

# **TANK FARM**

## **Groundwater Quality Analysis**

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**prepared for:**

Industrial Environmental Systems, Inc.

Saugerties, New York

**prepared by:**

**Dunn Geoscience Corporation**

**April 1985**

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## EXECUTIVE SUMMARY

The following report is a detailed summary and interpretation of a large volume of chemical analytical data developed from environmental monitoring programs at the Industrial Environmental Systems, Inc. (IESI) and Northeast Solite Corporation (NES) facilities in Saugerties, New York. Monitoring results from April, 1984 to March, 1985 are presented in an integrated manner to acquaint the reader with the complexities of chemical interpretations of low-level, multi-component, contamination problems encountered in this study.

It is the purpose of this executive summary to present a synopsis of the overall monitoring program and to focus the direction of remediation of any existing or future problems.

There are three main areas of interest where on-site groundwater has been subjected to organic monitoring: the IESI tank farm facility, the bedrock face seepage and the NES active stockpile area. Several conclusions can be drawn from the monitoring program which apply to the overall scope of this project:

- 1) Organic chemicals in the groundwaters of IESI/NES do not pose a health threat to workers on-site or residential homes in the vicinity of the plant. All currently considered problem areas are confined within IESI/NES boundaries.
- 2) Present aqueous, identifiable, organic concentrations are at low levels and except for well BR-4 (which shows a consistent level of total extractable hydrocarbons) and wells DFT-1, -2, -6, -9 and -10 (which show detectable levels of purgeable organics requiring monitoring), no other groundwater monitoring well has shown any consistent pattern of organics detection.
- 3) For non-consent order wells, less expensive gas chromatography laboratory methods have replaced those methods requiring expensive

mass spectroscopic techniques. The information gathered from the two methods is comparable; the change yields an expected 1985 savings of \$13,000 compared to 1984 monitoring costs.

- 4) Results show that April, 1984 organic levels in all sites (where they have been detected at least once) were significantly higher than any other time to date. This is likely a seasonal spring flush, but may also represent random leaching from an isolated, contaminated area. An out-of-sequence round of sampling (based on the proposed 1985 monitoring schedule) during late April, 1985 is recommended to obtain the data necessary to resolve this matter.
- 5) At all groundwater areas in this investigation, it has been our goal to define the problem and its extent and then to refine the plan of monitoring by eliminating "clean" wells. As a result, the number of required well samples and cost of laboratory analyses have been constantly decreasing without any reduction in monitoring quality.
- 6) The water quality of the bedrock face seepage has improved significantly, and levels of organic contaminants have dropped considerably during the past year of monitoring. This is expected to have a favorable impact on the down gradient groundwater quality, as well as signal a trend toward reduction of the source of the hydrocarbons.

A brief discussion of the three areas of interest follows:

#### IESI TANK FARM

Of the three wells, UFT-1A, DFT-1, and DFT-2, UFT-1A and DFT-2 seldom yield sufficient water for a complete analysis. However, when water has been available, DFT-2 showed elevated levels of several parameters while DFT-1 exhibited much lower and fewer compounds than were observed at DFT-2. The high levels of organics observed in DFT-2 are puzzling, since this well was installed in an excavation pit (#DGC8-83-1) and backfilled with clean crushed

shale. In a December 1, 1983 Dunn Geoscience Corporation (DGC) report entitled "Fuel Tank Storage Area: Monitoring Well Installations and Groundwater Quality Analysis", the test pit log reported 6 feet of sand and gravel fill over 3 1/2 feet of clayey silt with a little fine sand. A slight to moderate odor was detected at the 6 foot interface and very slight seepage at the northwest corner of the trench was noted, but the area was dry the following day. Any fill or soil in this trench which may have contained localized concentrated areas of organics would have been removed upon excavation. The organics must be from outside the trench area and they migrated to the well either as seepage in the unsaturated zone or by transport in the groundwater.

#### NES ACTIVE STOCKPILE AREA

Only eight of the fourteen wells originally installed to study this area of groundwater are required for the next phase of monitoring. Analytical results for four bedrock wells (BR-1, -2, -3 and -4) and four shallow overburden wells (DFT-6, -7, -9 and -10) indicate a necessity for continued monitoring, either because of the April, 1984 overall elevated hydrocarbon scans or because of volatile compounds detected repeatedly. In no well does the sum of the identified purgeable organics exceed the guideline 100 ppb maximum limit adopted by the New York State Department of Health, Bureau of Toxic Substance Assessment. However, 1,1,1-trichloroethane has been observed on two occasions in well DFT-6 in excess of the 50 ppb limit adopted by NYSDOH for individual compounds.

#### BEDROCK FACE SEEPAGE

Since early in 1984, the observed level of total purgeable organics has dropped from over 4000 ppb to less than 20 ppb during the summer, fall and early winter of 1984. Late winter of 1984 and early 1985 showed a slight rise, but no totals exceeded 70 ppb at any one sampling event. Further monitoring will tell whether this pattern is seasonal, random, or absolute (i.e., the seep is actually becoming cleaner.) The granular activated carbon (GAC) treatment system has been successful in removing the low levels of organic chemicals from the bedrock face seep water. However, the cost



effectiveness of this system is dependent on the expected future use of the water. If the water is only to be sent to a certified waste treatment facility (i.e. DuPont) as is presently being done, and if cost of this treatment is based on a higher level of dissolved organic carbon content and not on the low-level purgeables of our concern, then GAC on-site treatment may be unnecessary. However, if the seep water is to be used for any other off-site or on-site purposes, then continued treatment may be justified. At this time it is felt that the GAC program should continue.

The bedrock face seepage flow is made up of infiltrating precipitation and local groundwater flow. The IESI facility above the seep area was paved in November, 1984 to reduce the surface infiltration of precipitation. Rainfall data and seep flow data are presented in the report. There appears to be little correlation between local precipitation and immediate seep flow response since the site was paved.

Paving the IESI facility was a major step in reducing the immediate, high volume seep flow response to precipitation. The bedrock face seepage collection system and granular activated carbon (GAC) treatment are sufficient to contain the contaminated seepage while the local (IESI) low-yielding aquifer is receiving less recharge to reduce leaching and contaminant transport.

#### GENERAL CONSIDERATIONS

The presence of low level priority pollutants in the groundwater is generally sporadic and inconsistent. There is no indication that contamination is widespread on the site or that it extends off-site. Past practices at the IESI facility have contributed to soil and groundwater quality contravention; this has been observed during excavations and groundwater monitoring. Recent reconstruction of containment systems, tankage and piping at the IESI facility insure that any future spills or leaks will be detected early, will be contained and will provide no danger to the environment. However, the remaining organic contamination still present in the ground is dispersed through a permeable fill of sand and gravel overlying clayey silt and fractured bedrock. As stated in DGC's May 15, 1984 report, water from

precipitation that infiltrates through the fill collects in bedrock depressions or troughs. this water then moves through the upper fractured and jointed bedrock to the seepage face in a way that is controlled by the bedrock surface and bedrock discontinuities such as joints, fractures and bedding planes. Seepage from the bedrock face is from vertical fractures and an inclined bedding plane that intercepts water moving at or near the bedrock/fill interface.

The extensive test pit excavations and soil boring/monitoring well installations at IESI have not uncovered underground reservoirs or other concentrated sources of organic chemicals. Further exploration of this nature is not recommended.

In view of present soil and water characteristics, the changing nature of the seep quality and the intended return to use of liquid burnable materials (LBM, i.e., solvents), we recommend continued groundwater monitoring. The sampling and analysis protocols should be reviewed and adjusted periodically to avoid unnecessary costs.

The major recommendations of this study are summarized below:

- 1) Continued groundwater monitoring for bedrock wells BR-1-BR-4 and shallow overburden wells DFT-1, -2, -6, -7, -9 and -10.
- 2) Continuation of the granular activated carbon bedrock face seepage treatment.
- 3) Continued monitoring of the bedrock face seepage for Aroclors.
- 4) Flow monitoring of the bedrock face seepage with a continuous recorder.
- 5) Determination of GAC efficiency for extractable organics treatment by appropriate chemical analyses.

## 1.0 INTRODUCTION

This report presents the results of the most recent phase of investigation and monitoring at and in the vicinity of the Industrial Environmental Systems, Inc. (IESI) facility in Saugerties, New York.

This report is preceded by a Dunn Geoscience Corporation (DGC) report entitled Tank Farm - Monitoring Well Installation and Groundwater Quality Analysis dated May 15, 1984. The information presented herein has been developed since that report submittal.

## 2.0 PURPOSE

The purpose of this report is to present documentation regarding the results and interpretation of groundwater sampling and laboratory analysis. Recommendations are provided for the next phase of work.

## 3.0 PERSONNEL

This report was prepared by Sander Bonvell, Senior Chemist and Ed Fahrenkopf, Staff Chemist and reviewed by James P. Behan, Jr., P.E., Senior Engineer and Project Manager, by William J. Hall, Vice President and by George M. Banino, Project Advisor.

The following subcontractor laboratories were used:

EA Engineering, Science and Technology, Inc.  
Sparks, Maryland

Environmental Testing and Certification  
Edison, New Jersey

Bender Hygienic Laboratory  
Albany, New York

Energy Resources Company, Inc.  
Cambridge, Massachusetts

Adirondack Environmental Services, Inc.  
Rensselaer, New York

C.T. Male Associates  
Latham, New York

#### 4.0 PROJECT SCOPE

##### 4.1 Sampling and Analytical Protocols

Five rounds of groundwater sampling and analysis have been performed since the May 15, 1984 report was presented: April 11-12, 1984; June 13, 1984; August 16, 1984; November 16, 1984; and February 28, 1985. This report details the results of the first four rounds. Complete laboratory results are pending for the February round.

On August 7, 1984 verbal agreement was reached with Maureen Hogan of the New York State Department of Environmental Conservation (NYSDEC), Bureau of Hazardous Site Control, to adopt a modified protocol at the IESI sites. This included eliminating metals and wet chemistry analyses from the three IESI monitoring wells and the bedrock face seepage, adding acid extractable (EPA Method 625) organic analysis to wells DFT-1 and DFT-2 in lieu of the hydrocarbon scan and adding acid/base-neutral extractable (EPA Method 625) analyses to the bedrock face seepage, also in lieu of the hydrocarbon scan as we have been performing under the NYSDEC consent order. The analysis for purgeable organics by GC/MS (EPA Method 624) was maintained for all IESI sites and the hydrocarbon scan was kept for all monitoring wells at the Northeast Solite Corporation (NES) stockpile ("Western") area. The colorimetric phenols analysis (EPA Method 420.1) was also maintained for the on-site IESI wells and the bedrock face seepage.

Results of the April, 1984 round of sampling/analysis were submitted in a DGC letter report of May 21, 1984. Pertinent data from that report are repeated herein. Tables 1 and 2.1 list the laboratory results of the inorganic and wet chemistry analyses for the April round. Table 2.2 is a summary of bedrock seepage data for cyanide, sulfide, pH and ignitability.

Results of the June, 1984 round of sampling analysis were submitted in a DGC letter report of July 10, 1984. Pertinent data from that report are repeated herein; Table 3 lists the laboratory results of the inorganic and wet chemistry parameters for this round.

Table 4 lists the parameters sought in the analysis of purgeable hydrocarbons (EPA Method 624) by gas chromatography/mass spectroscopy. These analyses during April and June, 1984, were performed by EA Engineering, Science and Technology, Inc. (EA); those analyzed during August and November, 1984, were performed by Environmental Testing and Certification (ETC). Method detection limits are given for both laboratories.

Table 5 lists the results of the hydrocarbon scans by gas chromatography/mass spectroscopy (GC/MS) following methylene chloride extraction.

Table 6 lists the results of the analyses for acid extractable compounds by EPA Method 625, gas chromatography/mass spectroscopy, for DFT-1 and the bedrock face seepage.

Table 7 lists the analytical results of base-neutral extractable compounds (EPA Method 625, gas chromatography/mass spectroscopy) for the bedrock face seepage.

Tables 8-11 reflect summaries of purgeable hydrocarbons found at any level greater than "not detected".

Table 12 lists the phenolic compounds tentatively identified by a mass spectral library search of the seep for the sampling periods, April, August, and November. Mass spectral spectra are presented in Appendix A.

Table 13 is an updated chart on the analysis of the seep for purgeable organics (EPA Methods 601 and 602 or 503).

Table 14 is a summary of purgeable hydrocarbons identified and Quantified in the seep by GC/MS.

Table 15 is a list of tentatively identified compounds by a mass spectral library search of the seep before and after treatment.

Tables 16 and 17 present local precipitation data.

#### 4.2 Seep Treatment - Granular Activated Carbon

A preliminary report on the efficiency of the granular activated carbon (GAC) treatment of the bedrock face seepage was submitted to NES in a DGC letter report dated February 5, 1985. This report dealt with gas chromatographic monitoring of seep water and its effluent following carbon treatment. Pertinent information from that report and supporting GC/MS data are submitted herein. The February 5th report is included in Appendix B.

### 5.0 Analytical Results and Interpretation

#### 5.1 IESI Groundwater Monitoring

##### 5.1.1 Inorganic/Wet Chemistry Analysis

Groundwater monitoring at the IESI facility consists of one upgradient well, UFT-1A, and two downgradient wells, DFT-1 and DFT-2. Monitoring "downgradient" of the IESI facility consists of four bedrock wells, BR-1-BR-4 and six

overburden wells DFT-5,-6,-7,-9,-10 and -11 on NES property. These sites are illustrated on Plate 1. Historically, wells DFT-2 and UFT-1A have had insufficient water volume to allow for complete protocol analysis.

There is no evidence of inorganic groundwater contamination based on the results presented in Tables 1 and 3. Although manganese, and occasionally iron, are above groundwater standards (Title 6, NYCRR, Part 703), their levels are insignificant and probably arise from natural geologic sources.

Only one sulfate concentration of 340 ppm (DFT-2/June) was found to exceed groundwater standards, but levels are not consistent or high enough to consider it a problem. It is not unusual to find sulfate in shale bearing regions.

#### 5.1.2 Organic Analysis

##### Phenols

Phenols analysis showed elevated levels in well DFT-2 (320 and 58 ppb, April and June respectively) and sporadically in well DFT-1 (50 ppb in April and 5 ppb for June, August and November). These sites were analyzed by the 4-aminoantipyrine method. A GC/MS library search of DFT-2 results in April confirmed the presence of phenols. The search identified the following three compounds as tentatively being present in the seep:

3-(1,1-dimethylethyl)-phenol  
2-(1,1-dimethylethyl)-5-methyl-phenol  
4-(1-methyl-1-phenylethyl)-phenol

Due to their complexity, the GC/MS spectra are presented in Appendix A.

Purgeable Hydrocarbons: GC/MS

Table 4 lists the parameters of EPA Method 624 (Purgeable Hydrocarbons) that were sought in the analyses by gas chromatography/mass spectroscopy. Tables 8-11 list those parameters that were found at or above the method detection limit.

Hydrocarbons observed in water from DFT-2 most likely arose from random leaching of nearby soil and migrated to the well by seepage into an unsaturated zone or by groundwater (when sufficient) at the water table. These compounds are indicative of parameters which appear elsewhere in the vicinity but are probably not indicative of general groundwater in the area.

Consistent with its history, well DFT-1 continues to exhibit low levels of only a few compounds. These compounds, along with their respective concentrations (ppb) are listed below, under the month in which the analysis was done.

	<u>April</u>	<u>June</u>	<u>August</u>	<u>November</u>
1,1-dichloroethane	8	18	-	-
1,2-dichloroethane	15	18	31	11
1,1,1-trichloroethane	2	4	16	-
1,1,2-trichloroethane	3	-	-	-
toluene	14	-	-	-

None of these values exceeded the maximum contaminant level (MCL) of 50 ppb adopted for individual components by the New York State Department of Health (NYSDOH).

The two compounds, 1,2-dichloroethane and 1,1,2-trichloroethane (each at 2 ppb), observed during the June round of sampling in the upgradient well are



unexplainable. Their presence is inconsistent over time, and the values are close to the method detection limit. They are possibly a laboratory artifact.

Three wells in the stockpile area (DFT-6, -9, -10) of the NES property exhibit low to medium levels of a few purgeable organics, although the individual compounds seen in each well are not consistent over time. Although none of the wells exceeds the NYSDOH MCL of 100 ppb total hydrocarbons, two exceed the individual component MCL of 50 ppb. These are listed below, along with the concentration, date of sampling and the respective well.

DFT-6: 1,1,1-Trichloroethane (66 ppb April; 81 ppb June

DFT-10: Tetrachloroethylene (66 ppb August)

Of the bedrock wells, only two have shown evidence of the presence of purgeable hydrocarbons. In April, BR-4 exhibited 2 ppb chloroform, but this has not been seen in further testing. The same applies to BR-3 which showed 11 ppb of tetrachloroethylene in August.

#### Extractable Organics: GC/MS

Table 5 lists a summary of hydrocarbon scans performed by GC/MS following methylene chloride extraction of the water sample.

There appeared to be an overall drop in extractable hydrocarbon content for all wells between April and June. This is especially evidenced by the seep and well DFT-2, which underwent very large decreases in concentration Seep: 12,600 to 370 ppb and DFT-2: 7,400 to 580 ppb).

Well BR-1 showed an elevated level of 1,100 ppb in April, followed by two sampling rounds (June and August) in which it was dry. In November, when there was sufficient water for sampling, the value had decreased to 72 ppb.

Wells DFT-5, DFT-2, and the upgradient well UFT-1A had insufficient water for sampling in August and November. DFT-5 had an initial hydrocarbon concentration of 560 ppb in April but was "not detected" in June.

DFT-6, -9, -10, and -11 appear to be inconsistent over time. Of the four bedrock wells, BR-4 is the only one in which extractable hydrocarbons are consistently detected. Reported concentrations were 210, 170, 240 and 380 ppb for April, June, August and November respectively. Two sites, Ditch and DSP-5, were below the method of detection limit every time they were analyzed.

In a July 23, 1984 meeting with members of NYSDEC, NES and DGC, it was agreed that sites DFT-1 and DFT-2 would undergo priority pollutant analysis for acid extractable organics, and the seep for both acid and base/neutral priority pollutants by EPA Method 625 GC/MS. This was performed in August and November of 1984 for these sites except DFT-2 which was dry on both occasions. The results are shown in Tables 6 and 7. Of all the parameters, the only detected compound was 2,6-dinitrotoluene at 19 ppb in the August seep sample. All other parameters at both times at both sites were not detected or were below the method of detection limit.

In April of 1984, a mass spectral library search was conducted for wells DFT-2, DFT-7 and BR-1. The compounds tentatively identified and their associated spectra are presented in Appendix A.

### Chlorinated Organics: Pesticides and Aroclors

Wells DFT-1 and DFT-2 were analyzed for pesticides and Aroclors in April and June of 1984. The only compound detected was Aroclor 1260 in well DFT-2 which had concentrations of 1.17 ppb in April and 0.15 ug/L in June. This is consistent with historical data; values of 0.22 and 0.95 ppb were found in September and November, 1983 respectively. These levels are above the groundwater standard of 0.1 ug/L.

## 5.2 Bedrock Face Seepage

### 5.2.1 Inorganic/Wet Chemistry Analysis

Inorganic contamination of the seep is not a problem. Table 2.1 lists the results of the April sampling. Iron, manganese, and sulfate are the only parameters that are even slightly elevated with respect to groundwater standards. Iron had a value of 0.58 mg/L, manganese 0.57 mg/L and sulfate 393 mg/L. Groundwater standards are 0.3, 0.3 and 250 mg/L respectively. These levels are insignificant and arise from natural geologic sources.

In order to further characterize the hazardous/nonhazardous chemical nature of the seep, analyses for cyanide, sulfide, pH and ignitability have been performed. Table 2.2 lists the results for the above parameters. Values for both cyanide and sulfide have been below or slightly above the MDL for all sampling dates. The highest cyanide value of 0.02 mg/L is well below the MCL of 0.2 mg/L groundwater standard. pH has been consistently within acceptable groundwater limits. Ignitability as determined by flash

point analysis, has been uniformly negative. These data indicate that these parameters (cyanide, sulfide, pH, and ignitability) do not comprise a contaminant problem in the seep.

#### 5.2.2 Organic Analyses

##### Phenols

Below are the seep results for total phenols, analyzed by the 4-aminoantipyrine method.

<u>Date</u>	<u>Results, ppb</u>
April	340
August	62
September	42
November	62

These data indicate that phenol values for the seep are consistently above the groundwater standard of 1 ppb. This is consistent with historical data reported in the May 15, 1984 DGC report to NES (November, 1983, 340 ppb and January, 1984, 100 ppb).

Mass spectral library searches in April, August, and November corroborate the findings of the colormetric 4-aminoantipyrine method. Table 12 lists the phenol compounds that were tentatively identified as being present in the seep for each month. In general, the phenols tentatively identified (here and in DFT-2) are mono- or disubstituted with bulky, saturated alkane groups of four or more carbons.

Purgeable Organics: GC

Gas chromatographic analysis of the seep for purgeable organics has been by EPA Methods 601 and 602 or 503. Table 13 presents the seep data since July of 1984 and is an updated version of a chart submitted in the February 5, 1985 DGC letter report to NES. As noted in that report, seep water quality has a history of contamination with regard to total purgeable hydrocarbons (January, 1,369 ppb; March, 2,643 ppb; and April, 4,526 ppb). Beginning in July of 1984, seep water quality with respect to purgeable hydrocarbons underwent an immense improvement. From July until December, values ranged between 5.7 ppb and 17.8 ppb total purgeable hydrocarbons, with an average of 10.5 ppb. In January of 1985 these levels increased to 46.3 ppb; by February 12, 1985 total purgeable hydrocarbons decreased again to a level of 9.1 ppb. The last sample taken for which laboratory data are available, March 14, 1985, had a total purgeable organics value of 53.2 ppb. since July, 1984 only one compound, benzene, has exceeded the MCL for groundwater. Benzene is defined as being above MCL if it is found at any level above "Not Detected".

The improvement in seep water quality can be partially attributed to the decrease in precipitation during the months of June, July, and August. This results in diminished infiltration and recharge to the groundwater, therefore reducing the degree of contaminant migration. The reasoning behind this assumption (reduction in infiltration reduces contaminant migration) was presented in a May 15, 1984 DGC report under "Remedial Action". The paving in the vicinity of the solvent tanks (completed in November 1984) will assist in reducing infiltration into the ground. Continuous recorded monitoring of the seep flow is recommended in order to determine the extent of flow in the spring, when increased precipitation can be expected.

#### Purgeable Hydrocarbons GC/MS

Table 4 lists the parameters of EPA Method 624 (Purgeable Hydrocarbons that were sought in the seep analysis by GC/MS. Table 14 summarizes the parameters identified and quantified for the April, June, August and November consent order samplings.

Elevated hydrocarbon levels observed in April have since decreased and have remained consistently low; this decrease is well documented by the more frequent GC seep monitoring described in the previous section.

In June, the only parameters identified were 1,2-dichloroethane (10 ppb); 1,1,1-trichloroethane (4 ppb); 1,1-dichloroethane (3 ppb); chloroform (3 ppb); and tetrachloroethylene (3 ppb). None of these are above NYSDOH limits. In August, 1,2-dichloroethane and trichloroethylene were indicated at below the method detection limit (BMDL). All other compounds were "not detected". November had one compound, tetrachloroethylene, at BMDL; all other compounds were not detected.

#### Extractable Organics GC/MS

Seep analysis for extractable organics was performed by two different procedures. In April and June a total hydrocarbon scan by GC/MS (following methylene chloride extraction) was conducted. In August and November, priority pollutant analysis for acid and base/neutral extractables by GC/MS (EPA Method 625) was substituted for the total hydrocarbon scan. This involved adjusting the pH of the sample to greater than 11 and extracting with methylene chloride. The pH was then adjusted to less than 2 and the solution was extracted with fresh methylene chloride. The sample extracts were then analyzed by GC/MS.

In April, 1984, the seep had a total hydrocarbon value of 12,600 ppb; in June, total hydrocarbons had dropped to 370 ppb. This large decrease from April to June is consistent with results for other sampling sites at the IESI facility.

Tables 6 and 7 list the parameters and results of the analysis for acid and base/neutral extractables. In August and November, all acid extractable compounds were at the not detected level. In August, one base/neutral compound, 2,6-dinitrotoluene, was detected at a level of 19 ppb. This is below the MCL set by NYSDOH. Three compounds, bis (2-chloroethyl) ether, di-n-butylphthalate, and isophorone were BMDL; all others were ND. In November, two base/neutral parameters, 1,2-dichlorobenzene and naphthalene, were at the BMDL; all others were not detected. In view of these results, it is believed that the acid and base neutral extractable priority pollutants are not a contaminant problem in the seep. For future analyses, acid and base neutral extractables will be replaced by the hydrocarbon scan.

To further define the complex chemical nature of the seep, three mass spectral library searches have been conducted. The first was performed in April on data obtained from the total hydrocarbon scan. The second and third were conducted in August and November respectively, and were based on the volatile organic, acid extractable, and base neutral extractable analyses. The compounds tentatively identified and their associated spectra are found in Appendix A. The fact that the August and November mass spectral library searches did not indicate the presence of acid or base neutral priority pollutants is further evidence that these analyses can be replaced with the less expensive total hydrocarbon scan.

### Chlorinated Organics: Pesticides and Aroclors

On April 11, 1984 the seep at the bedrock face was analyzed for priority pollutant Aroclors and pesticides by GC (EPA Method 608). The only positive result was Aroclor 1260 at a level of 0.28 ppb. This value is well below previous levels seen in the seep: November, 1983, Aroclor 1260 = 4.2 ppb and Aroclor 1242 = 0.9 ppb. In January 1984, the Aroclor values were, 1260 = 4.3 ppb and 1242 = 0.46 ppb. The April 11th value of 0.28 ppb is still slightly above the groundwater MCL of 0.1 ppb. In view of these data, continued monitoring of the seep for Aroclors is recommended on a quarterly basis.

#### 5.2.3 Climatological and Seep Flow Data

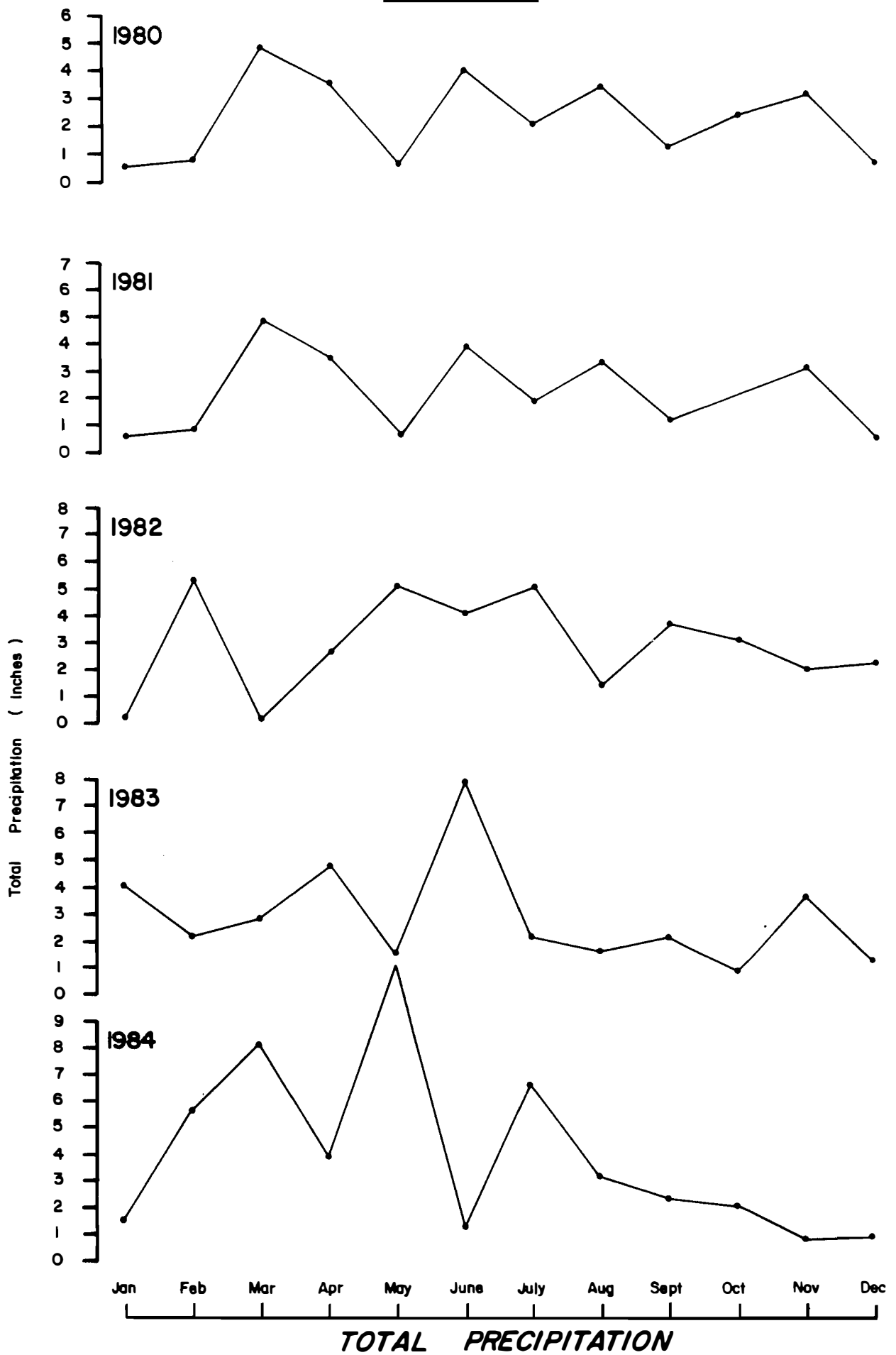
Precipitation measurements are made at the Hudson Correctional Facility in Hudson, NY. This is the nearest National Oceanic and Atmospheric Association (NOAA) Climatological Center in the vicinity of the IESI facility. These data were compiled in an attempt to determine if there is correlation between precipitation and seep flow.

Figure 1 is a graphic presentation of monthly precipitation from 1980 through 1984. Figures 2 through 5 are comparisons of daily precipitation and seep flow rates for December 1984, and January, February, and March, 1985. Tables 16 and 17 contain the precipitation data.

During the months of December, January, February and March there were different forms of precipitation (snow, rain, hail, etc.). Where rain may cause an immediate or short term time lag between precipitation and seep flow reaction, snowfall can cause a large delay period or no reaction

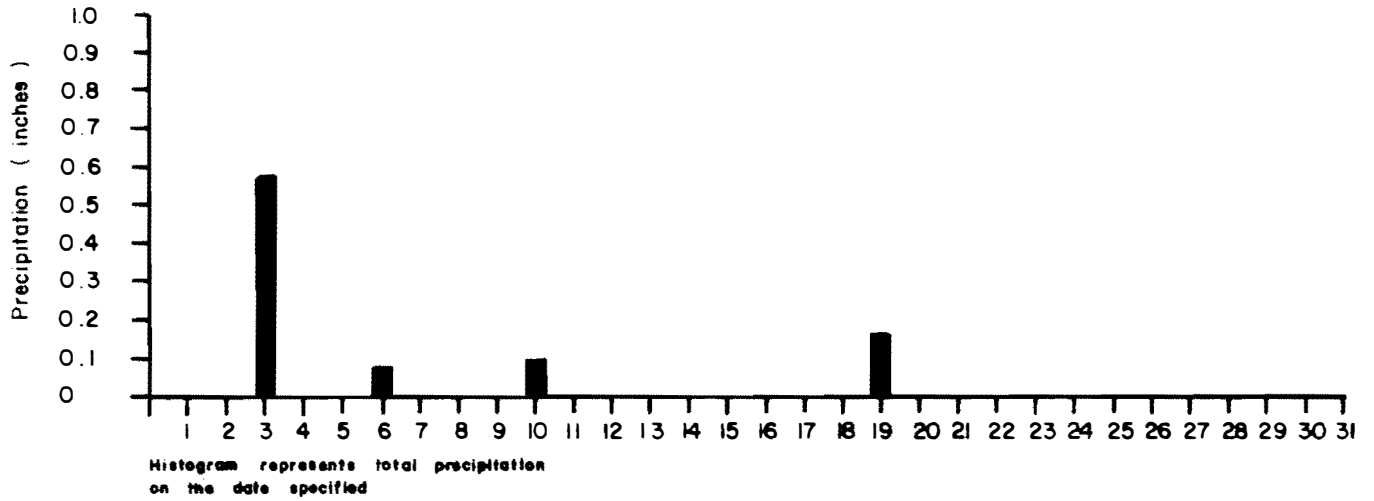


FIGURE 1



# PRECIPITATION

December 1984



SEEP FLOW  
December 1984

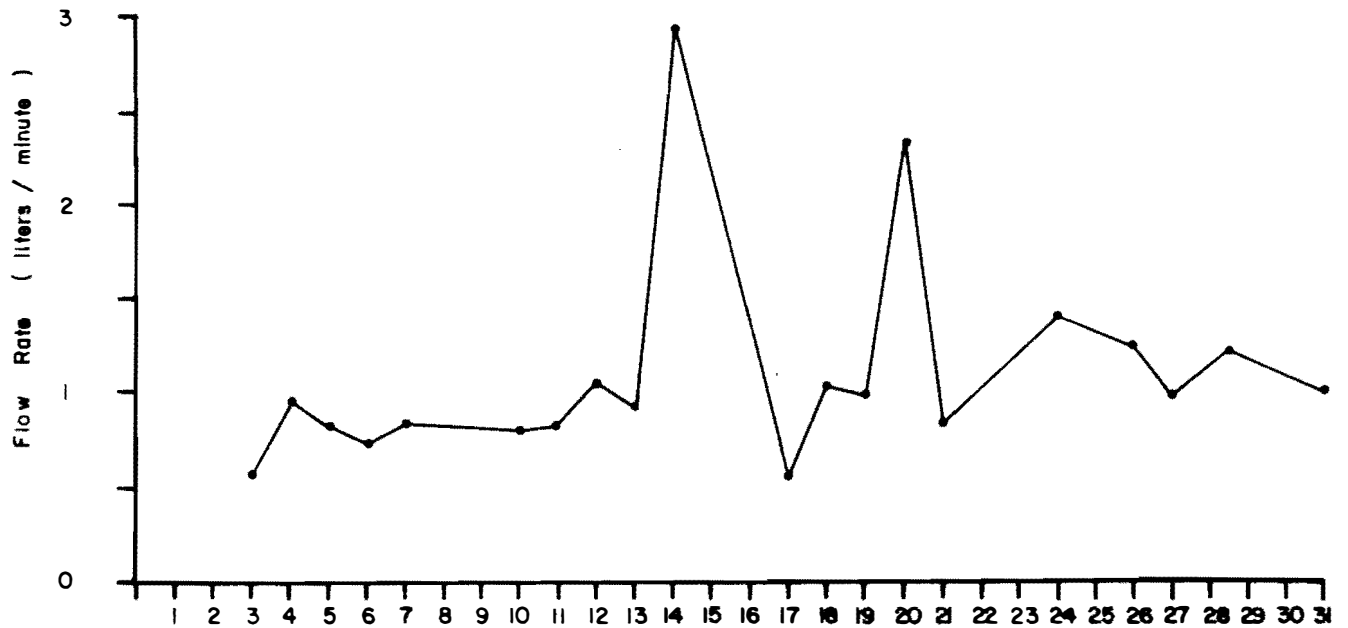
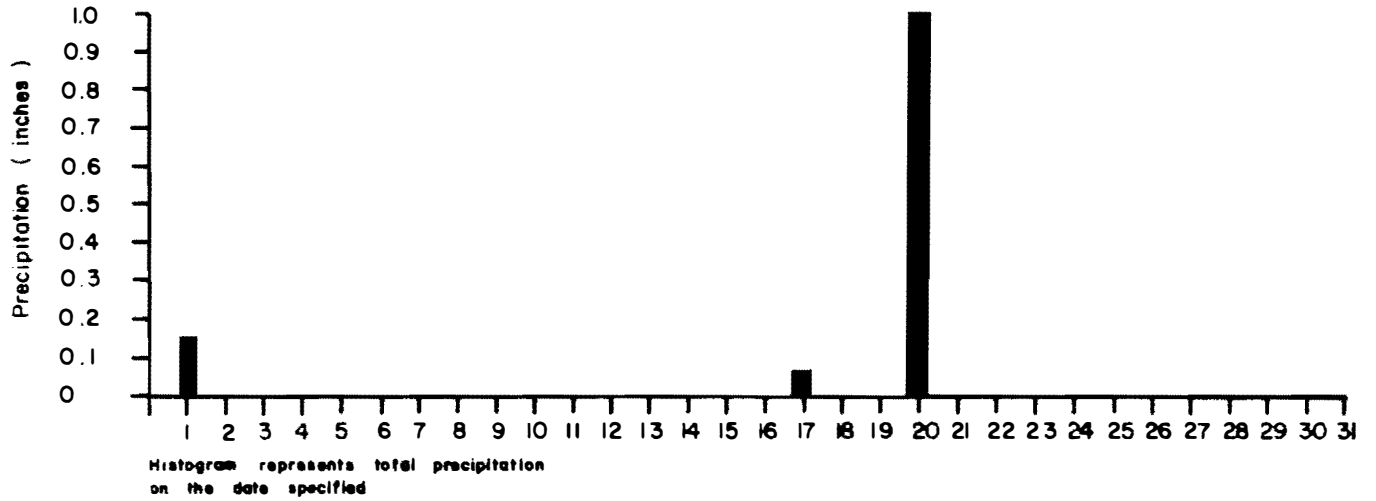


FIGURE 2

# PRECIPITATION

January 1985



SEEP FLOW  
January 1985

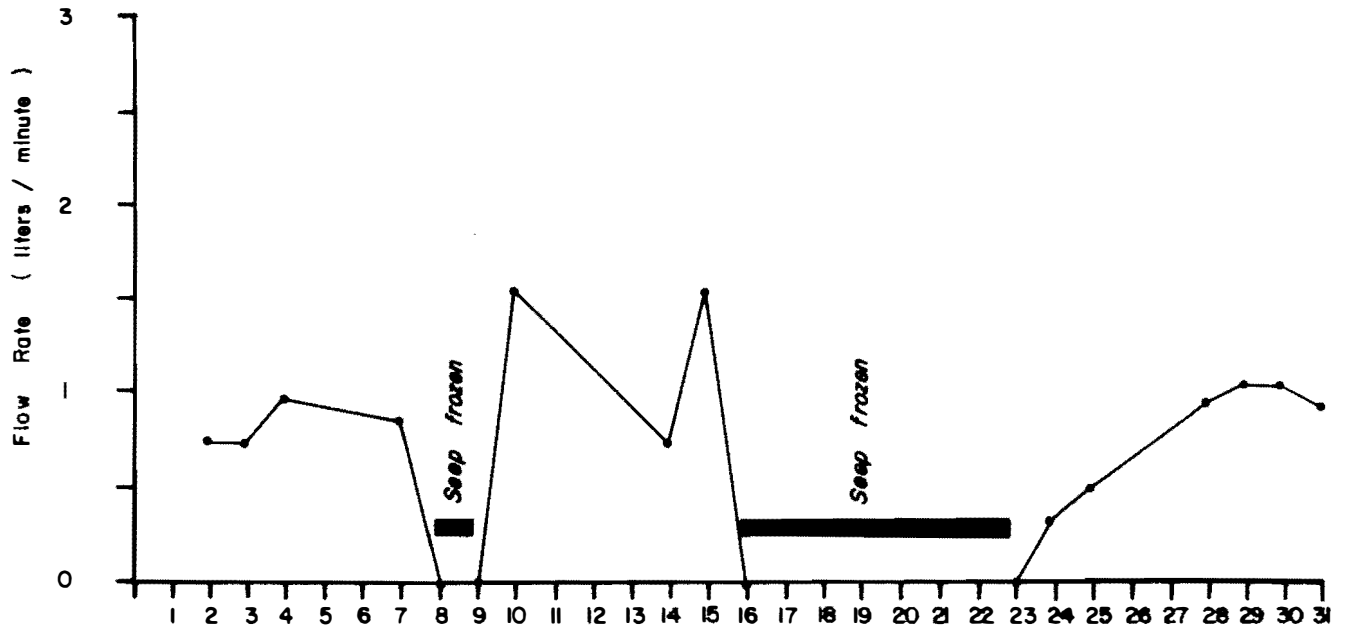
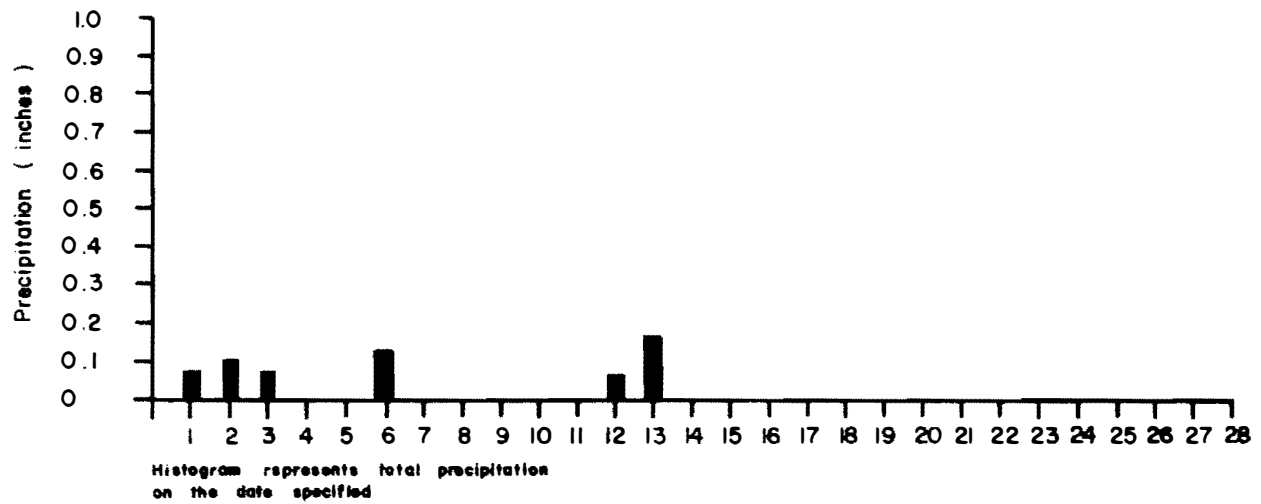


FIGURE 3

# PRECIPITATION

February 1985



SEEP FLOW  
February 1985

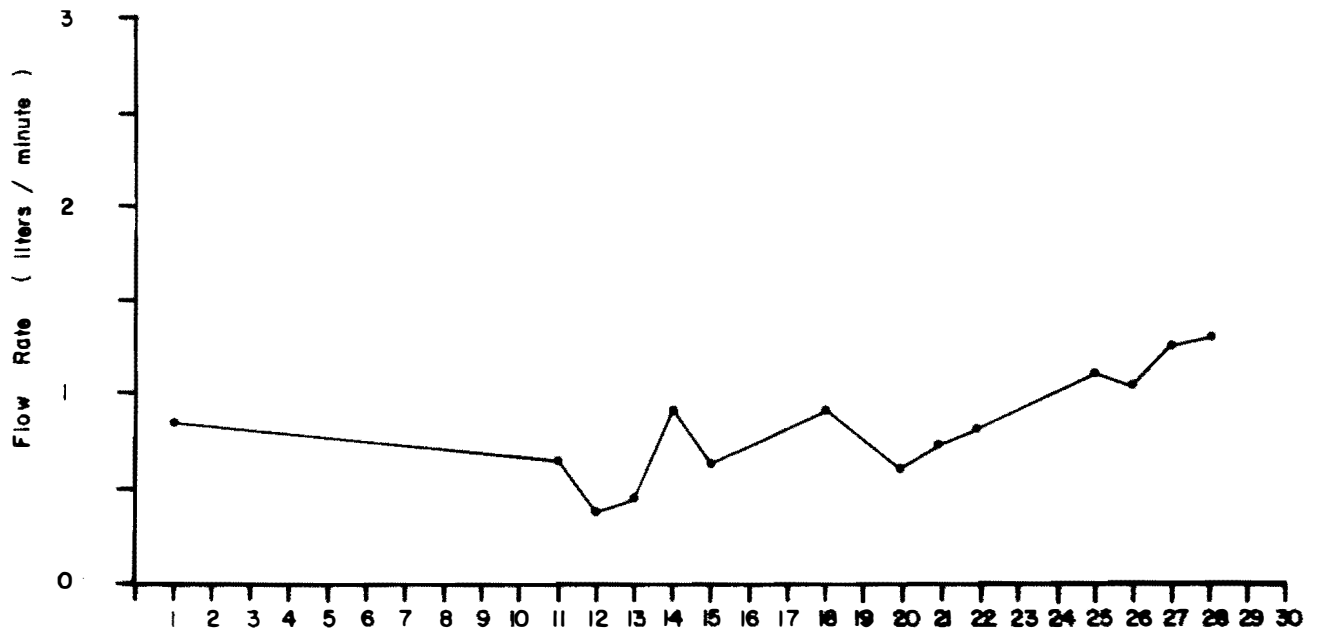
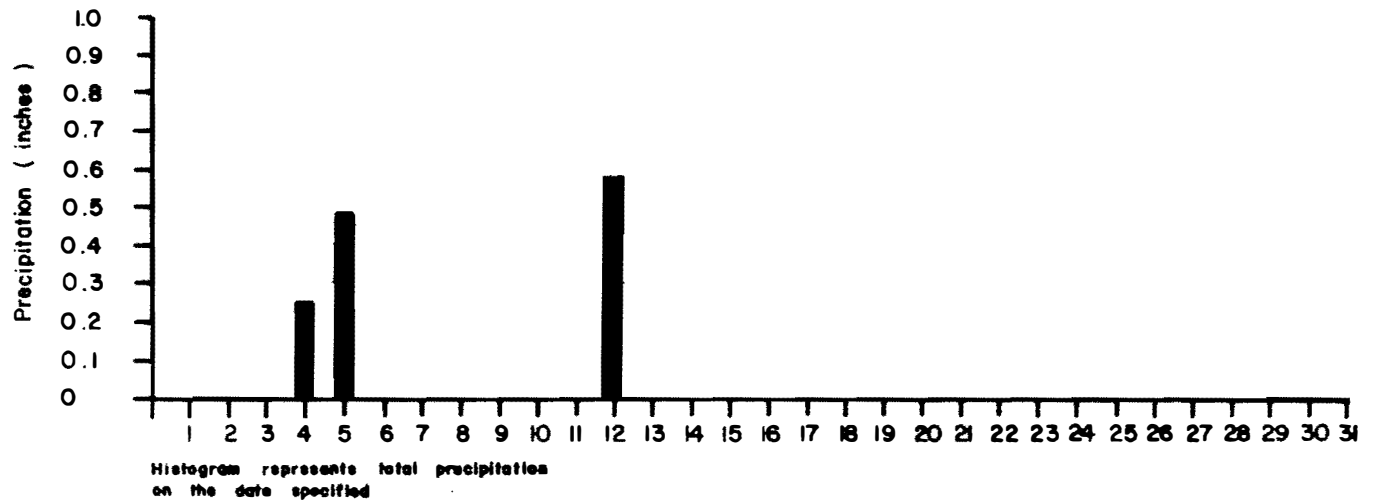


FIGURE 4

# PRECIPITATION

March 1985



SEEP FLOW  
March 1985

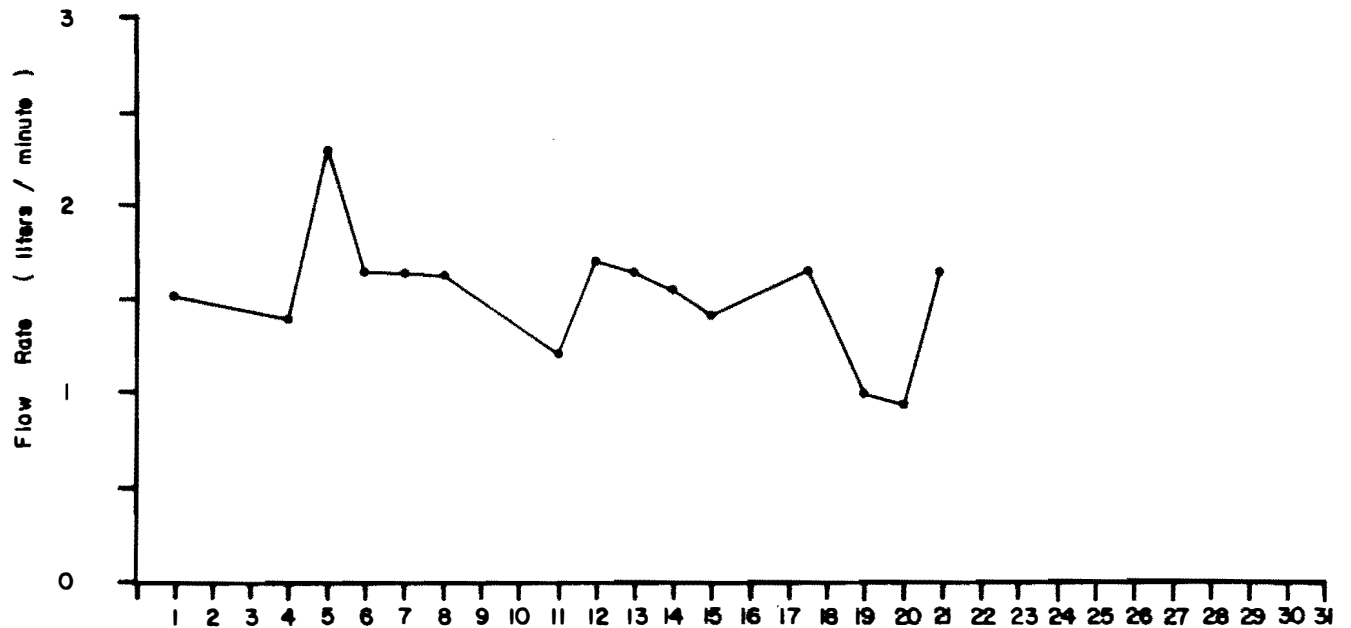


FIGURE 5

depending upon when, and at what rates, snow melt occurs. Seep flow is currently measured on a daily basis on working days. This is considered inadequate since flow rates can vary throughout the day and measurements are not taken on holidays or weekends.

The following recommendations are made to alleviate the above problems. A precipitation gauge should be installed on the NES property and measurements taken when appropriate. Seep flows should be monitored on a continuous basis with a flow meter that is equipped with a continuous recorder. This would allow us to calculate the total volume of flow within any given time frame. This information would enhance our knowledge of seep flow rates and volumes and contaminant concentration relationships.

### 5.3 Seep Treatment - Granular Activated Carbon

#### 5.3.1 February 5, 1985 Letter Report

On February 5, 1985 a letter report discussing the analytical results and efficiency of the granular activated carbon (GAC) used to treat the seep was submitted to NES. This letter is submitted in Appendix B.

This section presents and discusses additional analytical data on the seep, both treated and untreated.

#### 5.3.2 Mass Spectral Library Search (Before and After Treatment)

On April 11, 1984, total extractable hydrocarbons in the seep before treatment measured 12,600 ppb as isooctane. After treatment with GAC, total hydrocarbons dropped to 2,000 ppb. A mass spectral library search was conducted on the total hydrocarbon data both before and after treatment;

the search identified compounds present in the seep both before and after GAC filtration. Table 15 lists the parameters tentatively identified. The associated spectra are presented in Appendix A.

There were a number of compounds tentatively identified after treatment that were not seen before treatment. It is probable that these compounds were present before treatment, but due to the complexity of the spectra and higher chemical concentrations, the components in question were masked by, or coeluted with, other chemicals in the seep before filtration.

The majority of the extractable compounds are oxygenated as phenols, ketones, carboxylic acids or alcohols. None of the compounds listed in Table 15 are on the EPA list of priority pollutants.

The observed filtration/treatment efficiency for the seepage water (i.e., compounds tentatively identified by a GC/MS library search) is consistent with literature reported data for various individual compounds at loadings up to 1000 ppb. It is probable that compounds which were seen both before and after treatment resulted from breakthrough of a saturated carbon canister and not as a result of GAC adsorptive characteristics.

It is recommended that studies be undertaken to investigate the efficiency of extractable organics treatment at the current low organic concentrations. This would consist of minimal GAC influent/effluent analyses by gas chromatography - flame ionization detection. Spread over several months, the project would cost between \$500 and \$700.

## 6.0 ADDITIONAL MONITORING

The purpose of this section is threefold: to define additional monitoring at or in the vicinity of Industrial Environmental Systems, Inc.; to recommend modifications of the NYSDEC consent order analytical program; and to describe analytical protocol for the quarterly sampling of the consent order and western area sites. The consent order sites are DFT-1, DFT-2, UFT-1A and the bedrock face seepage; the western area sites are BR-1 - BR-4, and DFT-6,7,9 and 10.

### 6.1 Additional Monitoring: Total Hydrocarbon Scan

Currently the four consent order monitoring sites are analyzed for total hydrocarbons by GC/MS methods. Total hydrocarbon scans for the seep and DFT-2 (or DFT-1, depending on available water in wells), will also be determined concurrently by GC using flame ionization detection (FID). It is recommended that this procedure continue for three quarterly sampling rounds in an attempt to correlate the data between the two methods. If good correlation exists between the GC/MS and GC scans, it is advised that the GC/MS total hydrocarbon scan be replaced with the less expensive GC scan.

### 6.2 Modification of the NYSDEC Consent Order Analytical Protocol

This section recommends refinement of the existing monitoring program for the consent order sites. Sufficient evidence has been collected and reviewed to modify and improve the protocol for purgeable and extractable hydrocarbons.

Purgeable hydrocarbons are presently analyzed by GC/MS (EPA Method 624). It is recommended that this method be replaced by GC analyses, EPA Methods 601 and 602 or 503.

DFT-1 and DFT-2 are currently analyzed for acid extractables. This was initially conducted to increase our knowledge of the chemical



nature of these sites with regard to phenols. Review of the data from these analyses and the mass spectral library searches, indicates no contamination with regard to the parameters sought in these tests.

It is therefore recommended that acid extractables (EPA 625) be replaced with the less expensive total hydrocarbon scan, and to continue the analysis for phenols by the 4-aminoantipyrine method.

### 6.3 Quarterly Analysis

Recommended quarterly analysis for the consent order sites are as follows. Wells DFT-1, DFT-2, UFT-1A and the bedrock face seepage will be analyzed for Aroclors (EPA 608), purgeable organics by EPA Methods 601 and 602 or 503, phenols by the 4-aminoantipyrine method, and a total hydrocarbon scan by GC/MS. In addition, the total hydrocarbon scan for the seep and DFT-2 (or DFT-1) will be analyzed by GC with flame ionization detection. Sampling protocol for the NES stockpile ("Western") area will consist of wells BR-1 - BR-4 and DFT-6,-7,-9, and -10. These sites will be analyzed for purgeable hydrocarbons by 601/602 and for extractable hydrocarbons by GC and flame ionization detection.

Since a round of sampling was recently performed during February, 1985, quarterly monitoring as described would next be carried out in May. In addition to this schedule, we propose an additional round of sampling during late April, 1985 to augment our information about the groundwater and seep quality during the spring period of expected precipitation increase. The previously discussed \$13,000 cost savings for the non-consent order wells takes into account this extra round of sampling.

It is also recommended that well DFT-5 and the ditch be sampled once a year (as an outlier well) for purgeable organics by GC and for total hydrocarbon scan by GC and flame ionization detection.

TABLES

TABLE 1 RESULTS OF CHEMICAL ANALYSIS OF GROUND-WATER SAMPLES  
COLLECTED BY DUNN GEOSCIENCE - 11 APRIL 1984

Parameter	Unit	DFT-2	DFT-1	Field Blank
Chloride	mg/l	44	93	<0.2
Total Cyanide	mg/l	<0.02	<0.02	<0.02
Fluoride	mg/l	0.5	0.9	<0.1
Nitrate-Nitrogen	mg/l	1.26	0.69	<0.01
pH	Unit	6.4	6.8	3.9
Sulfate	mg/l	220	217	<2
Sulfide	mg/l	<14	<7	<1
Aluminum	mg/l	0.062	0.065	--
Arsenic	mg/l	0.003	<0.002	<0.002
Barium	mg/l	0.338	0.096	<0.005
Cadmium	mg/l	0.0017	0.0007	<0.0003
Hexavalent Chromium	mg/l	<0.001	<0.001	<0.001
Copper	mg/l	0.016	0.023	--
Iron	mg/l	0.28	0.47	<0.02
Lead	mg/l	0.003	0.004	--
Manganese	mg/l	1.97	1.62	<0.03
Mercury	mg/l	<0.0005	<0.0005	<0.0002
Nickel	mg/l	0.054	0.043	<0.05
Selenium	mg/l	0.005	0.004	<0.003
Silver	mg/l	0.0003	0.0002	<0.0002
Zinc	mg/l	0.17	0.04	<0.005
Oil and Grease	mg/l	4.2	<1	<1
Phenols	mg/l	0.32	0.05	<0.005
Surfactants	mg/l	0.21	<0.05	<0.05
Gross Alpha	pCi/l	12 $\pm$ 3	6.1 $\pm$ 2.2	--
Gross Beta	pCi/l	24 $\pm$ 2	14 $\pm$ 1	--

Note: 1) Insufficient volumes of water were collected from well UFT-1A for analysis.

TABLE 2.1 RESULTS OF ANALYSIS OF SAMPLES  
COLLECTED BY DUNN GEOSCIENCE  
11 APRIL 1984

Parameter	Unit	Seep Inlet	Field Blank
Chloride	mg/l	107	<0.2
Total Cyanide	mg/l	<0.02	<0.02
Fluoride	mg/l	1.1	<0.1
Nitrate-Nitrogen	mg/l	0.01	<0.01
pH	unit	7.3	3.9
Sulfate	mg/l	393	<2
Sulfide	mg/l	1	<1
Aluminum	mg/l	0.049	--
Arsenic	mg/l	0.004	<0.002
Barium	mg/l	0.128	<0.005
Cadmium	mg/l	0.0008	<0.0003
Hexavalent Chromium	mg/l	<0.001	<0.001
Copper	mg/l	0.011	--
Iron	mg/l	0.58	<0.02
Lead	mg/l	0.001	--
Manganese	mg/l	0.57	<0.03
Mercury	mg/l	<0.0002	<0.0002
Nickel	mg/l	0.039	<0.05
Selenium	mg/l	0.004	<0.003
Silver	mg/l	0.0004	<0.0002
Zinc	mg/l	0.02	<0.005
Oil & Grease	mg/l	6.4	<1
Phenols	mg/l	0.34	--
Surfactants	mg/l	0.47	<0.05
Gross Alpha	pCi/l	<3	--
Gross Beta	pCi/l	13±2	--

TABLE 2.2

Inorganic Chemical Data  
Bedrock Face Seepage

<u>DATE</u>	<u>CYANIDE mg/L</u>	<u>SULFIDE mg/L</u>	<u>pH, Units</u>	<u>IGNITABILITY (flash point)</u>
11/30/84	0.02	<0.7	-	-
04/11/84	<0.02	1.0	-	-
08/14/84	-	-	7.8	*negative
09/05/84	-	-	7.9	negative
09/13/84	-	-	7.9	negative
09/17/84	-	-	8.0	negative
09/19/84	<0.01	<1	-	-
10/05/84	-	-	7.9	negative
02/26/85	0.01	0.8	-	-

- = not analyzed for

\*negative = no flash point detected, sample is not ignitable

TABLE 3

Results of Chemical Analysis of Groundwater Samples  
June 13, 1984

<u>Parameter</u>	<u>DFT-1</u>	<u>DFT-2</u>
Chloride	106	133
Cyanide, Total	<0.010	<0.010
Nitrate-N	8.0	4.0
Sulfate*	210	340
Sulfide**	Interference	Interference
Aluminum	Insufficient Sample	Insufficient Sample
Arsenic	<0.020	<0.020
Barium	Insufficient Sample	Insufficient Sample
Cadmium	<0.002	0.0023
Chromium, Hex.	<0.01	<0.01
Copper	<0.05	<0.05
Iron	1.3	0.22
Lead	<0.010	<0.010
Manganese	1.82	1.57
Mercury	Insufficient Sample	Insufficient Sample
Nickel	<0.1	<0.1
Selenium	<0.002	0.003
Silver	<0.005	<0.005
Zinc	<0.05	<0.05
Oil & Grease	1	1
Phenols	<0.005	0.058
MBAS**	Interference	Interference
Fluoride	1.0	0.7
pH, units	6.8	6.6
Gross Alpha, pCi/L	3.0±1.7	2.6±2.0
Gross Beta, pCi/L	17±1	20±2

All values expressed in Mg/L except where noted.

\*Samples filtered thru 0.45 micron membrane prior to analysis.

\*\*Due to the turbid nature of the samples, unable to analyze for these parameters.

Insufficient water was available for inorganic sampling and analysis.  
Water which was collected was used for organic analysis.

TABLE 4  
Purgeable Hydrocarbons  
EPA Method 624  
Parameters Sought and Method Detection Limits\*

	EA	ETC
Acrolein	10	100
Acrylonitrile	10	100
Benzene	2	10
Carbon Tetrachloride	2	10
Chlorobenzene	2	10
1,2-Dichloroethane	2	10
1,1,1-Trichloroethane	2	10
1,1-Dichloroethane	2	10
1,1,2-Trichloroethane	2	10
1,1,2,2-Tetrachloroethane	2	10
Chloroethane	2	10
2-Chloroethylvinyl ether	10	10
Chloroform	2	10
1,1-Dichloroethene	2	10
Trans-1,2-Dichloroethene	2	10
1,2-Dichloropropane	2	10
1,3-Dichloropropane	2	10
Ethylbenzene	2	10
Methylene chloride	10	10
Chloromethane	2	10
Bromomethane	2	10
Bromoform	2	10
Bromodichloromethane	2	10
Trichlorofluoromethane	2	10
Dichlorodifluoromethane	2	10
Chlorodibromomethane	2	10
Tetrachloroethene	2	10
Toluene	2	10
Trichloroethene	2	10
Vinyl chloride	2	10
Xylene isomers	5	-
Acetone	40	10
Methyl ethyl ketone	20	10
Methyl isobutyl ketone	10	10

\*All values in ug/L, ppb

TABLE 5  
Total Hydrocarbon Scans\*  
Gas Chromatography/Mass Spectroscopy  
1984

	April	June	August	November
BR-1	1,100	I.S.	I.S.	72
BR-2	50	<20	<10	120
BR-3	<30	<20	<10	17
BR-4	210	170	240	380
DFT-5	560	<20	I.S.	I.S.
DFT-6	590	<20	<10	**
DFT-7	1,600	<20	<10	16
DFT-9	90	<20	398	31
DFT-10	300	23	125	31
DFT-11	110	<20	ND	**
Ditch	<30	<20	10	ND
DSP-5	<30	<20	ND	-
UFT-1A	55	<20	I.S.	I.S.
DFT-1	<30	<20	A.Ex.	A.Ex.
DFT-2	7,400	580	I.S.	I.S.
Seep	12,600	370	A/B-N Ex.	A/B-N Ex.
Seep Treated	2,000	-	<10±	8***

\*As ppb isooctane

\*\*Wells were damaged; unable to sample

\*\*\*GAC/MID/A7

I.S. - Insufficient water available for sampling

A.Ex. - Acid Extractables substituted for hydrocarbon scan

A/B-N Ex. - Acid and Base Neutral extractables substituted for hydrocarbon scan



TABLE 6  
Acid Extractable Compounds  
EPA Method 625

	DFT-1		SEEP	
	August	November	August	November
2-Chlorophenol	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND
4,6-Dinitro-o-cresol*	ND	ND	ND	ND
2,4-Dinitrophenol*	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
p-Chloro-m-cresol	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
Phenol	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND

\*Method detection limit for August and November was 250 ppb; other compounds MDL is 25 ppb.

Note: Well DFT-2 was dry during both August and November sampling

TABLE 7  
Base-Neutral Extractable  
EPA Method 625  
Bedrock Face Seepage

August

	August *	September **	November
Acenaphthene	ND	ND	ND
Acenaphthylene	ND	ND	ND
Anthracene	ND	ND	ND
Benzidine	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND
Benao(a)pyrene	ND	ND	ND
Benzo(b)fluoroanthene	ND	ND	ND
Benzo(ghi)perylene	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND
bis(2-Chloroethoxy)methane	ND	ND	ND
bis(2-Chloroethyl) ether	BMDL	ND	ND
bis(2-Chloroisopropyl)ether	ND	ND	ND
bis(2-Ethylhexyl)phthalate	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND
Butyl benzyl phthalate	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND
4-Chlorophenyl phenyl ether	ND	ND	ND
Chrysene	ND	ND	ND
Dibenzo(a,h)anthracene	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	BMDL
1,3-Dichlorobenzene	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND
3,3-Dichlorobenzidine	ND	ND	ND
Diethyl phthalate	ND	ND	ND
Dimethyl phthalate	ND	ND	ND
Di-n-butyl phthalate	BMDL	ND	ND
2,4-Dinitrotoluene	ND	ND	ND
2,6-Dinitrotoluene	19	ND	ND
Di-n-octyl phthalate	ND	ND	ND
1,2-Diphenylhydrazine	ND	ND	ND
Fluoranthene	ND	ND	ND
Fluorene	ND	ND	ND
Hexachlorobenzene	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND
Hexachloroethane	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	ND	ND	ND
Isophorone	BMDL	ND	ND
Naphthalene	ND	ND	BMDL
Nitrobenzene	ND	ND	ND
N-Nitrosodimethylamine	ND	ND	ND
N-Nitrosodi-n-propylamine	ND	ND	ND
N-Nitrosodiphenylamine	ND	ND	ND
Phenanthrene	ND	ND	ND
Pyrene	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND

\*Method detection limit for all compounds is 10 ppb.

\*\*Method detection limit for all compounds is 40 ppb.

ND - Not detected

TABLE 8

Summary of Purgeable Hydrocarbons Identified and Quantitated\*  
 Industrial Environmental Systems, Inc.  
 April, 1984  
 EPA 624

<u>Parameter</u>	<u>BR-4</u>	<u>DFT-1</u>	<u>DFT-2</u>	<u>DFT-6</u>	<u>DFT-9</u>	<u>SEEP</u>
Benzene	ND	ND	94	ND	ND	ND
Chlorobenzene	ND	ND	12	ND	ND	ND
Chloroform	2	ND	150	ND	3	27
1, 1-Dichloroethane	ND	8	27	23	2	7
1, 2-Dichloroethane	ND	15	110	ND	5	77
Methylene Chloride	ND	ND	190	ND	ND	70
Tetrachloroethylene	ND	ND	290	ND	ND	ND
Toluene	ND	ND	1900	ND	ND	ND
trans-1, 2-dichloroethylene	ND	ND	45	ND	ND	3
1,1,1-Trichloroethane	ND	2	1100	66	7	18
1,1,2-Trichloroethane	ND	3	11	ND	4	3
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	3	6
Trichloroethylene	ND	ND	180	ND	ND	6
Total Xylenes	ND	ND	1000	ND	ND	ND
Methyl ethyl ketone	ND	ND	400	ND	ND	1200
Methyl isobutyl ketone	ND	ND	800	ND	ND	1200
Acetone	ND	ND	1400	ND	ND	1900
1,2-Dichloropropane	ND	ND	ND	ND	ND	5
Tetrachloroethene	ND	ND	ND	ND	ND	4

\* Results in ug/L (ppb).

TABLE 9 SUMMARY OF VOLATILE ORGANIC COMPOUNDS IDENTIFIED AND QUANTIFIED IN SAMPLES  
COLLECTED BY DUNN GEOSCIENCE CORPORATION 13 JUNE 1984

<u>Organic Compound</u>	<u>Units</u>	<u>UFT-1A</u>	<u>DFT-2</u>	<u>DFT-1</u>	<u>DFT-6</u>	<u>DITCH</u>	<u>SEEP</u>	<u>DFT-9</u>
1,2-Dichloroethane	ug/l	3	65	18	ND	ND	10	ND
1,1,2-Trichloroethane	ug/l	3	7	ND	ND	ND	ND	ND
Benzene	ug/l	ND	26	ND	ND	ND	ND	ND
Chlorobenzene	ug/l	ND	3	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ug/l	ND	690	4	81	2	4	3
1,1-Dichloroethane	ug/l	ND	20	18	8	ND	3	2
1,1,2,2-Tetrachloroethane	ug/l	ND	19	ND	ND	ND	ND	2
Chloroform	ug/l	ND	93	ND	ND	ND	3	ND
trans-1,2-Dichloroethene	ug/l	ND	23	ND	ND	ND	ND	ND
1,2-Dichloropropane	ug/l	ND	2	ND	ND	ND	ND	ND
Methylene chloride	ug/l	ND	120	ND	ND	ND	ND	ND
Tetrachloroethene	ug/l	ND	130	ND	ND	ND	3	ND
Toluene	ug/l	ND	120	ND	ND	ND	ND	ND
Trichloroethene	ug/l	ND	85	ND	ND	ND	ND	ND
Total xylene isomers	ug/l	ND	250	ND	ND	ND	ND	ND

ND = Not detected

TABLE 10

Summary of Volatile Organic Compounds Identified and Quantitated\*  
August, 1984

	<u>BR-3</u>	<u>BR-4</u>	<u>DFT-1</u>	<u>DFT-6</u>	<u>DFT-9</u>	<u>DFT-10</u>	<u>DFT-11</u>	<u>DITCH</u>	<u>SEEP</u>
Tetrachloroethylene	11	ND	BMDL	BMDL	BMDL	66	BMDL	22	BMDL
Toluene	BMDL	ND	14	36	BMDL	BMDL	ND	ND	ND
Methylene Chloride	ND	BMDL	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	16	47	BMDL	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	BMDL	BMDL	BMDL	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	BMDL	ND	BMDL	ND	ND	ND	ND
Trichloroethylene	ND	ND	BMDL	ND	BMDL	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	31	ND	ND	ND	ND	ND	ND

\*Any result other than ND. Results expressed in ug/L (ppb).

ND = Not Detected

BMDL = Below Method Detection Limit

TABLE 11

Summary of Purgeable Hydrocarbons Identified and  
Quantified\* in Samples Collected by Dunn Geoscience Corporation  
November 16, 1984

<u>Parameter</u>	<u>BR-1</u>	<u>BR-2</u>	<u>BR-3</u>	<u>DFT-1</u>	<u>DFT-9</u>	<u>DITCH</u>	<u>SEEP</u>
Trichlorofluoroethane	ND	ND	BMDL	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	BMDL	BMDL	ND	BMDL
Methylene Chloride	BMDL	ND	ND	ND	ND	BMDL	ND
1,1-Dichloroethane	ND	ND	ND	BMDL	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	11	ND	ND	BMDL
Tetrachloroethylene	ND	BMDL	ND	BMDL	ND	ND	ND
Benzene	ND	ND	ND	BMDL	ND	ND	ND
Chlorobenzene	ND	ND	ND	BMDL	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	BMDL	ND	ND	ND
Toluene	ND	BMDL	ND	ND	ND	ND	ND

\* Any result other than ND. Results expressed in ug/L (ppb).

ND = Not Detected

BMDL = Below Method Detection Limit

NOTE: Wells DFT-6 and DFT-7 were accidentally damaged due to on-site vehicular activity and were unable to be sampled in November. They have since been replaced.

TABLE 12

Mass Spectral Library Search  
Phenol Compounds Tentatively Confirmed  
as being Present in the Seep

<u>SAMPLING PERIOD</u>	<u>COMPOUND IDENTIFIED</u>
April, 1984	3-(1,1-dimethylethyl)-phenol 2-(1,1-dimethylethyl)-6-methyl-phenol 2,6-Bis(1,1-dimethylethyl)-4-methyl-phenol 4-(2,2,3,3-tetramethylbutyl)-phenol 4-(1-methyl-1-phenylethyl)-phenol
August, 1984	4-(2,2,3,3-tetramethylbutyl)-phenol 2-methoxy-4-(1-propenyl)-phenol 4-(1-methyl-1-phenylethyl)-phenol
November, 1984	2-fluoro-phenol 3,5-dichloro-phenol 2,4,6-tribromo-phenol 2-(1,1-dimethylethyl)-4-methyl-phenol 4-(2,2,3,3-tetramethylbutyl)-phenol 4-(1-methyl-1-phenylethyl)-phenol

Purgeable Organics GC  
Seep Data

	7/24/84	8/2/84	8/10/84	8/30/84	9/5/85	10/11/84	10/29/84
Bromodichloromethane	-	-	-	-	-	-	-
Bromoform	-	-	-	-	-	-	-
Bromomethane	-	-	-	-	-	-	-
Carbon tetrachloride	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-
Chloroethane	-	-	-	-	-	-	-
2-Chloroethylvinyl ether	-	-	-	-	-	-	-
Chloroform	2.0	-	-	-	-	-	-
Chloromethane	-	-	-	-	-	-	-
Dibromochloromethane	1.0	-	-	-	-	-	-
1,2-Dichlorobenzene	-	-	-	-	-	-	-
1,3-Dichlorobenzene	-	-	-	-	-	-	-
1,4-Dichlorobenzene	-	-	-	-	-	-	-
Dichlorodifluoromethane	-	-	-	-	-	-	-
1,1-Dichloroethene	1.3	1.6	1.0	-	-	-	-
1,2-Dichloroethane	6.0	8.0	3.1	2	2.0	-	-
1,1-Dichloroethane	-	-	-	-	-	-	-
trans-1,2-Dichloroethene	-	-	-	-	-	-	-
1,2-Dichloropropane	-	-	-	-	-	-	-
cis-1,3-Dichloropropene	-	-	-	-	-	-	-
trans-1,3-Dichloropropene	-	-	-	-	-	-	-
Methylene chloride	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	-	-	-	-	1.0	-	-
Tetrachloroethene	4.0	1.4	1.0	1	-	-	-
1,1,1-Trichloroethane	2.1	1.1	-	-	-	-	-
1,1,2-Trichloroethane	-	-	-	-	-	-	-
Trichloroethene	1.4	1.0	-	-	-	-	-
Trichlorofluoromethane	-	-	-	-	-	-	-
Vinyl chloride	-	-	-	-	-	-	-
Benzene	-	X	-	-	-	-	-
Chlorobenzene	-	X	-	-	-	-	-
1,2-Dichlorobenzene	-	X	3.0	-	-	-	-
1,3-Dichlorobenzene	-	X	-	-	-	-	-
1,4-Dichlorobenzene	-	X	-	-	-	-	-
Ethylbenzene	-	X	1.9	1.5	2.7	-	1.3
Toluene	-	X	1.2	1.2	-	-	-
Ketones: MIBK	X	X	X	1	1.0	X	X
MEK	X	X	X	-	-	X	X
Acetone	X	X	X	-	-	X	X
m-xylene	X	X	X	1.5	2.6	-	-
o-xylene	X	X	X	2.4	3.6	-	3.1
p-xylene	X	X	X	1.0	1.9	-	1.3

- = non detected

All values expressed in ug/L

x = not analyzed for



TABLE 13  
Purgeable Organics GC  
Seep Data (Cont.)

	11/28/84	12/13/84	12/21/84	1/8/85	1/14/85	1/31/85	2/12/85	2/28/85	3/14/85
Bromodichloromethane	-	X	-	X	X	X	X	X	-
Bromoform	-	X	-	X	X	X	X	X	-
Bromomethane	-	X	-	X	X	X	X	X	-
Carbon tetrachloride	-	X	-	X	X	X	X	X	-
Chlorobenzene	-	X	-	X	X	X	X	X	-
Chloroethane	-	X	-	X	X	X	X	X	-
2-Chloroethylvinyl ether	-	X	-	X	X	X	X	X	-
Chloroform	-	X	-	X	X	X	X	X	-
Chloromethane	-	X	-	X	X	X	X	X	-
Dibromochloromethane	-	X	-	X	X	X	X	X	-
1,2-Dichlorobenzene	-	X	-	X	X	X	X	X	-
1,3-Dichlorobenzene	-	X	-	X	X	X	X	X	-
1,4-Dichlorobenzene	-	X	-	X	X	X	X	X	-
Dichlorodifluoromethane	-	X	-	X	X	X	X	X	-
1,1-Dichloroethene	-	X	-	X	X	X	X	X	-
1,2-Dichloroethane	-	X	-	X	X	X	X	X	1.0
1,1-Dichloroethane	-	X	-	X	X	X	X	1.1	-
trans-1,2-Dichloroethene	-	X	-	X	X	X	X	X	-
1,2-Dichloropropane									
cis-1,3-Dichloropropene	-	X	-	X	X	X	X	X	-
trans-1,3-Dichloropropene	-	X	-	X	X	X	X	X	-
Methylene chloride	-	X	-	X	X	X	X	X	1.0
1,1,2,2-Tetrachloroethane	-	X	-	X	X	1.3	X	X	-
Tetrachloroethene	-	X	-	X	X	X	X	1.7	2.8
1,1,1-Trichloroethane	-	X	-	X	X	X	X	X	-
1,1,2-Trichloroethane	-	X	-	X	X	X	X	X	-
Trichloroethene	-	X	-	X	X	X	X	X	1.2
Trichlorofluoromethane	-	X	-	X	X	X	X	X	-
Vinyl chloride	-	X	-	X	X	X	X	X	-
Benzene	1.4	1.7	1.6	6.8	3.8	2.9	1.4	3.3	-
Chlorobenzene	-	-	-	-	-	X	X	X	-
1,2-Dichlorobenzene	-	-	-	-	-	X	X	X	-
1,3-Dichlorobenzene	-	-	-	-	-	X	X	X	-
1,4-Dichlorobenzene	-	-	-	-	-	X	X	X	-
Ethylbenzene	1.9	2.1	2	12.3	9.2	8.8	2.2	4.2	8.4
Toluene	1.6	2.6	2	9.5	5.4	4.9	1.9	4.6	11
Ketones: MIBK	X	X	X	X	X	X	X	X	-
MEK	X	X	X	X	X	X	X	X	-
Acetone	X	X	X	X	X	X	X	X	-
m-xylene	-	-	-	5.3	3.6	3.0	X	3.6	7.8
o-xylene	-	-	-	16.3	11.0	11	2.1	8.6	11
p-xylene	1.0	.2	1.2	9.8	7.0	7.0	1.5	5.7	9.0

- = non detected

All values expressed in ug/L

x = not analyzed for

TABLE 14

Summary of Purgeable Hydrocarbons  
Identified and Quantified in the Seep  
by GC/MS EPA Method 624

<u>Parameter</u>	<u>April</u>	<u>June</u>	<u>August</u>	<u>November</u>
1,2-Dichloroethane	77	10	BMDL	ND
1,1,1-Trichloroethane	18	4	ND	ND
1,1-Dichloroethane	7	3	ND	ND
1,1,2-Trichloroethane	3	ND	ND	ND
1,1,2,2-Tetrachloroethane	6	ND	ND	ND
Chloroform	27	3	ND	ND
trans-1,2-Dichloroethylene	3	ND	ND	ND
1,2-Dichloropropane	5	ND	ND	ND
Methylene chloride	70	ND	ND	ND
Tetrachloroethylene	4	3	ND	BMDL
Trichloroethylene	6	ND	BMDL	ND
Acetone	1900	ND	ND	ND
Methyl ethyl ketone	1200	ND	ND	ND
Methyl isobutyl ketone	1200	ND	ND	ND

Results in ug/L (ppb).

TABLE 15  
Mass Spectra Library Search  
Compounds Tentatively Identified in the Seep,  
Before and After Treatment  
April 11, 1985

<u>Seep Before Treatment</u>	<u>Seep After Treatment</u>
4-methyl-2-pentanone	ND
N,N-dimethyl-formamide	*
acetate-2-propyn-1-ol	*
3-[1-(ethylsulfonyl)ethyl]-4-methyl-2,5-pyrrolidinedione	ND
1-phenyl-ethanone	*
alpha.,alpha.-dimethyl-benzenemethanol	*
3,6-dimethyl-3-octanol	*
3-(1,1-dimethylethyl)-phenol	ND
2-(1,1-dimethylethyl)-6-methyl-phenol	*
1-(2-hydroxy-5-methoxy-4-methylphenyl)-ethanone	ND
2,6-bis(1,1-dimethylethyl)-4-methyl-phenol	*
3-amino-5-nitro-methylester-benzoic acid	*
4-(2,2,3,3-tetramethylbutyl)-phenol	ND
4-(1-methyl-1-phenylethyl)-phenol	*
methylester-(triphenylphosphoranylidene)-acetic acid	*
	tetrahydro-3-methyl-2H-pyran
	1-methyl-2-pyrrolidinone
	2,2,4-trimethyl-1,3-pentanediol
	4, -(1,1-dimethylethyl)-phenol
	4-hydroxyphenylester-thiocyanic acid
	3-(3-hydroxy-1-butenyl)-2,4,4-trimethyl-2-cyclohexen-1-one
	4-(1,1,3,3-tetramethylbutyl)-phenol
	2(cyanohydroxymethyl)-ethylester-benzoic acid
	2,2-dimethoxy-1,2-diphenyl-ethanone
	3,5-bis(1,1-dimethylethyl)-4-hydroxy-benzoic acid
	2,5,8,11-tetraoxadodecane

\* = Compounds Tentatively Identified in Seep Before and After Treatment

TABLE 16

## PRECIPITATION DATA

	1980	1981	1982	1983	1984
January	.58	0.31	4.05	3.57	1.54
February	.89	5.39	2.26	2.79	5.70
March	4.90	0.18	2.87	5.97	8.27
April	3.53	2.76	4.81	8.50	3.90
May	0.63	5.18	1.57	2.65	11.23
June	4.02	4.09	7.89	3.01	1.16
July	2.01	5.16	2.10	1.29	6.78
August	3.40	1.43	1.60	3.65	3.16
September	1.34	3.77	2.11	2.15	2.39
October	2.45	3.16	0.87	1.99	2.01
November	3.14	2.11	3.65	6.15	0.84
December	0.66	2.41	1.33	7.30	0.98
Total	27.55	36.00	35.11	49.02	47.96

Hudson Correctional Facility

TABLE 17  
PRECIPITATION DATA

December 1984

3rd	0.58"
4th	0.01"
6th	0.08"
10th	0.1"
15th	0.01"
19th	0.16"
21st	0.03"
29th	0.01"

TOTAL 0.98"

January 1985

1st	0.16"
2nd	0.01"
5th	Trace
8th	0.01"
15th	0.02"
17th	0.07"
20th	1.0"

1.27"

February

1st	0.09"
2nd	0.12"
3rd	0.08"
6th	0.27"
7th	0.02"
12th	0.12"
13th	0.32"

TOTAL 1.02"

March 1985 - 21st

4th	0.25"
5th	0.49"
12th	0.57"

1.31"

TABLE 18  
Proposed Sampling and Analytical Schedule  
1985

	February	April	May	August	November
<u>UFT-1A</u>					
Purgeables: GC		*	*	*	*
GC/MS	†				
Hydrocarbon Scan, GC/MS	†	*	*	*	*
Aroclors		*	*	*	*
Phenols		*	*	*	*
<u>DFT-1</u>					
Purgeables: GC		*	*	*	*
GC/MS	†				
Hydrocarbon Scan, GC/MS	†	*	*	*	*
Aroclors	†	*	*	*	*
Phenols	†	*	*	*	*
<u>DFT-2</u>					
Purgeables: GC		*	*	*	*
GC/MS		*	*	*	*
Hydrocarbon Scans: GC/MS	DRY	*	*	*	*
GC/FID		*	*	*	*
Aroclors		*	*	*	*
Phenols		*	*	*	*
<u>Seep</u>					
Purgeables: GC	†	*	*	*	*
GC/MS	†	*	*	*	*
Hydrocarbon Scans: GC/MS	†	*	*	*	*
Aroclors	†	*	*	*	*
Phenols	†	*	*	*	*
<u>BR-1,-2,-3,-4</u>					
Purgeables: GC	†	*	*	*	*
Hydrocarbon Scan: GC/FID	†	*	*	*	*
<u>DFT-6,-7,-9,-10</u>					
Purgeables: GC	†	*	*	*	*
Hydrocarbon Scan: GC/FID	†	*	*	*	*
<u>DFT-5**/Ditch</u>					
Purgeables: GC	†		*		
Hydrocarbon Scan: GC/FID			*		

† Samples were collected February 28, 1985 in continuation of 1984 monitoring program.

\* Proposed protocol parameters

\*\* Not sampled during February