Phase II - Site Characterization
Remedial Investigation/Feasibility Study
Woodlawn Landfill
Cecil County, Maryland

Prepared By:
IT Corporation
Monroeville, Pennsylvania

RESPONSIVE TO THE NEEDS OF ENVIRONMENTAL MANAGEMENT
November 30, 1989

Dr. Mark R. Noll
Enforcement Project Manager
U.S. Environmental Protection Agency
Region III
841 Chestnut Building
Philadelphia, PA 19107

Re: Submittal: Updated pages for Phase I Reports, Phase II and IV Work Plans, RI/FS Reports Plan, QAPP and Health and Safety Plan; Woodlawn Landfill RI/FS, Cecil County, Maryland.

Dear Dr. Noll:

Enclosed are three (3) copies of each of the updated pages for the subject documents which are being submitted in accordance with the project Consent Order (U.S. EPA Docket No. III-89-05-DC, December 28, 1988). These documents are referenced as follows:

1. Report (Revision 01)
   Phase I - Preliminary Investigations
   Exclusive of Soil-Gas Survey Report and Resulting Recommendations
   Dated September 5, 1989; Revised November 30, 1989 (Revision 01)

2. Addendum Report (Revision 01)
   Soil-Gas Survey
   Phase I - Preliminary Investigations
   Dated October 10, 1989; Revised November 30, 1989 (Revision 01)

3. Detailed Work Plan (Revision 02)
   Phase II - Site Characterization
   Dated September 5, 1989; Revised October 10, 1989 (Revision 01), November 30, 1989 (Revision 02)

4. Detailed Work Plan (Revision 02)
   Phase IV - Additional Field Work
   Dated September 5, 1989; Revised October 10, 1989 (Revision 01), November 30, 1989 (Revision 02)

5. Plan (Revision 01)
   RI/FS Reports
   Dated September 5, 1989; Revised November 30, 1989 (Revision 01)
(6) Quality Assurance Project Plan (Revision 05)
Including Phases I, II, and IV
Submitted December 5, 1988; Revised: February 6, 1989
(Revision 01), April 20, 1989 (Revision 02), June 13, 1989
(Revision 03), September 5, 1989 (Revision 04), and November 30, 1989
(Revision 05);

(7) Health and Safety Plan (Revision 05)
Including Phases I, II, and IV
Submitted December 5, 1988; Revised: January 30, 1989
(Revision 01), April 20, 1989 (Revision 02), June 13, 1989
(Revision 03), September 5, 1989 (Revision 04), and November 30, 1989
(Revision 05).

Please advise us if you have any questions or comments.

Sincerely yours,

George B. Markert
Senior Environmental Consultant
Corporate Environmental Affairs

cc: Ms. Laura Boornazian, U.S. EPA - III (no enclosures)
Mr. David Healy, MDE (one copy of each enclosure)
Mr. Barry Belford, Cecil County (one copy of each enclosure)
Mr. Mark Grummer, Kirkland & Ellis (one copy of each enclosure)
Dr. Alan M. Jacobs, IT Corporation (no enclosures)
DETAILED WORK PLAN
PHASE II - SITE CHARACTERIZATION
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WOODLAWN LANDFILL
CECIL COUNTY, MARYLAND

PREPARED BY:
IT CORPORATION
MONROEVILLE, PENNSYLVANIA

SEPTEMBER 5, 1989
REVISED OCTOBER 10, 1989 (REVISION 01)
REVISED NOVEMBER 30, 1989 (REVISION 02)
PROJECT NO. 303486

Prepared by:

[Signatures and dates]

IT Project Manager
IT Project Director
IT Quality Assurance Officer
Client Representative
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### APPENDIX A - RESUMES
1.0 INTRODUCTION

In accordance with the Consent Order entered into on December 28, 1988 among Bridgestone/Firestone, Inc. (formerly The Firestone Tire & Rubber Company [Firestone]), Cecil County, Maryland, and the U.S. Environmental Protection Agency (U.S. EPA), IT Corporation (IT) is submitting a Detailed Work Plan for Phase II of the Remedial Investigation and Feasibility Study (RI/FS) for the Woodlawn Landfill, Cecil County, Maryland. The Work Plan is intended to satisfy data and reporting requirements consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and with relevant agency guidances.

The RI/FS, as outlined in the Scope of Work (IT Corporation, September 30, 1988, Revision 01 - November 2, 1988), is a phased study. The data collection phases are numbered as follows:

- Phase I - Preliminary Investigations
- Phase II - Site Characterization
- Phase III - Ground Water Evaluation
- Phase IV - Additional Field Work

After the data collection phases are completed, the RI/FS reports will be prepared.

This amended Work Plan is a detailed plan for Phase II - Site Characterization. It is based in part on the U.S. Environmental Protection Agency (U.S. EPA) document entitled "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA," Interim Final...
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The plan is also based on data requirements issued jointly by the U.S. EPA and the State of Maryland, entitled "Proposed Data Needs for a Remedial Investigation/Feasibility Study for the Woodlawn Landfill, Cecil County, Maryland." This plan is also based on the results of Phase I - Preliminary Investigations, as presented in the Report on Phase I (September 5, 1989) and the Addendum Report - Soil-Gas Survey (October 10, 1989).

The objective of the Phase II work is to:

Further characterize the hydrogeology, ground water chemistry, ground water flow, and solute migration at the Woodlawn Landfill Site and environs.

This objective will be met by:

Installing and testing monitoring wells and piezometers.

These wells and the borings that are advanced to install these wells will facilitate measurement, testing, and evaluation of the:

- Hydrostratigraphy
- Water levels
- Water well samples
- Downhole geophysical properties
- Hydrologic properties of the site soils and bedrock

The activities required to achieve the Phase II objectives include:

- Obtaining access to proposed monitoring well locations
- Installation and completion of new monitoring wells
• Surveying the locations of the new monitoring wells
• Measuring ground water levels and contouring the potentiometric surface
• Ground water sampling and analysis
• Conducting borehole geophysical measurements
• Performing rising head permeability tests
• Performing pumping tests
• Installing bedrock piezometers
• Completing a Phase II Report

1.1 PROJECT ORGANIZATION
Key individuals and support staff at IT have been organized into a project team for this work (Figure 1). Communication and direction are channeled through the IT project manager. The project manager is the link between IT and other parties. Although communication between outside agencies and IT flows through the Client, the project manager will be able to communicate directly with certain agency key individuals with proper notification to the Client. Resumes of key staff are included (Appendix A).

The project manager will be responsible for budget and schedule and for the proper direction of technical, health and safety (H&S), and quality oversight for the project.

IT will make every effort to maintain the same project team for the duration of the project. However, if it becomes necessary to replace key staff or alter their roles in this project after submittal of the Phase II Detailed Work Plan, the IT project manager will notify the Client, the U.S. EPA, and the state of Maryland of any changes by transmitting a memo and attaching pertinent resumes of new staff.
Subcontractor(s) for Phase II work has/have not been chosen as yet. Notification of the successful subcontractor(s), together with a statement of qualifications will be submitted for approval as per the Consent Order.

1.2 SCHEDULE
A bar chart diagram for the Detailed Work Plan for Phase II has been prepared (Figure 2). This diagram depicts the tasks in this phase and the sequential relationships among them. Phase II will be completed within six months after authorization to proceed is received from the U.S. EPA.

1.3 SITE BACKGROUND
The Woodlawn Landfill (Figure 3) occupies approximately 38 acres near Woodlawn, Maryland in northwestern Cecil County. Cecil County, Maryland is located in the northeastern corner of the state bounded by Pennsylvania on the north; Delaware on the east; Kent County, Maryland along the Sassafras River on the south; and the Chesapeake Bay and the Susquehanna River on the west. Cecil County is a rural area influenced by the metropolitan areas of northern Delaware. The landfill is owned and was operated by Cecil County.

The Woodlawn Landfill was originally a sand and gravel pit. It received wastes containing hazardous constituents from numerous parties during the period from the 1960s to the early 1980s. These wastes were placed wherever active landfilling operations were taking place at the time as well as elsewhere on the landfill. From 1979 to late 1980, polyvinyl chloride (PVC) sludge was placed in each of three cells (A, B, and C). Cell A was formed by the excavation for fill used to cover wastes at the active face of the landfill. Cell C overlies Cell B and comprises waste that was placed over the area of Cell B. This sludge was also placed in other sections of the landfill.
Geologically, the site is located on unconsolidated Cretaceous and Tertiary sedimentary deposits that overlie the metamorphic bedrock. Between the top of the rock and the base of the unconsolidated sediments, there is a thick layer of highly weathered residual soil (saprolite) that was derived from the bedrock.

1.4 GENERAL OUTLINE
Phase II work (Site Characterization) is covered in the sections of Chapter 2.0 and includes the following tasks: Data Management, Access Permission for Proposed Monitoring Well Locations, Monitoring Well Installation, Land Survey of Locations of Monitoring Wells, Construction of Ground Water Contour Maps, Ground Water Sampling and Analysis, Borehole Geophysics, Rising Head Permeability Tests, Pumping Test, Bedrock Piezometer Installation and Report Preparation.

Each section of this Detailed Work Plan, which details the various tasks, was written using the following general principle: Establish the objective of the task, state the method(s) that will be utilized to achieve the objectives, detail the method(s), and explain the reasons for the chosen method(s).

Appendix B summarizes current site data, data needs, data goals, and possible uses of data.

1.5 HEALTH AND SAFETY PLAN
The H&S Plan prescribes, in general, work place procedures which will be followed to safely perform the following Phase II tasks of the RI/FS at the Woodlawn Landfill:

- Monitoring well and piezometer installation
- Taking water-level measurements
- Borehole geophysical survey
• Performing permeability tests (rising head and pumping tests)

The H&S plan is designed to comply with the federal Occupational Safety and Health Administration (OSHA) regulations for General Industry (29 Code of Federal Regulations [CFR] 1910), the Construction Industry (29CFR1926), and, in particular, the Hazardous Waste Operations and Emergency Response regulations (29CFR1910.120).

The complete H&S plan has been submitted as a separate document (Revision 04, September 5, 1989).

1.6 QUALITY ASSURANCE PROJECT PLAN
The Quality Assurance Project Plan (QAPP) has been prepared to document the measures that will be undertaken by IT and outside subcontractors for Phase II investigations so that the work performed will be of proper quality to accomplish project objectives and will be responsive to the requirements of the U.S. EPA and the state of Maryland.

The project will be performed in conformance with the IT Quality Assurance (QA) Program requirements and applicable federal, state, and contract requirements. Project objectives are as follows:

• Scientific data generated will be of sufficient quality to stand up to scientific and legal scrutiny
• Data will be gathered or developed in accordance with procedures appropriate for the intended use of the data
• Data will be of known and acceptable precision, accuracy, representativeness, completeness, and comparability as required by the project

The complete QAPP has been submitted as a separate document (Revision 04, September 5, 1989).
1.7 COMMUNITY RELATIONS PLAN

A community relations plan for the dissemination of information to the public regarding investigation activities and results will be handled by the U.S. EPA Region III. IT will assist technically in community relations activities (such as public meetings and fact sheets) at regular intervals.
2.0 SITE CHARACTERIZATION


Recommendations for locations of monitoring wells had been presented in the September 5, 1989 submittal of this plan and have been modified herein based on the soil-gas survey results. The soil-gas survey results are presented in the Addendum Report for Phase I.

The following sections detail the plan for each of the Phase II tasks.

2.1 DATA MANAGEMENT
The data management process, developed for the project and described in the Detailed Work Plan for Phase I (DWP-I), and further discussed in the Phase I Report, will continue through Phase II work. The objectives and the procedures to achieve these objectives will remain the same.

2.2 ACCESS PERMISSION FOR PROPOSED MONITORING WELL LOCATIONS
As per Phase I, the process for obtaining access to land on or adjacent to the Site for the purpose of conducting Phase II tasks in the field will follow requirements in the Consent Order.

2.3 MONITORING WELL INSTALLATION
The objective of this task is to install monitoring wells in locations and with screened intervals that will adequately characterize the hydrostratigraphy, water levels, ground water quality, and hydrologic properties of the site aquifers in the overburden and bedrock. Furthermore,
these wells should be located in such places that solute plumes, if present, could be tracked. These wells will augment the existing monitoring well network. The proposed monitoring wells will be planned so as to make maximum use of existing wells at the site.

As stated, ground water monitoring wells will be installed to provide additional data on subsurface geology as well as ground water levels, water quality, and aquifer hydrogeologic properties. These wells have been located to intercept possible contaminant plumes. Well locations have been identified using data from the soil-gas and geophysical surveys. The exact locations of two well clusters to the west of the site, and one well cluster to the north of the site, will be determined based on water level determinations from soil piezometers.

A typical monitoring well installation is shown in Figure 4. General procedures during proposed monitoring well installations will be in accordance with U.S. EPA-recommended practices as well as Maryland state regulations.

2.3.1 Methodology
Monitoring wells will be screened in saturated hydrostratigraphic horizons, including the bedrock, the soils, and perched zones (if present). The static water level, the highest level of the saturated zone, appears to lie below landfill waste materials and below the unconsolidated sediments (sand and gravel with some clay lenses) that overlie the saprolite. The drilling will confirm the location of the static water level surface and the location of perched ground water zones, if present. In-hole water levels and the moisture content of soils during drilling will be used to identify the probable location of the top of the saturated zone and perched water (if present).

The following principles have been used to plan the locations of the screened intervals:
• In the overburden soils, ground water flow and solutes floating on or near the top of the saturated zone usually follow the slope of the ground water table (potentiometric surface)

• In the overburden soils, solute plumes near or on the bedrock surface usually follow the slope of the bedrock surface

• Within the bedrock, ground water flow (and solute plumes) usually follows fractures in the bedrock, irrespective of the slope of the potentiometric surface or the slope of the bedrock surface

The wells must contain enough water for sampling. The water level in the wells should reach equilibrium quickly after purging or sampling so that an accurate water level reading can be taken. If it appears from the drilling (in-hole water levels and moisture content of the soils) that these conditions are not met, then the planned screened interval will be adjusted.

The choice of the midpoint of the screened interval or a change in the location of the well greater than 20 feet from the proposed location will be suggested by the IT Task Manager for Geology or his/her on-site designate according to the principles and objectives stated herein. The IT Project Manager will approve the screened interval depth. The Client and Agencies will be apprised of these decisions.

In saturated soil wells it is anticipated that the well-screen intervals will be from the top of bedrock to approximately five feet above the water table. In bedrock wells, it is anticipated that the well-screen intervals will span fractured zones. In perched water zones, it is anticipated that the well-screen intervals will be ten feet long extending from the bottom of the perched water zone toward the surface.

Lateral movement of the location of the well more than 20 feet, aborting the location as a possible monitoring well, or deviating from the
specifications presented herein may be suggested by the Task Manager for Geology or his/her on-site designate. This suggestion would need the approval of the Project Manager, which, if approved, would become the IT recommended course of action. Notification will be made of these decisions to the Client and the Agencies.

2.3.2 Field Procedures

A total of 11 new monitoring wells will be installed to supplement the existing monitoring well network (Figure 3). The purpose of these new wells will be to confirm preliminary data gathered from Phase I investigations, better characterize the physical characteristics of the soil and bedrock aquifers and better define the nature and extent of ground water contamination. After well permits are obtained, drilling operations will commence. When drilling equipment arrives on site, all drilling equipment as well as materials used for well construction will be inspected by on-site IT personnel and observations documented on an IT drillers equipment form shown in Figure 5. In addition, materials used are recorded on the IT well completion diagram completed for each well installation. A typical well completion diagram is shown in Figure 4. Wells will be installed using hollow-stem augers and/or rotary drilling methods and completed according to the "Specifications for Design and Installation of Ground Water Monitoring Wells at Solid Waste Disposal Facilities, May, 1989," that were generated by the State of Maryland, and from appendices to the "Proposed Data Needs" that is referenced in the Introduction (Chapter 1.0).

As discussed in Section 2.3, all wells will be equipped with locking protective casings. Monitoring wells for this project will be secured with like-keyed locks. This procedure saves time during subsequent sampling activities. Keys will be maintained by the appropriate IT personnel in addition to the U.S. EPA Region III Enforcement Project Manager until all sampling activities have been completed.
Waste soil material brought to the surface during the drilling activities will be stored on site in drums near each source borehole until after completion of laboratory analyses. The maximum duration for on-site storage of waste soil material is 90 days (40CFR). Within this time period, one composite soil sample will be taken from each drum and analyzed in the same manner as that described in the soil samples in Phase IV. If contaminant concentrations exceed RCRA limits (40CFR) for soils, the respective drum(s) will be labeled as hazardous waste, manifested according to Maryland state and U.S. Department of Transportation (49CFR) laws and regulations, and transported to an approved RCRA disposal facility for disposal. Prior to transportation off site, the U.S. EPA and the state of Maryland will be notified. If contaminant concentrations are within the RCRA limits, then the waste soils will be retained on site.

Waste ground water generated during the pumping test and rising head slug test activity will be stored on site in (an) aboveground tank(s) until after the completion of laboratory analyses. The maximum duration for on-site storage of waste ground water is 90 days (40CFR). Within this time period, one composite water sample will be taken from each vessel and analyzed in the same manner as the other ground water samples. A risk assessment will be made to determine whether the water can be discharged on site with or without treatment. If treatment is required, the treatment method will be described in the risk assessment. The risk assessment results will be submitted to the U.S. EPA for approval with a copy to the state of Maryland. Discharge on site would be made in the retention basin in the south-central part of the landfill.

Monitoring wells can be grouped into three different types:

- Perched Water Monitoring Wells
- Saturated Soil Monitoring Wells
- Bedrock Monitoring Wells
The following sections provide details regarding the installation and construction specifications for each type of monitoring well.

2.3.2.1 Perched Water Monitoring Wells
Two perched water monitoring wells will be installed to study the quantity and quality of ground water present in the two areas of perched water identified on site. These wells will be located up gradient of the observed seepage areas where perched water is discharging to the surface.

Borings for perched water monitoring wells will be advanced using 6-1/4-inch-inside-diameter (I.D.) hollow-stem augers. Continuous split samples will be collected according to the American Standard Testing Method (ASTM) 1586. If drilling is conducted during wet weather, the perched zone will be identified by the presence of water and/or soil moisture at levels above the expected water table depth. If drilling occurs during dry weather, the soil stratum of the perched water may not be detectable on the basis of soil moisture. If the perched soil horizon is dry, then the well will be advanced to a depth correlating with the elevation of the surface seepage areas. A maximum depth of 20 feet is planned for perched monitoring well installations because of the locations chosen with respect to the elevation of the seepage areas.

Drilling and installation of perched water monitoring wells will be supervised by the IT project geologist on site. All information obtained during drilling operations will be recorded on the IT soil boring log forms as specified in Section 6.3.3.1 of the QAPP and shown in Figure 6-4. Soils will be visually classified according to the Unified Soil Classification System (USCS). The locations of the proposed perched water monitoring wells are shown on Figure 3.
After perched monitoring well borings have been drilled to the appropriate depth, the monitoring well will be installed. Prior to installation, well screens and risers will be steam cleaned. All monitoring wells will be constructed of 4-inch-I.D. Schedule 40 polyvinyl chloride (PVC) flush-threaded (nonglued) riser pipes and machine-slotted well screens. A 10-foot-long section of screen with a bottom cap and a sufficient length of riser pipe will be lowered into the monitoring well boring inside the hollow-stem augers. The screened section, with a tight fitting, threaded bottom cap will be lowered into the monitoring well boring inside the hollow-stem augers. The top of the riser pipe will be fitted with a slip-on cap. As the augers are withdrawn from the hole, the annular space around the screen will be backfilled with a pea gravel or course sand filter pack to a height of three feet above the well screen. Depths of well construction materials will be measured during installation. Depth of well materials will be measured using a weighted measuring tape lowered into the annular space around the casing. Filter pack material will be placed slowly into the well from the surface and measurements taken frequently to reduce the possibility of "bridging" of the filter pack or bentonite seal. A two-foot layer of fine sand will be placed above the screen filter pack followed by a two-foot bentonite seal using bentonite pellets. After installation of the bentonite, approximately five gallons of distilled water will be poured into the hole to initiate the expansion of the bentonite. This procedure is necessary for these shallow installations because the bentonite will not be in contact with sufficient ground water to saturate the bentonite. After allowing two hours for the bentonite seal to become saturated, the remainder of the annular space will be tremie grouted to the surface with an approved cement grout mixture. Cement/bentonite grout mixtures will be mixed using 95 percent cement and 5 percent bentonite by weight.
Each monitoring well installation will be equipped with a six-inch-diameter protective steel casing with a hinged locking cap. An 18-by-18-by-6-inch-thick concrete pad will be constructed around each well installation after completion. This pad will be sloped away from the monitoring well to keep surface water away from the well installation.

Guard posts will be installed around well locations which, in the judgment of the IT project geologist, require additional protection from vehicular traffic. When guard posts are required, four guard pipes will be installed at each designated well location. These pipes will be a minimum of five feet in length and be constructed of four-inch carbon steel. Pipes shall be buried at least three feet below the surface and concreted in place. Guard pipes shall be located a maximum distance of five feet from the well with a maximum distance of five feet between guard pipes. After installation, guard pipes will be painted with high-visibility paint.

2.3.2.2 Saturated Soil Monitoring Wells

A total of four saturated soil monitoring wells will be installed to supplement the existing monitoring well network (Figure 3). These wells have been located where additional information is needed to satisfy the objectives of the Phase II Site Characterization study. Proposed saturated soil monitoring wells have been located in areas expected to be down gradient from expected source areas of waste, where applicable.

The location of the monitoring wells north of B-1 (Well Nos. ITB-1 and ITS-1) and west of B-4 (Well Nos. ITB-3 and ITS-3) will depend on the results of piezometer measurements from three new piezometers at each location as per Figure 3. These piezometers at each location are at corners of a triangle which will determine the plane of the potentiometric surface in the saturated soil. The dip directions of these planes will approximate the ground water flow directions and will determine the placement of the saturated soil wells downgradient from...
areas of soil-gas anomalies. Companion bedrock wells (ITB-1 and ITB-3) will be placed adjacent to the saturated soil wells (Figure 3).

Piezometer installation will follow the procedures detailed in Section 2.10.1. Approximately two days after installation, water level readings will be used to site the monitoring wells at each location.

Borings for saturated soil monitoring wells will be advanced using 6-1/4-inch-I.D. hollow-stem augers. Split-spoon samples will be collected at 5-foot intervals using an 1-3/8-inch-I.D. split-spoon sampler following the procedures in ASTM Method 1586. This drilling and sampling method will continue until bedrock refusal is encountered.

Bedrock refusal is defined as a penetration of less than six inches with the split-spoon sampler after 50 blows with the sample hammer. This depth will be compared with the expected depth to the bedrock surface from the seismic refraction survey performed in Phase I. If depth to refusal is less than the anticipated depth from the seismic results, then the soil sampler may have encountered a boulder or other obstruction above the bedrock surface. In that case additional drilling using a rotary rock bit may be required to advance the boring to the expected depth of the bedrock surface. If the obstruction cannot be drilled out by reasonable efforts (as determined by the project geologist) then the boring may need to be abandoned and a new location will be chosen.

As discussed in Section 2.3.2.1, drilling activities will be supervised and all appropriate information recorded by the on-site IT geologist and recorded on the soil boring log forms.

After saturated soil monitoring well borings have been drilled to the appropriate depth, the monitoring well will be installed. Prior to installation, well screens and risers will be steam cleaned. All monitoring wells will be constructed of 4-inch-I.D. Schedule 40.
polyvinyl chloride (PVC) flush-threaded (nonglued) riser pipes and machine-slotted well screens. A section of well screen with a bottom cap and a sufficient length of riser pipe will be lowered into the monitoring well boring inside the hollow-stem augers. Screen length will extend from the bottom of the saturated soil aquifer to five feet above the aquifer. The screened section, with a tight fitting, threaded bottom cap will be lowered into the monitoring well boring inside the hollow-stem augers. The top of the riser pipe will be fitted with a slip-on cap. As the augers are withdrawn from the hole, the annular space around the screen will be backfilled with a pea gravel or course sand filter pack to a height of three feet above the well screen.

 Depths of well construction materials will be measured during installation. Depth of well materials will be measured using a weighted measuring tape lowered into the annular space around the casing. Filter pack material will be placed slowly into the well from the surface and measurements taken frequently to reduce the possibility of "bridging" of the filter pack or bentonite seal. A two-foot layer of fine sand will be placed above the screen filter pack followed by a two-foot bentonite seal using bentonite pellets. After installation of the bentonite, approximately five gallons of distilled water will be poured into the hole to initiate the expansion of the bentonite. This procedure is necessary for these shallow installations because the bentonite will not be in contact with sufficient ground water to saturate the bentonite. After allowing two hours for the bentonite seal to become saturated, the remainder of the annular space will be tremie grouted to the surface with an approved cement grout mixture. Cement/bentonite grout mixtures will be mixed using 95 percent cement and 5 percent bentonite by weight.

Each monitoring well installation will be equipped with a six-inch-diameter protective steel casing with a hinged locking cap. An 18-by-18-by-6-inch-thick concrete pad will be constructed around each well installation after completion. This pad will be sloped away from the monitoring well to keep surface water away from the well installation.
2.3.2.3 Bedrock Monitoring Wells

Bedrock aquifer monitoring wells will be installed at five locations (Figure 3) to obtain information regarding ground water flow rates and directions as well as the quality of the bedrock aquifer ground water. Well locations were selected to provide data on the overall characteristics of the bedrock aquifer at the site. The depths of bedrock monitoring wells will be controlled by the quantity of ground water entering the monitoring well. Compared to well yields of bedrock wells in the local area (Appendix D from DWP-I), a cumulative flow rate of one gallon per minute into the monitoring well has been established as a minimum monitoring well yield. Bedrock monitoring wells will be drilled to a depth so as to produce a minimum of one-half gallon per minute flow into the well. This is a sufficient flow rate for sampling purposes. This flow rate shall be determined by timed measurements of the water level in the well during drilling activities.

As shown on Figure 3, all bedrock monitoring wells will be located in close proximity to a saturated soil monitoring well. As a result, no soil samples will be collected from bedrock monitoring well locations. Bedrock monitoring wells will be installed using an air rotary drilling method. This method has been selected because a surface casing must be installed to seal off the saturated soil aquifer from the bedrock aquifer.

Bedrock monitoring well borings will be advanced five feet into bedrock using a rotary air drill equipped with a ten-inch diameter roller bit. Information on bedrock-surface depths will be obtained from the saturated soil monitoring well associated with that location. After the boring has been drilled to this depth, an eight-inch-I.D. steel surface casing will be installed in the boring. If required, the casing will be driven to the established, drilled depth. After the casing has been placed in the boring, the casing will be pressure grouted in place using cement grout to seal off the saturated soil aquifer. The boring will be
allowed to set for 24 hours after completion of grouting activities to allow the grout to cure before resuming drilling operations.

The well will be completed in the bedrock aquifer using air rotary drilling methods, drilling a 7-1/2-inch-diameter hole. Periodic water level measurements will be taken using an electronic water level meter to determine when sufficient water is flowing into the well to stop drilling. Based on ASTM recommendations, for silt and sand-type soils, wells should be installed with 0.02-inch-slotted screens and a filter pack between No. 30 and No. 8 standard United States sieve sizes. Bedrock wells will be drilled into the bedrock aquifer a minimum of 30 feet. This will permit the installation of the bentonite seal at least 15 feet below the top of the bedrock surface. Bedrock wells will be drilled into the bedrock aquifer a minimum of 30 feet.

After the required depth of the bedrock monitoring well has been determined, a ten-foot-long section of well screen with a bottom cap and a sufficient length of riser pipe will be lowered into the monitoring well boring inside the hollow-stem augers. The well will then be completed using similar procedures as described for completing other on-site monitoring wells.

In the case of the bedrock well near the existing F-3 saturated soil monitoring well, the bedrock will be cored prior to reaming out the hole to the appropriate diameter and installing the monitoring well. This well was chosen for coring because it is near the center of the site and will provide a representative section of the metamorphic bedrock. Rock coring will be accomplished using a soil boring drill rig equipped with an NX double walled core barrel with a diamond bit. Core runs will be ten feet in length and all core removed from the boring will be placed in core boxes for inspection by the IT geologist. After completion of coring operations, the boring will be reamed out to a diameter of 7-1/2 inches and the monitoring well installed as previously described.
A visual description of the bedrock materials encountered will be made by the IT geologist based on visual observations of the cuttings from air rotary drilling methods and/or rock core samples. Information obtained during drilling operations including depths to fracture zones that may be encountered will be recorded on a Visual Classification of Rock Boring Log as specified in Section 6.3.3.1 of the QAPP and shown in Figure 6-5 of the QAPP.

2.3.2.4 Well Development

New monitoring well installations will be developed after completion for approximately eight hours or until the water produced has a measured turbidity of 10 Nephelometric turbidity units (NTUs) or less, whichever occurs first, to insure that a satisfactory hydraulic connection exists between the well and the aquifer being monitored. Well development will consist of alternating mechanical and/or air surging techniques with pumping to remove any fine material remaining in the well or filter pack. Perched water and saturated soil monitoring wells will be developed using surge blocks and pumping. Surge blocks will be used to help flush fine materials from the surrounding filter pack. After the well has been purged, the water in the well will be pumped out with the submersible pump. Water will be pumped from wells during development using a four-inch submersible stainless steel pump. This pump shall have a minimum 5 gpm capacity for the well depth being pumped and operate on 120 volts of AC power. Bedrock wells will be developed using only a submersible pump. Since filter pack material will be washed and contain a minimal amount of fines, pumping should be sufficient for purposes of well development. Following development each well will be pump tested to determine hydraulic parameters of the aquifer and the approximate yield of the well. The yield of each monitoring well will be recorded on the borehole log (Well Completion Report) to be submitted by the drilling subcontractor to the State of Maryland.
The following potential problems can be associated with the following well development techniques for the deep bedrock wells:

1) Mechanical surging (surge block) - Can force fine-grained material including mica and clay back into the fractures in the bedrock.

2) Air surging (air lifting) - Can cause the aquifer to become air locked. In the bedrock wells, vertical joints should prevent air locking.

Using a combination of these methods, problems associated with either method will be avoided.

Waste ground water generated during the equipment decontamination, ground water sampling, well development, pumping tests, or rising head permeability test activity will be stored on site in (an) aboveground tank(s) until after the completion of the laboratory analyses. The maximum duration for on-site storage of waste ground water is 90 days (40CFR). Within this time period one composite water sample will be taken from each vessel and analyzed in the same manner as the other ground water samples. A risk assessment will be made to determine whether the water can be discharged on site with or without treatment. If treatment is required, the treatment method will be described in the risk assessment. The risk assessment results will be submitted to the U.S. EPA for approval with a copy to the state of Maryland. Discharge on site would be made in the retention basin in the south-central part of the landfill.

The type of pump to be used for this task is a stainless steel submersible pump.

2.3.2.5 Soil Sample Collection
As previously described, soil samples will be collected at various intervals during the drilling of monitoring well installations.
collection, split-spoon soil samples will be screened for volatile organic compound (VOC) content using a VOC photoionization detector (PID). A 10.5 eV lamp will be used on the PID instrument used for screening soil samples. This lamp is capable of detecting the volatile organic compounds identified in Table 2.1 of the Woodlawn Landfill QAPP. After soil samples have been visually inspected, they will be removed from the split-spoon sampler and placed in 500 ml glass jars and covered with an aluminum foil cover. On the same day of drilling samples will then be permitted to sit in an area kept at room temperature (68 degrees Fahrenheit) for a minimum of 30 minutes to allow any volatile organic vapors to volatilize into the glass sample jar. After the 30-minute waiting period, the tip of the PID probe will then be inserted into the glass jar by puncturing the aluminum foil cover. The VOC reading is given by the instrument in parts per million and will be noted on the borehole log. Waste soil material brought to the surface during the drilling activities will be stored on site in drums near each source borehole until after completion of the laboratory analyses. The maximum duration for on-site storage of waste soil material is 90 days (40CFR). Within this time period, one composite soil sample will be taken from each drum and analyzed in the same manner as that described in the soil samples in Phase IV. If contaminant concentrations exceed RCRA limits (40CFR) for soils, the respective drum(s) will be labeled as hazardous waste, manifested according to Maryland state and U.S. Department of Transportation (49CFR) laws and regulations, and transported to an approved RCRA disposal facility for disposal. Prior to transportation off site, the U.S. EPA and the state of Maryland will be notified. If contaminant concentrations are within the RCRA limits, then the waste soils will be retained on site.

The decontamination procedure for soil sampling will be according to the procedure identified in Section 6.3.6 of the Woodlawn Landfill QAPP. This procedure is as follows:
clean polyethylene sheeting until they are required for collecting additional samples. Bailers will be decontaminated after each use at a well location. After decontamination, bailers will be wrapped in polyethylene until they are used at the next sampling location.

2.4 LAND SURVEY OF LOCATIONS OF MONITORING WELLS
The objective of surveying the locations of monitoring wells and piezometers is to accurately locate the wells so that stratigraphic cross sections and contour maps can be accurately drawn. The well heads will be located with respect to Site coordinates and elevations.

To achieve this objective, an approved professional land surveyor will be chosen. The surveying will be supervised by the IT Site Manager. Monitoring well and piezometer coordinates will be based on the Maryland State Plane Coordinate System. Monitoring well elevations will be based on the 1927 North American Datum and will be recorded at the ground surface, top of the inside casing, and top of the outside of the casing (well elevations will be as feet above mean sea level and will be accurate to 0.01 foot). The survey will include the marking of each well's inside casing with a v-shaped notch to indicate the reference datum for all water level measurements.

2.5 CONSTRUCTION OF GROUND WATER CONTOUR MAPS
The objectives of constructing ground water contour maps are to determine Site area ground water flow directions and gradients in the saturated soil aquifer and in the bedrock aquifer.

To meet these objectives, ground water level (potentiometric surface) measurements will be obtained from the bedrock aquifer wells and from the saturated soil aquifer wells. The instrument to be used will be an electronic measuring device.
2.3.2.6 Equipment Decontamination

To prevent the possibility of cross contamination between monitoring well locations, drilling equipment will be decontaminated after the completion of each monitoring well location. This approved decontamination procedure will consist of steam cleaning all augers, drill bits, drill rods and other drilling equipment with a high pressure steam cleaner at the designated site decontamination area. Any water generated during decontamination activities will be stored on site, analyzed and disposed of at an appropriate facility.

In addition, equipment used for collection of soil samples (split-spoon samplers, hand trowels, sample pans, etc.) will be decontaminated between collection of each split-spoon sample. The decontamination procedure for soil sampling will be according to the procedure identified in Section 6.3.6 of the Woodlawn Landfill QAPP. This procedure is as follows:

- Detergent wash
- Tap water wash
- DI water rinse
- Methanol rinse
- Allow equipment time to air dry
- Final DI water rinse

Sampling equipment should be allowed sufficient time to air dry after decontamination before reuse. During drilling activities, split-spoon samplers will be decontaminated after collection of each soil sample. After spoons have been decontaminated, they will be placed on a piece of clean polyethylene sheeting until they are required for collecting additional samples. Bailers will be decontaminated after each use at a
2.4 LAND SURVEY OF LOCATIONS OF MONITORING WELLS
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2.5 CONSTRUCTION OF GROUND WATER CONTOUR MAPS
The objectives of constructing ground water contour maps are to determine Site area ground water flow directions and gradients in the saturated soil aquifer and in the bedrock aquifer.

To meet these objectives, ground water level (potentiometric surface) measurements will be obtained from the bedrock aquifer wells and from the saturated soil aquifer wells. The instrument to be used will be an electronic measuring device.
Contour maps of the potentiometric surfaces of the two aquifers will be constructed by plotting data points obtained during a single sampling event onto the site base map. The sampling will take place when all new wells proposed have been properly installed. Some sampling of existing wells will also be included. The sampling will be repeated one month later for comparison.

Elevations will be interpolated to produce working ground water contour maps having a contour interval of five feet. The contour interval chosen for specific presentations may vary depending upon data and map scale.

The following sampling scheme will be used to draw these contour maps. Monitoring wells existing on site that are known to be functional will be used to obtain water level readings. In addition, those domestic wells chosen for further study will be used. Water-level measurements of domestic wells will be taken using an acoustic sounder. The sounder will be calibrated using an M-scope on one of the site wells daily during domestic well measurement rounds.

During the period of collection of ground water level data from Bedrock Aquifer and Saturated Soil Aquifer wells, ground water level readings will also be recorded in Perched Aquifer wells. In the report for Phase II work, observed hydraulic relationships between the Perched Water Aquifer and the Saturated Soil Water Aquifer (if any exist) will be stated and discussed.

2.6 GROUND WATER SAMPLING AND ANALYSIS
Existing monitoring wells determined to be functional, new monitoring wells, and selected domestic wells will be sampled to characterize the contaminants in the perched, soil, and bedrock aquifers. The network may be modified during the Phase II investigations by prescribed protocol. The selection of wells to be a part of this network has been
made on the basis of functionality of wells. Samples will be submitted to the laboratory.

The IT Analytical Services (ITAS) Laboratory in Export, Pennsylvania and/or Edison, New Jersey will be used for the analyses. The U.S. EPA has been provided with the credentials of these laboratories. In-house laboratory capabilities will enable the project staff to better control schedules, costs, quality assurance, and data management than by subcontracting to an outside laboratory.

Monitoring wells will be sampled using a stainless steel and teflon bladder pump following procedures specified in the approved Quality Assurance Project Plan (QAPP). Prior to collection of ground water samples from each monitoring well, the well will be purged by pumping a minimum of three well volumes of ground water from the monitoring well. The wells will be purged according to the procedure established in Section 6.3.1 of the QAPP. Water removed during purging and sampling activities will be stored on site and disposed of after chemical analyses have been completed.

After purging, monitoring well ground water samples will be collected according to the procedures identified in Section 6.3 of the QAPP by placing the pump discharge line directly into the appropriate sample bottles. Each set of samples will be labeled at the time of collection and stored in a cooler with ice to maintain a temperature of approximately 4 degrees Celsius until final packaging is completed for shipment of samples to the laboratory.

Sampling pumps and discharge lines will be decontaminated after collection of ground water samples at each monitoring well location. The decontamination procedure will consist of pumping a minimum of five gallons of clean tap water through the pump and discharge line and rinsing the outside of the pump and discharge line with clean tap water.
This step would be followed by a final rinse with deionized water of the outside of the pump and discharge hose and pumping a minimum of five gallons of deionized water through the pump. All water generated during decontamination activities will be stored on site and sent to the appropriate disposal facility after chemical analyses have been completed.

In the case of domestic wells, samples will be collected from the faucet or valve closest to the well discharge point. If possible, samples will be collected prior to the water going through any type of filtering system which may be in use at that location. Before collecting any samples from domestic wells, the pump will be permitted to run for approximately 15 minutes to ensure a fresh ground water sample is collected. Domestic well samples will be placed in the appropriately labeled sample jars and stored in a cooler with ice until they are packaged for final shipment to the laboratory as prescribed in the approved project QAPP.

In addition to the laboratory analytical program, each ground water sample collected will be measured in the field for pH, specific conductance and temperature. These field tests will be completed with equipment which has been properly calibrated as per the approved QAPP as per Section 6.5.1 of the QAPP. The probes will be decontaminated by rinsing with deionized water after each use.

Ground water samples collected will be maintained by IT chain-of-custody protocol as specified in the Quality Assurance Project Plan (QAPP) from the time of collection to disposal of the samples after laboratory analyses have been completed. These procedures require that each sample be recorded on a Chain-of-Custody Log form. This completed form accompanies the samples after collection to the laboratory. In addition each sample is recorded on a Request for Analysis form which identifies the analytical program to be completed for each sample collected. A sample collection log will be completed for each sample which is used to
record specific sample collection information. A copy of the sample collection log is shown in Figure 6-2 of the QAPP.

The appropriate number of field blanks, trip blanks and field duplicate samples will be collected to meet the requirements established in the QAPP. These samples will each be given an individual sample number and sent to the laboratory as "blind" samples. This is to ensure that no special treatment will be given to QA/QC samples in the laboratory. Samples and blanks will be analyzed according to the analytical methods identified in Tables 2.1 and 2.2 of the Woodlawn Landfill QAPP.

The analytical program established for the initial sampling of all ground water samples includes volatile organic compounds (VOCs) on the CLP list plus acrolein, acrylonitrile, and 2-chloroethyl vinyl ether, base neutral/acid extractable organic compounds (BNAs) on the CLP list, chlorinated pesticides plus PCBs, and CLP metals minus selenium and antimony. These analyses will be completed using the U.S. EPA Contract Laboratory Program (CLP) protocols. The IT QA/QC laboratory procedures are specified in the project specific QAPP.

Based on the results of the initial sampling round, the analytical program and/or analytical methods utilized for analysis may be changed for the second sampling event during Phase III. Changes will be initiated by the IT Task Manager for Geology and will need the approval of the IT Task Managers for Hydrogeology and Laboratory Analyses. Changes will need the approval of the IT Project Manager, and if approved, will become the recommended course of action for IT. This recommended course of action will be presented to the Client for concurrence. Then it will presented to the Agencies.

Waste ground water generated during the equipment decontamination, ground water sampling, well development, pumping tests, or rising head permeability test activity will be stored on site in (an) aboveground
tank(s) until after the completion of the laboratory analyses. The maximum duration for on-site storage of waste ground water is 90 days (40CFR). Within this time period, one composite water sample will be taken from each vessel and analyzed in the same manner as the other ground water samples. A risk assessment will be made to determine whether the water can be discharged on site with or without treatment. If treatment is required, the treatment method will be described in the risk assessment. The risk assessment results will be submitted to the U.S. EPA for approval with a copy to the state of Maryland. Discharge on site would be made in the retention basin in the south-central part of the landfill.

The type of pump to be used for this task is a stainless steel submersible pump.

2.7 BOREHOLE GEOPHYSICS

The objective of the borehole geophysical survey is to better define the hydrogeologic and physical site conditions. Results of the borehole geophysical survey will be correlated with the results of the surface geophysical studies, where applicable.

Four borehole geophysical methods will be used:

- Spontaneous Potential (SP) logging
- Velocity (Sonic) logging
- Electromagnetic (EM) Induction logging
- Borehole Television logging

The geophysical methods consist of using a borehole probe and a surface console to monitor specific subsurface conditions. The probe traverses the borehole transmitting and/or receiving the appropriate data, while the surface unit controls the signal parameters and records the resulting responses.
2.7.1 **Spontaneous Potential Logs**
SP devices measure the electric potential difference between a fixed surface electrode and an electrode on the probe. The electric potential between the two electrodes changes as the probe electrode moves from one lithological unit to another. The interface is indicated by the inflection point on the log curve.

SP will provide information regarding the permeability of surrounding material, and help in stratigraphic correlation.

2.7.2 **Velocity (Sonic) Logging**
Sonic logs are developed by measuring the "internal transit time" for an acoustic wave to travel within geologic formations. The capacity of geologic formations to transmit sound waves varies with lithology and with rock texture, notably porosity.

The sonic logs will provide stratigraphic and porosity information regarding the surrounding formation. Interfaces between the fill material and natural soils and between the soils and bedrock shall be identified. To some extent it will also help identifying fractures and fractured zones, which can represent pathways for ground water flow. These data will be correlated with the results of surface (including seismic refraction) and subsurface studies.

2.7.3 **EM Induction Logging**
EM induction devices generate a primary electromagnetic field at a transmitter coil. The primary field induces electric currents in the surrounding material, where they are detected by their effects on a receiving coil. Strength and phase comparisons between the primary and secondary fields indicate the conductivity of the surrounding material.
EM induction will measure the electrical conductivity of the surrounding material. These data will indicate the absence or presence of electrolytes, (i.e., solute plumes), and will be correlated with surface EM survey data. In addition, buried metallic objects in close proximity to the borehole will be indicated.

2.7.4 Borehole Television Inspection
Borehole television inspection is performed by lowering a water proof television camera with integral lighted attachments down the well bore and viewing the side of the hole with either axial (downhole) or radial (sidehole) lenses. The view will be titled and videotaped. The method proposed will use a Westinghouse ETV-1252 black and white television inspection system or equivalent.

Borehole Television inspection will be used to evaluate the integrity of wells, to identify bedrock fractures, and to observe water movement at fracture zones. The latter can be accomplished by watching sediment particles in the ground water as they drift by fracture apertures. The displacement of particles indicates ground water flow into or out of the borehole from the surrounding strata through the fracture. If flow is seen, then the fracture is considered to be interconnected to the regional flow system. As compared with unfractured zones or fractures that are not interconnected with other fractures, these flowing fractures would more likely produce water. The information will be used to select the location of screens for water sampling and testing.

2.7.5 Borehole Requirements
The SP and sonic log measurements must be performed before the well casing is installed. This may be a problem if the borehole cannot be kept open in the soil horizons without the hole being cased. If the hole cannot be kept open using reasonable means, then these methods will not be used.
Borehole television inspection will be performed in existing wells for integrity evaluation in those wells that have been damaged or are suspected of having been damaged. Therefore, in this case an uncased hole will not be required. When borehole television inspection will be performed for the evaluation of fractures and ground water flow in bedrock, the borehole should have already been cased to the top of rock.

The EM induction method must be done in an open hole or through a dielectric casing (i.e., PVC) only as metal casing precludes this measurement.

2.7.6 Measurement Plan
A suite of geophysical logs will be performed on two bedrock monitoring wells chosen during the drilling. The Site Manager in collaboration with the Task Manager for Geophysics and the Project Manager will make this choice on the basis of providing the most representative data from the results of the drilling.

Borehole television inspection of existing wells will also be performed on those non-F-Series wells which are suspected of not functioning properly resulting from obvious damage or unusual data finds.

2.8 RISING HEAD SLUG TESTS
Rising head slug tests to determine the hydraulic conductivity will be performed in each well completed in the unconsolidated sediments because existing data indicate that the unconsolidated sediments have a specific yield too low to be suitable for another testing method.

Slug tests generally work in hydrogeologic units where the values of hydraulic conductivity is less than \(10^{-2}\) centimeters per second. In such environments they are generally reliable field methods for determining hydraulic conductivity near the screened zone of the well.
Prior to initiating the rising head slug test, the ground water level in each well will be recorded for several minutes using a pressure transducer connected to a Hermit Data Logger or similar device, and the average value of the readings will be taken.

A volume of water will be removed from the well producing an approximately 10 foot reduction in water level elevation. The actual rising head slug test starts with removal of the slug. The resulting drop in ground water elevation will be recorded by the transducer and this moment will be assigned as the starting time of the test. The rise in the water level in the well will be recorded periodically to the nearest 0.01 foot, at time intervals to be established during preliminary testing. Depth-time measurements will be recorded until the water level reaches equilibrium or a sufficient number of readings clearly show a trend on a semilog plot of time versus depth. The time required for slug test completion depends on the slug volume, and the formation hydraulic conductivity.

Precautions will be taken so that the wells are not contaminated by materials introduced during the tests. These testing materials will be decontaminated prior to and after each slug test.

Waste ground water generated during the equipment decontamination, ground water sampling, well development, pumping tests, or rising head permeability test activity will be stored on site in (an) aboveground tank(s) until after the completion of the laboratory analyses. The maximum duration for on-site storage of waste ground water is 90 days (40CFR). Within this time period, one composite water sample will be taken from each vessel and analyzed in the same manner as the other ground water samples. A risk assessment will be made to determine whether the water can be discharged on site with or without treatment. If treatment is required, the treatment method will be described in the risk assessment. The risk assessment results will be submitted to the
U.S. EPA for approval with a copy to the state of Maryland. Discharge on site would be made in the retention basin in the south-central part of the landfill.

The type of pumps to be used for this task is a stainless steel submersible pump [See Comment 60 and 61].

2.9 PUMPING TESTS
Constant rate drawdown pumping tests will be performed in two monitoring wells completed in the bedrock if these wells produce a minimum flow of 5 gpm required for conducting these tests.

The objective of these pumping tests is to evaluate aquifer characteristics and parameters such as hydraulic conductivity, transmissivity, and storage coefficient. Prior to initiation of the pumping tests, two piezometers will be installed in close proximity to each well to be tested, to monitor the variations in the ground water table elevation during the pumping test. Details regarding installation of piezometers is given in Section 2.10 of this work plan.

Prior to initiating the pumping test, the water level in the pumping well and the piezometers will be recorded. A submersible pump will be placed in the pumping well and the ground water level in the well will be allowed to stabilize to the initial level. In addition, transducers will be installed in the pumping well and piezometers to collect the water level information during the test. These transducers will be connected to a Hermit Data Logger or equivalent equipment. The equipment will be programmed to collect water level data in the pumping well and in each piezometer. The pumping well will be discharged at a constant rate. The pumping rate will be measured and recorded at the beginning and throughout the duration of the test. The duration of the test will depend upon the aquifer properties. Adequacy of data is
indicated when the log-time versus drawdown for the most distant observation well, or piezometer, begins to plot as a straight line on the semi-log graph paper. As a limiting condition, the test will be conducted until sufficient water level data are collected from the farthest monitoring well.

A pumping rate between 5 and 10 gpm is anticipated for this pumping test. Water level recovery data will be collected until the water level stabilizes to the initial level or recovers to at least 80 percent of that level. At the end of this period, the pumping test will nearly be completed and all equipment will be removed from the pumping and observation wells.

Pumping equipment and transducers will then be decontaminated according to the procedures established in this work plan, except that 20 gallons of water will be used to rinse the pump and discharge line.

If the yield of the wells completed in the bedrock is too low for performing the pumping tests, the hydraulic conductivity will be calculated by using slug tests as an alternative.

Field activities and data analysis for both slug tests and pumping tests described in Sections 2.8 and 2.9 will be conducted according to the project QAPP.

Waste ground water generated during the equipment decontamination, ground water sampling, well development, pumping tests, or rising head permeability test activity will be stored on site in (an) aboveground tank(s) until after the completion of the laboratory analyses. The maximum duration for on-site storage of waste ground water is 90 days (40CFR). Within this time period, one composite water sample will be taken from each vessel and analyzed in the same manner as the other ground water samples. A risk assessment will be made to determine
whether the water can be discharged on site with or without treatment. If treatment is required, the treatment method will be described in the risk assessment. The risk assessment results will be submitted to the U.S. EPA for approval with a copy to the state of Maryland. Discharge on site would be made in the retention basin in the south-central part of the landfill.

The type of pumps to be used for this task is a stainless steel submersible pump [See Comment 60 and 61].

2.10 PIEZOMETER INSTALLATION

Piezometers will be installed in close proximity to a saturated soil and/or bedrock monitoring well if the well location meets the criterion for conducting a formal drawdown pumping test. The boring will be located within approximately 50 feet of the proposed monitoring well and drilled to the same depth. After the well is advanced to the proper depth, a section of 1-inch-I.D. slotted PVC screen the same length as that used in its companion saturated soil monitoring well and a sufficient length of 1-inch-I.D. PVC riser will be placed in the borehole. The piezometer will be completed in the same manner as the monitoring wells.

2.10.1 Soil Piezometers
Piezometers will be installed in soil using a 3-1/2-inch-I.D. hollow-stem auger. The boring will be located within approximately 50 feet of the proposed monitoring well and drilled to the same depth. After the well is advanced to the proper depth, a section of one-inch-I.D. slotted PVC screen the same length as that used in its companion saturated soil monitoring well and a sufficient length of one-inch-I.D. PVC riser will be placed in the borehole. As the augers are withdrawn the annual space around the screen will be backfilled with a coarse sand filter pack to the elevation of the ground water table in the soil. The piezometer will be completed in the same manner as the monitoring wells.
The PVC riser and screen will be removed from the hole and the boring redrilled to the original depth with 3-1/2-inch-I.D. hollow-stem augers.

2.10.2 Bedrock Piezometers
Piezometers installed in bedrock will require a surface casing to be installed to seal off the upper soil aquifer. Bedrock piezometer borings would be advanced through the soil using a 6-1/4-inch-I.D. hollow-stem auger and augered to bedrock refusal. After bedrock refusal is reached, a five-inch-diameter roller bit will be inserted into the hole and the boring advanced five feet into the bedrock. The roller bit will then be removed from the hole and a three-inch-I.D. steel casing installed to the bottom of the boring. A tremie pipe will then be inserted to the bottom of the casing and the casing grouted in place to the ground surface as the augers are withdrawn.

After waiting a minimum of 24 hours for the grout to cure, the piezometer boring will be completed to the same depth as the proposed bedrock pumping well using a roller bit. The bedrock piezometer will be left as an "open hole" for use during the pumping test.

Upon completion of the pumping test, the piezometer will be grouted to the ground surface by installing a tremie pipe to the bottom of the boring. The steel surface casing would remain in place.

2.11 REPORT PREPARATION
After completion of the Phase II investigation, a report will be prepared that provides details regarding the methods used and results obtained for completing the tasks described in this plan as detailed above. These results will be used in the Ground Water Evaluation (Phase III) and in the Risk Assessment for the Remedial Investigation report. These results, along with the results of Phase IV as completed, also will be used for the Feasibility Study.
In addition to the Phase II report, a Detailed Work Plan for the Phase III investigation will be submitted. This work plan will include detailed methodologies for completion of the tasks outlined in Chapter 3.0 of the Scope of Work submitted to the U.S. EPA (latest Revision No. 01, November 2, 1988).
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<tr>
<th>TASK</th>
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<td>DETAILED WORK PLAN PHASE III</td>
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**LEGEND:**
- WORK PLAN (PHASE II) APPROVAL
- SUBMITTAL

**FIGURE 2**
BAR CHART DIAGRAM FOR PHASE II INVESTIGATION

PREPARED FOR
WOODLAWN AND FILL PLATS

© 1984 IT CORPORATION
ALL COPYRIGHTS RESERVED
"Do Not Scale This Drawing"
**LEGEND**

- **F-2**: Monitoring well installed by Firestone
- **OW-4**: Monitoring well installed by Cecil County
- **SW-1**: Monitoring well installed by the State of Maryland
- **B-2**: Proposed bedrock well (location approximate)
- **P-2**: Proposed bedrock well (location approximate)
- **S-6**: Proposed soil well (location approximate)
- **P-7**: Proposed perched-water well (location approximate)

**APPROXIMATE LOCATION OF CELLS B&C**

**APPROXIMATE LIMITS OF PROPERTY LINE**

**WOODLAWN LANDFILL**

- **(37.06 acres)**

**HOWER (16 ACRES)**

**MONTGOMERY BROTHERS INC.**

- **(5 acres)**

**APPROXIMATE LOCATION OF CELL A**

**JEFF TRAIL**

**APPROXIMATE LOCATION OF CELLS B&C**

**HOVER**

- **(16 ACRES)**

**WOODLAWN LANDFILL**

- **(37.06 ACRES)**

**CRAFT**

- **(2.91 ACRES)**

**HINDER**

- **(4.0 ACRES)**

**WAUEL**

- **(45.012 ACRES)**

**ENGHE ENTERPRISES, INC.**

- **(48.63 ACRES)**

**EXISTING BRIDGE**

**TRANSFER STATION**

**ST Ann STEEL MILL**

**PROPOSED MONITORING WELLS FOR PHASE II**

- Prepared for Woodlawn Landfill R/FS

**FIGURE 3**

- APPROXIMATE LOCATION OF B-2
- APPROXIMATE LOCATION OF OW-4
- APPROXIMATE LOCATION OF SW-1
- APPROXIMATE LOCATION OF P-2
- APPROXIMATE LOCATION OF S-6
- APPROXIMATE LOCATION OF P-7

**SCALE**

- 0 200 400 FEET
N. FOSTER ALLEN

Professional Qualifications

With wide-range training and experience in various disciplines in civil engineering, namely hydraulics, hydrology, geotechnical, and structural, Dr. Allen has over 10 years of experience providing technical direction and assistance to projects involving civil engineering analysis and design. His experience includes structural and seismic analysis of nuclear power plants, and evaluation of soil-structure interaction criteria.

Education

Ph.D., Civil Engineering, The University of Michigan, Ann Arbor, Michigan; 1977
M.S.E., Civil Engineering, The University of Michigan, Ann Arbor, Michigan; 1972
B.S.E., Civil Engineering, The University of Michigan, Ann Arbor, Michigan; 1971

Experience and Background

1978 - Present  Civil Engineer, IT Corporation, Pittsburgh, Pennsylvania. Formerly responsible for technical coordination of Secondary Parallel Calculations for Sandia National Laboratories. Adapted the geochemical aqueous specialization-solubility computer codes EQ3/6 for use on Westinghouse Cray. Principal Project Engineer with D'Appolonia which was acquired by IT Corporation in February 1984. Assignments have included:

- Structural analysis for safety evaluation of primary coolant loop and reactor building, Big Rock Point Nuclear Power Plant, Michigan.

- Evaluation of methods for performing soil-structure interaction analyses and determining seismic input, United States Nuclear Regulatory Commission.

- Evaluation of structural models incorporating aseismic bearing pads for nonlinear seismic analysis.

- Evaluation of seismically induced stresses in buried transmission tunnels, Trillo Nuclear Power Plant, Spain.

- Pile foundation integrity analysis including load capacity of rock sockets for end-bearing piles, Angra Nuclear Power Plant, Brazil.

- Evaluation of hydrologic cooling system, KO-RI Nuclear Power Plant, South Korea.

- Evaluation of storm runoff and flood levels and their effects, Mobay Corporation, New Martinsville, West Virginia.
- Evaluation of surface subsidence due to creep closure of horizontal shafts in a salt formation, Waste Isolation Pilot Project, Carlsbad, New Mexico.

- Coordination of updating DAPROK computer code and obtaining Quality Assurance certification for this rock mechanics Fortran program.

- Test plan and conceptual design of apparatus and instrumentation for full-scale waste package degradation tests, Basalt Waste Isolation Project, Hanford, Washington.

- Evaluation concepts of borehole plugging in salt, Waste Isolation Pilot Project, Carlsbad, New Mexico.

- Evaluation of economic impact of mining regulations, Office of Surface Mining, United States Government.

- Evaluation of potential settlement of nuclear waste processing facility, Savannah River Plant, Georgia.

- Adaption of the Method of Characteristics to determine flow from pressurized caverns, Strategic Petroleum Reserve, Louisiana; Waste Isolation Pilot Plant, New Mexico.

- Design of hydrologic control systems for surface mine, Wyoming.

1978 Engineer, Bechtel Corporation, Ann Arbor, Michigan. Dr. Alien worked on a temporary basis with Bechtel Power Corporation in Ann Arbor, Michigan, designing and evaluating power plant foundations and structural components through which he gained a working knowledge and familiarity with codes such as AISC and ACI.

1974 - 1977 Laboratory Technician, Stoll, Evans, Woods and Associates, Ann Arbor, Michigan. While with the geotechnical firm of Stoll, Evans, Woods and Associates, Mr. Allen worked on dynamic caisson evaluation and conducted a series of experiments evaluating the use of the Comprimeter for monitoring compaction of roadway base course material. These experiments also involved establishing a correlation between density readings by the Comprimeter and the densities as determined by the Modified Proctor compaction test.

Professional Affiliations

American Society of Civil Engineers

Publications


JOSEPH BERN

Professional Qualifications

Dr. Bern has advanced training and extensive experience in the fields of public health, environmental engineering and science, regulatory practices, and project management. Dr. Bern is especially capable of working with a multidisciplinary team of geologists, geochemists, civil engineers, chemical engineers, toxicologists, and attorneys to conduct health and environmental risk assessments, evaluation of regulatory actions, and engineering reviews related to federal CERCLA (Superfund), SARA, RCRA, and HSWA activities. He is conversant with various state environmental programs (California, Texas, Louisiana, Colorado, Illinois, Michigan, Pennsylvania, New Jersey, New York, and Massachusetts).

Recently, Dr. Bern has been involved in developing approaches for determining cleanup levels in the context of CERCLA (ARARs and other requirements) and RCRA (clean closures, ACLs and variance from requirement of latest technology for impoundments) based on health-related goals. His varied experience makes him especially suited to delineate the objectives of remedial programs, and to produce practical and pragmatic decision models that form the core of soil elevation, ground water remediation, and site cleanup programs that meet environmental and statutory requirements. He has also performed SARA III Release Inventory projects and property transfer liability evaluations.

For the past two years, Dr. Bern has testified as an expert witness before Environmental Hearing Boards and in the Federal Court in toxic tort cases, property damage and requests for regulatory relief. He has advised attorneys and Potential Responsible Party Legal and Technical Committees.

He has developed procedures for performing quantitative and qualitative health risk and endangerment assessments associated with hazardous waste processing and disposal facilities, chemical manufacturing plants, primary steel production, paper industry plants, petrochemical activities, pesticide formulation, and abandoned hazardous waste sites. The assessments include hazard evaluation (toxicological nature and dose-response character) of contaminants and potential for exposure based on the fate of chemical contaminants in air, water, and soils.

Dr. Bern has conducted endangerment assessments related to approximately 30 Superfund sites and supervised the risk assessment for 20 additional sites during the past five years. Some of the above were very detailed studies of polychlorinated biphenyls (PCBs), dioxin, and pesticide-contaminated facilities.

An environmental toxicologist and registered environmental engineer, Dr. Bern can assist in the overall integration of all aspects of investigations including scientific, engineering, regulatory, and public interface based on his experience in consulting, industry, academia, and as a hearing examiner and officer of an environmental regulatory agency.

AR300699
Joseph Bern

Dr. Bern was the primary author and/or reviewer of the following risk assessments and related projects:

Risk Assessments:

<table>
<thead>
<tr>
<th>For Potentially Responsible Parties (PRP):</th>
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<tbody>
<tr>
<td>• Brio Refining (coauthor) (TX)</td>
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<tr>
<td>• Riverdale Chemical Company (IL)</td>
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<td>• Fields Brook (OH)</td>
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<tr>
<td>• Vine Hill (IT site) (CA)</td>
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<td>• Firestone Tire &amp; Rubber (CA)</td>
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<td>• Kroger Company (WV)</td>
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<td>• Volney Landfill (NY)</td>
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<td>• Fulton Terminals (NY)</td>
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<td>• Clothier Site (NY)</td>
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<td>• CBF Landfill (CA)</td>
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<tr>
<td>• IWC (Reviewer) (AK)</td>
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<tr>
<td>• American Metals Corp. (Westlake) (OH)</td>
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<td>• LTV Steel Company (OH)</td>
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<td>• Union Chemical Company (NJ)</td>
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<tr>
<td>• Fernald Materials Processing Center (OH)</td>
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<td>• Arco-Monaca Site (PA)</td>
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<tr>
<td>• Conoco-Vista Lake Charles Chemical Complex (LA)</td>
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<td>• Packaging Corporation of America (MI)</td>
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<td>• Duriron Site (OH)</td>
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<tr>
<th>Critical Review of Remedial Investigation/Feasibility Study (RI/FS) Report and Risk Assessment by Others:</th>
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<tr>
<td>• Millcreek (PA)</td>
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<td>• Cleve Reber Site (LA)</td>
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<td>• Vertac (off site) (AR)</td>
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<td>• Clothier Site</td>
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<td>• Sand Springs (OK)</td>
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<td>• Industrial Excess Landfill (OH)</td>
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<tr>
<th>For U.S. Environmental Protection Agency (U.S. EPA):</th>
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<tbody>
<tr>
<td>• Lone Pine Landfill (Landfill with volatile organics: NJ)</td>
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<tr>
<td>• Beacon Heights (Landfill with halogenated aliphatics: MA)</td>
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<tr>
<td>• Drake Chemical (Former dye mfg. facility-beta-naphthalamine: PA)</td>
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<tr>
<td>• American Creosote Company (PNAs: FL)</td>
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<tr>
<td>• Bog Creek Farms (Unauthorized burial-volatile organics: NJ)</td>
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<tr>
<td>• Bridgeport Recycling &amp; Oil Service (PCBs in oil: NJ)</td>
</tr>
<tr>
<td>• New Bedford Estuary (PCBs in estuary pediments and ambient air: MA)</td>
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<td>• Lake Sandy Jo (Landfill-volatile organics: IN)</td>
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<td>• Tybouts Corner (Landfill-halogenated aliphatics: DE)</td>
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<tr>
<td>• Krysavaty Farm (Landfill-benzidine: NJ)</td>
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<td>• Rockaway Borough (Contaminated public water supply: NJ)</td>
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<tr>
<td>• McAdoo Site (Former incinerator site-deep mines: PA)</td>
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<tr>
<td>Project Mgr.: RI/FS</td>
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</tbody>
</table>
Joseph Bern

- Hudson River PCB Study (PCBs—river env.: NY)
- Swope Oil Co. (Oil recycling facility—PNAs and volatiles: NJ)
- Charles George Landfill (Large landfill—ketones: MA)

Directed and Reviewed for U.S. Environmental Protection Agency:

- Baird & McGuire (Pesticide formulation operation: MA)
- Cannon Engineering (Shoreline contamination: MA)
- Nyanza Chemical Co. (Lead contamination: MA)
- Tinkham Garage (PNAs, volatile organics, PCBs: NH)
- Caldwell Trucking (TCE cont. of ground water: NJ)
- Chemical Control Co. (Aftermath of fire: NJ)
- D'Imperio Landfill (Volatile organic cont. of GW: NJ)
- GEMS Landfill (Review only)
- Harvey-Knott Disposal Site (Buried drums—vol. org. in soils: DE)
- Blosenski Landfill (Review: PA) Proj. Mgr. RI/FS
- Douglassville Oil Recycling (Oil recycling—PNAs: PA)
  Proj. Mgr.: RI/FS
- Heleva Landfill (TCE GW contamination: PA)
- Millcreek Site (Vol. org. contam. of GW: PA)
  Reviewed for PRPs also
- Leetown Pesticide (Pesticides in soils: VA)

He has worked extensively with legal committees during the critical reviews of the RI/FS reports. Dr. Bern has also appeared as an expert witness before environmental hearing boards and in court.

Education

Sc.D., Hygiene, with minor in Economics and Systems Analysis, University of Pittsburgh, Pittsburgh, Pennsylvania; 1982
M.S., Hygiene, University of Pittsburgh, Pittsburgh, Pennsylvania; 1970
M.P.W., Public Works Administration, University of Pittsburgh, Pittsburgh, Pennsylvania; 1970
B.S.M.E., Mechanical Engineering, Purdue University, West Lafayette, Indiana; 1949

Experience and Background

1985 – Present

Distinguished Technical Associate, IT Corporation, Pittsburgh, Pennsylvania. Performs risk and endangerment assessments, conducts human and environmental exposure evaluations, and designs environmental media and biota sampling and analysis programs. Responsibilities include:

- Development of soil cleanup/levels for CERCLA RODs and RCRA "Clean Closure."
- Implementation of a comprehensive risk assessment program to cover environmental audits, exposure assessment information, determination of environmental fate of pollutants, hazard evaluation, and assessment protocol development.
• Coordination with health and environmental regulatory agencies at local, state, and federal levels.

• Provision of technical support for routine and emergency hazardous materials spills response, abandoned waste site remedial investigations and feasibility studies, and Resource Conservation and Recovery Act (RCRA) permitting procedures (exposure assessment information).

• Investigation, evaluation, and recommendation of environmental health solutions relating to design and operation of proposed new and modified treatment facilities and disposal sites.

• Expert consulting services to attorneys, PRP legal committees, and PRP technical committees.

• Conduct environmental liability assessments, environmental audits, and SARA III reporting requirements.

• Develop decision models for disposal of contaminated soils; goals for ground water pump and treat programs. Optimization analysis of ground water treatment programs.

1983 - Supervisor, Toxicology and Risk Assessment, NUS Corporation, Pittsburgh, Pennsylvania. Provided technical assistance, guidance, and management of risk assessment activities for over 50 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Superfund) sites as the prime contractor to the U.S. Environmental Protection Agency (U.S. EPA). Developed and authored approximately 20 health risk evaluations. Provided technical support and assistance in the design and implementation of specialized air monitoring programs and sampling and analysis plans. Acted as the project manager for the remedial investigation of three CERCLA sites. Trained new personnel in the methods and perspectives of health risks associated with environmental exposure to low levels of hazardous materials and determining their environmental fate in the environmental multimedia. Provided technical assistance to the health and safety division.

Has managed or has been the principal participant on the following projects while at NUS Corporation:

• Performed risk assessments needed to define the extent of contamination, exposure potential, and health risks associated with 60 Superfund sites in the eastern United States, including:

  - Two pesticide manufacturing or formulation plants where pesticides, dioxin, and herbicides were found in soils and ground water. One included an investigation of the inactivation needed to determine the need for demolition.
- A PCB-contaminated estuary where the chemical was found in high concentrations in fish and shellfish and accompanied by heavy metals contamination of the sediments. Another PCB project included a risk assessment of PCB contamination of the upper reaches of the Hudson River.

- A former creosote manufacturing plant, where sludges were disposed of by land burial for 70 years. The plant was located near shore to the Gulf of Mexico. This project required an extensive investigation relating to impacts on marine biota and tidal influences on environmental transport mechanisms.

- Many former landfills where spent solvents were released into a variety of soils underlain by some major aquifers used for drinking water sources.

- An inactive chemical plant where dyes and herbicides were produced and residues from the process were impounded in surface structures. Contaminants included beta-naphthylamine and the herbicide Fenac. A detailed study of the environmental fate of these and other pollutants in a complicated hydrogeological setting was required.

- Three projects entailed study of abandoned hazardous waste sites that were located in strip-mined areas which were further complicated by underlying deep mines.

- Acted as project manager for three Superfund sites. Directed field crews during subsurface investigations in conjunction with the site geologist. Provided technical assistance for test pit excavations and acted as the site safety officer. One project entailed study of deep mine workings, borehole TV investigation of the deep mine entry shaft, and an extensive magnetometer survey. Developed a field screening technique using the Organic Vapor Analyzer (OVA) to characterize the contamination patterns in the subsurface soils.

- Headed an investigation of indoor pollution of a new computer sciences building at a local university where formaldehyde was the suspected contaminant. Worked closely with an occupational health physician to respond to worker complaints.

- Provided scientific and technical assistance to project management for the assessment of health risks, hazard characteristics, environmental criteria, and regulatory requirements of residuals and radioactive wastes generated at the U.S. Department of Energy (DOE) Savannah River Facility.

- Performed a critical analysis for a DOE contractor of regulations to control gasoline vapors in service stations and distribution facilities. This included an evaluation of the health risks and exposure characterization where air dispersion models were used to determine the receptor population.
1977 - President, Bern Associates, Pittsburgh, Pennsylvania. Provided consulting services to the solid waste and hazardous waste industries. Designed and supervised construction of three sanitary landfills and one industrial waste (pickling liquor neutralization) facility. Provided liaison between the client and environmental enforcement agencies and prepared permit applications coordinating with geotechnical consultants (as the lead consultant). At the same time, worked as a research associate in the Civil Engineering Department, University of Pittsburgh.

Was associated with some relevant projects as follow:

- An environmental audit and inventory of the Pittsburgh Energy Technology Center that included developing a residuals management plan that complied with all existing regulatory requirements.

- Performed a detailed study of the health implications and the environmental engineering aspects of coal conversion residuals.

- Analysis and evaluation of short-term mutagenicity test systems as they apply to mixed chemicals with special emphasis on the test sample preparation methods.

1977 - Hearing Examiner, Pennsylvania Department of Environmental Resources (PADER), Bureau of Surface Mine Reclamation, Harrisburg, Pennsylvania. Concurrent with the above activities, acted as a hearing examiner to conduct public hearings as required for permit issuance for surface mining operations. Wrote findings and recommendations for PADER.

1973 - Vice President, U.S. Utilities Services, Monroeville, Pennsylvania. Provided management of technical projects and operations. This included general management of overall operation of four power plant fly ash disposal sites and three sanitary landfills. Marketed, designed, and operated mini-dredging of coal refuse and fly ash impoundments. Developed marketing programs for processing of hazardous materials. Determined policies and procedures regarding liability and indemnification matters. Worked closely with the corporation attorney in litigation, although on an infrequent basis.

1970 - Chief Solid Waste Engineer, PADER, Division of Solid and Hazardous Waste Management, Harrisburg, Pennsylvania. Provided technical review of permit applications for solid waste treatment and disposal facilities. Reviewed over 120 permit applications and made recommendations for issuance or denial. Implemented a development program to determine requirements for disposal of power plant sulfur removal residues and for other industrial waste streams. Reviewed county solid waste management plans. Provided technical assistance to the division chief, geologists, and soil scientists.
1950 - Project Manager/Product Line Administrator, Westinghouse Electric
1968 Corporation, Hagan Controls Division, Blawnox, Pennsylvania. Pro-
vided contract administration and technical supervision for chemical
plant controls, central power station combustion and feedwater con-
trols. Product line administrator for the steel industry and naval
boiler controls, and territorial supervisor for all west coast proj-
ects. Was involved in design, testing, and installation of controls
at 20 to 30 central power stations, 60 naval vessels, four steel
facilities, and many chemical plants (ammonia manufacturing, etc.).

Registrations/Certifications

Professional Engineer: Commonwealth of Pennsylvania

Professional Affiliations

Adjunct Professor at the University of Pittsburgh, Graduate School
of Public Health, Department of Industrial and Environmental
Health Sciences
American Academy of Environmental Engineers
American Public Health Association
American Society of Civil Engineers (ASCE)
Society for Risk Analysis
Sigma Xi, Science Honorary
Tau Beta Pi, Engineering Honorary

Publications

Bern, J., 1987, Development of Clean-up Levels for Hazardous
Materials in the Environmental Media, presented at the New Jersey
Water Pollution Control Federation Meeting, Atlantic City,

Bern, J. and S. Pederson, 1985, One Method of Risk Assessment for
Abandoned Hazardous Waste Sites, presented at the EPA/AICHE
Conference, Chicago.

Bern, J., 1985, The Risk Assessment for CERCLA Sites, presented at
the EPA/HAZPRO Conference, Baltimore.

Bern, J., 1982, Characterization and Leachability of Mutagenic
Components in Coal Conversion Residuals and Wastewater Treatment

Bern, J. and G. Keleti, 1982, "Mutagenicity of SRC-11 Coal Liquefac-
tion Wastewater Treatment Residues," Environmental Science and
Technology.

Wastewater Treatment Sludges from Synfuels Facilities: Charac-
terization and Implications for Disposal," Environmental Aspects of
Fuel Conversion Technology—VI, U.S. EPA.


JOHN A. BROSCIOUS

Professional Qualifications

Mr. Broscious manages the site investigation and risk assessment division of the Pittsburgh engineering office. He also manages projects requiring evaluation and design of site remediation and closure, treatment of hazardous waste and industrial wastewater, waste stabilization/solidification, leaking underground storage tank testing, and site assessment. His experience includes evaluation of closure alternatives for hazardous waste sites and permitting assistance and negotiations with regulatory agencies.

Education

B.S., Civil Engineering, Lehigh University, Bethlehem, Pennsylvania; 1955

Experience and Background

1981 - Present  Manager, Investigation and Assessment Division, IT Corporation (IT), Pittsburgh, Pennsylvania. Responsible for management of site investigation and risk assessment proposal and project activities including site closure evaluation and design, ground water remediation, underground tank regulatory compliance, sludge stabilization/solidification studies, and hazardous waste/wastewater treatment projects. Experience includes:

- Evaluation of technologies and remedial action alternatives for remediation of hazardous and mixed waste contamination at a U.S. Department of Energy (DOE) nuclear weapons production facility. Evaluation included screening technologies and development of remedial alternatives for various categories of operable units including pits, landfills, silos, contaminated soil and ground water, and water courses.

- Management of contamination assessment and site remediation including well installation, design, installation and operation of free-product recovery system, and design and operation of ground water treatment facility.

- Evaluation and design of closure alternatives for 90 acres of hazardous waste surface impoundments. Closure concepts included liquid waste deinventory, sludge solidification, ground water control systems, slurry walls, and capping. Unique sampling and analytical testing programs included determining extent of contamination in the soil under and around the impoundments and chemical characterization of liquid waste and sludge in the impoundments. Laboratory studies included solidification testing of tetraethyl lead waste, oily waste and other sludges, and biodegradability of oily sludges.

- Establishing and management of the underground storage tank assessment and removal program for a major corporation with
facilities located throughout the U.S. Program included coordination of work performed by various IT regional offices.

- Underground fuel tank leak assessment and remediation. Extent of soil and ground water contamination was determined and free product recovered. Cleanup levels were successfully negotiated with the regulatory agency using a limited health risk assessment approach. Remediation was limited to capping.

- Management of a literature search and report on current and developing technologies for detection, prevention, and corrective action of releases from underground tanks.

- Management of a research project evaluating leak detection methods for testing underground storage tanks. First phase of the project included preparation of a report reviewing existing leak detection methods. Second phase included the design of a test apparatus to evaluate the capability of selected leak detection methods to accurately measure leak rates considering the variables which affect testing accuracy.

- Permitting assistance for fuel recovery project resulting from the spill of diesel fuel in close proximity to public water supply wells. Product was removed from the water supply aquifer using a product pump and a depression pump followed by an oil separator and carbon treatment.

- Evaluation of disposal alternatives to close two chemical waste ponds. Pilot dewatering tests were performed to evaluate volume reduction by filter press, belt filter, and centrifuge. Stabilization mix design testing was performed to establish a design use and evaluate the toxicity of the leachate from the stabilized sludge. Disposal alternatives evaluated included on-site landfill, off-site landfill, off-site incineration of solids, and on-site carbon treatment of liquid waste using existing plant facilities or mobile treatment facilities. The two chemical waste ponds initially contained five to six million gallons, respectively. Increases in pond volumes were projected based on the scheduling of design, permitting, and field closure activities.

- Evaluation of and permitting assistance for wastewater discharges at a major chemical research facility. Evaluation included identification of various waste discharge piping systems, sampling and laboratory analyses of waste streams, flow gaging, water use balance, and modification of existing treatment facilities.

- Preliminary design and costing of system to dispose of 11.5 million gallons of hazardous waste tars. Disposal system included off-site burning of pumpable wastes and stabilization and on-site landfill of nonpumpable wastes. Wastes were stabilized with fly ash and cementitious materials.
• Field investigation of abandoned coke works site; design of wastewater treatment facilities for ponded water, contaminated runoff during construction, and leachate from waste isolation structure; and preparation of documentation for Resource Conservation and Recovery Act (RCRA) Part B permit application.

• Conceptual design of process to recover oil from 400,000 cubic yards of waste oil-clay. Processes evaluated included solvent recovery and vacuum evaporation. Conceptual design included closure of waste pile area and adjacent ponds.

• Preliminary design of system to treat combined chemical waste pond leachate and mine drainage. Treatment system included chemical precipitation, biological nitrification, and denitrification to remove metals and nitrates; carbon adsorption to remove phenols; and ion exchange to remove dissolved solids. Preliminary design included site closure and costing of capital and long-term operating costs.

• Evaluation of treatment alternatives and permitting of process wastewater from a protein recovery plant. Processes evaluated included electrofloation and dissolved air flotation to remove fats, oil, and grease prior to discharge to a publicly owned treatment works. Project work also included negotiations with permitting agencies for the wastewater discharge, permitting of a noncontact cooling water discharge, design of pumping facility to discharge to a publicly owned treatment works, and treatment process/pump station operating assistance.

• Conceptual design and costing of systems to pretreat wastewater with high concentrations of suspended lead oxide from an electronics plant.

• Preliminary evaluation of uncontrolled hazardous waste sites in connection with business development efforts.


1956 - 1963 Sanitary Engineer, Gannett Fleming Corddry & Carpenter, Pittsburgh, Pennsylvania. Responsibilities included design of municipal wastewater treatment plants, segregation of sanitary waste from industrial process and cooling waters, industrial waste treatment studies and acid mine drainage studies.
John A. Broscious


1955 - 1956

Engineer Trainee, Bethlehem Steel Company, Johnstown, Pennsylvania.

Registrations/Certifications

Professional Engineer: Pennsylvania

Professional Affiliations

National Society of Professional Engineers
Pennsylvania Society of Professional Engineers
Water Pollution Control Association of Pennsylvania
Water Pollution Control Federation

Publications

DENNIS E. BRUNNER

Professional Qualifications

Mr. Brunner has over 12 years of experience in environmental, hydrogeologic, and geotechnical studies. He is responsible for the direction of project field activities, including geologic reconnaissance, subsurface exploration, monitoring well installation, and field sampling efforts, as well as preparation of various types of proposals and project reports. He provides technical assistance to and supervision of field personnel as well as project management duties for remedial investigations and other engineering studies. Mr. Brunner has served as the Quality Assurance Officer for the Pittsburgh Engineering Group. In this position, Mr. Brunner provided direction and verification for the corporate and Pittsburgh Quality Assurance Program. Mr. Brunner is presently the Geoscience Section Manager within the Pittsburgh Site Assessment Division.

Education

Graduate Studies, Geology, University of Pittsburgh, Pittsburgh, Pennsylvania
B.S., Geology, Indiana University of Pennsylvania, Indiana, Pennsylvania; 1973

Experience and Background

1988 - Present Geosciences Section Manager, IT Corporation, Pittsburgh, Pennsylvania. In charge of the administrative functions for and training of staff geologists and other technical personnel in the Pittsburgh geosciences group. Duties include:

- Personnel scheduling, training, and other administrative functions associated with the supervision of geologists and other technical personnel in the geosciences group.

- Management of projects within the geosciences group. Responsible for project schedules and budgets, liaison activities with clients, data evaluation and report preparation for these projects.

- Development of a sampling program, sampling techniques and supervision of field personnel for collection of sludge samples from 24 sludge ponds in California.

- Preparation of sampling plans, supervision of field personnel, data evaluation, and report preparation of sections of environmental audits associated with the real estate transfers.

- Technical review of geologic information prepared by staff members for various proposals and engineering reports.
Dennis E. Brunner

1987 - 1988  
**Quality Assurance Officer, Environmental Projects Group, IT Corporation, Pittsburgh, Pennsylvania.** Responsible for the operation of the Quality Assurance Program within the Environmental Projects Group. Duties include:

- Orientation and continuous training of engineering staff in the requirements of the Quality Assurance Program.

- Preparation, review, and/or approval of Quality Assurance Project Plans.

- Administration and/or performance of project-specific technical audits.

- Technical review of project activities and reports.

- Provide day-to-day source of quality-related information for personnel throughout the Environmental Projects Group.

1984 - 1987  
**Geologist, IT Corporation, Pittsburgh, Pennsylvania.** Responsible for supervision and training of field personnel, development of field sampling programs and procedures, coordination of field activities, and project management responsibilities within the Pittsburgh Geosciences Group. Experience includes:

- Supervision of field sampling personnel and drilling operations as well as task management responsibilities for a large remedial investigation and cleanup for dioxin contamination.

- Management of field activities and overall project responsibility for a hydrogeologic investigation site remediation study and remediation activities for a hydrocarbon/ground water contamination study.

- Supervision of drilling operations, monitoring well installation, and field sampling of soils and ground water, as well as report preparation responsibility for a remedial investigation for abandoned lagoons containing chromium contamination.

- Coordination of field personnel and sampling activities for investigation of an industrial plant contaminated with polychlorinated biphenyls (PCBs).

1980 - 1983  
**Project Geologist, Chester Engineers, Coraopolis, Pennsylvania.** Supervised field investigations for several different site investigations and field sampling efforts. Participated in a field investigation, development of remedial action alternatives, and conceptual design of a new hazardous waste and industrial waste facility at a large steel and coke making plant. Planned the investigation activities, performed data evaluation, and participated in the development of a conceptual design and regulatory permit submittal for a large sanitary waste landfill facility.
Dennis E. Brunner

1974 - 1980  Staff Geologist, Green International Inc., Sewickley, Pennsylvania. Acted as principal investigator for a variety of geotechnical investigations, including soils and foundation investigations for highways, landslide investigations, and foundation studies for buildings and other structures. Involved with construction inspection activities for bridge rehabilitation, concrete structures, and earth fills. Worked as a technician involved with field sampling and laboratory testing of water, soils, and construction materials.

 Registrations/Certifications

Certified Professional Geologist No. 6356, American Institute of Professional Geologists
North Carolina Licensed Geologist No. 722

 Professional Affiliations

American Institute of Professional Geologists
National Water Well Association, Technical Division
JOSEPH M. BURDICK

Professional Qualifications

Mr. Burdick is a geophysicist/geologist with a strong technical background in environmental impact studies and hazardous waste site investigations, including EPA Superfund investigations. He has undertaken a wide range of responsibilities throughout his career, including roles as project manager, project geophysicist, field drilling supervisor, and environmental sampling field team member. Mr. Burdick is knowledgeable of a variety of geophysical techniques often incorporated in environmental assessments of hazardous waste sites. He is thoroughly familiar with the design and installation of ground water monitor wells and is very experienced with EPA sampling protocol.

Education

M.S., Geophysics, Wright State University, Dayton, Ohio; 1985
B.S., Geology, Youngstown State University, Youngstown, Ohio; 1982
Geology Field Course, Waynesburg College, Florissant, Colorado; 1982
40-hour Superfund Training Class, NUS Corporation, Pittsburgh, Pennsylvania.

Experience and Background

1987 - Present
Geophysicist/Project Supervisor, IT Corporation, Pittsburgh, Pennsylvania. Involved in a number of roles relevant to geophysical investigations and report preparation. Specifically:

• Coordinate all geophysical activities conducted out of the Pittsburgh Engineering facility

• Perform geophysical investigations (experienced with electromagnetic conductivity, magnetic, resistivity, and seismic refraction field techniques and data interpretation)

• Prepare proposals and final reports

• Supervise drilling subcontractors during the installation of ground water monitor and recovery wells (experienced with hollow-stem auger, mud rotary, air rotary, and cable-tool methods)

• Perform duties as project supervisor during environmental field investigations (involved with data collection and analysis)

1985 - 1987
Geophysicist/Geologist, NUS Corporation, FIT IV, Atlanta, Georgia.
Performed duties as project manager, field drilling manager, geophysicist, and sampling field team member on a variety of hazardous waste site investigations. Conducted site inspections. Demonstrated ability to manage field crews. Experienced in the preparation of drilling bid specifications, design and installation of monitor wells, and supervision of drilling subcontractors. Assisted in the preparation of an EPA Hazard Ranking System Quality Control Guidance Manual. Trained in all health and safety aspects of
Joseph M. Burdick

hazardous waste investigations. Thoroughly familiar with EPA sampling protocol.

1983 - Graduate Teaching Assistant, Wright State University, Dayton, Ohio.
1984
Responsible for the preparation and lecturing of physical and historical geology laboratory courses. Conducted field trips. Designed departmental midterm and final examinations. Developed strong communication skills.


Professional Affiliations

Association of Ground Water Scientists and Engineers
National Water Well Association
JAMES R. CLEMENTS

Professional Qualifications

Mr. Clements is experienced in all phases of the building industry, such as carpentry, plumbing and electrical work. He has operated a variety of heavy construction equipment. Mr. Clements is also experienced in the repair and maintenance of small equipment, as well as maintenance of general equipment.

Education

Undergraduate Studies, Community College of Allegheny County, Pittsburgh, Pennsylvania; 1968-69
Undergraduate Studies, Computer Technology, Community College of Westmoreland County, Greensburg, Pennsylvania; 1971
Repair and Dressing of Hand Tools, United States Steel Corporation

Experience and Background

1989 - Remediation Technician, IT Corporation, Pittsburgh, Pennsylvania. Present
Assists in preparing and running geophysical instruments such as magnetometers and EM-31. Calibrates and uses sampling devices such as HNUs and Photo Vac Tip units. Assists project engineer in establishing contamination reduction zone areas. Responsible job site inventories. Helps maintain clean and safe job site.

Contractor in the building trade. Carpenter, plumber and electrical work. Quality construction of custom-built homes, framing to fine trim work, complete plumbing and electrical work, all aspects of remodeling and reading blueprints.

1970 - Various Positions, United States Steel, Homestead Works, Homestead, Pennsylvania. Tool repairman, rubber-tired crane operator, truck driver, crew leader, burner. Responsibilities included repair and maintenance of hand tools, power tools, and inventory of Maintenance of Way Department. Operation of rubber-tired Pettibone Speed Swing, large, single-axle flatbed trucks with truck-mounted cranes and large, single-axle vans, Supervised 15 men in construction, repair and design of 125 miles of railroad tracks. Experienced in the use of various hand torches required to cut metal, and ability to read blueprints.
Professional Qualifications

Mr. Cochenour is an experienced analyst of soil and water samples for pesticides, polychlorinated biphenyls, herbicides, volatile organic analyses, base-neutral/acid extractions, total organic carbon and total organic halogens. He has extensive experience in analytical laboratory testing and supervision, and is the Pittsburgh laboratory, Organics Laboratory Manager. He directs the three organic sections, which includes 21 personnel, with respect to new method development and implementation, quality control, data management and reporting functions. His analytical and instrumental experience includes atomic absorption spectrophotometry, X-ray diffraction, gas chromatography, gas chromatograph/mass spectrometry (GC/MS), total organic carbon analyses, and wet chemical testing. He has active involvement in interpreting mass spectral data and determining laboratory compliance with Environmental Protection Agency Contract Laboratory Program (EPA CLP) protocols for Hazardous Substance List compounds.

Education

B.S., Biology, Waynesburg College (Chemistry Minor), Waynesburg, Pennsylvania; 1976

Experience and Background

1981 - Present Organics Laboratory Manager, IT Analytical Services, Pittsburgh, Pennsylvania. Responsible for management and supervision of the organics section of the laboratory to include internal coordination with the project coordinator, technical director, geotechnical lab manager, and general manager. Duties include:

• Preparing, reviewing, and approving reports generated by the gas chromatography group, gas chromatograph/mass spectrometry (GC/MS) group, and total organic halogens/total organic carbon group of the laboratory.

• Coordinating with section group leaders in completing project work accurately, on schedule, and within budget

• Scheduling of laboratory personnel within a two shift per day and weekend framework

• Directing the application of IT Corporation policies and EPA approved testing procedures

• Implementing new analytical methodologies and modifications through organics section group leaders

• Enforcing quality control program as specified in the IT Analytical Services Quality Assurance Manual.
1976 - 1981  **Physical Science Technician, Energy Technology Center, U.S. Department of Energy, Bruceton, Pennsylvania.** Analyzed water, waste, and solids generated by coal research projects using chemical, physical, and instrumental methods. Developed expertise performing analyses by fluorescence indicator adsorption chromatography, vacuum-type distillation, X-ray diffraction, and other gravimetric, titrimetric, and instrumental techniques, and assembled data from investigative studies and prepared analytical reports for internal project use.

**Professional Affiliations**

Society for Analytical Chemists of Pittsburgh
JOHN DERUBEIS

Professional Qualifications

Mr. DeRubeis is a Group Leader in the Organic Preparation Group. His primary responsibility is the preparation of samples for organics analysis by gas chromatography (GC) and gas chromatography/mass spectrometry (GC/MS).

Education

Diploma, St. Elizabeth High School, Pleasant Hills, Pennsylvania; 1977

Experience and Background

1988 - Present  Group Leader, Organic Preparation, IT Analytical Services, Pittsburgh, Pennsylvania.

• As section Group Leader, he is responsible for preparation of samples for organic analysis by GC and GC/MS
• Trains laboratory personnel in the performance of organic sample preparation
• Organizes and schedules sample preparation within the group
• Prepares samples for analysis of base/neutral acid extractables (BNA), pesticides, polychlorinated biphenyls (PCBs), and herbicides
• Supervises and/or performs preparations of performance evaluation samples

1988 - Field Technician 8, IT Analytical Services, Pittsburgh, Pennsylvania. Duties include:

• Clean glassware
• Sample tracking
• BNA, pesticide, PCB, and herbicide sample preparation
• Contract laboratory procedure (CLP) and non-CLP procedures
• Soil, water, concrete core, and wipe sample extractions
• Equipment maintenance

1986 - Field Technician, IT Analytical Services, Pittsburgh, Pennsylvania. Duties included PCB cleanup work.
Professional Qualifications

Dr. Darrel Dunn is a hydrogeologist with more than thirty years of broad field and investigative experience. He has been developing and using computer programs for finite-difference ground water modeling for over twenty years; and he has also created and used hydrologic software on ground water contamination, water well fields, ground water mounds, pumping test analysis, stream depletion, ditch seepage, water quality data, and other hydrologic and geologic applications.

Education

Ph.D., Geology, University of Illinois, Urbana, Illinois; 1967
B.Sc., Geology, University of Illinois, Urbana, Illinois; 1955

Experience and Background

1988 - Manager of Hydrogeologic Modeling, IT Corporation, Pittsburgh, Pennsylvania. Manages environmental assessment and site characterization projects in which emphasis is on ground water and modeling.

- Managed two- and three-dimensional finite-difference computer modeling of ground water flow and contaminant transport at a large U.S. Department of Energy (DOE) uranium processing site. Using SWIFT III and particle tracking programs.


- Performs field inspections for investigation of ground water contamination at industrial sites.

1974 - Independent Consultant, Earth Science Services, Inc., Bozeman, Montana. Completed over 130 hydrology and geology projects, including:

- Designing a ground water monitoring system for the tailings site of a large underground gold mining operation, including monitoring well design and placement, well testing, ground water sampling, and analysis of the ground water system for a mining permit application.

- Performing the hydrologic parts of an environmental assessment for a deep oil and gas exploration hole in the overthrust belt of the Northern Rocky Mountains, testifying at hearings on the permit application, designing a ground water sampling program for nearby domestic wells and springs, and performing daily ground water sampling for six months.
• Performing pumping tests on a water supply well of a paper mill and analyzing the results in terms of well rehabilitation and the effects of ground water contamination on aquifer permeability.

• Performing the Montana statewide wastewater impoundment assessment for the Montana Water Quality Bureau and the U.S. Environmental Protection Agency (U.S. EPA) which involved evaluating the ground water contamination potential of industrial, municipal, and agricultural wastewater impoundments throughout the state.

• Investigating the effects of urbanization and changes in agricultural practices on ground water levels and quality in an intermontane valley for a planning organization funded by the U.S. EPA.

• Performing the hydrologic part of a Federal Energy Administration investigation of the possibility of developing a large energy facility in the high plains coal region, which included evaluating potential ground water and surface water depletion and contamination.

• Performing ground water availability analysis, testing existing water wells, supervising test well drilling and testing, writing production well specifications, supervising production well drilling, and testing a production well at Montana State Prison, Deer Lodge, Montana.

• Designing water supply wells for the Fort Harrison Veterans Administration Hospital, Helena, Montana, including flow meter testing.

• Developing a finite-difference ground water model for analysis of availability of ground water for property involved in a federal condemnation suit for the U.S. Department of Justice.

• Miscellaneous investigations for the Montana Water Quality Bureau involving ground water contamination and availability of ground water for real estate developments and municipal water supplies.

• Performing a baseline environmental geology study for a large proposed platinum mine, including engineering geology and snow avalanche hazard.

• Developing finite-difference ground water models for analysis of availability of ground water for real estate developments.

• Performing environmental assessments and providing estimates of availability of ground water using analytical ground water models for many real estate subdivisions.

D. Performing the Montana statewide wastewater impoundment assessment for the Montana Water Quality Bureau and the U.S. Environmental Protection Agency (U.S. EPA) which involved evaluating the ground water contamination potential of industrial, municipal, and agricultural wastewater impoundments throughout the state.
• Analysis of availability of ground water for expanding municipal water supplies for Missoula, Hamilton, and Seeley Lake, Montana.

• Analysis of the hazard of contaminating ground water via installation of septic tanks for the Montana Subdivision Bureau.

• Analysis of the hydrologic effects of a federal highway barrow pit for the Montana Agency Legal Services Bureau.

• Analysis of low streamflow frequency in the eastern Montana coal region for a planning agency funded by the U.S. EPA.

• Many investigations for law firms, including ground water contamination, water well construction, basement flooding, waterlogging of land, slope stability, ground vibrations, western water rights, and water well interference. This work involved depositions and testifying in court.

• Designing water wells for municipal, irrigation, and geothermal water supplies.

• Performing pumping tests on industrial, municipal, geothermal, and irrigation wells.

• Analysis of flood hazard in proposed real estate developments along the Yellowstone River, Montana.

• Analysis of the stability of slopes and probability of major earthquakes for a condominium development at a major ski area.

• Quantitative analyses of the probability of future earthquakes in the vicinity of a proposed major ski area and a large underground gold mine.


1967 - Assistant Professor of Geology, Montana State University, Bozeman, Montana. Taught courses titled Ground Water Hydrology, Advanced Hydrogeology, and Historical Geology. Did research on computer simulation of the hydrologic systems of mountain watersheds including gathering field data on mountain watersheds and comparing the field data to computer results. Performed research on the effects of weather modification on streamflow.
1966 - 1977
Ground Water Geologist, Alberta Research Council, Ground Water Division, Edmonton, Alberta, Canada. Worked on hydrogeology of the Stettler area, Alberta, Canada, which included finite-difference modeling of a municipal well field, collecting water quality samples and developing computer programs to process lithologic and hydrologic data.

1962 - 1966
Assistant Instructor and Research Assistant, University of Illinois, Urbana, Illinois. Research on baseflow to streams. In addition, summer employment with the Pure Oil Company, in Regina, Saskatchewan and Olney, Illinois, working on hydrodynamics problems related to oil accumulation and production.

1957 - 1962
Geologist, Pure Oil Company, Grand Junction, Denver and Durango, Colorado. Subsurface geologic mapping, geophysical borehole log interpretation, well site geology, surface geologic mapping, and petroleum prospecting, high plains and Colorado Plateau.

1955 - 1957
Radio Operator, 1st Armored Division, Fort Polk, Louisiana.

1955

Professional Affiliations
Geological Society of America, Hydrogeology Division
American Association of Petroleum Geologists

Publications


Professional Qualifications

Mr. Gaillot is the Manager of the Ground Water Department and a Certified Ground Water Professional and Licensed Professional Geologist with over 12 years of experience assessing the hydrologic, hydrogeologic, and hydrogeochemical environment, with particular emphasis on ground water hydrology and its relationship to surface water hydrology. Techniques include analytical and numerical computer modeling, ground water hydraulics and flow theory, geophysics, and geochemistry, including environmental isotopes.

Mr. Gaillot has planned, managed, and participated in a variety of projects to investigate ground and surface water contamination, ground water supply potential, salinity control, canal leakage, water salvage, artificial recharge, subsidence, dam safety, and ground water extraction and injection well design. He has considerable field experience, collecting hydrogeologic data, along with monitoring and directing drilling operations for pumping and monitoring well installations. His work has required monitoring and coordinating contracts and project activities with private firms and with state and federal agencies.

Additionally, Mr. Gaillot has continued his postgraduate education by attending numerous short courses. These courses have included such topics as aquifer testing, remote sensing, emergency response, modeling subsurface flow and contaminant transport, ground and surface water evaluation techniques, ground water remediation, ground water/surface water relationships, environmental quality engineering, project management, and employee supervision.

Education

M.S., Hydrology (Ground Water), University of Idaho, Moscow, Idaho; 1979
B.S., Earth Sciences, Pennsylvania State University, University Park, Pennsylvania; 1974

Experience and Background

1985 - Present Manager, Ground Water Department, IT Corporation, Pittsburgh, Pennsylvania. Senior hydrogeologist, plans, coordinates, conducts and manages projects designed to assess and characterize hydrogeologic environments. Projects involve investigating and designing remedial actions for ground and surface water and soils contamination at industrial, hazardous, and nuclear mixed waste sites, for both government and industry. Specific assignments have included:

- Preparing documentation for site investigations, data analyses, and costing/scheduling of major projects for conducting remedial investigations/feasibility studies and litigation support.

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• Participation in and managing projects for investigating the potential impacts of mining and industrial activities.

• Proposal preparation for various types and sizes of projects.

• Evaluating field and laboratory data for design of remedial action alternatives.

• Managing and conducting field assessments to collect geotechnical, geochemical and hydrogeologic data for the design of remedial actions.

• Planning, conducting and evaluating aquifer test investigations.

• Computer modeling for assessing ground water flow and contaminant transport and for evaluating and designing ground water remediation programs.

• Conducting project review meetings with clients and regulatory agencies.

• Planning field investigations for leaky underground storage tank sites.

• Design of ground water monitoring and extraction programs.

1983 - 1985

Regional Ground Water Specialist for the Southwest Region (Five-State Area) of the U.S. Bureau of Reclamation, Amarillo, Texas. Technical specialist in ground water hydrology and its conjunctive relationship to surface water hydrology. Responsibilities included planning, conducting, managing, and reviewing Bureau studies related to ground water hydrology. Work required the use of various techniques and procedures to assess the hydrologic, hydrogeologic, and hydrogeochemical environment, which included the use of analytical and numerical models, ground and surface water hydraulics and flow theory, geophysics, and geochemical techniques, including environmental isotopes.

Managed and participated in various projects to investigate ground and surface water supply potential, water quality, salinity control, canal leakage, water salvage, artificial recharge, subsidence, dam safety, and injection well design. Some of this work required monitoring contracts with private firms and interagency agreements with state and other federal agencies. Conducted considerable field work, collecting basic hydrologic and hydrogeologic data, along with monitoring and directing drilling operations and installing piezometers.

Interdisciplinary team experience working with engineers, geologists, biologists, economists, and sociologists on water resource planning, design and construction, and operation and maintenance projects.
Report writing and technical presentations at public and professional meetings.

1981 - District Hydrologist (Southeast Utah), U.S. Bureau of Land Management, Moab, Utah. Responsible for both surface water and ground water evaluation and management within the district. Provided technical assistance, guidance, and coordination to all district personnel. District Program Leader for the Soil, Water, Air, and Earth Science Program and the Forestry Program. Coordinated all activities within these programs with other state and federal agencies. Major duties included:

- Supervising temporary summer employees.
- Conducting water quality and quantity inventories and monitoring data entry into the appropriate computer data storage and retrieval system.
- Conducting special studies related to watershed problems such as salinity control, coal mining hydrology, and tar sands development.
- Acting as District Water Rights Coordinator.
- Providing input for environmental analyses and statements and land use planning documents.
- Representing the district at professional meetings and at state, federal, and public meetings.
- Overall operation of the climatological data-gathering network.

1980 - Hydrologist and Project Leader, U. S. Geological Survey, Iowa City, Iowa. Hydrologist and project leader of a study to compile and evaluate the water resource data available for north-central Iowa. Data were published as an Iowa State Water Resources Atlas. Worked with other hydrologists and technicians collecting water quality, stream flow, sediment, and water level data in different sections of Iowa. Operated district logging truck and collected borehole geophysical data from numerous sites.

Summer - Field Hydrologist (Temporary), University of Idaho, Moscow, Idaho. Coordinated and conducted the hydrologic and geologic field work for the Gospel Hump Roadless Area study conducted by the U.S. Forest Service through the College of Forestry. Work involved site selection and installation of sediment traps in first-order drainages of several different rock types and site classifications in order to evaluate their on-site erosion potential, both before and after logging and road construction. Acted as liaison between University and Forest Service personnel in the field. Conducted library research and worked with Forest Service geologists to determine the location and type of geologic units within the study area.
1975 - 1977 Hydrologic Field Assistant/Hydrologist, Physical Science Technician, USGS, Anchorage, Alaska. As a temporary hydrologic field assistant, maintained computer files for storage and retrieval of water resource data and assisted the section head in a variety of jobs that required computer solutions. May 1976, transferred to a hydrologist position on an intermittent status, collected discharge and water quality field data, and trained in data processing procedures. Transferred to USGS Conservation Division as a Physical Science Technician. Maintained files on geophysical records, and assisted area geologists in performing lease tract evaluations for oil and gas lease tract sales.

Registrations/Certifications

Certified Ground Water Professional, Association of Ground Water Scientists and Engineers, National Water Well Association; No. 174
Licensed Professional Geologist: North Carolina, No. 443

Professional Affiliations

Association of Ground Water Scientists and Engineers, National Water Well Association
PAMELA S. HALL

Professional Qualifications

Ms. Hall is a geologist with a strong analytical background and is part of the Geophysics group at IT Pittsburgh. She is familiar with many geophysical survey techniques, software used for the interpretation of geophysical data, and computer modeling techniques. Ms. Hall has performed environmental assessments associated with real estate transactions and underground storage tank compliance audits. In addition, Ms. Hall has experience in identifying asbestos containing materials and familiarity with radon detection equipment. She has also given presentations of her work at various professional meetings.

Education

M.S., Geology, West Virginia University, Morgantown, West Virginia; 1988
B.S, Physics, Edinboro University of Pennsylvania; 1983

Experience and Background

1989 - Engineer/Scientist, IT Corporation, Pittsburgh, PA. As part of the Geophysics group, responsible for acquisition and interpretation of geophysical data. Duties include:

• Use of Magnetometer, EM31, EM34, GPR and resistivity sounding equipment.
• Use of various software packages for interpreting geophysical data.
• Provide technical support services on additional projects as required.

1988 - Senior Laboratory Technician, Volz Environmental Services, Inc. Pittsburgh, Pennsylvania. Primary responsibility was the identification of asbestos containing materials using the McCrone method. Other duties included:

• Perform fiber counts on air monitoring filters.
• Perform visual environmental assessments for real estate transactions.

Professional Affiliations

National Well Water Association
Pittsburgh Geologic Society
PAMELA S. HALL

Publications

Hall, Pamela S., 1988, Deformation and metamorphism of the aluminous schist member of the Setters Formation, Cokeys ville, Maryland: unpublished Masters Thesis, West Virginia University, 99 pages.


MARK J. HARDNER

Professional Qualifications

Mr. Hardner is a hydrogeologist with a technical background in hazardous waste site investigations. The techniques used in these investigations include development of work plans and field sampling programs, evaluation of hydrologic and geologic data, and report preparation. His field experience is concentrated in the areas of soil and water sampling and monitoring well installation.

Education

M.S., Civil Engineering, Water Resources, University of Pittsburgh, Pittsburgh, Pennsylvania, completed course work and currently preparing thesis; 1989
B.A., Geology, Mercyhurst College, Erie, Pennsylvania; 1980

Experience and Background

1989 - Hydrogeologist, IT Corporation, Pittsburgh, Pennsylvania. Involved in tasks relevant to site investigations and report preparation including the following:

- Participated in the development of work plans and field sampling programs
- Involved in field work and report preparation for several projects
- Experienced in various techniques of project field work including soil sample collection, surface and ground water sampling, soil-gas surveying, well installation, and various drilling methods
- Supervised drilling subcontractors during the installation of ground water monitoring and recovery wells
- Assisted in test pit excavations

1988 - Hydrologic Technician, U.S. Geologic Survey, Pittsburgh, Pennsylvania. Involved in field work for countywide water resource projects including aquifer testing and water quality sampling. Processed and entered hydrogeologic information for the nationwide ground water site inventory (GWSI) data base.

1987 - Teaching Assistant, University of Pittsburgh, Pittsburgh, Pennsylvania. Instructed undergraduate-level laboratory courses in fluid mechanics and hydrology.
Mark J. Hardner

1986 - Geologist, U.S. Department of the Interior, Office of Surface Mining, Pittsburgh, Pennsylvania. Participated in subsurface investigations utilizing a borehole camera system. Researched local documented mine subsidence cases and created a computer data base for these events.

1985 Supervised a team of geologists and technicians during drilling operations for hydrocarbon recovery.
LAWRENCE J. BASER

Professional Qualifications

Mr. Baser is a civil engineer who has a background of 10 years of construction engineering experience followed by 28 years of consulting engineering practice. He has managed engineering and construction projects, with emphasis on the geotechnical aspects of the projects. His experience includes evaluation of impoundment slope and foundation stability conditions, seepage through and under embankments, landfill design, building foundation studies, and lateral support considerations.

Education

M.S., Civil Engineering, University of Pittsburgh, Pittsburgh, Pennsylvania; 1964
B.S., Civil Engineering, University of Pittsburgh, Pittsburgh, Pennsylvania; 1950

Experience and Background

1988 - Present
Manager, Engineering Operations, IT Corporation, Pittsburgh, Pennsylvania. Responsible for the engineering operations of the Pittsburgh office and serves as Project Director on major projects. He also supervises the Pittsburgh office Quality Assurance Program. Project involvement includes:

- Project Director for design of a 400,000 ton hazardous waste vault in Canton, Ohio. Effort to date includes siting, design, permitting, compatibility testing with significant interaction required with both U.S. EPA Region V and OEPA.

- Senior management oversight for feasibility studies, remedial design, and tumulus design for FMPC at Fernald, Ohio.

1987 - 1988
Senior Consultant, IT Corporation, Pittsburgh, Pennsylvania. Served as senior consultant relative to geotechnical aspects of projects which included:

- Stability and settlement evaluation of a proposed 200-foot-high hazardous waste landfill. Required consideration of effect of existing buried, soft, compressible waste on the site.

- Project management for design and construction of a 350,000-cubic-yard hazardous waste landfill. This project required mixing of bentonite with the existing on-site soil to produce material suitable for liner construction.

- Review of reports and designs for projects involving:
  - Slurry walls
  - Caps
  - Landfills
  - Drainage
Lawrence J. Haser

- Hydrogeologic characterization
- Ground water recovery

1960 - Vice President, Ackenhel and Associates, Geosystems, Inc., Pittsburgh, Pennsylvania. Responsible for projects which included:

- Waste disposal
- Landslides
- Soil and rock slope design
- Mine subsidence risk
- Building foundations
- Dams
- Highway soil studies
- Site development
- Vibration related effects
- Seepage and drainage.

Experience included:

- Evaluation of a waste impoundment embankment stability adjacent to an interstate highway. Project considered potential for liquefaction under seismic conditions in addition to usual stability and seepage considerations.

- Field investigation and study to develop recommendations for covering an impoundment containing a semisolid hazardous waste. Investigation included field sampling and subsequent laboratory testing to provide data for evaluating material to solidify and/or cover the waste.

- Investigation of ground water and stability considerations for permitting of a 150-year-old industrial waste landfill. Involved demonstrating to agencies why current regulations could not apply literally to conditions at this site.

- Design of a cover for abandonment of a section of an industrial landfill. Involved extensive investigation to locate and test borrow materials for suitability.

- Evaluation of stability of an industrial waste lagoon dike immediately adjacent to a stream. Project involved field sampling, laboratory testing, and analysis to estimate risk of dike failure.

- Analysis and study of an underground solution mining operation to develop recommendations for locating future wells. This study was required to reduce loss of pumping equipment due to underground collapse of mined areas and to permit forecasting future successful well locations.

- Numerous studies for industrial, commercial, and public building foundations, including spread footings, mats, piles, and caissons. Projects also included recommendations for lateral support considerations, such as for sheet piling and soldier beams with
tiebacks; and several coal refuse fire projects.

- Design and investigation of dams, including coal slurry impoundments, industrial waste water retention ponds, and water supply and recreational uses.

- Deep coal mine studies to estimate risk of future subsidence of overlying bedrock. Recommend methods to reduce such risk when unacceptable.

1954 - Construction Engineer, Pittsburgh Board of Education, Pittsburgh, Pennsylvania. Responsible for construction inspection of school building projects for compliance with plans and specifications. Involved actual field inspection and liaison between contractors and design architects.


Registrations/Certifications

Professional Engineer: Pennsylvania, Ohio, West Virginia, Maryland, Virginia, and Kentucky

Professional Affiliations

American Society of Civil Engineers
International Society for Soil Mechanics and Foundation Engineers

Publications


WARREN HOUSEMAN

Professional Qualifications

Mr. Houseman has twelve years of diversified industrial hygiene and safety experience in heavy industry and hazardous waste and is certified by the American Board of Industrial Hygiene.

Education

M.S., Hygiene, University of Pittsburgh, Pittsburgh, Pennsylvania; 1982
B.S., Biology, California University of Pennsylvania, California, Pennsylvania; 1976

Experience and Background

1987 - Present  Health and Safety Coordinator, IT Corporation, Pittsburgh, Pennsylvania. Responsible for industrial hygiene, occupational safety, training, worker's compensation, and medical surveillance programs for the Remediation division of IT Corporation. Duties include:

- Administration of the industrial hygiene program for recognition, evaluation, and control of workplace health hazards.
- Supervision of a comprehensive loss control program, including audits, accident investigations, employee training and establishment of health and safety requirements for projects and facilities.
- Coordination and technical support of field health and safety technicians.
- Design and implementation of health and safety plans for remedial investigations, decontamination and remediation projects.
- Coordination with health and safety regulatory agencies at local, state, and federal levels.

1985 - 1987  Environmental Health Engineer, USS Division, USX Corporation, Lorain, Ohio. Responsible for the implementation and direction of the Lorain Works Industrial Hygiene Program. Experience includes:

- Recognition and measurement of occupational hazards, including organic vapors, asbestos, lead, silica, ionizing radiation and noise.
- Instruction of training programs concerning asbestos, respiratory protection, hearing conservation, radiation survey equipment, gas testing equipment and hazard communication.
- Achievement of compliance with OSHA and NRC regulations.
Warren Houseman

- Participation in joint union-management safety committee meetings.
- Supervision of gas rescue personnel.
- Interaction with the plant safety function.

1984 - 1985
Industrial Hygienist, Mon Valley Works, USS Corporation, Dravosburg, Pennsylvania. Shared responsibility for the implementation and direction of the Industrial Hygiene Program at five facilities. Experience included:
- Evaluation of collected survey data followed by written conclusions and recommendations.
- Development of programs, including respiratory protection program for air purifying respirators and guidelines for the handling and removal of asbestos-bearing materials.
- Evaluation of employee exposure histories for occupational disease claim petitions.

1983 - 1984
Environmental Health Technician, Edgar Thomson Works of USS Corporation, Braddock, Pennsylvania. Responsible for Industrial Hygiene at the Edgar Thomson and Duquesne plants. Experience included:
- Participation in gas program, radiation committee, and safety program audit teams.
- Collection, evaluation, and management of Material Safety Data Sheets.
- Recognition and measurement of occupational hazards.

1976 - 1983
Environmental Health Technician, Clairton Works, USS Corporation, Clairton, Pennsylvania. Conducted Industrial Hygiene surveys and provided written conclusions and recommendations.

Registrations/Certifications
Certified Industrial Hygienist: American Board of Industrial Hygiene

Professional Affiliations
American Industrial Hygiene Association (full member)
American Academy of Industrial Hygiene

Publications
ALAN M. JACOBS

Professional Qualifications

Dr. Jacobs is a Certified Professional Geologist with expertise in groundwater, engineering geology, mine reclamation, hazardous waste cleanup, nuclear waste isolation, dam rehabilitation, contaminant migration studies, and geologic and hydrogeologic surveys. He helped to develop specialized techniques and hardware for the underground and underwater TV probe used in boreholes and monitoring wells. His graduate training at Indiana concentrated on geomorphology/hydrogeology, and his doctoral dissertation addressed discrimination between glacial and landslide deposits in southwest Montana. He taught geomorphology, glacial geology, and field geology at Indiana University, and is currently a part-time instructor in the Department of Civil Engineering at Carnegie-Mellon University.

Education

Ph.D., Geology, Indiana University, Bloomington, Indiana; 1967
M.A., Geology, Indiana University, Bloomington, Indiana; 1965
B.S., Geology, The City College, City University of New York; 1963

Experience and Background

1988 - Project Manager, IT Corporation, Pittsburgh, Pennsylvania. Manages the Site Characterization Department comprising hydrogeologists, geophysicists, geochemists, and hydraulic engineers. Technical oversight of the projects to which this Department is assigned. Managed projects involved with siting and remediation of chemical waste and radwaste sites.

1979 - President and Chief Geologist, Geoprobe, Pittsburgh, Pennsylvania. 1988
Provided independent consulting services, offering new geologic techniques using borehole television surveys. Techniques were applied to mine reclamation, dam rehabilitation, foundation studies, subsidence, and ground water pollution abatement.

Provided geologic assessment for nuclear power plant safety at sites in Nebraska, Wisconsin, New York, Connecticut, South Carolina, North Carolina, Spain, Italy, the Middle East, Pakistan, and South Korea. Prepared state-of-the-art reports for nuclear waste isolation in geologic repositories. Evaluated foundation conditions and determined site safety for the Olympic Sports Complex in Montreal, Canada; the Federal Building in Honolulu, Hawaii; a proposed steel complex in southern Italy; an ore processing plant in eastern Venezuela; a storage complex near the Persian Gulf; a proposed silver ore mill complex in California; and a uranium ore mill in Wyoming. Evaluated hydrogeologic conditions of chemical, nuclear, and coal refuse disposal in terrains containing glacial outwash, loess, and cavernous limestone.
Alan M. Jacobs

1974 Experience included mapping, glacial stratigraphy, and environmental
geology in southern Illinois, St. Louis metropolitan area, and the
Lake Michigan shoreline.

Registrations/Certifications

Certified Professional Geologist, CPG #2675, AIPG, 1974
Professional Geologist, #209, Delaware, 1974
Registered Geologist, #3452, California, 1978
Certified Engineering Geologist, #1053, California, 1979

Professional Affiliations

American Institute of Professional Geologists
   Pennsylvania Section, Secretary/Treasurer: 1981-82;
   President, 1983-84; Executive Committee, 1985-86
Geological Society of America
   Explorers Club, New York, Fellow
Pittsburgh Geological Society
   Sigma Xi Research Society

Publications

Proceedings, Second International Conference on New Frontiers for

In addition to the above, Dr. Jacobs has authored more than
35 publications dealing with environmental geology, surficial
geology, engineering geology, hydrogeology, mine reclamation, and
borehole TV.
Professional Qualifications

Mr. Jordan is a geologist with a technical background in hazardous waste site investigations. The techniques used in these investigations include development of work plans and field sampling plans, evaluation of data, and report preparation. Mr. Jordan's field experience is concentrated in the areas of soil sampling and monitoring well installation.

Education

M.S., Geology, West Virginia University, Morgantown, West Virginia, Completed coursework currently preparing thesis; 1987.
B.S., Earth Sciences, Pennsylvania State University, University Park, Pennsylvania; 1983.

Experience and Background

1988 - Present Geologist, IT Corporation, Pittsburgh, Pennsylvania. Involved in a number of tasks relevant to site investigations and report preparation:
• Participated in the development of work plans and field sampling plans.
• Involved in the field work and report preparation for numerous projects.
• Experienced in various techniques of project field work including: various drilling methods, soil sample collection, ground water sample collection, and well installation.
• Supervised drilling subcontractors during the installation of ground water monitoring and recovery wells.
• Assisted in the installation of a ground water recovery and treatment system.


1985 - 1986 Teaching Assistant, West Virginia University, West Virginia. Instructed introductory-level physical geology and senior-level geomorphology laboratory courses.

1984 - 1985 Research Assistant, West Virginia University, West Virginia. Interpreted the depositional history of an alluvial- and colluvial-filled valley based on field observations and laboratory analyses. Project became M.S. Thesis topic.
1982 - Research Assistant, Pennsylvania State University, Pennsylvania.
1983 Aided in the gathering, computer modeling, and interpreting of dissolved oxygen data from small streams.

Professional Affiliations

American Association of Petroleum Geologists
Pittsburgh Geological Society

Publications


MUSA M. KESEBIR

Professional Qualifications

Mr. Kesebir specializes in the fields of hydrogeology, geochemistry, water resources development, and engineering geology.

Education

M.S. Hydrogeology, The University of Akron, Ohio (May 1986)
B.S. Engineering Geology, University of Istanbul in Turkey (1980)

Experience and Background

1989 - Present
Hydrogeologist, Assistant Quality Assurance Officer, Hydrogeology/Geochemistry Section, IT Corporation, Pittsburgh, Pennsylvania. Design and application of hydrogeologic site characterizations and remedial actions under the EPA's enforcement policies for both abandoned and active hazardous waste sites causing contamination of our drinking water resources (ground and surface waters) [Title 40 CFR (Code of Federal Registration) Protection of Environment (Parts 1 - 799)].

- Conducting variable field work including drilling, soil/water sampling, monitoring well installation, testing programs for contaminated sites
- Application of geophysical methods (experienced with ground probing radar (GPR) to delineate the locations of underground storage tanks (UST's), plume directions, and water table depth and/or differentiation of formation material and extentions.
- Computer proficiency, including Fortran 77, IBM basic programming, and several many menu driven scientific softwares
- Proposal preparation, technical reviews of hydrogeologic site assessments, remedial investigations, and feasibility studies.

1987 - 1988
Research Hydrogeologist, Center for Environmental Studies of the University of Akron, Akron, Ohio. Development and application of remedial investigations of Uniontown (IEL) superfund site and continuous monitoring for ground water contamination for the city landfill of Akron, Ohio. Design and implement methane (CH₄) collection systems and/or monitoring CH₄ movement in landfills.

1986 - 1987
Hydrogeologist, Environmental Design Group Incorporated (EDG), Stow, Ohio. Involved in several projects which include: continuous monitoring of ground water in a major chemical solid waste disposal site near Akron, Ohio; design of an extension to the existing city landfill along with monitoring leachate movement and evaluating its effects on ground water resources near Dayton, Ohio; in addition...
monitoring wells and evaluation of ground water samples under RCRA
due to chemical spills near Dallas, Texas, and Akron, Ohio; and
emergency response sampling for PCB's content in Detroit, Michigan.

1986 - Consulting Geologist, Eagon & Associates, Incorporated, Worthington,
Ohio. Conducted a project under contract with the City of Kent to
perform studies related to their existing water wells and ground
water resources of the area.

1985 - Teaching and Research Assistant, Environmental Studies, University
1986 of Akron. Taught and organized Natural Science Geology.

1980 - Engineering geology work at "Kepez" dam construction in central
Summer Turkey for B.S. thesis.

1979 - Geologic mapping in an island of "Imroz" located in Aegean sea
Summer (between Turkey and Greece).

1978 - Uranium and geothermal prospect by Mediterranean region for Mineral
Summer Research and Exploration Company of Turkey.

Professional Affiliations

Association of Ground Water Scientists and Engineers (AGWSE of NWWA))
of National Water Well Association

Publications

Kesebir, M. M., 1986, "Hydrogeology of Hinckley Township, Medina
County, Ohio." Abstract in Ground Water (September - October 1986)
ROBERT G. NIES

Professional Qualifications

Mr. Nies is responsible for the design and implementation of soil and ground water monitoring programs. He is experienced in the acquisition and interpretation of field data related to site investigations. He has extensive drilling experience in the New Jersey Coastal Plain and Piedmont physiographic provinces. His drilling experience includes bedrock and overburden well design and construction using mud and air rotary, air hammer, hollow stem auger, and cable tool drilling techniques. He has conducted several environmental investigation in conjunction with state and local officials under the federal Superfund program.

Education:


Experience and Background

1988 - Geologist, Geosciences, IT Corporation, Edison, New Jersey. Designed and implemented several ground water investigations for private clients, including ECRA and UST sampling and analysis plans.

1986 - Geologist, Geology/Engineering Division, NUS Corporation, Edison, New Jersey. Site manager for preliminary assessments and site inspections at hazardous waste sites. Responsible for design and implementation of ground water monitoring programs, including supervision of field activities. On-site geologist during well installation and geophysical programs under CERCLA and SARA programs.

1986 - Field Technician/Geologist, IT Corporation, Edison, New Jersey. Responsible for collection of quality environmental samples for soil/ground water investigation. Also used as geologist for the supervision of monitor well installation and soil classification.

1985 - Field Technician/Staff Geologist, Erie Geological Contractors, Erie, Pennsylvania. Assisted in hydrogeologic studies involving hazardous waste, site permitting for solid waste disposal, and private water supply. Drafted stratigraphic columns and correlated borehole data into facies maps of study area.

Professional Affiliations

Association of Ground Water Scientists and Engineers (NWWA)
American Association of Petroleum Geologists
CHARLES L. PETERMAN

Professional Qualifications

Mr. Peterman is a project geologist and field supervisor for projects involved in the assessment of ground water quality and soils investigations. His experience includes extensive sampling programs from various sites in the United States, installation, operation, and site management of a ground water recovery and treatment system, and five years of drilling and contractor management experience in the natural gas industry.

Education

Graduate studies, Geology, Indiana University of Pennsylvania, Indiana, Pennsylvania; 1978-80

Experience and Background

1987 - Project Geologist and Senior Technician, IT Corporation, Present Pittsburgh, Pennsylvania.

- Project work involving the preparation of reports concerning environmental assessments, progress reports, and technical reports on treatment systems construction, operation and management.
- Field supervision of the installation of a ground water recovery and treatment system. Project included installation of production and observation wells, construction of the water treatment building, treatment system, and collection system, operation and maintenance of the collection and treatment systems, ground water monitoring and sampling, and sampling of influent and effluent streams in the water treatment system.
- Sample team supervisor at a hazardous waste disposal site. Collection of liquid and solid waste samples from a multi-pond site was undertaken to characterize contaminants for treatment evaluation. Health and safety of sample team members and support personnel was of primary concern along with the establishment of an effective sampling program to produce quality samples.

1985 - Self employed - Business was involved with all phases of construction and repair of residential properties, private and commercial.

1985 - Responsibilities included production and exploration geology, development of drilling programs, evaluation of drilling prospects developed by outside concerns, and management of lease holdings and acquisitions.
Charles L. Peterman

1984 - Responsible for all production and exploration geology, development and presentation of drilling prospects to management and investor groups, field engineering of gas well drilling and competition, environmental compliance, and lease acquisition.

1987 - Office Manager/Field Technician, Agway Petroleum Corporation,
Responsibilities included scheduling of personnel, credit management, and customer relations.

Professional Affiliations

American Association of Petroleum Geologists
Pittsburgh Geological Society
Michael Pupeza

Professional Qualifications

Mr. Pupeza is the Manager of the Data Analysis Section in the Ground Water Department with over 12 years of experience in the use of various procedures and techniques to assess the hydrogeologic and geologic environment. The techniques include the use of ground water hydraulics and flow theory, complex geophysical methods (surface survey and downhole geophysics), and numerical computer models.

Mr. Pupeza is experienced with surface and subsurface investigations and analysis of geological strata using geological and geophysical survey (resistivity and I.P. methods and potential field data) and well log analysis of clastic rocks. He has been involved in data collection as well as in data compilation.

Education

M.Sc., Engineering Geologist/Geophysicist, University of Bucharest, Romania; 1977
B.Sc., Geological Engineering, University of Bucharest, Romania; 1974
B.Sc., Electrical Engineering, Polytechnical Institute, Bucharest, Romania; 1971
Short course on the Regulations, Science and latest Technological Developments in Ground Water Monitoring, East Brunswick, New Jersey; 1987

Experience and Background

1988 - Present
Manager, Data Analysis Section, Ground Water Department, IT Corporation, Pittsburgh, Pennsylvania.

• Senior Hydrogeologist - plans, coordinates and manages hydrogeology projects/tasks that are the responsibility of the Ground Water Department. Projects involve remedial investigation and design for ground water and soils contamination at industrial, hazardous, and nuclear mixed waste sites.

Project Engineer - Ground Water Department, IT Corporation, Pittsburgh, Pennsylvania.

• Senior Hydrogeologist - participates in projects designed to assess hydrogeologic environments.

• Preparing documentation for site investigation and data analyses for hydrogeologic projects.

• Planning, conducting and evaluating aquifer test investigations.
Michael Pupeza

- Use of modeling techniques for plume evaluation and design of remedial action alternatives for contaminant plume definition.

- Use of geophysical methods for contaminant plume definition.

- Hydrogeologic/geologic assessment on nuclear/mixed waste sites.

- Design and implementation of drilling, sampling, monitoring and testing programs for hazardous waste sites.

- Conduct of field work to collect hydrogeologic, geologic and geophysical data and review of those data for contaminant plume definition and design of remedial action alternatives.

- Technical reviews of environmental impact statements, remedial investigations and feasibility studies.

1987 - Engineer/Hydrogeologist, CTUIR, Nuclear Waste Study Program, Pendleton, Oregon. Was in charge of the technical hydrogeologic and geologic review of the Site Characterization Plan for the Basalt Waste Isolation Project (BWIP) at Hanford, Washington, as related to CTUIR's Nuclear Study Program. Duties included:

- Providing technical Engineering, hydrogeologic and geological assessment to the program's director, technical coordinator, and technical contractors.

- Reviewing technical documents from the BWIP as required for hydrogeology, geology, and technical accuracy.

- Recommending hydrogeologic and geologic activities at Hanford regarding the BWIP. Observed borehole data construction techniques and reviewed borehole data produced or maintained at Hanford as they were related to the Nuclear Waste Study Program.

- Reviewing portions of the BWIP Site Characterization Plan, technical study plans, and reports prepared by BWIP's contractors.

- Reviewing computer models used by BWIP in its hydrogeology program.


- Research on oil and gas resources in Romania.

- Studies on ground water contamination (oil spills and naturally occurring contaminants).
Michael Pupeza

- Studies for the geologic/hydrogeologic site characterization of a nuclear power plant.
- Studies on the ground water contamination of the aquifers in southern Romania because of the Chernobyl accident.

- Exploration on occurrence and movement of ground water.
- Well site selection, drilling and sampling programs.
- Geophysical investigation as part of a study on saltwater intrusion.
- Use of radioactive tracers in aquifer intercommunication studies.
- Use of numerical computer models in the characterization of flow systems.
- Analysis of aquifers using pumping test data.
- Use of electrical and refraction seismic models for the determination of the depth of the confining layers and bedrock.
DAVID C. SPATTA

Professional Qualifications

Mr. Spatta has developed a broad range of technical knowledge in his role as a geophysical field technician. He has acquired practical experience in the use and capabilities of such geophysical methods as magnetics, electromagnetics, electrical resistivity, and ground penetrating radar. He has been involved with a number of geophysical investigations and is thoroughly familiar with data acquisition techniques.

Education

- 40 hours OSHA Health and Safety Course
- Marine Corps. Institute of Studies
- Washington D.C. Non-Commissioned Officer School, Quantico, Virginia
- Penn Hills Senior High School, Penn Hills, Pennsylvania

Experience and Background

1988 – Present

- Geophysical Technician, IT Corporation, Pittsburgh, Pennsylvania
- Technician and advisor in geophysical activities as well as report preparation responsibilities.
- Perform geophysical field investigations; experienced with electromagnetic conductivity, magnetic, GPR, and electrical surveys.
- Soil-gas sample collection.
- Collection of soil and ground water environmental samples.
- Performance of pump test to characterize ground water flow regimes.

1987 – 1988

- HVAC Acquiviva General Contracting, Pittsburgh, Pennsylvania
- Responsibilities included installation of furnaces and air conditioning units for housing projects.

1983 – 1987

- United States Marine Corp. Marine Barracks 8th & I, Washington D.C.
- Numerous duties including the safe guard of the Secretary of Defense
- White House Evacuation Plan: Safe Guard of the President of the United States in the event of a National Emergency
- Squad leader of 15 marines
Professional Qualifications

Dr. Troxell has over twenty years' experience in the geotechnical and structural areas, including the analysis of soil-structure interaction, vibrations and structural dynamics, static and dynamic slope stability and bearing capacity, laboratory determination of material properties and behavior, and the stress analysis of structures for extreme loads. He was formerly a vice president with D'Appolonia, which was acquired by IT Corporation in 1984. In 1973, he initiated and implemented a corporate Quality Assurance Program in response to regulations associated with the nuclear power industry. In addition to preparing and maintaining this program, he served as project manager and principal investigator for several quality assurance projects.

His experience with U.S. Nuclear Regulatory Commission and Environmental Protection Agency quality assurance requirements relating to field investigation, laboratory analyses and design qualifies him to address unique problems of applying quality assurance to earth and environmental sciences. For example, he has spoken at Department of Energy-sponsored meetings relating to the national effort in design and construction of repositories for nuclear wastes and the American Society for Quality Control Energy Division annual meeting. In addition, he has taught short courses at the Pittsburgh and Denver Technical Centers for the Office of Surface Mining (OSM) to provide an introduction to quality assurance for OSM personnel, and at the Regional Loss Prevention Seminar for the Association of Soil and Foundation Engineers. Dr. Troxell served on the Guidelines for Design and Analysis of Nuclear Safety-Related Earth Structures Committee sponsored by the American Society of Civil Engineers, and has been affiliated with the Association of Soil and Foundation Engineers' Laboratory Accreditation Program.

Specific quality assurance projects include:

- Preparation of a Manual for Data Quality Assurance for the National Oceanic and Atmospheric Administration.

- Establishment of a Quality Assurance Manual and Manuals of Technical Practice, which met the requirements of the U. S. Nuclear Regulatory Commission, for a major construction company involved in nuclear power plant construction.

- Preparation of guidelines for the application of quality assurance to the earth sciences for the Office of Nuclear Waste Isolation.

For his accomplishments in the area of civil engineering, Dr. Troxell was named Young Engineer of the Year in 1982 by the Pittsburgh Section of the American Society of Civil Engineers.
David E. Troxell

Education

Ph.D., Civil Engineering, Carnegie-Mellon University, Pittsburgh, Pennsylvania; 1970
M.S., Civil Engineering, Carnegie-Mellon University, Pittsburgh, Pennsylvania; 1967
B.S., Civil Engineering, Carnegie-Mellon University, Pittsburgh, Pennsylvania; 1965

Experience and Background

1966 - Present
Director, Technology Development and Quality Assurance, IT Corporation, Pittsburgh, Pennsylvania. Manages IT's Technology Development Program for Hazardous and Mixed Waste. Responsible for the development, implementation, and maintenance of the corporate Quality Assurance Program, including:

• Establishing uniform requirements within IT for general quality assurance/quality control activities.

• Providing for the implementation of regulatory quality assurance requirements.

• Auditing various laboratory, engineering and remediation service groups and projects for conformance to IT and regulatory policy.

In addition, Dr. Troxell serves as internal consultant and peer reviewer for earth sciences-related design and remediation projects.

Registrations/Certifications

Professional Engineer: Pennsylvania

Professional Affiliations

American Nuclear Society
American Society of Civil Engineers
American Society for Quality Control
American Society for Testing and Materials
International Society of Soil Mechanics and Foundation Engineering
Sigma Xi

Publications


RENHY V. ZAJAC

Professional Qualifications

Seven years of data processing experience with background in the analysis, design, implementation, and programming of geotechnical, laboratory, system, and business applications. Hardware experience includes Prime computers and IBM personal computers. Languages include FORTRAN, BASIC, INFO, CPL, dBASE III+, and Lotus 1-2-3.

Education

B.S., Computer Science, University of Pittsburgh, Pittsburgh, Pennsylvania; 1980

Experience and Background

1984 - Present
  Programmer/Analyst, IT Corporation, Pittsburgh, Pennsylvania.

- Assigned as the project leader to implement and upgrade the micro-based interface between the corporate Job Tracking System and the micro-based Primavera Project Planner; to develop and publish file transfer methods between five different types of computer hardware within the corporation and subsequent recommendation on the methods to implement; to obtain a corporate license for microcomputer version of SAS and issuance to users; to publish a list of most-used software based on contacts and discussions with engineering users throughout the organization on software utilized.

- Participated in the development of a Systems Requirement Definition (SRD) for engineering computing within the corporation. Activities included interviewing personnel in different offices; compiling and analyzing the collected materials; and preparing a final document for review by the corporation. The SRD for each office contained the present system description, hardware/software inventory, and data processing requirements. Based on the interviews, 21 recommendations were presented in the SRD.

- Participated in the design, coding, testing, and documentation of a cost estimating system in dBASE III+ and Lotus for use by the corporation. This system was a result of combining two existing cost estimating systems currently in use.

- Participated in the analysis and design and was responsible for the programming, testing, and implementation of a micro-based interface between the corporate Job Tracking System, resident on the corporate mainframe, and micro-based Primavera Project Planner. This system allows for the merging of Job Tracking information with schedules to create a performance measuring tool to assist the Project Manager in making management decisions for...
the project. Responsibility included the evaluation and the recommendation of personal computer hardware, software, and communications for use with the job tracking to project management interface system.

- Participated in the development of a four-day training program for the corporation to train personnel on the Project Management System and the interface programs. Was involved in the training of 300 personnel in 8 locations.
- Responsible for 180 applications consisting of geotechnical geophysical, structural, hydrology, hydraulics, environmental, laboratory, graphics, and Prime operating system products.
- Responsible for the design, programming, and implementation of software that enhances Prime's spool capability to control printers attached to a modem. This removes the restriction that printers controlled via Prime's spool be connected to a dedicated line. Features include automatic dialing, establishing the connection, controlling the printer, and disconnecting the line.
- Responsible for the implementation of a new revision to the Prime operating system. The project lasted four months and included the supervision of the programming and the operations staff.

1980 - 1984
Programmer to Programmer/Analyst, D'Appolonia Consulting Engineers, Pittsburgh, PA.

- Involved in the analysis/design and was responsible for the programming, maintenance, and testing of geotechnical, laboratory applications and software used to control printing/plotting devices, hasp emulator, and batch jobs for the Prime computer.
- Participated in the analysis of laboratory automation.
## APPENDIX B

**DATA NEEDS AND USES**

<table>
<thead>
<tr>
<th>SITE SUMMARY</th>
<th>REFERENCE</th>
<th>DATA GAPS</th>
<th>RATIONALE/GOALS / OBJECTIVES OF PHASES II AND IV DATA COLLECTION - RI</th>
<th>POSSIBLE USES OF DATA FOR MODELING (PHASE III), RISK ASSESSMENT, AND REMEDIAL ALTERNATIVE STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The landfill contains municipal and industrial wastes; buried ferromagnetic debris is contained in the formerly active areas of landfilling in isolated areas in the central parts of the property.</td>
<td>RMS; Phase I Report (Magnetic Survey)</td>
<td>Nature of debris (drums, transformers, tanks, domestic appliances, vehicles, etc.)?</td>
<td>Characterize the wastes; drilling to avoid direct impact of impenetrable or hazardous debris (Phases II and IV).</td>
<td>Excavation plan; installation of recovery wells; assessment of risks from excavation activities.</td>
</tr>
<tr>
<td>- Wastes were placed on and in depressions in surficial sands and gravels; the fill is approximately 20 feet deep at its maximum.</td>
<td>RMS; Appendix D-2 (Borings)</td>
<td>Volume of wastes?</td>
<td>Further characterize wastes by performing a limited boring program in areas of suspected waste placement.</td>
<td>Quantity of wastes to remediate; nature of wastes for treatment; depth of wastes for treatment.</td>
</tr>
<tr>
<td>- Sands and gravels are underlain by a thick sequence of residual soil (saprolite) derived from underlying highly weathered metamorphic bedrock (Port Deposit gneiss); the soils (fill, sands and gravels and saprolite) are approximately 70 feet thick at the northern boundary of the site and thin progressively to a thickness of approximately 40 feet at the southern boundary.</td>
<td>Appendix D-2 (Borings); Phase I Report (Seismic Refraction Survey)</td>
<td>Nature of bedrock surface—permeable or impermeable to ground water flow from soil to bedrock? Nature of the bedrock—location of fracture zones?</td>
<td>Sample soils and core bedrock (Phases II and IV); borehole geophysics (Phase II); permeability tests (Phase II).</td>
<td>Possible cleanup of soils; evaluation of bedrock surface (NAPS); recovery well design; cutoff wall design; ground water modeling; assessment of risks from exposure due to possible off-site transport of solutes via ground water pathways.</td>
</tr>
</tbody>
</table>

See footnotes at end of table.
### Appendix B
(continued)

<table>
<thead>
<tr>
<th>Site Summary</th>
<th>Reference</th>
<th>Data Gaps</th>
<th>Rationale/Goals/OBJECTIVES OF PHASES II AND IV DATA COLLECTION - RI</th>
<th>Possible Uses of Data for Modeling (Phase III), Risk Assessment, and Remedial Alternative Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>- There are two main aquifers; a shallow unconfined aquifer in the saprolite; and a deep aquifer in fractured bedrock</td>
<td>Appendix D-2 (Borings); Phase I Report (Seismic Refraction Survey)</td>
<td>Is deep aquifer confined? Is there hydraulic connection between the aquifers?</td>
<td>Monitoring wells in soils and bedrock; pumping tests (Phase II)</td>
<td>Recovery well options; if no movement of ground water into bedrock, cutoff wall design; ground water modeling; assessment of risks from exposure due to possible off-site transport of solutes via ground water pathways</td>
</tr>
<tr>
<td>- The potentiometric surface of the ground water in the upper aquifer in general follows the topographic and bedrock surface. A broad and flat, wedge-shaped ground water divide (upper aquifer) is present in the northern part of the landfill. The narrowest part of the wedge is located at the northeast corner of the landfill (at Firetower and Hamilton roads intersection). The divide extends and widens from this point to the west and southwest. South of this divide, the potentiometric surface slopes to the south. At the widest part of the divide in the west-central part of the landfill, the</td>
<td>Appendix D-1 (Woodward-Clyde Reports); Phase I Report (Seismic Refraction Survey)</td>
<td>Confirmation of water levels, especially in the southern part of the site and the area north of Monitoring Well B-1</td>
<td>Monitoring wells; construction of ground water contours; installation of piezometers (Phase II)</td>
<td>Cutoff wall to north; recovery wells to north; ground water modeling</td>
</tr>
</tbody>
</table>

See footnotes at end of table.
### SITE SUMMARY

1. **Potentiometric surface slopes** to the west. Immediately north of the northern property boundary and north of Monitoring Well B-1, the bedrock surface slopes gently toward the north, and it may be assumed that the potentiometric surface slopes north, also.

2. Little is presently known about the potentiometric surface of the ground water in the bedrock; the regional trend should be westward toward the Susquehanna River and Chesapeake Bay, although local slopes may differ.

3. Polyvinyl chloride sludge was placed in Cells A and B/C. The sludge was also placed in other locations in the landfill.

4. Anomalous concentrations of volatile organic compounds in the soil-gas were found in the west-central, northwest, and central portions of the property (not in Cells A and B/C). These concentrations may be higher than from PVC sludge.

---

### APPENDIX B

(continued)

<table>
<thead>
<tr>
<th>Reference</th>
<th>Data Gaps</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Potentiometric surface of bedrock aquifer in the site vicinity</em></td>
<td><em>Monitoring wells in bedrock (Phase II)</em></td>
</tr>
<tr>
<td><em>Nature of VOCs from wastes other than from PVC sludge</em></td>
<td><em>Further characterization of waste (Phases II and IV)</em></td>
</tr>
<tr>
<td>Phase I Addendum Report (Soil-Gas Survey)</td>
<td><em>Movement of VOCs in ground water</em></td>
</tr>
<tr>
<td></td>
<td><em>Monitoring wells; water sampling and analyses (placement of wells downgradient from possible source areas and plumes) (Phase II)</em></td>
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<tr>
<td></td>
<td><em>Recovery wells; ground water modeling; risk assessment of pathways for solute transport</em></td>
</tr>
<tr>
<td></td>
<td><em>Bioremediation possibilities; deemphasis of vapor extraction for VCM in cells</em></td>
</tr>
</tbody>
</table>

See footnotes at end of table.
### SITE SUMMARYa

Anomalies may indicate the locations of the former placement of wastes or of compounds derived from the transport or chemical breakdown of these wastes.

- Conductivity anomalies suggest the presence of conductive ground water plumes that emanate from the central portions of the landfill and off to the southwest part of the site.
- Perched water is restricted to areas to the south of Cells B/C.
- Organic compounds present on site include the 11 target compounds plus additional hydrocarbons and metals.

### APPENDIX B (continued)

<table>
<thead>
<tr>
<th>SITE SUMMARY</th>
<th>REFERENCEb</th>
<th>DATA GAPS</th>
<th>RATIONALE/GOALS/OBJECTIVES OF PHASES II AND IV DATA COLLECTION - RI</th>
<th>POSSIBLE USES OF DATA FOR MODELING (PHASE III), RISK ASSESSMENT, AND REMEDIAL ALTERNATIVE STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Phase I Report (EM Survey)</td>
<td>Confirm movement of organic solutes</td>
<td>Monitoring wells; water sampling and analyses (placement of wells downgradient from possible source areas) (Phase II)</td>
<td>Recovery wells; solute transport modeling; assessment of risks from exposure due to possible off-site transport of solutes via ground water pathways</td>
</tr>
<tr>
<td></td>
<td>Seeps downslope</td>
<td>Other areas of perched water?</td>
<td>Borings for monitoring wells (Phase II) sampling and analyses of seeps</td>
<td>Interceptor trenches for leachate collection; bioremediation</td>
</tr>
<tr>
<td></td>
<td>Consent Order; Appendix D-3 Analytical Data; Text for Detailed Work Plan--Phase I (Soil-Gas)</td>
<td>More ground water quality data at south, to the west, and to the north of the site; organics and metals</td>
<td>Monitoring wells; seeps, sediments and surface water sampling and analyses</td>
<td>Compound-specific treatment design; assessment of risks based on toxicity of compounds</td>
</tr>
</tbody>
</table>

See footnotes at the end of the table.
### APPENDIX B (continued)

**SITE SUMMARY**

- No evidence at present for off-site migration of solutes in the ground water

**REFERENCE**

- Phase I Report; Appendix D-3 (Analytical Data)

**DATA GAPS**

- No off-site soil wells; no wells at the southwestern or southern part of the site

**RATIONALE/GOALS/OBJECTIVES OF PHASES II AND IV DATA COLLECTION - RI**

- Additional wells to the west of the site; additional wells to the north of the site; additional wells in the southwestern and southern part of the site (Phase II)

**POSSIBLE USES OF DATA FOR MODELING (PHASE III), RISK ASSESSMENT, AND REMEDIAL ALTERNATIVE STUDY**

- Potential remediation of off-site areas and areas in the southern part of the site (ground water); assessment of risks to nearby domestic wells

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*a*Indications from available site data and conclusions obtained from work prior to and during Phase I (Preliminary Investigations).

*b*RMS (Records Management System) - Historical files; Appendix D: Detailed Work Plan - Phase I; Phase I Report (September 5, 1989).