (SIGN)	6/9/88 1000	2 Nils Thompson (SIGN)
2 Nils Thompson (SIGN)	6/9/88 10:13	3 Judy Ostrowski (SIGN)
3 (SIGN)		4 (SIGN)

ADDITIONAL SIGNATURE SHEET REQUIRED ☐

METHOD OF SHIPMENT: Auto

SHIPPED BY: NILS THOMPSON

RECEIVED FOR LABORATORY BY: (SIGN) Judy Ostrowski

DATE/TIME 6/9/88 10:13

CONDITION OF SEAL UPON RECEIPT:

GENERAL CONDITION OF COOLER:

COOLER OPENED BY: (SIGN) Nils Thompson

DATE/TIME 6/9/88 10:13

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

№ 4575

APPENDIX G

APPENDIX G

ANALYTICAL RESULTS

WASTE DRUM SAMPLES

2243

ADVANCED ENVIRONMENTAL SERVICES INC.

WASTE CHARACTERIZATION OF MATERIAL FOUND AT
UNION CARBIDE CORPORATION SOLID WASTE MANAGEMENT FACILITY

Report Prepared For

UNION CARBIDE CORPORATION
CARBON PRODUCTS DIVISION

Karen E. Kuklis

Karen E. Kuklis
Project Manager

Catherine Mocniak for

Janette Bingert
Quality Control Manager

April 26, 1988
AES Report COH

COMMITMENT
TO
HONESTY - QUALITY - SERVICE

SCOPE OF WORK

Mr. Alvin Ogg of Union Carbide Corporation requested that samples of material found at Union Carbide Solid Waste Management Facility be analyzed for Waste Characterization.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Client: UNION CARBIDE   A.E.S. Job Code COH

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- 16385 / Sample ID - CODE 59 MAT'L / Sample Date- 11/20/87	18688 / SOLID / 3/18/88	18689 / PITCH / 3/18/88	18690 / DP-21-1 / 3/18/88
COMPONENTS OF COAL TAR PITCH:						
Benzene (ug/l)*	602	2.00	BQL	BQL**	BQL	BQL
Toluene (ug/l)*	"	2.00	8.48	BQL	BQL	BQL
m/p-Xylene (ug/l)*	"	2.00	28.2	4.48	BQL	3.82
o-Xylene (ug/l)*	"	2.00	27.8	2.78	BQL	5.11
Napthalene (ug/l)*	610	3.00	BQL	16.4	125	16.4
Anthracene (ug/l)*	"	3.00	BQL	34.5	19.4	71.4
Thiophene (mg/l)*	Supelco 816	2.00	BQL	BQL	BQL	BQL
Total Rec. Phenol(mg/l)*	420.2	0.005	.009	0.124	0.046	0.084
Ammonia (As N) (mg/l)*	350.1	0.01	0.12	60	BQL	46
DIETHYL SULFATE (mg/l)* (presumptive test)	375.2	2.0	89	198	4.2	186
FURFURAL (mg/l)*	Supelco 790	2.00	22.7	BQL	BQL	BQL

Margaret L. Skowron
Margaret L. Skowron
Wet Chemistery Supervisor

Susan C. Scrocchi
Susan C. Scrocchi
Gas Chromatography Supervisor

* On E.P. Toxicity extraction.
** Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Client: UNION CARBIDE A.E.S. Job Code COH

Analytical Parameter(s)	Method No.	Quant. Limits			
			AES Lab No.-	18691	18692
			Sample ID -	DP-21-2	DP-21-3
			Sample Date-	3/18/88	3/18/88
COMPONENTS OF COAL TAR PITCH:					
Benzene (ug/l)*	602	2.00		BQL**	BQL
Toluene (ug/l)*	"	2.00		BQL	BQL
m/p-Xylene (ug/l)*	"	2.00		5.11	4.97
o-Xylene (ug/l)*	"	2.00		2.46	2.21
Napthalene (ug/l)*	610	3.00		23.5	22.7
Anthracent (ug/l)*	"	3.00		15.3	426
Thiophene (mg/l)*	Supelco 816	2.00		BQL	BQL
Total Rec. Phenol(mg/l)*	420.2	0.005		0.179	0.150
Ammonia (As N) (mg/l)*	350.1	0.01		60	27
DIETHYL SULFATE (mg/l)* (presumptive test)	375.2	2.0		130	28
FURFURAL (mg/l)*	Supelco 790	2.00		BQL	BQL

Margaret L. Skowron

Margaret L. Skowron
Wet Chemistry Supervisor

Susan C. Scrocchi

Susan C. Scrocchi
Gas[redacted]ro[redacted]gr[redacted]y S[redacted]rvi[redacted]

* On E.P. Toxicity extraction.
** B[redacted]w [redacted]ti[redacted]ble[redacted]mi[redacted]

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: RESULTS - WET CHEMISTRY

Client: UNION CARBIDE A.E.S. Job Code COH

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. - 18689 Sample ID - PITCH Sample Date- 3/18/88
Softening Point (°C)*	ASTMD36	---	58
Quinolline Insoluble (%)*	ASTMD2318	---	11.22
Toluene Insoluble (%)*	ASTMD4072	---	22.97
Coking Valve (%)*	ASTMD189	---	61.46

* Subcontracted to Phoenix Chemical Laboratory, Inc.

Margaret L. Skowron

Margaret L. Skowron
Wet Chemistry Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Liter, or ppb
Client: UNION CARBIDE A.E.S. Job Code:COH

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Benzene	18688	<2.00	<2.00	<2.00	None	None
Toluene	18688	<2.00	<2.00	<2.00	None	None
m/p-Xylene	18688	4.53	4.42	4.48	0.11	2.4
o-Xylene	18688	2.81	2.74	2.78	0.07	2.5
Naphthalene	18692	21.7	23.7	22.7	2.0	8.9
Anthracene	18692	415	436	426	21	4.9
Thiophene (mg/l)	18691	<2.00	<2.00	<2.00	None	None
Furfural (mg/l)	18691	<2.00	<2.00	<2.00	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: UNION CARBIDE A.E.S. Job Code: COH

(Units: ug/l, or ppb)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Benzene	18689	SPK	34.4	<2.00	31.0	111
Toluene	18689	SPK	37.5	<2.00	35.7	105
m/p-Xylene	18689	SPK	25.4	<2.00	26.2	97
Naphthalene	18692	SPK	354	22.7	335	99
Furfural (mg/l)	18692	SPK	13.5	<2.00	12.6	107
Thiophene (mg/l)	18690	SPK	7.57	<2.00	9.65	78

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Analysis: Milligrams/Liter or ppm
Client: UNION CARBIDE A.E.S. Job Code:COH

Analytical Parameters	Sample No.	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Ammonia	18689	BQL*	BQL	BQL	None	None
Total Recoverable Phenols	18692	0.150	0.150	0.150	None	None
Sulfate	18692	26	30	28	4.0	14

Relative Percent Difference =
Range/Average X 100
* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: UNION CARBIDE A.E.S. Job Code: COH

(Units:mg/l or ppm)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Ammonia	18689	SPK	0.48	BQL**	0.50	96
Ammonia	9916	EPA	8.0	8.0	---	100
Total Recoverable Phenols	18692	SPK	0.336	0.150	0.200	93
Total Recoverable Phenols	731	STD	0.286	0.300	---	95
Sulfate	18692	SPK	148	28	100	120
Sulfate	384-2	EPA	6.8	7.2	---	94

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)
** Below quantifiable limits.

APPENDIX H

APPENDIX H

ANALYTICAL DATA

GROUNDWATER SAMPLING PROGRAM

CC . NF file

ADVANCED
ENVIRONMENTAL SERVICES INC.

GROUNDWATER MONITORING PROGRAM
CRA PROJECT #2293
(FOR UNION CARBIDE)

Report Prepared For

CONESTOGA ROVERS & ASSOCIATES, INC.

Catherine Mocniak
Catherine Mocniak
Project Manager

Janette Bingert
Janette Bingert
Quality Control Manager

April 14, 1988
AES Report CRF

COMMITMENT
TO
HONESTY - QUALITY - SERVICE

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: RESULTS - WET CHEMISTRY

Client: CRA | A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. - / Sample ID - / Sample Date-	18739 OW1-88 GRAB 3/22/88	18740 OW2-88 GRAB 3/22/88	METHOD BLANK
Total Cyanide (mg/l)	335.3	0.01		BQL*	BQL	BQL
Total Rec. Phenols (mg/l)	420.2	0.005		0.044	BQL	BQL

* Below quantifiable limits.

Margaret L. Skowron
Margaret L. Skowron
Wet Chemistry Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: PCBs AND PESTICIDES

Units Of Measure: Micrograms/Liter, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	18739 OW1-88 3/22/88	18740 OW2-88 3/22/88	METHOD BLANK
Aldrin	608	0.50		BQL*	BQL	BQL
alpha-BHC	"	0.50		0.52	BQL	BQL
beta-BHC	"	0.50		BQL	BQL	BQL
gamma-BHC	"	0.50		BQL	BQL	BQL
delta-BHC	"	0.50		BQL	BQL	BQL
Chlordane	"	5.00		BQL	BQL	BQL
4,4´-DDT	"	0.50		BQL	BQL	BQL
4,4´-DDE	"	0.50		BQL	BQL	BQL
4,4´-DDD	"	0.50		BQL	BQL	BQL
Dieldrin	"	0.50		BQL	BQL	BQL
alpha-Endosulfan	"	0.50		BQL	BQL	BQL
beta-Endosulfan	"	0.50		BQL	BQL	BQL
Endosulfan Sulfate	"	0.50		BQL	BQL	BQL
Endrin	"	0.50		BQL	BQL	BQL
Endrin Aldehyde	"	0.50		BQL	BQL	BQL
Heptachlor	"	0.50		BQL	BQL	BQL
Heptachlor Epoxide	"	0.50		BQL	BQL	BQL
PCB-1242	"	0.50		BQL	BQL	BQL
PCB-1254	"	0.50		BQL	BQL	BQL
PCB-1221	"	0.50		BQL	BQL	BQL
PCB-1232	"	0.50		BQL	BQL	BQL
PCB-1248	"	0.50		BQL	BQL	BQL
PCB-1260	"	0.50		BQL	BQL	BQL
PCB-1016	"	0.50		BQL	BQL	BQL
Toxaphene	"	5.00		BQL	BQL	BQL

Susan C. Scrocchi
Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS

Units Of Measure: Micrograms/Liter, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.-	18739	18740	18741
			Sample ID -	OW1-88 GRAB	OW2-88 GRAB	FIELD BLANK
			Sample Date-	3/22/88	3/22/88	3/17/88
Chloromethane	624	10		BQL*	BQL	BQL
Vinyl Chloride	"	10		BQL	BQL	BQL
Chloroethane	"	10		BQL	BQL	BQL
Bromomethane	"	10		BQL	BQL	BQL
2-Chloroethyl Vinyl Ether	"	10		BQL	BQL	BQL
Ethylbenzene	"	5.0		BQL	BQL	BQL
Methylene Chloride	"	5.0		BQL	BQL	BQL
Chlorobenzene	"	5.0		BQL	BQL	BQL
1,1-Dichloroethylene	"	5.0		BQL	BQL	BQL
1,1-Dichloroethane	"	5.0		BQL	BQL	BQL
trans-1,2-Dichloroethylene	"	5.0		BQL	BQL	BQL
Chloroform	"	5.0		BQL	BQL	BQL
1,2-Dichloroethane	"	5.0		BQL	BQL	BQL
1,1,1-Trichloroethane	"	5.0		BQL	BQL	BQL
Carbon Tetrachloride	"	5.0		BQL	BQL	BQL
Bromodichloromethane	"	5.0		BQL	BQL	BQL
1,2-Dichloropropane	"	5.0		BQL	BQL	BQL
trans-1,3-Dichloropropene	"	5.0		BQL	BQL	BQL
Trichloroethylene	"	5.0		BQL	BQL	BQL
Benzene	"	5.0		BQL	BQL	BQL
cis-1,3-Dichloropropene	"	5.0		BQL	BQL	BQL
1,1,2-Trichloroethane	"	5.0		BQL	BQL	BQL
Dibromochloromethane	"	5.0		BQL	BQL	BQL
Bromoform	"	5.0		BQL	BQL	BQL

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: VOLATILE ORGANICS

Units Of Measure: Micrograms/Liter, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.-	18739	18740	18741
			Sample ID -	OW1-88 GRAB	OW2-88 GRAB	FIELD BLANK
			Sample Date-	3/22/88	3/22/88	3/17/88
1,1,2,2-Tetrachloroethylen	624	5.0		BQL*	BQL	BQL
1,1,2,2-Tetrachloroethane	"	5.0		BQL	BQL	BQL
Toluene	"	5.0		BQL	BQL	BQL
Trichlorofluoromethane	"	5.0		BQL	BQL	BQL

* Below quantifiable limits.

Jim Tigh for:
Susan C. Scrocchi
Gas Chromatography Supervisor

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: BASE/NEUTRAL EXTRACTABLES

Units Of Measure: Micrograms/Liter, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- Sample ID - Sample Date-	18739 OW1-88 GRAB 3/22/88	18740 OW2-88 GRAB 3/22/88	18741 FIELD BLANK 3/17/88
N-Nitrosodimethylamine	625	10		BQL*	BQL	BQL
Bis(2-Chloroethyl)Ether	"	10		BQL	BQL	BQL
1,3-Dichlorobenzene	"	10		BQL	BQL	BQL
1,4-Dichlorobenzene	"	10		BQL	BQL	BQL
1,2-Dichlorobenzene	"	10		BQL	BQL	BQL
Bis(2-Chloroisopropyl)		10		BQL	BQL	BQL
Ether	"	10		BQL	BQL	BQL
Hexachloroethane	"	10		BQL	BQL	BQL
N-Nitrosodi-N-Propylamine	"	10		BQL	BQL	BQL
Nitrobenzene	"	10		BQL	BQL	BQL
Isophorone	"	10		BQL	BQL	BQL
Bis(2-Chloroethoxy)Methane	"	10		BQL	BQL	BQL
1,2,4-Trichlorobenzene	"	10		BQL	BQL	BQL
Naphthalene	"	10		BQL	BQL	BQL
Hexachlorobutadiene	"	10		BQL	BQL	BQL
Hexachlorocylopentadiene	"	10		BQL	BQL	BQL
2-Chloronaphthalene	"	10		BQL	BQL	BQL
Dimethylphthalate	"	10		BQL	BQL	BQL
Acenaphthylene	"	10		BQL	BQL	BQL
2,6-Dinitrotoluene	"	10		BQL	BQL	BQL
Acenaphthene	"	10		BQL	BQL	BQL
2,4-Dinitrotoluene	"	10		BQL	BQL	BQL
Diethylphthalate	"	10		BQL	BQL	BQL

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: BASE/NEUTRAL EXTRACTABLES

Units Of Measure: Micrograms/Liter, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.- / Sample ID - / Sample Date-	18739 OW1-88 GRAB 3/22/88	18740 OW2-88 GRAB 3/22/88	18741 FIELD BLANK 3/17/88
Fluorene	625	10		BQL*	BQL	BQL
4-Chlorophenylphenylether	"	10		BQL	BQL	BQL
Diphenylamine(N-Nitroso)	"	10		BQL	BQL	BQL
1,2-Diphenylhydrazine (Azobenzene)	"	10		BQL	BQL	BQL
4-Bromophenylphenylether	"	10		BQL	BQL	BQL
Hexachlorobenzene	"	10		BQL	BQL	BQL
Phenanthrene	"	10		14	BQL	BQL
Anthracene	"	10		BQL	BQL	BQL
Di-N-Butylphthalate	"	10		BQL	BQL	BQL
Fluoranthene	"	10		13	BQL	BQL
Benzidine	"	50		BQL	BQL	BQL
Pyrene	"	10		12	BQL	BQL
Butylbenzylphthalate	"	10		BQL	BQL	BQL
Benzo(a)Anthracene	"	10		BQL	BQL	BQL
3,3´-Dichlorobenzidine	"	30		BQL	BQL	BQL
Chrysene	"	10		BQL	BQL	BQL
Bis(2-Ethylhexyl)Phthalate	"	10		BQL	BQL	BQL
Di-N-Octylphthalate	"	10		BQL	BQL	BQL
Benzo(b)Fluoranthene	"	10		BQL	BQL	BQL
Benzo(k)Fluoranthene	"	10		BQL	BQL	BQL
Benzo(a)Pyrene	"	10		BQL	BQL	BQL
Indeno(1,2,3-C,D)Pyrene	"	10		BQL	BQL	BQL
Dibenzo(a,h)Anthracene	"	10		BQL	BQL	BQL
Benzo(g,h,i)Perylene	"	10		BQL	BQL	BQL

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: ACIDS

Units Of Measure: Micrograms/Liter, or ppb
Client: CRA A.E.S. Job Code CRF

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No.-	18739	18740	18741
			Sample ID -	OW1-88 GRAB	OW2-88 GRAB	FIELD BLANK
			Sample Date-	3/22/88	3/22/88	3/17/88
Phenol	625	10		BQL*	BQL	BQL
2-Chlorophenol	"	10		BQL	BQL	BQL
2-Nitrophenol	"	10		BQL	BQL	BQL
2,4-Dimethylphenol	"	10		BQL	BQL	BQL
p-Chloro-m-Chesol	"	10		BQL	BQL	BQL
2,4,6-Trichlorophenol	"	10		BQL	BQL	BQL
2,4-Dinitrophenol	"	20		BQL	BQL	BQL
4-Nitrophenol	"	20		BQL	BQL	BQL
4,6-Dinitro-O-Cresol	"	20		BQL	BQL	BQL
Pentachlorophenol	"	20		BQL	BQL	BQL
2,4-Dichlorophenol	"	10		BQL	BQL	BQL

Susan C. Scrocchi
Gas Chromatography Supervisor

* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT

Type of Analysis: METALS

Client: CRA A.E.S. Job Code CRF

(All results are in mg/l)

Analytical Parameter(s)	Method No.	Quant. Limits	AES Lab No. -	18739	18740	METHOD BLANK
			Sample ID -	OW1-88 GRAB	OW2-88 GRAB	
			Sample Date-	3/22/88	3/22/88	
Soluble Antimony (Sb)	204.2	0.020		BQL*	BQL	BQL
Soluble Arsenic (As)	206.2	0.005		0.014	BQL	BQL
Soluble Beryllium (Be)	210.1	0.05		BQL	BQL	BQL
Soluble Cadmium (Cd)	213.1	0.04		BQL	BQL	BQL
Soluble Chromium (Cr)	218.1	0.50		BQL	BQL	BQL
Soluble Copper (Cu)	220.1	0.20		BQL	BQL	BQL
Soluble Lead (Pb)	239.1	1.00		BQL	BQL	BQL
Soluble Mercury (Hg)	245.2	0.001		BQL	BQL	BQL
Soluble Nickel (Ni)	249.1	0.30		BQL	BQL	BQL
Soluble Selenium (Se)	270.2	0.005		BQL	BQL	BQL
Soluble Silver (Ag)	272.1	0.10		BQL	BQL	BQL
Soluble Thallium (Tl)	279.2	1.00		BQL	BQL	BQL
Soluble Zinc (Zn)	289.1	0.05		0.06	0.12	BQL

Janette Bingert
Janette Bingert
Atomic Spectroscopy Supervisor

* Below quantifiable limits.

APPENDIX A

QUALITY CONTROL PRECISION AND ACCURACY DATA

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Analysis: Milligrams/Liter or ppm
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample No.	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Total Cyanide	18740	BQL*	BQL	BQL	None	None
Total Recoverable Phenols	18740	BQL	BQL	BQL	None	None

Relative Percent Difference =
Range/Average X 100
* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units:mg/l or ppm)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Total Cyanide	18740	SPK	0.24	BQL**	0.25	96
Total Cyanide		STD	0.10	0.10	---	100
Total Recoverable Phenols	18740	SPK	0.220	BQL	0.200	110
Total Recoverable Phenols	731	STD	0.286	0.300	---	95

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)
** Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
WET CHEMISTRY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
sDonovan	420.2	18739, 18740	3/28/88	1500
sDonovan	335.3	18739, 40	3/29/88	1700

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Liter, or ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Aldrin	18739	<0.50	<0.50	<0.50	None	None
alpha-BHC	18739	0.52	<0.50	N/A*	N/A	N/A
beta-BHC	18739	<0.50	<0.50	<0.50	None	None
gamma-BHC	18739	<0.50	<0.50	<0.50	None	None
delta-BHC	18739	<0.50	<0.50	<0.50	None	None
Chlordane	18739	<5.00	<5.00	<5.00	None	None
4,4´-DDT	18739	<0.50	<0.50	<0.50	None	None
4,4´-DDE	18739	<0.50	<0.50	<0.50	None	None
4,4´-DDD	18739	<0.50	<0.50	<0.50	None	None
Dieldrin	18739	<0.50	<0.50	<0.50	None	None
alpha-Endosulfan	18739	<0.50	<0.50	<0.50	None	None
beta-Endosulfan	18739	<0.50	<0.50	<0.50	None	None
Endosulfan Sulfate	18739	<0.50	<0.50	<0.50	None	None
Endrin	18739	<0.50	<0.50	<0.50	None	None
Endrin Aldehyde	18739	<0.50	<0.50	<0.50	None	None
Heptachlor	18739	<0.50	<0.50	<0.50	None	None
Heptachlor Epoxide	18739	<0.50	<0.50	<0.50	None	None
PCB-1242	18739	<0.50	<0.50	<0.50	None	None
PCB-1254	18739	<0.50	<0.50	<0.50	None	None
PCB-1221	18739	<0.50	<0.50	<0.50	None	None
PCB-1232	18739	<0.50	<0.50	<0.50	None	None
PCB-1248	18739	<0.50	<0.50	<0.50	None	None
PCB-1260	18739	<0.50	<0.50	<0.50	None	None
PCB-1016	18739	<0.50	<0.50	<0.50	None	None
Toxaphene	18739	<5.00	<5.00	<5.00	None	None

Relative Percent Difference =
Range/Average X 100
* Not applicable.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units: ug/l, or ppb)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
beta-BHC	18740	SPK	1.22	<0.50	2.00	61
Heptachlor Epoxide	18740	SPK	1.85	<0.50	2.00	92
Heptachlor Epoxide		EPA	1.43	---	2.0	72
Endosulfan I		EPA	2.18	---	2.0	109
Endosulfan II		EPA	7.47	---	10.0	75

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
GAS CHROMATOGRAPHY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF EXTRACTION
Joseph S. Nocez	608	18739,40	3/29/88

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
GAS CHROMATOGRAPHY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
Patrick A. Fama	608	18739,40	3/29/88	2011-2400

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Liter, or ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Chloromethane	18739	<10	<10	<10	None	None
Vinyl Chloride	18739	<10	<10	<10	None	None
Chloroethane	18739	<10	<10	<10	None	None
Bromomethane	18739	<10	<10	<10	None	None
2-Chloroethylvinylether	18739	<10	<10	<10	None	None
Ethylbenzene	18739	<5.0	<5.0	<5.0	None	None
Methylene Chloride	18739	<5.0	<5.0	<5.0	None	None
Chlorobenzene	18739	<5.0	<5.0	<5.0	None	None
1,1-Dichloroethylene	18739	<5.0	<5.0	<5.0	None	None
1,1-Dichloroethane	18739	<5.0	<5.0	<5.0	None	None
trans-1,2-Dichloroethylene	18739	<5.0	<5.0	<5.0	None	None
Chloroform	18739	<5.0	<5.0	<5.0	None	None
1,2-Dichloroethane	18739	<5.0	<5.0	<5.0	None	None
1,1,1-Trichloroethane	18739	<5.0	<5.0	<5.0	None	None
Carbon Tetrachloride	18739	<5.0	<5.0	<5.0	None	None
Bromodichloromethane	18739	<5.0	<5.0	<5.0	None	None
1,2-Dichloropropane	18739	<5.0	<5.0	<5.0	None	None
trans-1,3-Dichloropropene	18739	<5.0	<5.0	<5.0	None	None
Trichloroethylene	18739	<5.0	<5.0	<5.0	None	None
Benzene	18739	<5.0	<5.0	<5.0	None	None
cis-1,3-Dichloropropene	18739	<5.0	<5.0	<5.0	None	None
1,1,2-Trichloroethane	18739	<5.0	<5.0	<5.0	None	None
Dibromochloromethane	18739	<5.0	<5.0	<5.0	None	None
Bromoform	18739	<5.0	<5.0	<5.0	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Liter, or ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
1,1,2,2-Tetrachloroethylene	18739	<5.0	<5.0	<5.0	None	None
1,1,2,2-Tetrachloroethane	18739	<5.0	<5.0	<5.0	None	None
Toluene	18739	<5.0	<5.0	<5.0	None	None
Trichlorofluoromethane	18739	<5.0	<5.0	<5.0	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Liter, or ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
N-Nitrosodimethylamine	18739	<10	<10	<10	None	None
Bis(2-Chloroethyl)Ether	18739	<10	<10	<10	None	None
1,3-Dichlorobenzene	18739	<10	<10	<10	None	None
1,4-Dichlorobenzene	18739	<10	<10	<10	None	None
1,2-Dichlorobenzene	18739	<10	<10	<10	None	None
Bis(2-Chloroisopropyl)Ether	18739	<10	<10	<10	None	None
Hexachloroethane	18739	<10	<10	<10	None	None
N-Nitrosodi-N-Propylamine	18739	<10	<10	<10	None	None
Nitrobenzene	18739	<10	<10	<10	None	None
Isophorone	18739	<10	<10	<10	None	None
Bis(2-Chloroethoxy)Methane	18739	<10	<10	<10	None	None
1,2,4-Trichlorobenzene	18739	<10	<10	<10	None	None
Naphthalene	18739	<10	<10	<10	None	None
Hexachlorobutadiene	18739	<10	<10	<10	None	None
Hexachlorocylopentadiene	18739	<10	<10	<10	None	None
2-Chloronaphthalene	18739	<10	<10	<10	None	None
Dimethylphthalate	18739	<10	<10	<10	None	None
Acenaphthylene	18739	<10	<10	<10	None	None
2,6-Dinitrotoluene	18739	<10	<10	<10	None	None
Acenaphthene	18739	<10	<10	<10	None	None
2,4-Dinitrotoluene	18739	<10	<10	<10	None	None
Diethylphthalate	18739	<10	<10	<10	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Liter, or ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Fluorene	18739	<10	<10	<10	None	None
4-Chlorophenylphenylether	18739	<10	<10	<10	None	None
Diphenylamine(N-Nitroso)	18739	<10	<10	<10	None	None
1,2-Diphenylhydrazine(Azobenzene)	18739	<10	<10	<10	None	None
4-Bromophenylphenylether	18739	<10	<10	<10	None	None
Hexachlorobenzene	18739	<10	<10	<10	None	None
Phenanthrene	18739	14	14	14	0	0
Anthracene	18739	<10	<10	<10	None	None
Di-N-Butylphthalate	18739	<10	<10	<10	None	None
Fluoranthene	18739	13	10	11.5	3	26
Benzidine	18739	<50	<50	<50	None	None
Pyrene	18739	12	<10	N/A*	N/A	N/A
Butylbenzylphthalate	18739	<10	<10	<10	None	None
Benzo(a)Anthracene	18739	<10	<10	<10	None	None
3,3´-Dichlorobenzidine	18739	<30	<30	<30	None	None
Chrysene	18739	<10	<10	<10	None	None
Bis(2-Ethylhexyl)Phthalate	18739	<10	<10	<10	None	None
Di-n-Octylphthalate	18739	<10	<10	<10	None	None
Benzo(b)Fluoranthene	18739	<10	<10	<10	None	None
Benzo(k)Fluoranthene	18739	<10	<10	<10	None	None
Benzo(a)Pyrene	18739	<10	<10	<10	None	None
Indeno(1,2,3-c,d)Pyrene	18739	<10	<10	<10	None	None
Dibenzo(a,h)Anthracene	18739	<10	<10	<10	None	None
Benzo(g,h,i)Perylene	18739	<10	<10	<10	None	None

Relative Percent Difference =
Range/Average X 100
* Not applicable

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Measure: Micrograms/Liter, or ppb
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample Code	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Phenol	18739	<10	<10	<10	None	None
2-Chlorophenol	18739	<10	<10	<10	None	None
2-Nitrophenol	18739	<10	<10	<10	None	None
2,4-Dimethyphenol	18739	<10	<10	<10	None	None
p-Chloro-M-Cresol	18739	<10	<10	<10	None	None
2,4,6-Trichlorophenol	18739	<10	<10	<10	None	None
2,4-Dinitrophenol	18739	<20	<20	<20	None	None
4-Nitrophenol	18739	<20	<20	<20	None	None
4,6-Dinitro-o-Cresol	18739	<20	<20	<20	None	None
Pentachlorophenol	18739	<20	<20	<20	None	None
2,4-Dichlorophenol	18739	<10	<10	<10	None	None

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units: ug/l, or ppb)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
1,1-Dichloroethane	18740	SPK	35	<5.0	28	125
Methylene Chloride	18740	SPK	59	<5.0	48	123
Chloroform	18740	SPK	38	<5.0	30	126
Trichloroethylene	18740	SPK	22	<5.0	32	69
1,1,2-Trichloroethane	18740	SPK	30	<5.0	40	75
Tetrachloroethylene	18740	SPK	24	<5.0	36	67
1,2-Dichloroethane-d4	18739	Surrogate	52	---	50	104
Toluene-d8	18739	Surrogate	43	---	50	86
4-Bromofluorobenzene	18739	Surrogate	40	---	50	80
Naphthalene	18740	SPK	84	<10	100	84
Acenapthene	18740	SPK	71	<10	100	71
Anthracene	18740	SPK	65	<10	100	65
Diethylphthalate	18740	SPK	63	<10	55	115
Di-N-Butylphthalate	18740	SPK	57	<10	63	90
Butylbenzylphthalate	18740	SPK	54	<10	60	90
Bis-2-Ethylhexylphthalate	18740	SPK	61	<10	65	94
Di-N-Octylphthalate	18740	SPK	75	<10	95	79

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
GAS CHROMATOGRAPHY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
Jim Figh	624	18739-40	3/24/88	18:00 - 21:30
Jim Figh	625	18739-40	4/6/88	14:00 - 19:00

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - PRECISION

Type of Analysis: Duplicate Analysis
Units of Analysis: Milligrams/Liter, or ppm
Client: CRA A.E.S. Job Code:CRF

Analytical Parameters	Sample No.	Original Conc.	Duplicate Conc.	Average Conc.	Range	Rel. % Difference
Soluble Antimony (Sb)	18739	BQL*	BQL	BQL	None	None
Soluble Arsenic (As)	18739	0.013	0.014	0.014	0.001	7
Soluble Beryllium (Be)	18739	BQL	BQL	BQL	None	None
Soluble Cadmium (Cd)	18739	BQL	BQL	BQL	None	None
Soluble Chromium (Cr)	18739	BQL	BQL	BQL	None	None
Soluble Copper (Cu)	18739	BQL	BQL	BQL	None	None
Soluble Lead (Pb)	18739	BQL	BQL	BQL	None	None
Soluble Mercury (Hg)	18739	BQL	BQL	BQL	None	None
Soluble Nickel (Ni)	18739	BQL	BQL	BQL	None	None
Soluble Selenium (Se)	18739	BQL	BQL	BQL	None	None
Soluble Silver (Ag)	18739	BQL	BQL	BQL	None	None
Soluble Thallium (Tl)	18739	BQL	BQL	BQL	None	None
Soluble Zinc (Zn)	18740	BQL	BQL	BQL	None	None

Relative Percent Difference =
Range/Average X 100
* Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
LABORATORY REPORT
QUALITY CONTROL - ACCURACY

Type of Analysis: Matrix Spikes and E.P.A. Standards
Client: CRA A.E.S. Job Code: CRF

(Units:mg/l or ppm)

Analytical Parameters	Sample No.	Type	Observed Conc.	Original Conc.	Added Conc.	Percent Recovery*
Soluble Antimony (Sb)	18740	SPK	0.304	BQL**	0.300	101
EPA (Sb) std.	581	EPA	0.084	0.087	---	96
Soluble Arsenic (As)	18740	SPK	0.098	BQL	0.100	98
EPA (As) std.	386	EPA	0.034	0.030	---	113
Soluble Beryllium (Be)	18740	SPK	1.78	BQL	2.00	89
EPA (Be) std.	386	EPA	1.03	0.99	---	104
Soluble Cadmium (Cd)	18740	SPK	2.02	BQL	2.00	101
EPA (Cd) std.	1085	EPA	1.07	1.01	---	106
Soluble Chromium (Cr)	18740	SPK	10.24	BQL	10.00	102
EPA (Cr) std.	283	EPA	2.94	3.25	---	90
Soluble Copper (Cu)	18740	SPK	5.20	BQL	5.00	104
EPA (Cu) std.	386	EPA	1.13	0.99	---	114
Soluble Lead (Pb)	18740	SPK	19.46	BQL	20.00	97
EPA (Pb) std.	1085	EPA	5.12	5.12	---	100
Soluble Mercury (Hg)	18740	SPK	0.011	BQL	0.010	110
EPA (Hg) std.	1183	EPA	0.0040	0.0046	---	87
Soluble Nickel (Ni)	18740	SPK	4.48	BQL	5.00	90
EPA (Ni) std.	386	EPA	1.05	0.99	---	106
Soluble Selenium (Se)	18740	SPK	0.093	BQL	0.100	93
EPA (Se) std.	386	EPA	0.008	0.007	---	100
Soluble Silver (Ag)	18740	SPK	3.80	BQL	4.00	95
EPA (Ag) std.	1085	EPA	2.46	2.50	---	98
Soluble Thallium (Tl)	18740	SPK	22.20	BQL	20.00	111
Independent (Tl) std.		EPA	10.50	10.00	---	105
Soluble Zinc (Zn)	18740	SPK	1.02	0.12	1.00	91
EPA (Zn) std.	386	EPA	0.49	0.50	---	98

* % Recovery=100 x ((Observed Conc. - "background" Original Conc.)/"Spike" Added Conc.)
** Below quantifiable limits.

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
ATOMIC SPECTROSCOPY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
F. Scrivano	213.1	18739-40	3-29-88	2100
	249.1	18739-40	3-28-88	1400
	239.1	18739-40	3-29-88	1900
	289.1	18739-40	2-28-88	1800
	245.2	18739-40	3-24-88	2100

ADVANCED ENVIRONMENTAL SERVICES, INC.
PARAMETER TRACEABILITY REPORT
ATOMIC SPECTROSCOPY DEPARTMENT

AES JOB CODE CRF

ANALYST	ANALYTICAL METHOD	SAMPLE CODE	DATE OF ANALYSIS	TIME OF ANALYSIS
P. McMahon	204.2	18739-40	3-24-88	1300
	206.2	18739-40	3-24-88	1000
	270.2	18739-40	3-24-88	1100
F. Serrano	210.1	18739-40	3-23-88	1700
	220.1	18739-40	3-23-88	1600
	279.1	18739-40	3-23-88	1900
	218.1	18739-40	3-23-88	1800
	272.1	18739-40	3-23-88	1300

APPENDIX B

CHAIN OF CUSTODY RECORDS

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

SHIPPED TO (Laboratory name): AES

CHAIN OF CUSTODY RECORD

PROJECT №: 2293

PROJECT NAME: Union Carbide-Republic, Groundwater

SAMPLER'S SIGNATURE C. Dunnige (SIGN)

SEQ. №	SAMPLE №	DATE	TIME	SAMPLE LOCATOIN	SAMPLE TYPE	№ OF CONTAINERS	REMARKS
		3/22/88	1030	OW1-88	VOA	2	-
					Metals	2	HNO_3, filt
					Cyanide	1	NaOH
					Phenol	1	H_2SO_4, $CuSO_4$
					Lead	1	-
					PCB	2	-
					625	2	-
		3/22/88	1200	OW2-88	VOA	2	-
					Metals	2	HNO_3, F.H.
					Cyanide	1	NaOH
					Phenol	1	H_2SO_4, $CuSO_4$
					Lead	1	-
					PCB	2	-
					625	2	-
				Trip Blank	VOA	1	-
				TOTAL NUMBER OF CONTAINERS		23	

ANTICIPATED CHEMICAL HAZARDS: Unknown

RELINQUISHED BY:	DATE/TIME	RECEIVED BY:
1 C. Dunnige (SIGN)	3/22/88 1310	2 [illegible] (SIGN)
2 (SIGN)	/	3 (SIGN)
3 (SIGN)	/	4 (SIGN)
ADDITIONAL SIGNATURE SHEET REQUIRED ☐		

METHOD OF SHIPMENT:	SHIPPED BY:	RECEIVED FOR LABORATORY BY:	DATE/TIME
		(SIGN) [illegible]	3/22 1:15

CONDITION OF SEAL UPON RECEIPT:	COOLER OPENED BY:	DATE/TIME
GENERAL CONDITION OF COOLER:	(SIGN)	/

WHITE – CRA OFFICE COPY
YELLOW – RECEIVING LABORATORY COPY
PINK – CRA LABORATORY COPY
GOLDEN ROD – SHIPPERS

№ 4534

27

ADVANCED ENVIRONMENTAL SERVICES INC.

2186 LIBERTY DRIVE
NIAGARA FALLS, NY 14304
(716) 283-3120

CHAIN OF CUSTODY RECORD	JOB CODE	PROJECT NAME
	CRF	CRA UNION CARBIDE

SAMPLER'S SIGNATURE: C. Dunnigan

SAMPLE NO.	SEQ. NO.	DATE	TIME	SAMPLE LOCATION	GRAB	COMP	SAMPLE TYPE	NO. OF CONTAINERS	REMARKS
		3/22/88	1030	OW1-88	X		WATER	11	containers
		3/22/88	1200	OW2-88	X		"	11	"
				TRIP BLANK			"	1	
							TOTAL CONTAINERS	23	

28

RELINQUISHED BY (Sign)	DATE	TIME	RECEIVED BY (Sign)
1 C. Dunnigan	3/22/88	1:15 p.m.	2 Judy Ostrowski
2			3
3			4
4			5

REMARKS:

APPENDIX I

APPENDIX I

WATERMAIN INSTALLATION PROGRAM

SAMPLE "A" RESULTS

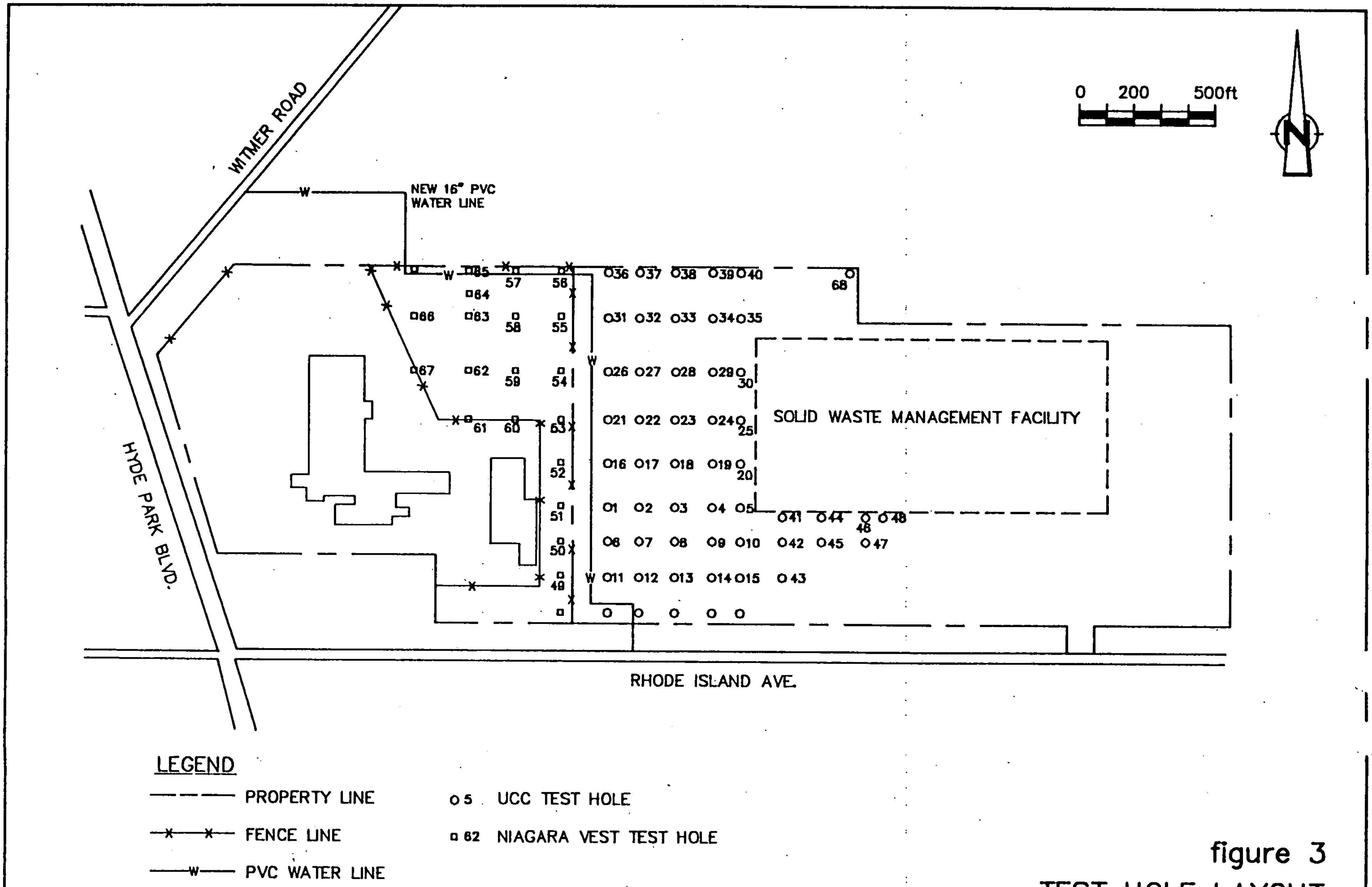
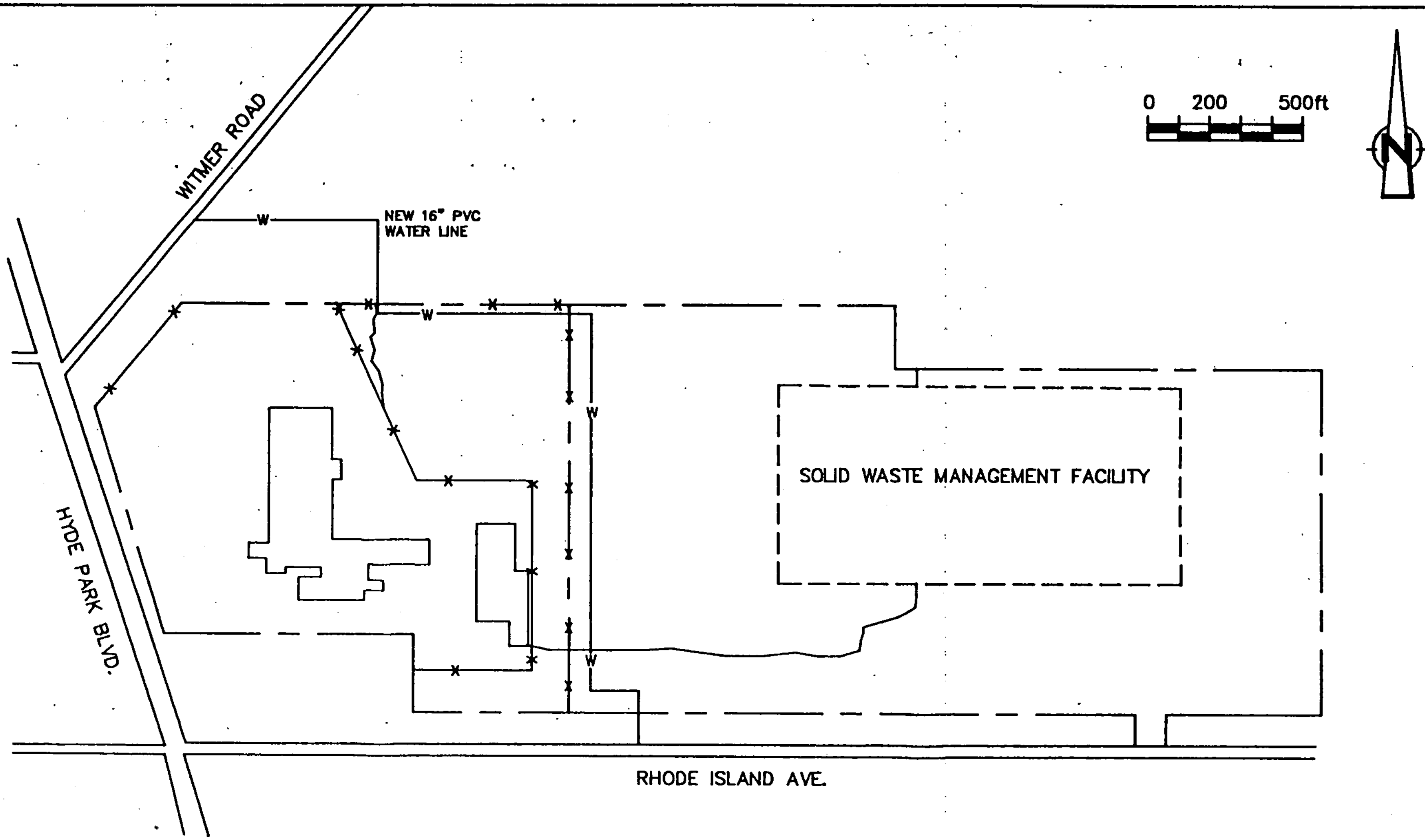


figure 3

TEST HOLE LAYOUT
NIAGARA PLANT–REPUBLIC LOCATION
Union Carbide Corporation

1851–10/07/87–P–0



LEGEND

- PROPERTY LINE
- FENCE LINE
- PVC WATER LINE
- UCC PROPERTY CONTAINING WASTE (±20 acres)
- NIAGARA VEST PROPERTY CONTAINING WASTE (7 acres)

figure 2

AREAS CONTAINING WASTE
NIAGARA PLANT–REPUBLIC LOCATION
Union Carbide Corporation

1851–10/07/87–P–0

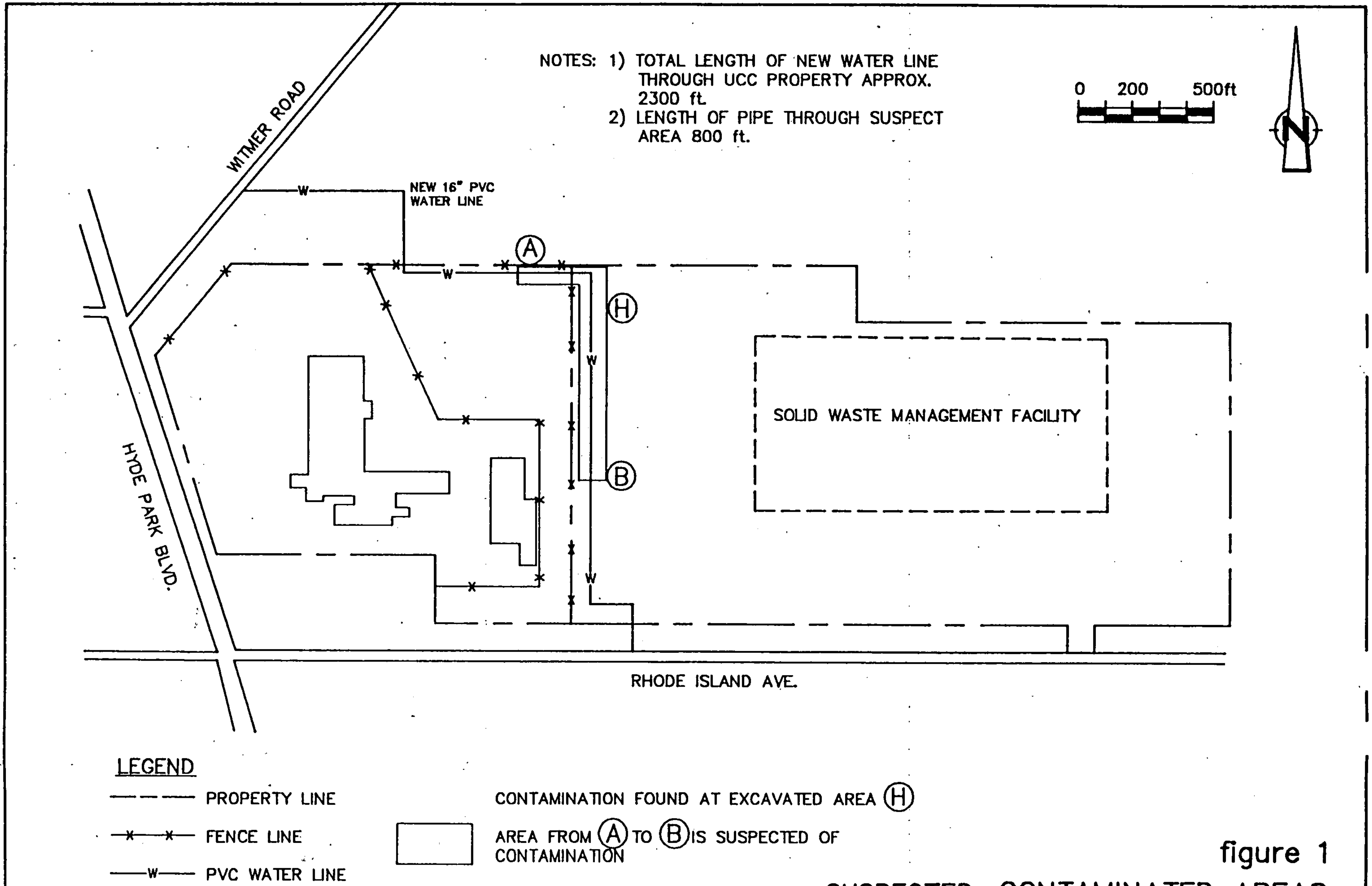


figure 1

SUSPECTED CONTAMINATED AREAS
NIAGARA PLANT—REPUBLIC LOCATION
Union Carbide Corporation

1851–10/07/87–P–0

TABLE 7

COMPARISON OF SOIL DATA TO EP TOXICITY LIMITS

Parameter	Soil	EP TOX[5] ppm
METALS		
Total Aluminum	1.99	--
Total Barium	0.225	100
Total Calcium	224	--
Total Chromium	0.006	5.0
Total Cobalt	0.056	--
Total Copper	0.021	--
Total Iron	2.73	--
Total Lead	0.191	5.0
Total Magnesium	70.4	--
Total Manganese	2.47	--
Total Mercury	<0.001	0.2
Total Nickel	0.163	--
Total Potassium	2.71	--
Total Sodium	1390	--
Total Thallium	0.018	--
Total Zinc	2.38	--
PAHs		
Napththalene	ND	--
Acenaphthylene	ND	--
Acenaphthene	13.6	--
Fluorene	ND	--
Phenanthrene	50.0	--
Anthracene	15.9	--
Fluoranthene	114	--
Pyrene	92.7	--
Chrysene	83.8	--
Benzo(a)anthracene	68.7	--
Benzo(b+k)fluoranthene	130	--
Benzo(e)pyrene	ND	--
Benzo(a)pyrene	70.0	--
Perylene	ND	--
Indeno(1,2,3-CD)Pyrene	46.0	--
Dibenz(a,h)anthracene	20.7	--
Benzo(g,h,i)perylene	49.3	--

PRELIMINARY

NOTE:

Soil Data Result of TCLP Procedure

TABLE 6

METALS

	Water Cons (mg/L)	EPA MCL[1] (mg/L)	EPA WQC[2] (mg/L)	EPA Proposed RMCL[3] (mg/L)	N.Y. State Health Advisory[4] (mg/day)	N.Y. State Groundwater Standards[5] (mg/L)	N.Y. State Ambient Water Stands[6] (mg/L)
Total Aluminum	0.171					0.025	
Total Barium	0.081	1.0		1.5	1.8	1.0	1.0
Total Calcium	141						
Total Chromium	<0.005	0.05	0.05	0.12	0.170	0.05	0.05
Total Cobalt	0.014						
Total Copper	0.007		1 *	1.3		1.0	0.2
Total Iron	0.101	0.3				0.3	0.3
Total Lead	0.010	0.05	0.05	0.02	0.020	0.025	0.05
Total Magnesium	30.0						35.0
Total Manganese	1.86	0.05				0.3	0.3
Total Mercury	0.001	0.002	0.0001	0.003	0.006	0.002	0.002
Total Nickel	0.037		0.0134		0.350		
Total Potassium	7.86						
Total Sodium	2.5						
Total Thallium	<0.005		0.013				
Total Zinc	0.09	5.0	5 *			5	0.3

Notes:

(1) Maximum Contaminant Levels, Primary and Secondary Drinking Water Standards,40 CFR Parts 141 and 143
(2) EPA Ambient Water Quality Criteria, Federal Register, November 28, 1980
- * based on taste and odor
- ** protection of human health (toxicity) ingested through water and contaminated aquatic organisms

(3) Proposed Recommended Contaminant Levels, Primary Drinking Water Standards, Federal Register, November 13, 1985
(4) EPA Drinking Water Health Advisories, Lifetime
(5) NYSDEC Groundwater Classes and Quality Standards for Groundwaters (Class GA Water) Part 703.5
(6) NYSDEC Ambient Water Quality Standards, Part 702, Appendix 31

PRELIMINARY

TABLE 5

POLYNUCLEAR AROMATIC HYDROCARBON DATA

	Water Con (ug/L)	EPA MCL (1) (ug/L)	EPA WQC (2) (ug/L)	EPA Proposed RMCL (3) (ug/L)	N.Y. State Health Advisory (4) (ug/day)	N.Y. State Groundwater Standards (5) (ug/L)	N.Y. State Ambient Water Stands (6) (ug/L)
Naphthalene		--	--	--	--	--	10
Acenaphthylene		--	--	--	--	--	--
Acenaphthene		--	20 *	--	--	--	20
Fluorene	25.5	--	--	--	--	--	--
Phenanthrene	148	--	--	--	--	--	--
Anthracene	41.7	--	--	--	--	--	--
Fluoranthene	321	--	42 **	--	--	--	--
Pyrene		--	--	--	--	--	--
Chrysene	280	--	--	--	--	--	--
Benzo(a)anthracene	286	--	--	--	--	--	--
Benzo(b+k)fluoranthene	705	--	--	--	--	--	--
Benzo(e)pyrene		--	--	--	--	--	--
Benzo(a)pyrene			2.8×10^{-3}	--	--	ND	--
Perylene		--	--	--	--	--	--
Indeno(1,2,3-CD)Pyrene		--	--	--	--	--	--
Dibenz(a,h)anthracene		--	--	--	--	--	--
Benzo(g,h,i)perylene		--	--	--	--	--	--

Notes:

(1) Maximum Contaminant Levels, Primary and Secondary Drinking Water Standards, 40 CFR Parts 141 and 143
(2) EPA Ambient Water Quality Criteria, Federal Register, November 28, 1980
- * based on taste and odor
- ** protection of human health (toxicity) ingested through water and contaminated aquatic organisms

(3) Proposed Recommended Contaminant Levels, Primary Drinking Water Standards, Federal Register, November 13, 1985
(4) EPA Drinking Water Health Advisories, Lifetime
(5) NYSDEC Groundwater Classes and Quality Standards for Groundwaters (Class GA Water) Part 703.5
(6) NYSDEC Ambient Water Quality Standards, Part 702, Appendix 31

TABLE 4

PESTICIDES AND PCBs
(ug/L)

Parameter	Detection Limits	Water	Soil	WQC[1]
Lindane	0.10	ND	ND	.0123
Endrin	0.10	ND	ND	1
Heptachlor	0.50	ND	ND	.00028
Heptachlor epoxide	0.50	ND	ND	--
Methoxychlor	5.0	ND	ND	--
Toxaphene	5.0	ND	ND	.00071
Chlordane	5.0	ND	ND	.00046
2,4-D	0.10	ND	ND	--
Silvex	0.10	ND	ND	--
PCB 1260 *	0.50	ND	ND	.000079
PCB 1254 *	0.50	ND	ND	.000079
PCB 1242 *	0.50	ND	ND	.000079

Notes:

* Since the analysis for PCBs were performed on the original soil sample, the units of measure and mg/kg (ppm).

ND: Not Detected at or above the reported detection limits.

[1] EPA Ambient Water Quality Criteria for Protection of Human Health, Aquatic Organisms and Drinking Water.

TABLE 3

PETROLEUM PRODUCTS
(ppm)

Parameter	Detection Limits	Water	Soil	"TAR"
Kerosene	0.25	ND	ND	ND
Fuel Oil #2	0.25	ND	ND	ND
Fuel Oil #4	0.25	ND	ND	ND
Fuel Oil #6	0.25	ND	ND	ND
Gasoline	0.25	ND	ND	ND
Lubricating Oils	0.25	ND	ND	ND
Tar Primer	0.25	3.17	269	(Present)

TABLE 2

SEMI-VOLATILE ORGANICS
(ug/L)

Parameter	Detection Limits	Water	Soil	WQC[1]
Phenol	20	ND	ND	3500
Bis(2-chloroethyl)Ether	20	ND	ND	0.030
1,4-Dichlorobenzene	20	ND	ND	400
1,2-Dichlorobenzene	20	ND	ND	400
Hexachlorobenzene	20	ND	ND	.00072
Nitrobenzene	20	ND	ND	19800
Hexachlorobutadiene	20	ND	ND	0.45
2,4,5-Trichlorophenol	20	ND	ND	2600
2,4,6-Trichlorophenol	20	ND	ND	1.2
Pentachlorophenol	20	ND	ND	1010
2,3,4,6-Tetrachlorophenol	20	ND	ND	1.0
4-Methyl Phenol (p-Cresol)	20	ND	ND	--
2-Methyl Phenol (o-Cresol)	20	ND	ND	--
2,4-Dinitrotoluene	20	ND	ND	0.11

[1]EPA Ambient Water Quality Criteria for Protection of Human Health, Aquatic Organisms and Drinking Water.

TABLE 1

VOLATILE ORGANICS
(ug/L)

Parameter	Detection Limits	Water	Soil	WQC[1]
1,1-Dichloroethylene	10	ND	ND	.033
1,2-Dichloroethane	10	ND	ND	0.94
2-Butanone	10	ND	ND	—
Benzene	10	ND	ND	0.66
Acrylonitrile	100	ND	ND	0.058
Carbon Disulfide	10	ND	ND	—
Carbon Tetrachloride	10	ND	ND	0.4
Chlorobenzene	10	ND	ND	488
Chloroform	10	ND	ND	0.19
Methylene Chloride	10	ND	ND	--
Tetrachloroethylene	10	ND	ND	0.8
Toluene	10	ND	ND	14300
Vinyl Chloride	10	ND	ND	2.0
1,1,2,2-Tetrachloroethane	10	ND	ND	0.17
1,1,2-Trichloroethane	10	ND	ND	0.6
1,1,1-Trichloroethane	10	ND	ND	18400
1,1,1,2-Tetrachloroethane	10	ND	ND	—
Trichloroethylene	10	ND	ND	2.7

ND: Not Detected at or above the reported detection Limits.

[1] EPA Ambient Water Quality Criteria for Protection of Human Health, Aquatic Organisms and Drinking Water.

The sample described as being soil is in fact a TCLP extract of a soil sample collected from the excavation pit. This data has been compared to the criteria for EP Toxicity. (Table 7). Assuming that this sample is representative of the fill materials in the area and that the extract method is equivalent to the requirements outlined for EP Toxicity, it can be seen that this material would not be characterized as hazardous by these standards. However, it should be noted that these assumptions may not be valid.

You will note, from the attached tables, that only selected Polynuclear Aromatic Hydrocarbons and metals were found in either the soil extract or the groundwater.

However, there are some questions that arise out of the evaluation of the reported data. The fact that the excavation pit was open for an undetermined amount of time and that only grab samples were taken for the initial characterization, could have led to the potential lost of any volatile compounds which may have been present.

At this stage, we can not comment on the representativeness of the samples and how they may or may not reflect the true in situ conditions.

We will, however, caution you to avoid making any major decisions based on the results of one sample set and encourage you to consider resampling the area to establish a sound database for a proper evaluation.

The resampling should be carried out in such a manner as to ensure that samples collected are representative of in situ conditions.

Should you have any questions or comments regarding this issue, please do not hesitate to contact our office.

Yours very truly,

CONESTOGA-ROVERS & ASSOCIATES

Paul E. Plotz

Paul E. Plotz, B.Sc.

PEP/jh
Encl.

c.c. Jim Kay
Carol Dunnigan

CRA
Consulting Engineers

CONESTOGA-ROVERS & ASSOCIATES LIMITED
651 Colby Drive,
Waterloo, Ontario, Canada N2V 1C2
(519) 884-0510

July 11, 1987

Reference No. 1851

Mr. Michael Balent
Chief Plant Engineer
Union Carbide Corporation
P.O. BOX 887
Niagara Falls, New York
U.S.A. 14302

Dear Mr. Balent:

Re: Samples from Excavation Site

The analytical data associated with the water and soil samples collected from the excavation of the UCC Repulic Plant Solid Waste Management Facility, was received from Advanced Environmental Systems (AES).

The attached tables summarize the Priority Pollutant analysis of the soil and water samples and compares the reported values to the available drinking water quality objectives as listed in the referenced sources. (Tables 5 and 6).

With the exception of the Polynuclear Aromatic Hydrocarbons (PAHs), all of the reported concentrations in the water samples are below the drinking water standards. The regulating agencies have set very few guidelines on objectives for the PAH compounds. In fact, only three of the compounds (Acenaphthene, Fluoranthene and Benzo(a)pyrene) have ambient Water Quality Criteria levels established. (Table 5).

Of the PAHs found in the samples analyzed only Fluoranthene had reported levels higher than the quoted objective of 42 ug/L for the protection of human health by ingestion of water and contaminated aquatic organisms.

Thus, assuming this sample is representative of the groundwater in the area, there appears to be no significant risk to public health.

For the most part, compounds for which there are no objectives listed are generally non-toxic and consequently not of concern.

continued....

APPENDIX J

APPENDIX J

SURFACE WATER SAMPLE RESULTS

1851

#2

WASTEWATER DISCHARGE MONITORING
REPUBLIC #3

FOURTH QUARTER 1984

Report Prepared For

UNION CARBIDE CORPORATION
CARBON PRODUCTS DIVISION

By

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

Prepared by:

Susan M Cerquetti

Susan M. Cerquetti
GC Division

Kathleen A. Martin

Kathleen A. Martin
Wet Chemistry Division

W. Joseph McDougall

W. Joseph McDougall
Technical Evaluation

January 31, 1984
AES Job AEI

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: PURGEABLE AROMATICS
UNITS OF MEASURE: MICROGRAMS/LITER, OR PPB
CLIENT: UNION CARBIDE A.E.S. JOB CODE AEI

ANALYSIS	METHOD	REF	SAMPLE IDENTIFICATION RO 12/17/84 REP #3	DETERMINABLE* LIMITS
MONOCHLOROBENZENE	602	1	BDL	25
BENZENE	"	"	BDL	25
ETHYLBENZENE	"	"	BDL	25
TOLUENE	"	"	BDL	25

*CITY'S REQUIRED LIMITS

Susan M Cerquetti
SUSAN M. CERQUETTI
G. C. DIVISION

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: PHTHALATE ESTERS
UNITS OF MEASURE: MICROGRAMS/LITER, OR PPB
CLIENT: UNION CARBIDE   A.E.S. JOB CODE AEI

ANALYSIS	METHOD	REF	SAMPLE IDENTIFICATION R9 12/27/84 REP #3	DETERMINABLE* LIMITS
BIS(2-ETHYLHEXYL) PHTHALATE	606	1	BDL	47
BUTYL BENZYL PHTHALATE	"	"	BDL	100
DIMETHYL PHTHALATE	"	"	BDL	47
DIETHYL PHTHALATE	"	"	BDL	47
DIBUTYL PHTHALATE	"	"	BDL	100

*CITY'S REQUIRED LIMIT

Susan M Cerquetti
SUSAN M. CERQUETTI
C[redacted]VI[redacted]N

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: PURGEABLE HALOCARBONS
UNITS OF MEASURE: MICROGRAMS/LITER, OR PPB
CLIENT: UNION CARBIDE A.E.S. JOB CODE AEI

ANALYSIS	METHOD	REF	SAMPLE IDENTIFICATION RO 12/17/84 REP #3	DETERMINABLE** LIMITS
CARBON TETRACHLORIDE	601	1	BDL	50
CHLORODIBROMOMETHANE	"	"	BDL	10
DICHLOROBROMOMETHANE	"	"	BDL	10
CHLOROFORM	"	"	BDL	45
1,1- DICHLOROETHYLENE	"	"	BDL	37.5
BROMOFORM	"	"	BDL	10
CIS-1,3-DICHLOROPROPENE	"	"	BDL	25
1,1,2,2-TETRACHLOROETHANE	"	"	BDL	25
TETRACHLOROETHYLENE	"	"	BDL	25
1,1,1-TRICHLOROETHANE	"	"	BDL	25
TRICHLOROETHYLENE	"	"	BDL	25
METHYLENE CHLORIDE	"	"	BDL	187.25
VINYL CHLORIDE	"	"	BDL	37.5
1,1,2-TRICHLOROETHANE	"	"	BDL	25
TRANS-1,2-DICHLOROETHYLENE	"	"	BDL	37.5
TRANS-1,3-DICHLOROPROPENE	"	"	BDL	25

Susan M Cerquetti
SUSAN M. CERQUETTI
G. C. DIVISION

**CITY's REQUIRED LIMITS

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: POLYNUCLEAR HYDDOCARBONS
UNITS OF MEASURE: MICROGRAMS/LITER, OR PPB
CLIENT: UNION CARBIDE A.E.S. JOB CODE AEI

ANALYSIS	METHOD	REF	SAMPLE IDENTIFICATION R9 12/27/84 REP #3	DETERMINABLE* LIMITS
ACENAPHTHENE	610	1	BDL	10
FLUORANTHENE	"	"	BDL	3
CHRYSENE	"	"	BDL	3
NAPHTHALENE	"	"	BDL	10
BENZO (A) ANTHRACENE	"	"	BDL	3
PYRENE	"	"	BDL	10
PHENANTHRENE	"	"	BDL	3

*CITY's REQUIRED LIMITS

Susan M Cerquetti
SUSAN M. CERQUETTI
G. C. DIVISION

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: CHLORINATED HYDROCARBONS
UNITS OF MEASURE: MICROGRAMS/LITER, OR PPB
CLIENT: UNION CARBIDE   A.E.S. JOB CODE: AEI

ANALYSIS	METHOD	REF	SAMPLE IDENTIFICATION R-9 12/27/84 REP #3	DETERMINABLE* LIMITS
1,2,4-TRICHLOROBENZENE	612	1	BDL	3
1,2-DICHLOROBENZENE	"	"	8.44	3
HEXACHLOROBENZENE	"	"	BDL	3
HEXACHLOROBUTADIENE	"	"	BDL	3
HEXACHLOROCYCLOPENTADIENE	"	"	BDL	10

*CITY'S REQUIRED LIMIT

Susan M Cerquetti
SUSAN M. CERQUETTI
G. C. DIVISION

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: RUSULTS-WET CHEMISTRY
UNITS OF MEASURE: MILLIGRAMS/LITER, OR PPM
CLIENT: UNION CARBIDE A.E.S. JOB CODE AEI

ANALYSIS	METHOD	REF	SAMPLE IDENTIFICATION RO REP #3 12/17-18	R1 REP #3 12/18-19	R2 REP # 3 12/19-20	R3 REP # 3 12/20-21	R5 REP # 3 12/21-22
SOC	415.1	3	8.28	9.28	7.88	8.12	9.88
TSS	160.2	3	14.9	6.5	5.3	7.3	17.7

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: GC - QUALITY CONTROL DUPLICATE**
UNITS OF MEASURE: MICROGRAMS/LITER, OR PPB
CLIENT: UNION CARBIDE A.E.S. JOB CODE AEI

ANALYSIS	SAMPLE	ORIGINAL CONC.	DUPL. CONC.	AVERAGE CONC.	RANGE	REL. % DIFF.
PYRENE	R9	6.95	2.31	4.63	4.64	100.2
DIETHYL PHTHALATE	R9	53.89	55.64	54.76	1.75	3.2
1,2-DICHLOROBENZENE	R9	7.74	9.13	8.44	1.39	16.5

**ALL COMPOUNDS NOT LISTED ARE BELOW DETERMINABLE LIMITS

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: GC - QUALITY CONTROL DUPLICATE**
UNITS OF MEASURE: MICROGRAMS/LITER, OR PPB
CLIENT: UNION CARBIDE A.E.S. JOB CODE AEI

ANALYSIS	SAMPLE	ORIGINAL CONC.	DUPL. CONC.	AVERAGE CONC.	RANGE	REL. % DIFF.
METHYLENE CHLORIDE	RO	2.68	3.22	2.95	0.54	18.3
CHLOROFORM	RO	0.75	0.68	0.72	0.07	9.7
TETRACHLOROETHYLENE	RO	0.34	0.29	0.32	0.05	15.6

**ALL COMPOUNDS NOT LISTED WERE BELOW DETERMINABLE LIMITS

Relative Percent Difference =
Range/Average X 100

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

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TYPE OF ANALYSIS: GC - TEST CONTROLS
UNITS OF MEASURE: MICROGRAMS/LITER, OR PPB
CLIENT: UNION CARBIDE   A.E.S. JOB CODE   AEI

ANALYSIS	TYPE	ORIGINAL CONC.	ADDED CONC.	EXPECTED CONC.	REPORTED CONC.	PERCENT RECOVERY	95% CONFIDENCE INTERVAL
ACENAPHTHENE	R9-SPK	2.68	226.2	228.9	156.5	68.4	**NA
BENZO (A) ANTHRACENE	R9-SPK	<2.04	75.2	75.2	88.5	117.7	**
HEXACHLOROBENZENE	R9-SPK	<0.20	113.68	113.68	109.01	95.9	**
1,2-DICHLOROBENZENE	R9-SPK	8.44	110.04	118.48	68.43	57.8	**

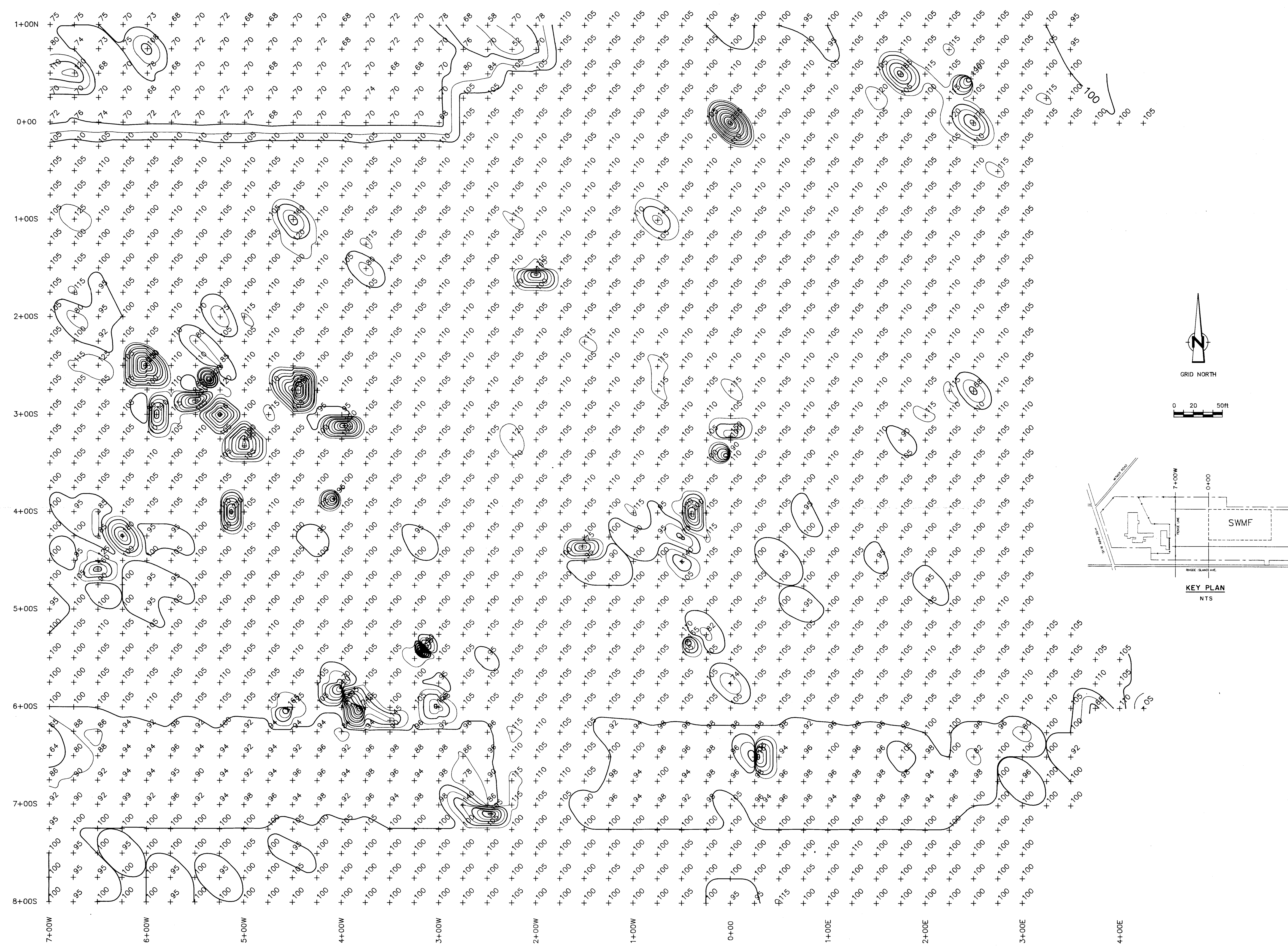
**NA-NOT APPLICABLE

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: GC - TEST CONTROLS
UNITS OF MEASURE: MICROGRAMS/LITER, OR PPB
CLIENT: UNION CARBIDE A.E.S. JOB CODE AEI

ANALYSIS	TYPE	ORIGINAL CONC.	ADDED CONC.	EXPECTED CONC.	REPORTED CONC.	PERCENT RECOVERY	95% CONFIDENCE INTERVAL
VINYL CHLORIDE	RO-SPK	<0.35	11.01	11.01	9.63	87.5	5.9-15.1
TRANS-1,2-DICHLOROETHYLENE	RO-SPK	<0.25	12.79	12.79	12.03	94.1	8.8-15.2
CHLOROFORM	RO-SPK	0.72	12.65	13.37	13.94	104.2	11.6-16.2
TRICHLOROETHLENE	RO-SPK	<0.17	13.96	13.96	14.74	105.6	10.9-16.3
TETRACHLOROETHLENE	RO-SPK	<0.19	14.68	14.68	13.51	92.1	12.2-15.9
BENZENE	RO-SPK	<1.64	30.06	30.06	33.34	110.9	21.1-36.8
TOLUENE	RO-SPK	<2.74	28.32	28.32	34.71	122.6	20.6-34.7
ETHYL BENZENE	RO-SPK	<4.36	24.72	24.72	30.54	123.5	15.4-35.1
1,2,4-TRICHLOROBENZENE	R9-SPK	<0.10	133.65	133.65	42.36	31.7	**NA
HEXACHLOROBUTADIENE	R9-SPK	<0.10	92.61	92.61	25.49	27.5	**
HEXACHLOROCYCLOPENTADIENE	R9-SPK	<0.10	149.80	149.80	48.37	32.3	**
DIBUTYL PHTHALATE	R9-SPK	<4.5	110.96	110.96	141.99	128.0	**

**NA-NOT APPLICABLE



LEGEND

+70 MAGNETOMETER READING IN GAMMAS (γ)x100

VERTICAL MAGNETIC FIELD GROUND CONTOUR
CONTOUR INTERVAL 150γ(x100)

NR —NO READING

OS —OFFSCALE

Nº	Revision	Date	Initial

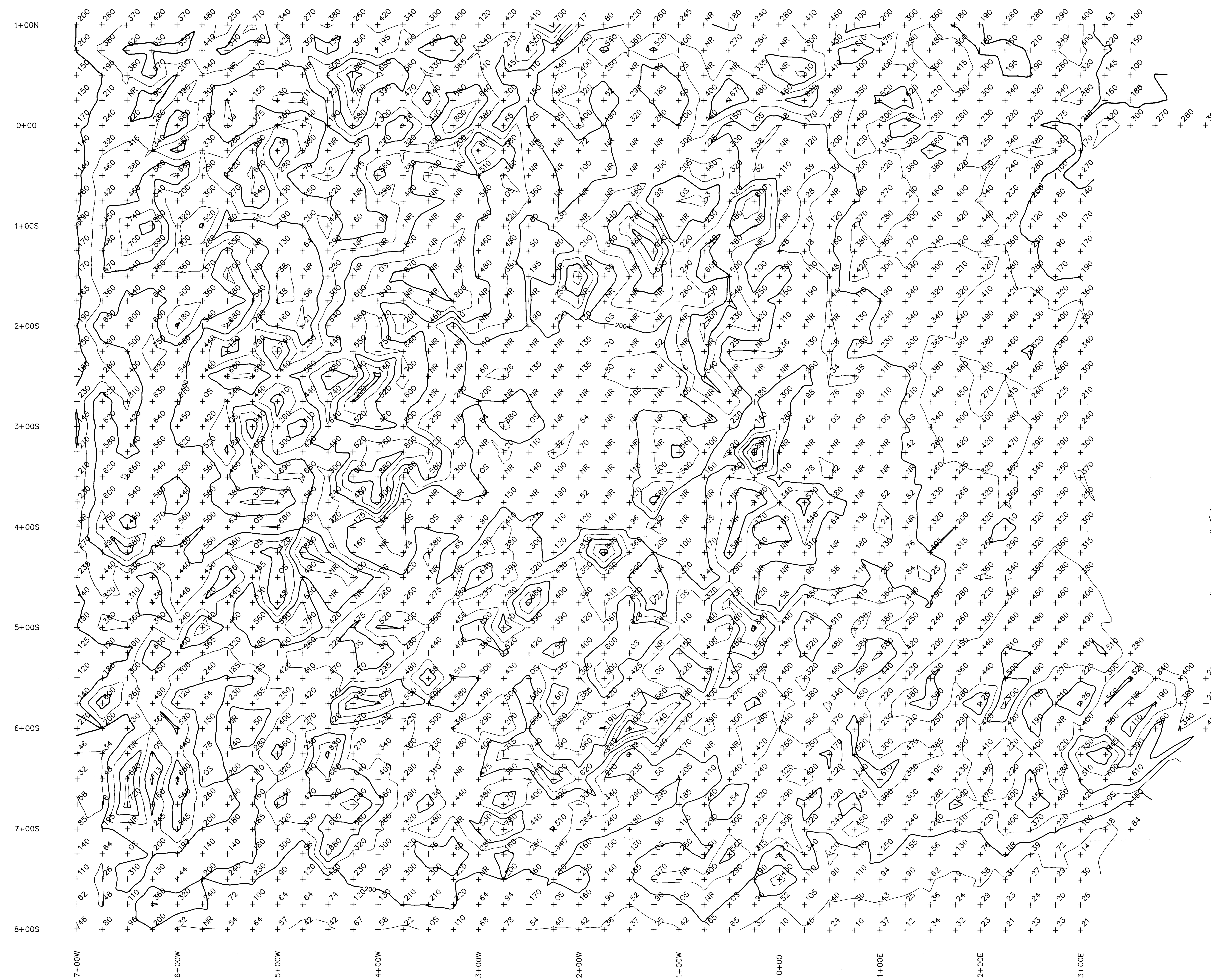
Approved

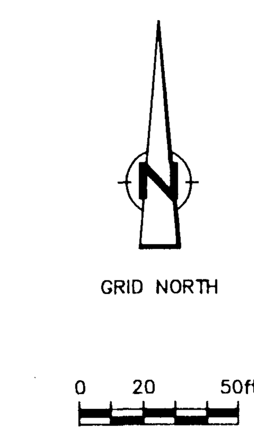
UNION CARBIDE CORPORATION
CARBON PRODUCTS DIVISION
REPUBLIC PLANT, NIAGARA NEW YORK

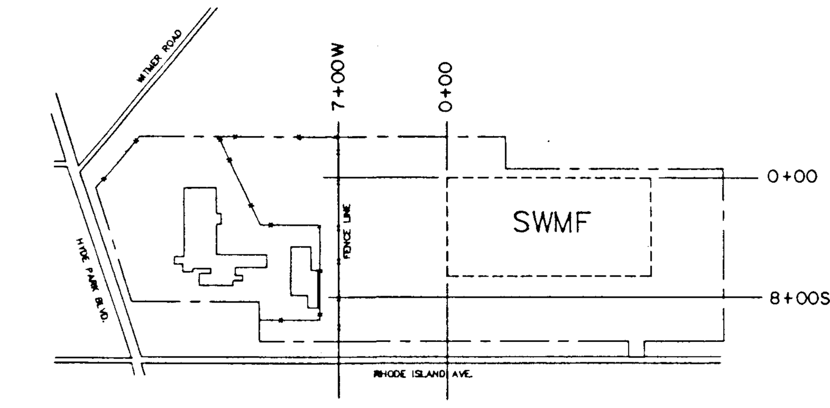
MAGNETOMETER SURVEY

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

Drawn by: B.T.S.	Scale: 1"=50'	Date: MARCH 14, 1988	File Nº: S	Rev.Nº:
Designed by: C.H.G.	Field book:	Project Nº: 2293	Drawing Nº: 01 (TS-2) PLAN 2	
Checked by:				







KEY PLAN

NTS

LEGEND

+46 GROUND CONDUCTIVITY READING IN mS/m

GROUND CONDUCTIVITY CONTOUR INTERVAL 150 mS/m

NR —NO READING

OS —OFFSCALE

Nº	Revision	Date	Initial

Approved

UNION CARBIDE CORPORATION
CARBON PRODUCTS DIVISION
REPUBLIC PLANT, NIAGARA NEW YORK

GROUND CONDUCTIVITY (EM31)

CRA Consulting Engineers
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Drawn by: B.T.S.	Scale: 1"=50'	Date: MARCH 14, 1988	File Nº: S	Rev.Nº:
Designed by: C.H.G.	Field book:	Project Nº: 2293	Drawing Nº: 02 PLAN 1	
Checked by:				