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RD/RA work plan. pdf

WORK PLAN

Remedial Design/Remedial Action

Former Accurate Die Casting Site
Fayetteville, New York

March 1995

O'BRIEN & GERE
ENGINEERS, INC.

2488.396

Work Plan

Remedial Design/Remedial Action

Former Accurate Die Casting Site
Fayetteville, New York

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March 1995

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1. Introduction

1.1. General

This document is the Work Plan for Remedial Design/Remedial Action (RD/RA) activities to be conducted at the former Accurate Die Casting Site located at 547 East Genesee Street in the Village of Fayetteville, New York (Figure 1). Based on the results of the Remedial Investigation and Feasibility Study completed in August 1994, the New York State Department of Environmental Conservation (NYSDEC) has issued a Record of Decision (ROD) directing that remedial design/remedial action be performed at the Site.

This Work Plan summarizes how the five elements of the selected remedy identified in Section 7 of the ROD issued by the NYSDEC in December 1994 (Site Number 7-34-052) will be implemented. This Work Plan includes a description of the design and anticipated construction activities necessary to implement the selected remedy at the site. These activities will be initiated according to the schedule presented as Table 1.

This section of the Work Plan presents background information pertaining to the site, a description of the selected remedy for the site, and purpose and scope of this Work Plan.

1.2. Background

The facility was constructed in 1950 as a die casting industry. Die Casting activities were conducted at the site until mid-1988 when the then owners, the former Accurate Die Casting Corporation and George and Theresa Slyman, abandoned the facility. In December

1988, ITT Commercial Finance Corporation (ITT), as mortgagee-in-possession of the property, became the successful bidder and finalized the foreclosure proceeding relative to the Site.

After the conclusion of the foreclosure process, a consultant for ITT conducted a Phase I (June 1989) and Phase II (September 1990) environmental assessment. During the Phase II environmental assessment:

- Approximately 70 drums of waste found inside the building after foreclosure were characterized and disposed;
- Sludge from an abandoned trichloroethylene (TCE) degreasing system was removed and the system was decontaminated; and
- A TCE free product pool, which was discovered adjacent to and outside the northeast corner of the building proximal to monitoring well MW-3 (Figure 2), was pumped and disposed until no TCE free product was detected in samples.

Upon reviewing the Phase II assessment of the former Accurate Die Casting site, the NYSDEC required that a Remedial Investigation be conducted. The investigation was completed in accordance with the Remedial Investigation (RI)/Feasibility Study (FS) Work Plan (Stearns & Wheler, May 1992). In the RI Report (Stearns & Wheler, December 1993), it was concluded that:

- A TCE plume extends in the overburden aquifer from outside the northeast corner of the facility north towards Bishop Brook;
- Bedrock ground water had been impacted by TCE;
- The highest TCE concentrations in soils were observed at about 20 to 25 feet below grade outside the northeast corner of the facility, at the interface between the sand/gravel and clayey till layers;
- Surface and subsurface soils contain residues of polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAH), and volatile organic compounds (VOCs) in the location referred to as the PCB/PAH/VOC Soils Area shown on Figure 2; and

- The material inside the abandoned septic tank contains levels of zinc that could present a risk to the environment.

In May 1994, an Interim Remedial Measure (IRM) Work Plan was prepared to separately address the soils exhibiting TCE outside the northeast corner of the facility and the TCE impacted overburden aquifer. The IRM Work Plan was subsequently approved by the NYSDEC in a letter dated May 23, 1994. In accordance with the approved Work Plan, the soil remediation activities were initiated on May 24, 1994 and completed on June 22, 1994, as documented in the Summary Report dated October 1994. Activities to address the overburden aquifer were initiated in September 1994.

As part of the soil remediation activities conducted outside the northeast corner of the facility, approximately 3,000 cubic yards (CY) of soil were excavated. Of that amount, approximately 1,250 CY of soil exhibited TCE levels above the established Remedial Action Objective (RAO) of 0.7 mg/kg, but below 15 mg/kg. The soil exhibiting TCE above 0.7 mg/kg was processed on site through a mechanical volatilization system. Once processed, the average residual TCE concentration was 0.13 mg/kg. The treated soils, as well as the excavated soils that did not contain TCE above the RAO, were subsequently used to backfill the excavation. However, before backfilling, a 3 to 4 feet layer of clay was placed and compacted at the bottom of the excavation to replace clay that was removed from above the bedrock.

In association with the soil remediation activities conducted outside the northeast corner of the facility, a ground water collection sump was constructed on top of the clay layer at the base of the excavation, prior to backfilling. The sump is located approximately 20 feet from the north wall of the east building addition, and approximately 20 feet east of the main building, as shown in Figure 2. The purpose of the ground water collection sump is to monitor the quality and facilitate removal of overburden ground water in the previously excavated area.

In accordance with the approved IRM Work Plan (O'Brien & Gere, May 1994), an overburden aquifer test recovery well, RW-1, was also installed on site (Figure 2) for the purpose of conducting a 24-hour pump test and hydrogeologic evaluation. The results of the 24-hour pump test and hydrogeologic evaluation are presented in the Basis of Design Report (Appendix A) which also presents a description of the proposed overburden ground water recovery and treatment system. The Basis of Design Report was approved by the NYSDEC in a letter dated December 29, 1994.

A "constructable quality" design is presently being prepared for approval by the NYSDEC for the overburden ground water recovery and treatment system based on the Basis of Design Report. As discussed during the meeting attended by the NYSDEC, NYS Department of Health, and O'Brien & Gere on January 25, 1995, the sump installed outside the northeast corner of the building will also be utilized as a ground water recovery point as part of the overburden ground water recovery and treatment system.

As a result of the January 25, 1995 it was also agreed that:

- Based upon data collected during the first two quarters following start-up of the overburden ground water recovery system, ITT will assess the need for and, if necessary, recommend to the NYSDEC locations for additional piezometers to fill data gaps. Upon NYSDEC approval, the additional piezometers would be installed.

- Quarterly letter reports will be submitted to the NYSDEC during the first year of operation presenting the data obtained during that quarter. The letter reports will also include an assessment of the effectiveness of the recovery system, and discuss the need for system modifications or additional wells, if any.

- Piezometer PZ-2 will be utilized as a ground water sampling point to provide water quality data for the area between monitoring wells MW-6 and MW-17.

1.3. NYSDEC selected remedial alternative

Based upon the results of the RI/FS at the former Accurate Die Casting site and the criteria identified for the evaluation of alternatives, the NYSDEC has further directed that the contaminated soil and sludge be excavated and disposed off-site and the TCE impacted bedrock ground water be extracted and treated on-site.

The elements of the selected remedy identified in Section 7 of the ROD are as follows:

- The PCB/PAH/VOC soils from the former oil spill area, located on the northwest portion of the site, will be excavated and disposed in a permitted landfill;
- The sludge from the septic tank, located on the north-east portion of the site, will be excavated and disposed in a permitted landfill;
- The TCE impacted bedrock ground water will be extracted and treated on-site. The treated ground water will be discharged to Bishop Brook;
- Soil samples will be obtained from the area northeast of the facility, where soils containing TCE were excavated as part of an Interim Remedial Measure, to verify that a potentially significant source of TCE is no longer present in the vadose zone soils; and
- A long-term ground water monitoring program will be implemented to monitor the effectiveness of the ground water (overburden and bedrock) and soil remediation program.

1.4. Purpose of the RD/RA work plan

The purpose of this work plan is to present a description of the remedial design and remedial action tasks to be completed to implement the five elements of the selected remedy for the site. The work plan also includes:

- A Progress Monitoring and Reporting Plan which:
  - Describes the actions that will be taken to apprise the NYSDEC of activities completed and those proposed.
  - Identifies the individuals responsible for providing project status updates.
  - Provides samples of the forms and format that will be utilized to document project progress.

- o Establishes benchmark events soon after which a job progress meeting may be proposed with the NYSDEC.
- o Provides the procedure by which the NYSDEC and ITT will be apprised of emergency or unforeseen conditions at the site;

- A draft outline of the Operations & Maintenance Manual that will be prepared following the installation of the overburden aquifer ground water recovery and treatment system;
- A draft outline of the Sampling & Analysis Plan that will describe the monitoring that will be performed;
- A Health & Safety Plan for the protection of people at and in the vicinity of the site during construction;

2. Pre-design activities

2.1. General

This section presents a description of the pre-design tasks to be completed prior to initiating design activities appropriate to the selected remedy for the site. For convenience, each of the five components of the remedy presented in Section 1.3 is addressed separately. The first two components consist of characterization of the soils in the PCB/PAH/VOC soils area and the sludge in the septic tank. The other three components involve evaluation of the bedrock aquifer, verification sampling in the former TCE excavation area, and long-term ground water monitoring.

2.2. PCB/PAH/VOC soils area

The PCB/PAH/VOC soils area will be addressed in accordance with the Work Plan dated February 1995 that has been prepared and submitted to NYSDEC for approval. The PCB/PAH/VOC Soils Excavation Work Plan (Appendix B) presents the pre-design activities that will be undertaken to characterize the soils for disposal off-site and to delineate the approximate vertical and horizontal extent of PCB/PAH/VOC residues in the soil.

2.3. Septic tank sludge

The septic tank and the sludge contained within the tank will be addressed in accordance with the Work Plan dated February 1995 prepared for excavating the PCB/PAH/VOC soils area. The PCB/PAH/VOC Soils Excavation Work Plan presents the pre-design sampling and analyses that will be performed to characterize the septic tank sludge for disposal. Following pre-characterization, the septic tank and its contents will be removed and disposed off-site concurrently with the removal of soils containing PCB/PAH/VOCs above the RAOs.

2.4. Bedrock ground water

This section presents the pre-design activities for addressing the bedrock aquifer, including:

- Data review and recovery well design
- Test bedrock recovery well installation
- Hydrogeologic evaluation
- Ground water treatment system evaluation
- Preparation of a bedrock ground water Basis of Design Report

A description of the pre-design tasks associated with bedrock ground water is presented below.

2.4.1. Data review/recovery well design

Prior to design and installation of the test bedrock recovery well, available data pertaining to the bedrock geology, ground water flow and ground water quality will be reviewed. This information will be used to finalize the location and design of the recovery well. The well design will consider the depth to and competency of the underlying bedrock in addition to structural and hydrogeologic characteristics of the bedrock.

2.4.2. Test bedrock recovery well installation

Based on current site conditions, it is anticipated that a single bedrock recovery well (RW-2) will be installed near the northeast corner of the facility. The bedrock aquifer water quality data (Table 2) obtained during the Remedial Investigation indicates that this area exhibits the highest dissolved concentrations of TCE in the bedrock aquifer.

Installation will consist of drilling a nominal 16-inch diameter borehole approximately 5 feet into competent bedrock and securing a 12-inch casing into bedrock using a portland cement/bentonite grout. A 11-7/8-inch borehole would then be advanced to 75 feet.

Should field conditions indicate that the competency of the shallow bedrock will not support an open-hole design, an 8-inch diameter screen and casing would be installed into the borehole.

Subsequent to installation, the test bedrock recovery well will be developed using either a combination of mechanical surging and pumping or air lift methods. Well development will continue until the well yields relatively sediment-free water.

2.4.3. Bedrock hydrogeologic evaluation

Following installation of the test bedrock recovery well, a pump test will be performed to estimate the design flow rates and to provide a preliminary evaluation of the bedrock aquifer characteristics. The well will be pumped continuously for up to 24 hours at a constant flow rate. The flow rate for the test will be established based on well yields obtained following well installation and development. Water levels in the pumping well, nearby bedrock monitoring wells, and selected overburden monitoring wells will be measured throughout the test. Once the test is complete and the pump is turned off, water level monitoring will continue until the water levels approximate static conditions observed prior to the test.

In addition, one discharge water sample will be collected during the test and will be analyzed for VOCs utilizing EPA Method 8010/8020 to assess VOC influent concentrations. Ground water generated during the pump testing will be treated and discharged to Bishop Brook in accordance with the NYSDEC SPDES Permit included in Appendix C.

2.4.4. Ground water treatment system evaluation

The ground water treatment system, installed to treat overburden aquifer ground water as part of an IRM, will be evaluated utilizing data obtained as a result of the bedrock hydrogeologic evaluation. The evaluation will focus on the ground water treatment system capacity, the influent flow rate generated by the overburden ground water recovery system and that expected from the bedrock ground water recovery system, anticipated influent VOC concentrations, and the ability of the system to accommodate the additional influent flow while maintaining compliance with the treated water discharge permit.

2.4.5. Basis of Design Report

A bedrock ground water Basis of Design Report will be prepared and submitted to the NYSDEC prior to initiating design. The Basis of Design Report will present the results and conclusions of the bedrock hydrogeologic evaluation and ground water treatment system evaluation, and present a description of ground water treatment system modifications that may be necessary to accommodate bedrock ground water flows. The Basis of Design Report will also present details of the bedrock test recovery well, a piping and system component diagram for the ground water treatment system installed as part of the overburden aquifer IRM depicting modifications required, and preliminary specifications for major system components.

2.5. TCE soils excavation verification sampling

Pursuant to the NYSDEC letter dated October 28, 1994, six soil borings will be advanced in the former TCE excavation area outside the northeast corner of the facility. Three of the borings will be located within the limits of the backfilled excavation, two will be installed along the eastern edge of the backfilled excavation, and one will be installed along the northern edge of the backfilled excavation as shown on Figure 3. The borings will be completed to a depth equal to the highest recorded static ground water level (Table 3) in this area but not deeper than 25 feet.

The soil borings will be completed using conventional hollow-stem auger drilling techniques and soil samples will be obtained at two foot intervals for field screening using a photoionization detector (PID) in accordance with the procedures provided as Appendix D. The PID, equipped with a 10.2 eV lamp, will be calibrated to correct for the photoionization sensitivity of 8.9 for TCE compared to an isobutylene standard of 7 ppm (v/v).

Based on the results of the field screening, two soil samples will be obtained from each of the borings installed and analyzed in a laboratory for the presence of VOCs utilizing EPA Method 8010/8020. The soil samples selected from each boring will be from the two, non-contiguous depth intervals exhibiting the highest PID readings during field screening. Should no PID readings be observed, then soil samples will be obtained from intervals corresponding to approximately 1/3 and 2/3 of the boring depth.

The results of the soil analyses and the field screening data will be submitted to the NYSDEC for review in a letter report within 20 business days of the receipt of the final laboratory report by O'Brien & Gere.

2.6. Long-term ground water monitoring program

Within 60 calendar days of completing construction and initiating operation of the overburden aquifer ground water recovery and treatment system, installed as part of an interim remedial measure, a long-term ground water monitoring program plan will be submitted to the NYSDEC for approval. The ground water monitoring program plan will include a summary of the long-term ground water treatment system performance monitoring requirements. A draft outline of a ground water monitoring program plan is provided as Appendix E for review.

In general, the monitoring plan will include a schedule for measuring water levels as well as collecting ground water samples for analysis. It is anticipated that, following start-up of the overburden and bedrock recovery systems, water levels will be measured weekly for the first month, biweekly for the following two months and monthly for a period of six months. The frequency may be modified depending upon information obtained. Ground water samples will be collected during 1995 from all the on-site monitoring wells on a quarterly basis beginning in January 1995. The number of wells sampled per event, and the frequency of the sampling events, may be modified in subsequent years as appropriate based on the information obtained in 1995.

As may be appropriate, the ground water monitoring program plan would be revised within 60 days after completing construction of the bedrock aquifer ground water recovery and treatment system.

2.7. Health and safety plan

A site specific Health and Safety Plan, provided as Exhibit A, was prepared to provide guidance for O'Brien & Gere Technical Services, Inc. personnel during the conduct of remedial activities. This document is adopted for O'Brien & Gere Engineers' on-site personnel during the installation of soil borings, and conduct of soil sampling and excavation activities. The Health and Safety Plan was prepared in accordance with the Federal Occupational Safety and Health Administration guidelines (29 CFR 1910.120) utilizing data generated during the RI, including site history and subsurface conditions.

O'Brien & Gere Technical Services will be responsible for the implementation and enforcement of the Health and Safety Plan (HASP) during the activities to be conducted on the site.

3. Design activities

3.1. General

This section presents the remedial design activities that are to be completed as part of design of a bedrock ground recovery system at the site. The design activities include preparation of a Pre-Final (90 Percent) Design package followed by a Final (100 Percent) Design package. Design activities associated with the removal and disposal of the PCB/PAH/VOC soils and septic tank are addressed in the PCB/PAH/VOC Soils Excavation Work Plan dated February 1995.

3.2. Pre-Final (90 percent) design

A Pre-Final (90 Percent) Design package of "constructable quality" documents for the bedrock ground water recovery and treatment system will be submitted to the NYSDEC for review. The pre-final (90 percent) Design will include:

- Special provisions specifying procedures for collection, destruction, treatment, and/or disposal of hazardous wastes and substances and their constituents and degradation products, and of any soil or other materials contaminated thereby.
- Special provisions for physical security of the site, as well as for monitoring the health and safety of persons living and/ or working at or in the vicinity of the site while undertaking remedial activities.

The Pre-Final (90 Percent) Design documents will consist of the elements described in the following sections.

3.2.1. Technical specifications

The Technical Specifications will define the qualitative requirements for products, materials, and workmanship for the major components associated with Remedial Action Construction activities. The Technical Specifications will be prepared using the Construction Specifications Institute (CSI) format.

3.2.2. Contract drawings

The Contract Drawings will be prepared using AutoCADD, and the drawings will be D-size (24 inch x 36 inch). The Contract Drawings will include a Site Plan showing the location of ground water recovery well, routing of pipe and the treatment facility, ground water treatment process schematic, and mechanical, electrical, and structural drawings providing necessary details for construction.

3.2.3. Construction Quality Assurance Plan (CQAP)

The CQAP will cover elements necessary to document that the completed Remedial Action Construction meets the requirements of the Remedial Design. The CQAP implementation begins at the start of construction and continues through the completion of construction. Operation of the ground water treatment system will be addressed separately in the Operation and Maintenance (O&M) Manual.

3.2.4. Citizen participation plan

The Citizen Participation Plan incorporates appropriate activities outlined in the NYSDEC publication, "New York State Inactive Hazardous Waste Citizen Participation Plan", dated August 30, 1988, and any subsequent revision thereto, and 6 NYCRR Part 375. It is assumed that the NYSDEC will continue to implement the Citizen Participation Plan activities for the site.

3.2.5. Air monitoring plan

Air monitoring procedures to be implemented during construction of the remedial action are described in the HASP (exhibit A). Air monitoring requirements and protocols to be implemented during operation of the ground water treatment system will be addressed in the operations and maintenance manual, as appropriate.

3.3. Final (100 percent) design

After receipt of one round of consolidated comments from the NYSDEC on the Pre-Final (90 percent) design, O'Brien & Gere will execute the required revisions and submit the Final (100 percent) Design documents to the NYSDEC for approval. The Final (100 percent) Design documents will be of "constructable quality" for use by O'Brien & Gere Technical Services in completing construction of the bedrock ground water recovery and treatment system, and will have the signature and seal of a professional engineer licensed to practice in the State of New York.

4. Remedial action construction

4.1. General

Upon NYSDEC's approval of the final bedrock aquifer ground water recovery and treatment system design, the Remedial Action Construction phase of the project will be initiated. This phase will commence upon approval of the remedial design and it will be completed upon NYSDEC's certification of completion of construction work and the successful start-up of the bedrock ground water recovery and treatment system.

This section does not address construction activities associated with the removal and disposal of the PCB/PAH/VOC soils and septic tank since these activities are described in the PCB/PAH/VOC Soils Excavation Work Plan dated February 1995.

4.2. Requirements

Within 90 calendar days of NYSDEC's approval of the Final Design, construction of the bedrock aquifer recovery and treatment system will be initiated. Within 45 calendar days of award of the contract, the following items will be submitted to NYSDEC:

- Requests for modification of the approved Final Design based on construction methods identified by the Remedial Action Contractor, or modifications of the Construction Schedule, or other new information.

- A construction schedule of sufficient detail to monitor the progress of key project phases and tasks on the Contractor's critical path. The schedule will be maintained by the Contractor and the Contractor will provide a letter detailing the circumstances of any changes or delays of schedule.

4.3. Performance of remedial action construction

Upon receipt of NYSDEC's written approval of the final design as well as the written approval or disapproval of any requests for modification of the final design and/or construction schedule, Remedial Action Construction will be initiated in accordance with this work plan and the approved remedial design.

5. Progress monitoring and reporting

5.1. General

This section identifies the individuals that are responsible for monitoring the progress of the remedial design and remedial actions, and for providing periodic status updates to NYSDEC. This section also presents the format and describes the contents of the monthly progress reports, identifies certain benchmark events after which progress meetings may be conducted, and establishes the procedures by which ITT and NYSDEC will be apprised of emergency or unforeseen conditions encountered at the site.

5.2. Project management and responsibilities

A project management team from both O'Brien & Gere Technical Services, Inc. and O'Brien & Gere Engineers, Inc. (O'Brien & Gere) has been assembled to plan, implement, and monitor the progress of remedial design and remedial activities at the site. O'Brien & Gere Technical Services, Inc. will be the lead organization for managing the implementation of the RD/RA activities. O'Brien & Gere has been retained by O'Brien & Gere Technical Services to prepare and implement the engineering activities defined in this RD/RA Work Plan. O'Brien & Gere will also be responsible for preparing the monthly progress reports incorporating data provided by O'Brien & Gere Technical Services for submittal to ITT and the NYSDEC.

The individuals assigned to this program, as well as a description of their respective roles and responsibilities, are identified below.

5.2.1. Project officer

Terry L. Brown, P.E. of O'Brien & Gere Technical Services will serve as project officer for the RD/RA program. Mr. Brown is responsible for coordinating the overall management of the RD/RA activities, directing field and office personnel, and managing the administrative aspects of the project. Mr. Brown will be the primary point of contact for all written correspondence from the NYSDEC and ITT to the Companies of O'Brien & Gere.

5.2.2. Engineering project manager

David S. Towers, P.E. of O'Brien & Gere will serve as the engineering project manager for the RD/RA program. Mr. Towers is responsible for coordinating the preparation of this and associated work plans, remedial design documents, and monthly monitoring reports. Mr. Towers will also serve as the secondary contact for the NYSDEC to address questions with regard to the progress of project and status of verification sampling efforts.

5.2.3. Engineering coordinator

Alfred R. Farrell, P.E. of O'Brien & Gere will serve as the engineering coordinator for the RD/RA program. Mr. Farrell is responsible for the day-to-day monitoring of the status of activities being conducted by O'Brien & Gere Technical Services.

5.2.4 Project supervisor

Mr. Anthony Geiss of O'Brien & Gere Technical Services will serve as the project supervisor during implementation of the remedial actions. Mr. Geiss' responsibilities will include managing the day-to-day activities in the field in accordance with this and associated work plans, and the remedial design documents. Mr. Geiss will also be responsible for providing Mr. Farrell weekly reports, while construction activities are underway, detailing the activities completed during the week and the activities proposed to be undertaken during the following two weeks.

Mr. Geiss will also be responsible for apprising Mr. Brown and Mr. Farrell of conditions encountered in the field that either were unforeseen or may result in a delay of the task completion time.

5.3. Progress monitoring and documentation

Progress reports, using the format presented in Appendix F, will be prepared for submittal to NYSDEC each month, starting one month after the approval of this Work Plan and the effective date of the Consent Order, and continuing until the tasks described within this Work Plan are complete. These progress reports, which will be submitted to the NYSDEC by the 10th day of each month, will present a summary of the activities performed during the proceeding month and a summary of the activities proposed to be undertaken within the next 45 calendar days.

The progress reports will also include information regarding estimated task completion dates, and provide a description of unresolved delays encountered or anticipate that may affect the future schedule for implementation of the RD/RA activities and efforts made to mitigate those delays or anticipated delays.

5.4. Progress meetings

O'Brien & Gere Technical Services, Inc. will provide the NYSDEC written notice, at least 5 business days in advance, of scheduled project progress meetings, including the pre-construction and substantial completion meetings, and initiation of the following field activities:

- Soil boring installations;
- Ground water sampling events;
- Invasive activities such as soil excavation;

- Start-up and testing of ground water recovery and treatment system.

For planning purposes, it is anticipated that a scheduled project progress meeting may occur on or shortly after the following events:

- Submittal of the TCE soils excavation verification sampling letter report to the NYSDEC;
- Initiation of continuous operation of the overburden ground water recovery and treatment system; and
- Submittal of the first Annual Ground Water Monitoring Report.

This notification requirement is waived for activities performed in response to unforeseen and emergency conditions.

5.5. Unforeseen and emergency condition notification

In the event of a potentially significant unforeseen or emergency condition, O'Brien & Gere Technical Services, Inc. will immediately notify ITT and the NYSDEC by telephone, with follow-up notification provided in writing. The notice will apprise the recipient of the nature of the unforeseen or emergency condition, potential impact to the project schedule, and measures taken or initiated to remedy the situation or minimize impacts.

For no unforeseen or emergency condition shall the NYSDEC require advance notice, or penalize ITT for failure to provide advance notification.

5.6. Field changes

During performance of the Remedial Actions described in this Work Plan, conditions on-site may necessitate changes to the NYSDEC approved design and/or associated work plans. Such requests will be submitted in writing and include a description of the situation/conditions necessitating a field change, and a description of the modifications proposed and the potential impact to the completion of the remedial actions.

6. Post-remedial construction activities

6.1. General

This section identifies the documents that are to be submitted to the NYSDEC following completion of the remedial actions described within this Work Plan and the PCB/PAH/VOCs Soils Excavation Work Plan (O'Brien & Gere, February 1995).

6.2. Notice of completion

Within 30 calendar days of the completion of remedial construction activities on site, a Notice of Completion for Remedial Action Construction will be submitted to NYSDEC.

6.3. Operation and Maintenance Plan

Within 60 calendar days of completing construction and initiating operation of the overburden aquifer ground water recovery and treatment system, an Operation & Maintenance Plan will be submitted to the NYSDEC for approval. The Operation & Maintenance Plan will provide a summary of the ground water recovery and treatment system controls and functions, normal operation parameters, required system inspection frequency, maintenance requirements, and a trouble shooting guide. A draft outline of an Operation & Maintenance Plan is provided as Appendix E for review.

The Operations & Maintenance Plan would be subsequently revised, if necessary, within sixty days of completing bedrock aquifer remedial actions.

6.4. Record drawings and certification

Within 60 calendar days of completing construction and initiating operation of the bedrock aquifer ground water recovery and treatment system, a set of Record Drawings depicting the ground water recovery and treatment system will be submitted to the NYSDEC. The Record Drawings will accompany a letter, signed and stamped by an engineer licensed to practice in New York State, certifying that the ground water recovery and treatment system was completed in accordance with the NYSDEC approved remedial design, and the NYSDEC approved modifications thereto.

6.5. Remedial actions summary report

Within 60 calendar days of completing all remedial actions described within this Work Plan and PCB/PAH/VOC Soils Excavation Work Plan (O'Brien & Gere, February 1995), a Remedial Actions Summary Report will be submitted to the NYSDEC. The Remedial Actions Summary Report will present an overview of the remedial actions completed at the former Accurate Die Casting site to implement the components, listed in section 1.3, of the remedy presented in the ROD. The summary report will also present a summary of the previously completed Interim Remedial Measures and provide a reference listing of pertinent Work Plans and Reports prepared previously for the site.

In accordance with the Consent Order, the Remedial Actions Summary Report will be signed and stamped by an engineer licensed to practice in New York State, and will include a statement certifying that the remedial actions were completed at the site in accordance with the NYSDEC approved work plans and the NYSDEC approved revisions thereto.

6.6. Remedial actions contingency plan

As part of the long-term ground water monitoring program, an annual ground water monitoring report will be submitted to the NYSDEC. If, based on the long-term ground water monitoring data, it becomes apparent that the remedial actions completed in accordance with this Work Plan are not effectively remediating the site, a Remedial Actions Contingency Plan will be prepared and submitted to the NYSDEC.

The Contingency Plan would include a description of the status of remedial efforts, present data obtained as a result of the monitoring efforts, and present practicable and feasible measures that may be implemented to facilitate remediation. In the event that practicable measures are not available, the Contingency Plan would present the data and conclusions that may warrant a revision of the RAOs for the site.

TABLES

Table 1
Project Schedule

Former Accurate Die Casting Site
Fayetteville, New York

Description	1995 Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1996 Jan	Feb
PRE-DESIGN ACTIVITIES												
1. PCB/PAH/VOC soils area pre-characterization	■	■										
2. Septic tank sludge pre-characterization	■	■										
3. Bedrock Ground Water Evaluations												
– Test bedrock recovery well installation & pump test		■										
– Bedrock hydrogeologic evaluation			■									
– Ground water treatment system evaluation					■							
– Bedrock ground water Basis of Design Report					■							
– NYSDEC review of Basis of Design Report (1)						■						
4. TCE soils excavation clean-up verification												
– Sampling & analysis	■	■										
– TCE soils verification sample results letter report		■	■									
5. Long-term Ground Water Monitoring Plan					■							
DESIGN ACTIVITIES												
1. PCB/PAH/VOC Excavation Plan		■										
2. Bedrock Ground Water Recovery and Treatment System												
– Pre-final (90%) design submittal							■					
– Construction Quality Assurance Plan Submittal							■					
– Final design submittal								■				
– NYSDEC review of final design (1)									■			
REMEDIAL ACTION CONSTRUCTION												
1. Overburden Ground Water Recovery and Treatment System Construction (2)				■								
2. PCB/PAH/VOC Soils Area Excavation (2)				■	■							
3. Bedrock Ground Water Recovery and Treatment System (2)										■		
POST-REMEDIAL CONSTRUCTION ACTIVITIES												
1. Notice of Completion											■	
2. Operation & Maintenance Plan												■
3. Record Drawings & Certification												■
4. Remedial Actions Summary Report												■

Notes: (1) Schedule provides 30 calendar days for review by the NYSDEC. al\rdratab1
(2) Actual duration of construction is not known. A detailed construction schedule will be provided prior to initiating construction activities on-site.
(3) Monthly progress reports will be submitted to the NYSDEC in accordance with the Consent Order.
(4) Shading indicates the anticipated period during which the identified task will start and be completed, unless otherwise noted.

Table 2

Ground Water TCE Concentrations

Accurate Die Casting Facility
Fayetteville, NY

	Trichloroethylene Concentrations (1)					
Date Sampled:	**8/30/89**	**12/4/89**	**5/20/90**	**5/28/92**	**7/22/94**	**10/18/94**
Monitoring Well (3)						
MW-1	112	ND	2	ND	NS	Dry
MW-2	ND	ND	1	ND	NS	ND
MW-3	Free Product	>55,000	440,000	340,000	Abandoned	Abandoned
MW-4	NS	7	43	6	270	23
MW-5	NI	340	344	110	330	410
MW-6	NI	700	454	510	390	360
MW-7 (B)	NI	ND	ND	ND	ND	ND
MW-8	NI	ND	ND	ND	NA	ND
MW-9	NI	109	106	60	72	74
MW-10 (B)	NI	NI	NI	4,500	1,600	1300
MW-11 (B)	NI	NI	NI	5,200	5,500	5300
MW-12	NI	NI	NI	36	44	35
MW-13	NI	NI	NI	110	740	510
MW-14	NI	NI	NI	67	150	120
MW-15 (B)	NI	NI	NI	NI	NS	14
MW-16 (B)	NI	NI	NI	NI	NS	6
MW-17	NI	NI	NI	NI	260	140

Notes: ND - Not detected at concentrations greater than analytical detection limit.
NS - Not sampled.
NI - Well not installed at time of sampling.
NA - Not analyzed.
(1) - Concentrations reported in ug/L (ppb).
(2) - Sample collected 8/19/92 because MW-13 and MW-14 were dry on 5/28/92.
(3) - Monitoring wells MW-1 through MW-16 installed by Stearns & Wheler, monitoring well MW-17 installed by O'Brien & Gere Engineers, wells MW-1, MW-7, MW-10, MW-11, MW-15, and MW-16 are bedrock ground water monitoring wells.
(B) - Bedrock well.

TABLE 3
MONITORING WELL SPECIFICATIONS AND GROUND WATER ELEVATIONS
ACCURATE DIE CASTING
FAYETTVILLE, NY

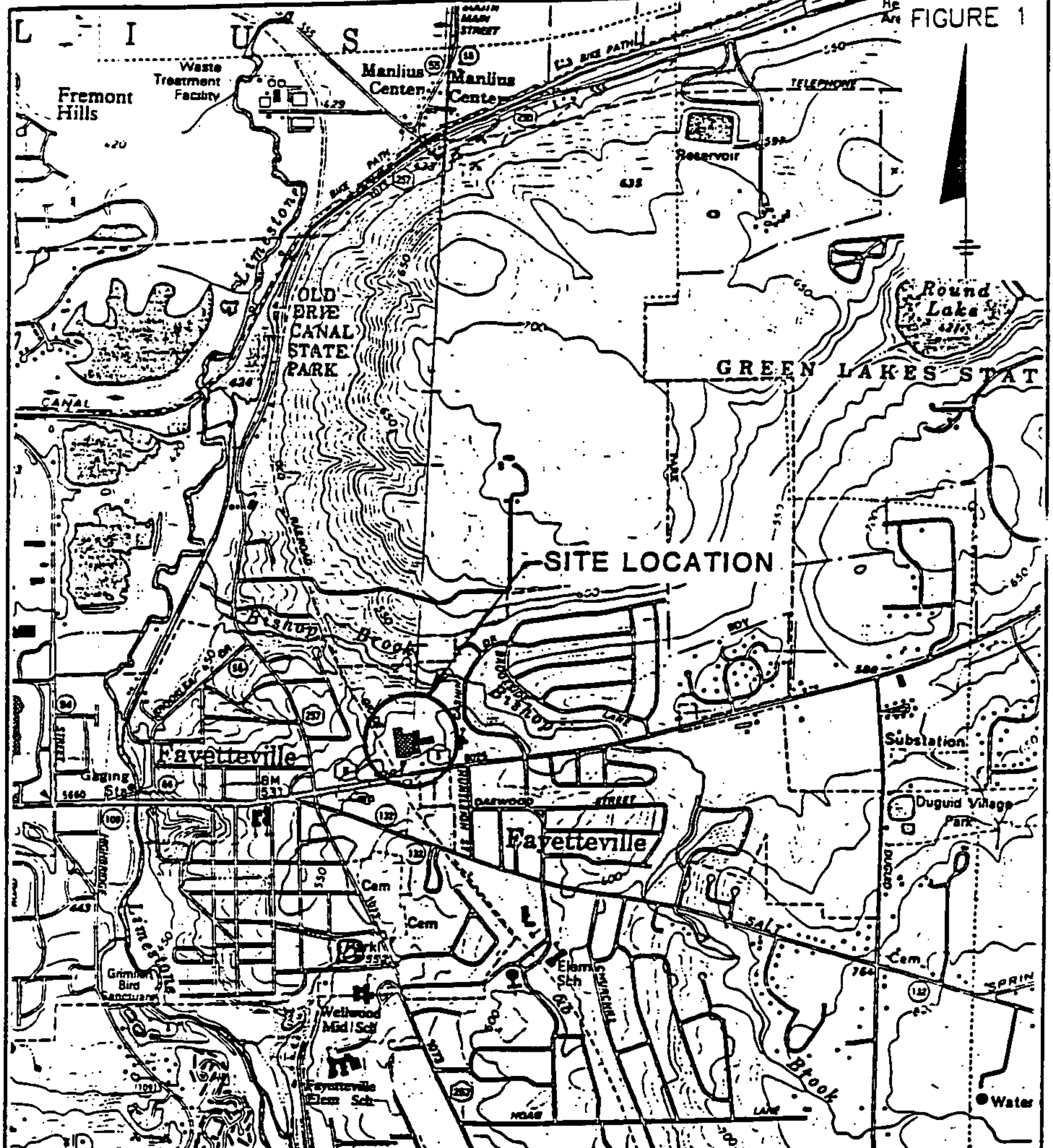
Well No.	Ground Elevation	Well Casing Elevation	Screened Interval Elevation	GROUND WATER ELEVATIONS 5/28/92	6/26/92	8/7/92	9/26/94	9/27/94	10/18/94	11/2/94	11/17/94	11/30/94	12/15/94	12/27/94	1/13/95	1/25/95
MW-1	99.36	101.11	75.4 - 85.4	DRY	DRY	79.69	—	—	DRY	—	—	—	—	—	—	—
MW-2	91.8	94.68	76.6 - 86.6	83.21	82.81	84.32	83.10	83.28	80.12	—	—	—	—	—	—	—
MW-3	97.65	99.63	73.7 - 83.7	80.44	80.09	81.63	ABDN	ABDN	ABDN	Abandoned						
MW-4	65.62	68.52	46.6 - 56.6	51.08	49.95	50.81	47.22	52.21	46.79	—	—	—	—	—	—	—
MW-5	88.21	90.42	49.2 - 59.2	60.71	63.76	61.22	59.87	59.91	59.45	—	—	—	—	—	—	—
MW-6	77.46	79.38	46.4 - 56.4	60.50	60.49	60.46	59.51	59.52	59.05	—	—	—	—	—	—	—
MW-7(B)	75.66	78.34	34.3 - 44.3	54.59	54.55	54.47	53.90	53.97	53.55	—	—	—	—	—	—	—
MW-8	88.21	91.78	53.9 - 63.9	66.38	66.38	66.83	61.59	61.65	60.99	—	—	—	—	—	—	—
MW-9	102.44	104.03	49.7 - 59.7	60.46	60.51	61.83	59.57	59.59	59.08	—	—	—	—	—	—	—
MW-10(B)	97.51	99.69	43.03 - 53.03	61.15	61.99	61.69	—	—	56.02	55.07	55.19	54.94	55.19	55.02	54.94	54.95
MW-11(B)	91.48	93.80	43.1 - 53.1	62.34	63.70	63.66	58.41	58.39	57.47	50.01	56.68	55.59	56.63	56.55	55.63	55.63
MW-12	93.62	94.14	51.9 - 61.9	62.24	60.74	62.77	59.77	59.79	59.31	—	—	—	—	—	—	—
MW-13	98.73	100.92	77.7 - 87.7	DRY	80.62	80.92	—	—	78.70	82.92	78.21	78.21	80.92	78.34	78.25	77.83
MW-14	98.76	100.62	74.6 - 84.6	75.11	79.07	81.54	—	—	86.18	80.12	80.54	80.54	80.20	80.54	80.62	80.45
MW-15(B)	96.1	98.90	32.7 - 42.7	NI	NI	NI	—	—	53.47	—	—	—	—	—	—	—
MW-16(B)	98.5	100.85	50.8 - 60.8	NI	NI	NI	—	—	61.67	—	—	—	—	—	—	—
MW-17	66.9	69.24	53.7 - 63.7	NI	NI	NI	54.61	54.61	54.08	—	—	—	—	—	—	—
PZ-1	81.8	83.95	49.8 - 59.8	NI	NI	NI	59.56	59.57	59.10	—	—	—	—	—	—	—
PZ-2	80.6	83.06	42.8 - 52.8	NI	NI	NI	59.35	59.36	58.89	—	—	—	—	—	—	—
RW-1	78.4	80.28	29.4-39.4 - 45.4-50.4	NI	NI	NI	56.88	56.89	58.22	—	—	—	—	—	—	—
Sump	—	98.50	— - —	—	—	—	—	—	—	76.04	74.83	75.00	75.17	74.83	75.00	75.00

Notes: (B) - Bedrock well.
NI - Well not installed at time of monitoring.
— - Water level not monitored.
ABDN - Abandoned.
MW-1 through MW-16 installed during Remedial Investigation (Stearns & Wheler).

FIGURES

MHB H:\DIVISION\71\ACCURATE\SITE SF=1 04/15/94

FIGURE 1



ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK

SITE MAP

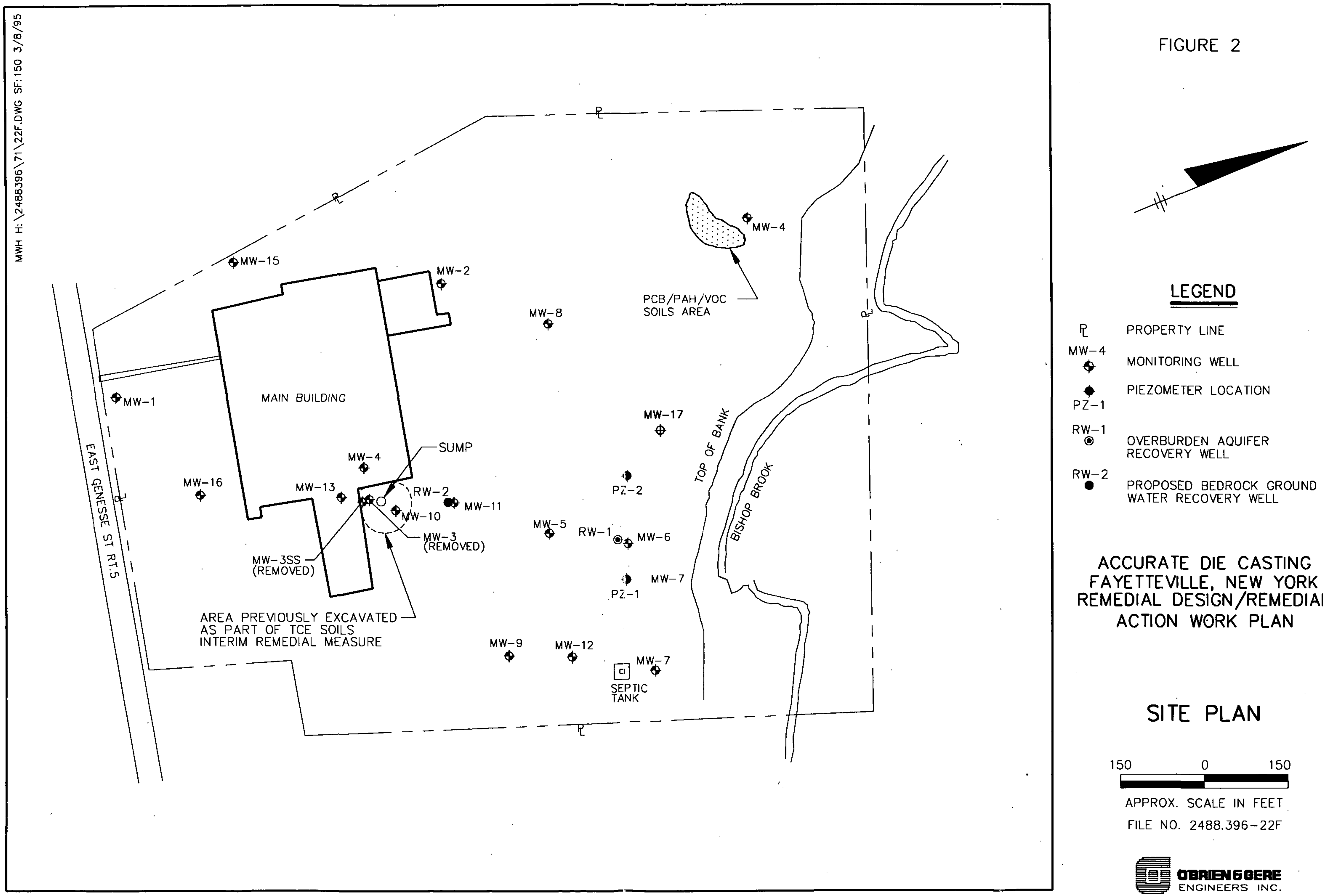
SCALE: 1" = 2,000 FT.

USGS TOPOGRAPHIC 7.5 MIN. QUAD
SYRACUSE EAST, N.Y. QUADRANGLE

FILE NO. 2488.396-

O'BRIEN & GERE ENGINEERS, INC.

FIGURE 2



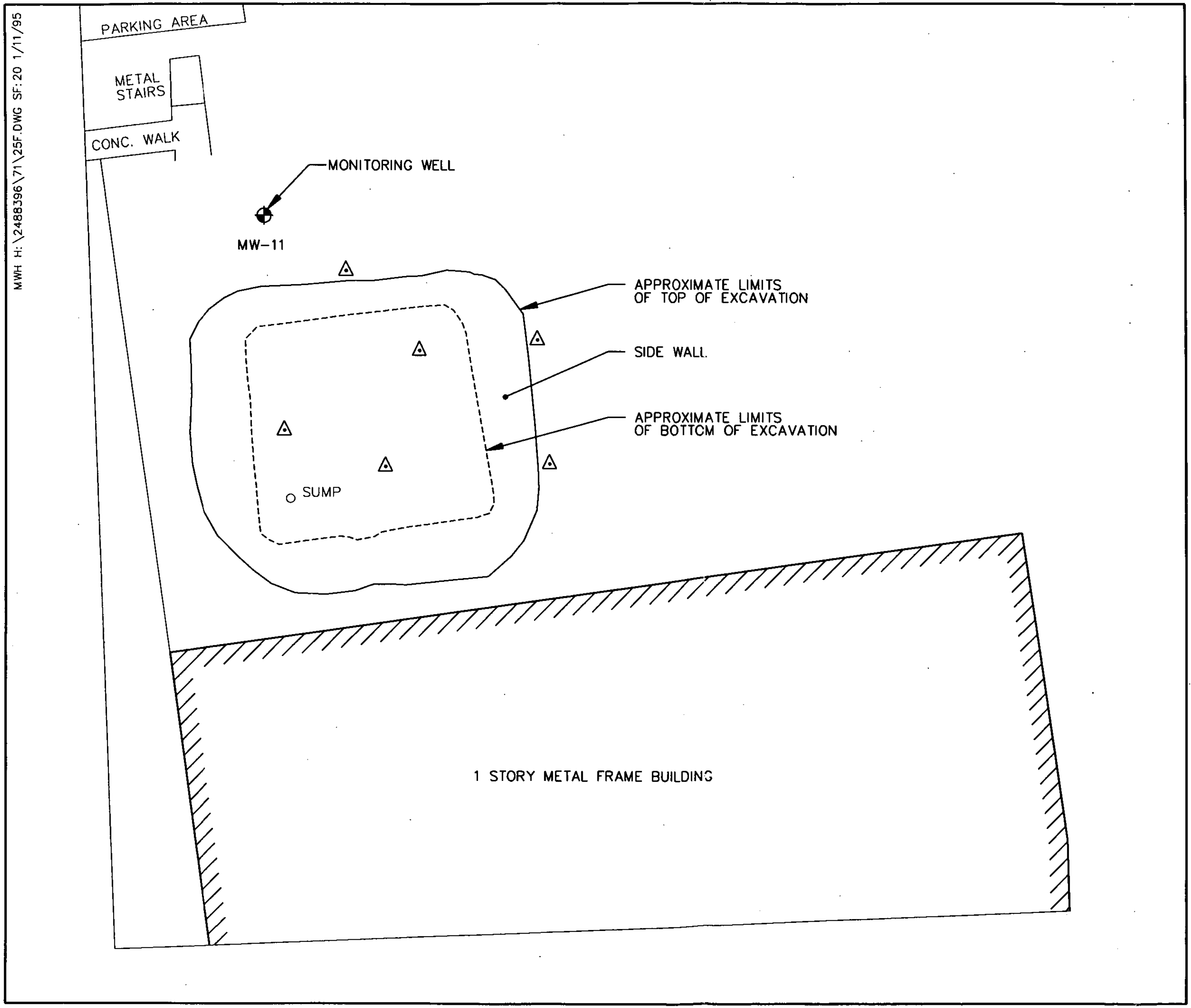
ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK
REMEDIAL DESIGN/REMEDIAL
ACTION WORK PLAN

SITE PLAN

FILE NO. 2488.396-22F

O'BRIEN & GERE
ENGINEERS INC.

FIGURE 3



LEGEND

APPROX. LIMITS OF EXCAVATION BOTTOM

APPROX. LIMITS OF EXCAVATION TOP

PROPOSED SOIL BORING LOCATION

ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK
REMEDIAL DESIGN /
REMEDIAL ACTION WORK PLAN

TCE SOILS EXCAVATION BORING PLAN

0 10 20

APPROX. SCALE IN FEET

FILE NO. 2488.396-25F

O'BRIEN & GERE ENGINEERS INC.

APPENDICES

APPENDIX A

BASIS OF DESIGN REPORT (DECEMBER 1994)

BASIS OF DESIGN REPORT

Accurate Die Casting Site Ground Water Recovery and Treatment System

ITT Commercial Finance Corporation

December 1994

O'BRIEN & GERE ENGINEERS, INC.

2488.396

Basis of Design Report

Accurate Die Casting Site Ground Water Recovery and Treatment System

ITT Commercial Finance Corporation

December 1994

5000 Brittonfield Parkway
P.O. Box 4873
Syracuse, New York 13221

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1. Introduction

1.1. General

The purpose of this Report is to present the Basis of Design of the ground water recovery and treatment system for the former Accurate Die Casting facility located at 547 East Genesee Street in the Village of Fayetteville, New York. As proposed in the Interim Remedial Measure (IRM) Work Plan dated May 1994 and approved by the New York State Department of Environmental Conservation (NYSDEC) in a letter dated May 23, 1994, a ground water recovery and treatment system will be installed to address overburden ground water containing volatile organic compounds (VOCs) on site.

This section presents background information about the site, and select Remedial Investigation (RI) data that are pertinent to the design of a ground water recovery and treatment system. This section also presents the remedial action objectives (RAOs) of a ground water recovery and treatment system.

Subsequent sections present the results of the aquifer performance test conducted to assess site hydrogeologic conditions, and present a description of the proposed ground water recovery and treatment system. Included within these sections are the data, calculations and assumptions used during evaluation of the hydrogeologic conditions and preparation of the design.

1.2. Project background

The Accurate Die Casting site is located on a 32-acre parcel at 547 East Genesee Street in the Village of Fayetteville, New York (Figure 1). Bordering properties include out-of-service farmland to the north, residential areas to the east and west, and commercial properties to the south along East Genesee Street. An out-of-service railroad siding extends along the western border of the site and Bishop Brook extends along the northern border of the site.

The facility was constructed in the early 1950s as a die casting industry. Die casting activities were performed at the site until mid-1988, at which time the then facility owners abandoned the facility. In December 1988, ITT Commercial Finance Corporation was the successful and sole bidder at a foreclosure sale. ITT Commercial Finance Corporation is the current owner of the property. In January 1990, the facility was included in the NYSDEC's Registry of Inactive Hazardous Waste sites as a Class 2 site.

While die casting operations were conducted at the site, a degreaser system was used to degrease castings inside the building. Through performance of the RI, it was concluded that releases of TCE from the degreaser system have resulted in an impact to the soil and ground water at the site. In the RI Report (Stearns & Wheeler, December 1993), it was concluded among other things that:

- Ground water quality had been impacted by TCE. An overburden TCE plume extends from near monitoring well MW-3 north towards Bishop Brook;
- The highest TCE concentrations in soils were observed at about 20 to 25 feet below grade around MW-3, at the interface between the sand/gravel and till layers;
- Soils beneath the floor of the building had not been impacted. Soil samples from two monitoring wells (MW-13 and MW-14) installed just inside the building did not exhibit TCE levels above the analytical detection limit (<0.04 mg/kg).

1.2.1. TCE soils IRM summary
The area of TCE-contaminated soil identified during the RI is located on the northern side of the east addition to the main building in the vicinity of the former location of MW-3, as shown on Figure

2. Soil remediation activities in this area were initiated on May 24, 1994 in accordance with the Interim Remedial Measure (IRM) Work Plan (May 1994) approved by the NYSDEC and were completed on June 22, 1994.

As part of the Soil Remediation IRM, approximately 3,000 cubic yards (CY) of soil were excavated. Of that amount, approximately 1,250 CY of soil exhibited TCE levels above the established RAO of 0.7 mg/kg, but below 15 mg/kg. The soil exhibiting TCE above 0.7 mg/kg was processed on site through a mechanical volatilization system. Once processed, the average residual TCE concentration was 0.13 mg/kg. The treated soils, as well as the excavated soils that did not contain TCE above the RAO, were subsequently used to backfill the excavation.

Prior to backfilling the excavation, samples of soil were obtained from the base of the excavation as well as from the side walls. Based on this sampling, the soils exhibiting TCE above the RAO were limited to a semi-confining layer. Additional information with regard to the Soil Remediation Activities IRM is presented in the Summary Report dated October 1994.

In association with the Soil Remediation Activities IRM, a ground water collection sump was constructed on top of the clay layer at the base of the excavation, prior to backfilling. The sump is located approximately 20 feet from the north wall of the east building addition, and approximately 20 feet east of the main building as shown in Figure 2. The sump consists of a 24-inch diameter slotted pipe installed vertically to a depth of approximately 22 feet. This pipe is coupled to a horizontal 12-inch diameter slotted pipe placed on top of the 3 feet of clay placed at the bottom of the excavation prior to backfilling.

The purpose of the ground water collection sump is to facilitate removal of shallow ground water in the area of the excavation, if necessary. In accordance with the recommendations presented in the Soil Remediation Activities IRM Summary Report, ground water elevations in monitoring wells MW-10, MW-11, MW-13 and MW-14 and the sump installed within the excavation will be measured on a bi-weekly basis between October 31, 1994 and January 1, 1995. Once ground water levels have been measured, the sump will be bailed and sampled. The ground water sample will be analyzed for the presence of VOCs using EPA Method 8010/8020. The purpose of the bailing and sampling is to confirm that overburden ground water in the location of the excavation is no longer impacted by soils, and to assess whether the need exists for additional soil remedial or sampling efforts, or ground water recovery in the area of the excavation. The data obtained as a result of this monitoring, as well as recommendations for future actions in this area, will be presented to the NYSDEC.

1.2.2. Ground water

Based on the data generated as a result of the RI and subsequent investigations, it has been concluded that TCE is present in both the shallow and bedrock aquifers on site. Ground water quality is discussed further in Section 2.3.

1.3. Ground water recovery and treatment remedial action objectives

The overall remedial action objective for the Accurate Die Casting site is to provide for the protection of human health and the environment by controlling the sources of VOCs at the site and/or minimizing the migration of the ground water containing VOCs. The specific remedial action objectives associated with the proposed ground water recovery and treatment system are:

- Minimize the migration via ground water of dissolved TCE from the site towards Bishop Brook (or other receptors);
- Pursuant to the NYSDEC's directive, reduce the amount of TCE in the aquifer to the maximum practical extent by appropriate and technically practicable methods in an effort to achieve VOC concentrations less than 5 $\mu g/l$;
- Eliminate or minimize the potential for significant releases to surface water; and
- Minimize, to the extent practicable, the potential risks associated with implementing remedial actions.

2. Site hydrogeologic evaluation

2.1. General

In accordance with the NYSDEC approved IRM Work Plan, a hydrogeologic evaluation was completed at the former Accurate Die Casting site to develop design parameters for the construction and operation of a shallow overburden ground water remediation system. Tasks conducted pursuant to the IRM Work Plan included the installation of two piezometers, one overburden ground water monitoring well, one ground water test recovery well, and the completion of a 24-hour aquifer performance test. This section presents the results of the hydrogeologic evaluation.

2.2. IRM piezometer and monitoring well installations

In accordance with the approved IRM Work Plan, two piezometers (PZ-1, PZ-2), and one monitoring well (MW-17) were installed to further characterize site hydrogeologic conditions and provide additional monitoring points for the aquifer performance test. PZ-1 and PZ-2 were installed approximately 50 feet west and 100 feet east of MW-6, respectively. MW-17 was installed approximately 240 feet west of MW-6 (Figure 2). In addition to acquiring hydrogeologic information, MW-17 was installed to assess ground water quality between MW-6 and MW-4.

PZ-1, PZ-2, and MW-17 were installed by OP-TECH Environmental Services, Inc. between August 1 and August 4, 1994. The piezometers and monitoring well were installed to the bedrock surface using conventional hollow stem auger drilling techniques. Bedrock was encountered at PZ-1, PZ-2, and MW-17 at depths of approximately 30, 36, and 12 feet below grade, respectively.

Continuous split spoon samples were collected at two foot intervals throughout PZ-1, and below the water table at PZ-2. Split spoon samples were collected at five foot intervals at MW-17. Each soil sample was described by the on-site hydrogeologist. Boring logs are contained in Appendix A.

PZ-1, PZ-2, and MW-17 were constructed with 2-inch diameter PVC. Ten feet of 0.010-inch slot PVC well screen were utilized at PZ-1 and PZ-2 which was flush threaded to appropriate lengths of PVC riser casing to bring each well head approximately 2.5 feet above grade. Eight feet of 0.010-inch slot screen was utilized at MW-17. A silica sandpack compatible with a 0.010-inch slot well screen was installed from the bottom of the screen to approximately 2 feet above the screened interval in each well. Approximately 2.5 feet of bentonite pellets were installed on top of the sandpack in each well. The remaining annular space was filled with cement bentonite grout to grade. Each piezometer/well was completed with a locking steel protective guard pipe. Monitoring well specifications are listed in Table 1.

2.3. Overburden ground water quality

Ground water samples were collected from site monitoring wells on two occasions; July 22 and October 18 and 19, 1994 to evaluate the concentration of VOCs in the ground water. The ground water samples were delivered to O'Brien & Gere Laboratories, Inc. subsequent to daily sample collection using chain of custody procedures. Ground water samples were analyzed for volatile organic compounds (VOCs) by EPA Method 8010/8020. Table 1 presents a summary of TCE concentrations. Figure 3 illustrates the overburden aquifer TCE concentrations based on samples collected in October 1994. Laboratory data sheets are contained in Appendix B.

As illustrated on Figure 3, TCE in the overburden ground water extends from MW-13 north to MW-6. MW-9 and MW-12 define the eastern extent and MW-17 defines the western extent.

TCE was detected in monitoring well MW-4 at a concentration of 23 $\mu g/l$. It should be noted that MW-4 is located in the vicinity of a prior waste oil spill discovered by the NYSDEC (*circa* 1986) cross-gradient to the overburden ground water flow.

2.4. Site hydrogeologic conditions

Site hydrogeologic conditions indicate that the extent of the overburden aquifer is limited to the south, east, and west of RW-1. The limited nature of the aquifer is evidenced by an analysis of geologic conditions, saturated thicknesses, and ground water conditions observed while excavating the source area soils.

2.4.1. Geologic conditions

Site geologic conditions were assessed using the geologic descriptions presented in the RI Report (Stearns & Wheler, December 1993) and through additional work completed by O'Brien & Gere as part of the IRM.

The available geologic information indicates that the site geology consists of glacially derived overburden material consisting of varying amounts of sand, silt, clay, gravel, and cobbles overlying Upper Silurian sedimentary bedrock composed of shale to shaley dolostone.

The overburden stratigraphy consists of two distinct units as follows:

1. A more permeable silty fine to coarse grained sand and gravel unit; overlying

2. A less permeable, dense till composed of poorly sorted silt, clay, and gravel with varying amounts of sand.

Figure 4 presents a hydrogeologic cross-section A-A' (Figure 2) that extends from south to north across the site. As illustrated on Figure 4, the thickness of the overburden sand and gravel unit ranges from approximately 22 feet at MW-1 to approximately 40 feet at MW-5, generally increasing from south to north. Till thickness ranges from approximately 1 foot at MW-1 to approximately 9 feet at MW-10 and 11. Till was not encountered at MW-5 based on boring log information

Figure 5 presents a hydrogeologic cross-section B-B' (Figure 2) that extends from east to west across the northern portion of the site. The site overburden aquifer is thickest along an axis extending between MW-6 and MW-9 (approximately 47 ft to 53 ft) in the vicinity of RW-1. From this point, the aquifer thins out to 24 ft to the east in the vicinity of MW-7 and 20 ft to the west in the vicinity of MW-4.

As illustrated on Figure 5, the thickness of the sand and gravel unit in the northern portion of the site ranges from approximately 10 feet at MW-17 and MW-9 to approximately 24 feet at MW-6. The thickness of the till material ranges from approximately 2 feet at MW-17 to approximately 16 feet at PZ-2. Till was not encountered at MW-4 based on boring log information.

2.4.2. Overburden aquifer saturated thickness

The overburden aquifer saturated thickness, as expected, correlates with overburden geology. Figure 6 illustrates the site overburden saturated conditions as a whole. Figure 7 illustrates the saturated thickness of the sand and gravel overburden material.

Saturated conditions are thickest (approximately 27 ft) at RW-1 and MW-6 (Figure 6). From this point, saturation decreases toward the southern portion of the site with saturation ranging from approximately 6 feet at MW-13 to approximately 11 feet at MW-14 (Figure 6). Wells MW-10, 11, 15, and 16 are screened in bedrock, however boring logs completed by Stearns & Wheler indicate that the overburden was dry at the time of installation.

The saturated thickness of the overburden aquifer in the northern portions of the site ranges from approximately 0.5 feet at MW-17 to approximately 27 feet at MW-6 (Figure 6). Saturated conditions decrease towards the east to approximately 21 ft at MW-9.

The sand and gravel materials, being more permeable than the till unit, provide a preferential migration pathway for VOCs in the overburden aquifer. As a result, the relatively permeable sand and gravel unit should also contain the higher concentrations of contaminants. Comparison of the TCE plume (Figure 3) and the sand and gravel saturated thickness map (Figure 7) indicates that the distribution of VOCs correlates to the saturated sand and gravel thickness. In addition, as indicated on Figure 7, the saturated sand and gravel material is limited in areal extent to the northeast portion of the site.

The saturated thickness of the sand and gravel material is also limited at the southern portion of the site. As evidenced by dewatering operations during the excavation of source area soils, the overburden aquifer in the southern portion of the site does not yield significant quantities of ground water. As described in the Soil Remediation Activities IRM Summary Report (O'Brien & Gere Engineers, October, 1994) dewatering was achieved by initially pumping approximately 3,000 gallons to a holding tank inside the former Accurate Die facility. Subsequent to removing the initial volume of stored ground water, it was noted that overburden aquifer yield in this vicinity was only approximately 2 gpm. As indicated in section 1.2.1., overburden aquifer characteristics in this area are continuing to be evaluated.

2.5. Test recovery well installation

An 8-inch test recovery well RW-1 was installed approximately 15 feet south of MW-6 as illustrated in Figure 2. This location meets two design criteria:

1. Located in the thickest portion of the overburden aquifer to provide the greatest possible drawdown; and

2. Screens approximately 10 ft of saturated sand and gravel that contains VOCs to provide hydraulic control of the preferential migration pathway at the site.

RW-1 was installed to evaluate overburden characteristics and develop the necessary data for the design of a ground water recovery system. RW-1 was drilled, installed, and developed by A.W. Kincaid Well Drilling during September and October 1994, under supervision of the on-site hydrogeologist and NYSDEC personnel.

RW-1 was installed using cable tool drilling methods. Initially, a 12-inch diameter temporary steel casing was advanced to the bedrock surface at a depth of approximately 50 feet below grade. The 12-inch diameter borehole was then advanced approximately four feet into the bedrock to allow the screen to be set at the bottom of the overburden aquifer.

RW-1 was constructed with two screen sections, as illustrated on Figure 8. The purpose of this well design was to maximize recovery of ground water from both the sand and gravel and till portions of the overburden aquifer thereby increasing well efficiency.

As illustrated, RW-1 was constructed with a five foot carbon steel sump section from a depth of approximately 49 to 54 feet below grade. A bentonite slurry was emplaced around the sump section to provide a seal between the overburden and bedrock. A "shale packer" was fastened approximately six inches from the top of the sump section to aid in supporting the weight of the overlying sandpack, as well as to provide a seal between the overburden and bedrock. A ten foot length of 0.030-inch slot continuous wire wound stainless steel well screen (lower screen) was welded to the top of the sump section. The lower screen was installed from approximately 39 to 49 feet below grade. A six foot carbon steel blank section was welded to the top of the ten foot lower screen section. The six foot blank was installed from approximately 33 to 39 feet below grade. A five foot length of 0.030-inch slot continuous wire wound stainless steel screen (upper screen) was welded to the top of the six foot blank section. The upper screen was installed from approximately 28 to 33 feet below grade. Carbon steel casing was welded to the top of the upper screen to bring the well head approximately 2.5 feet above grade.

A silica sandpack compatible with a 0.030-inch slot screen was installed around the lower screened section from approximately 35 to 49 feet below grade. A bentonite seal was installed around the blank section separating the upper and lower screens from approximately 33.5 to 35 feet below grade. A sandpack was installed around the upper screen from approximately 21 to 33.5 feet below grade. A bentonite seal was installed from approximately 19 to 21 feet below grade. The remaining annular space was filled with a cement/bentonite grout from approximately 19 feet to grade.

Subsequent to installation, RW-1 was developed to optimize well efficiency. Development, consisting of surging and pumping methods, was conducted on September 16 and 19, 1994.

Surging was conducted within both the upper and lower screened sections. Subsequent to surging, sediment and sandpack material which were pulled into the well were removed using a bailer and contained on plastic sheeting near the well. The amount of sediment being pulled into the well decreased with each subsequent surging and bailing period.

The pumping portion of development was initiated when the coarse grained sediments ceased to enter the well during surging. The well was pumped at various rates between 15 and 60 gallons per minute (gpm) to assess the effectiveness of development and to provide a preliminary aquifer performance test flow rate.

Development water was contained in the on-site 50,000 gallon storage tank and subsequently treated by granular activated carbon (GAC) filtration. Treated ground water was discharged to the bank of Bishop Brook in accordance with the NYSDEC discharge requirements.

2.6. Aquifer performance test

A 24-hour aquifer performance test was conducted on September 28 and 29, 1994 to evaluate and select an optimal remedial flow rate for the recovery well, evaluate aquifer characteristics, and assess the influence of pumping on the existing shallow overburden and bedrock aquifers.

A 5 horsepower submersible pump was used to conduct the test. The test was performed at a flow rate of 25 gpm. An in-line flow meter (totalizer) was used to monitor flow rate. Measurements were recorded hourly throughout the test. Discharge was directed to a 50,000 gallon holding tank in the former Accurate Die facility.

The following thirteen wells were selected to be monitored during the aquifer performance test:

Overburden Aquifer:	RW-1, PZ-1, PZ-2, MW-2, MW-4, MW-5, MW-6, MW-8, MW-9, MW-12, and MW-17
Bedrock Aquifer:	MW-7 and MW-11

Prior to the start of the aquifer performance test, two rounds of water levels were recorded from the wells on September 26 and 27, 1994, to assess background conditions.

During the aquifer performance test, drawdown measurements were obtained using electronic water levels probes. Water level data were collected in the wells RW-1, MW-6, PZ-1, and PZ-2 at the following frequency:

Elapsed Time	Measurement Frequency
0 to 10 minutes	Every minute
10 to 60 minutes	Every 5 minutes
1 to 2 hours	Every 15 minutes
2 to 24 hours	Every hour

Wells at greater distances from the recovery well were monitored at least every hour. Upon completion of the aquifer performance test, recovery rates were measured in all wells which were influenced by pumping. The aquifer performance test drawdown data are included in Appendix C.

After 24 hours of pumping, drawdown in the overburden aquifer ranged from 0.09 feet at MW-5 to 0.47 feet at MW-6. Drawdowns of 1.15 and 0.03 feet were recorded in bedrock wells MW-7 and MW-11, respectively.

A water level decrease of 0.85 feet was recorded at MW-4, however, declines in water levels in MW-4 appear to be more related to rain events which may have increased water levels prior to the pump test. The water level in MW-4 was continuing to drop more than 24 hours after the pump was turned off. Wells MW-2 and MW-8 water levels continually increased during the test. The water level increases are most likely the result of periodic rain events occurring prior to and during the test.

Drawdown data obtained from the monitoring points installed in the overburden aquifer indicate the area of influence created by pumping at RW-1 extends approximately 400 feet to the east-southeast and approximately 300 feet to the west (Figure 9). Periodic precipitation, prior to and during the test, influenced water level data obtained in the western portion of the site (MW-2, MW-8, and MW-4), therefore making it difficult to assess whether the zone of influence extends to these areas.

The bedrock aquifer appears to be hydraulically connected to the overburden aquifer as indicated by the drawdown recorded at MW-7. Drawdown in bedrock well MW-11 varied between 0.01 and 0.03 feet.

Aquifer test time-drawdown data was analyzed using the Cooper-Jacob straight-line method (unconfined conditions) for each well under the influence of pumping. The test data was also analyzed using Theis solutions for unconfined aquifer conditions contained in the AQTESOLV™ Aquifer Test Solver program Version 10 Documentation (Geraghty and Miller, Inc., 1988, 1989). Aquifer performance test analysis plots are included in Appendix B.

Aquifer transmissivity values were calculated for early and later portions of the time-drawdown curves. The early time-drawdown data indicate an average transmissivity of approximately 66,000 gallons/day/foot (gpd/ft), which appears to represent ground water storage in the sand and gravel materials.

The later time-drawdown data indicate an average transmissivity of approximately 25,000 gpd/ft that results from breaks in the time-drawdown curves approximately 250 to 300 minutes into the test. The breaks in the Jacob plots indicate a boundary condition was encountered during the aquifer performance test. This boundary condition likely reflects the limited areal extent of the saturated sand and gravel.

The decrease in aquifer transmissivity as indicated by time-drawdown data likely represents initial dewatering of the limited sand and gravel portion of the overburden aquifer. As such, transmissivity values should continue to decrease in conjunction with long-term aquifer pumping. Similar to conditions observed in the source area excavation, aquifer yield should decrease as ground water is removed from storage.

2.7. Conceptual hydrogeologic model and ground water recovery scenario

2.7.1. Conceptual hydrogeologic model

Ground water flow in the overburden aquifer is generally south to north toward Bishop Brook under a hydraulic gradient of approximately 0.04 feet/foot (RI Report, Stearns & Wheler, December 1993). Review of the site hydrogeologic conditions indicates a small saturated thickness in the southern portion of the site. This condition suggests limited upgradient recharge to the northern portion of the overburden aquifer.

Site hydrogeologic conditions also indicate decreasing overburden saturated conditions to the east and west of RW-1 in the northern portion of site. This condition, combined with a moderately steep ground water flow gradient, indicates a limited potential for lateral site overburden aquifer recharge from these areas.

Review of Figures 7 and 9 indicates that the aquifer performance test area of influence corresponds to the thick sand and gravel portions of the saturated overburden aquifer. This correlation suggests that RW-1 pumping at 25 gpm is apparently recovering ground water along the axis extending from MW-9 to MW-6. In addition, this area of influence encompasses a significant portion of the area containing VOCs in the ground water as shown in Figure 3, and indicates that hydraulic control will be achieved through pumping of RW-1.

RW-1 will unlikely recover water from the thinner portion of the aquifer to the west in the vicinity of MW-17 and MW-4. In addition, the small aquifer saturated thickness in this area suggests an additional recovery well would be an inefficient method of ground water recovery in this area.

2.7.2. Ground water recovery scenario

The focus of ground water recovery should be in the thickest portion of the saturated overburden aquifer. In addition, recovery should focus on recovering and controlling ground water in the sand and gravel unit, the preferential migration pathway.

Given the limited extent of the site overburden aquifer and the poor upgradient and lateral potential for recharge, ground water recovery should consist of initial dewatering of the northern portion of the aquifer along the axis of extending from MW-6 to MW-9 (Figure 6) with RW-1 pumping at 25 gpm. However, it should be noted that RW-1 discharge should decrease over time as the aquifer is dewatered.

Subsequent to recovery system design and implementation, a ground water monitoring program would be undertaken to monitor aquifer response to long-term pumping. This program would track dewatering rates and assess aquifer response to seasonal variations.

Based on the data obtained as a result of the monitoring program, an assessment of the system performance and effectiveness would be made. If necessary, modifications to the design or operation of the proposed ground water recovery and treatment system described in the following section would be made.

3. Ground water recovery and treatment system

3.1. General

This section presents a description of the ground water recovery and treatment system that is proposed to remediate overburden ground water at the site. This section also includes the data, calculations, and assumptions used during development of the Basis of Design. A process schematic of the proposed ground water recovery and treatment is presented as Figure 10. For convenience, this section discusses the major system components separately, as listed below:

- Ground Water Recovery and Conveyance system;
- Ground Water Treatment system;
- Instrumentation and controls; and
- Treated Water discharge

3.2. Ground water recovery and conveyance system

Test recovery well RW-1 will be utilized for ground water recovery. The construction details of this recovery well are presented on Figure 8. As presented in Section 2, a 24-hour pump test was performed on this recovery well on September 26 and 27, 1994. Based on the results of the 24-hour pump test, it is expected that this recovery well will initially produce ground water at a rate of 25 gpm. The long-term continuous well ground water production rate, however, is expected to be less than 25 gpm, as presented to in the preceding section.

The recovery well pump proposed for use in RW-1 has the following characteristics, and was selected based on the criteria presented below:

Operating flow rate: 18 to 32 gpm

Pump performance points:

Capacity (gpm)	Head (ft)
10	90
20	70
25*	60
30	50

(* - design flow rate)

Motor characteristics: ½ Hp, 3450 rpm, 1 pH, 230 volt

Pump discharge pipe size: 1½"

The recovery well pump inlet and controls will be set in accordance with the recovery well schedule presented below in Table 3.2-1.

Table 3.2-1. ***Recovery Well Schedule***

Pump Water Intake Elevation	Water "Pump On" Elevation	Water "Pump Off" Elevation	Pump Failure Alarm Water Elevation	Redundant Pump Off and Alarm Water Elevation
478 ft	498 ft	485 ft	502 ft	482 ft

Recovered ground water will be conveyed to a 500 gallon equalization tank, located inside the main building approximately 500 feet from the recovery well, via a 2-inch diameter high density polyethylene (HDPE) pipe, as shown on Figure 11. The HDPE pipe will have a dimension ratio of 17.0 and a pressure rating of 100 psi.

The 500 gallon equalization tank will be equipped with the following:

- Removable cover;

- 2 inch top entry water inlet;

- 1¼ inch water discharge (suction) pipe with foot valve. Discharge pipe inlet will be set 1 foot above the bottom of the tank;

- 2 inch tank vent pipe. The vent pipe will be vented outside the facility;

- 3 level float switches. The lower two float switches will be used to turn the equalization tank discharge pump on and off. The third and uppermost float switch will be used to trigger a tank full alarm and turn the recovery well pump off to prevent overfilling.

The equalization tank discharge pump shall be a close-coupled, self-priming centrifugal type having the following characteristics:

Suction connection: 1¼" NPT

Discharge connection: 1½" NPT

Motor characteristics: ¾ HP, 230 volt, single phase.

Pump performance points:

Capacity (gpm)	Head (psi)
39	20
30	30
11	40

Notes: Based on a suction lift of 10 ft.
Design flow rate is 25 gpm.

3.3. Ground water treatment system

The recovered ground water will be treated by granular activated carbon (GAC) filtration. The treatment system will consist of two 1,000 pound capacity GAC vessels connected in series, the first operating as the primary treatment vessel and the second operating as a backup treatment vessel. However, the GAC vessels will be headered together such that either can serve as the primary unit.

The ground water treatment system will be equipped with three water sample collection taps: one located upstream of the first GAC vessel, one between the two GAC vessels, and one downstream of the second GAC vessel. The ground water treatment system will also be equipped with two pressure gauges and one electronic pressure sensor. A pressure gauge and the electronic pressure sensor will be located upstream of the first GAC vessel, and the second pressure gauge will be located between the two GAC vessels.

The ground water treatment system proposed has the following characteristics, and was designed based on the criteria presented below:

<u>Average influent flow rate:</u> 25 gpm

<u>Pressure drop through each 1,000 lb. GAC vessel:</u> 3 psig (approx.) (at start up with flow rate of 25 gpm)

<u>Influent trichloroethylene concentration:</u> 500 μg/L to 5,000 μg/L

<u>Anticipated GAC use rate:</u> 5 lbs/day to 30 lbs/day

<u>Anticipated Primary GAC unit break-through time:</u>
(@ 25 gpm, continuous flow) 1 to 6 months depending on VOC concentrations

Additional background water quality data is presented below in Table 3.3-1.

Table 3.3-1. Ground water characteristics

Compound	Concentration	
Iron (total)	0.29	mg/L
Iron (filtered)	0.15	mg/L
Sulfate	9	mg/L
Calcium	77	mg/L
Total dissolved solids	280	mg/L

Table 3.3-1. Ground water characteristics

Compound	Concentration	
Total alkalinity	260	mg/L
pH	7.3	
Calcium carbonate	192	mg/L
Corrosivity	-0.2	
Sodium	8	mg/L
Magnesium	24	mg/L
Hardness	290	mg/L
Specific conductance	570	µmho/cm
Total suspended solids	5	mg/L
Total organic carbon	2	mg/L
Methylene Blue Act. substances	<0.1	
Total Kjeldahl nitrogen (as N)	0.92	mg/L

Note: Data based on sample obtained during pump test. Laboratory Report included as Appendix D.

3.4. Instrumentation and controls

The ground water recovery and treatment system will be equipped with instruments and controls that will allow it to operate continuously in an unattended mode with only occasional monitoring.

3.4.1. Ground water recovery well pump

The ground water recovery well will be equipped with a ground water level transducer connected to the pump controls and alarm. Four ground water elevation settings will be provided to provide the following described functions:

- High water setting to trigger an alarm to notify the operator that the recovery well pump may not be operating;

- Pump on setting;

- Pump off setting; and

- Low water setting to trigger an alarm to notify the operator that the recovery well pump may not have turned off. The setting will trip a relay opening the power circuit to the pump.

The power circuit to the recovery well pump will also be wired so that it is open whenever an alarm condition has been triggered by the tank full float switch placed inside the equalization tank.

3.4.2. Water flow meter, strip chart recorder and flow totalizer
A flow meter with flow totalizer will be installed between the equalization tank and first GAC unit to monitor the quantity of ground water that has been recovered and treated.

3.4.3. Pressure sensor
A pressure sensor will be installed immediately upstream of the primary GAC vessel and will be set to trigger a high pressure alarm at a preset level. Such an alarm condition will disconnect power to the recovery well and equalization tank pumps.

3.4.4. Alarm notification devices
Since the ground water treatment facility will generally be unmanned, an audible alarm device will be installed to alert the operator of alarm conditions at the site. The control panel will also be equipped with indicator lights that will indicate the current operating status of the recovery well pump and other system components.

3.5. Treated water discharge

It is proposed that treated water be discharged, via a 2 inch diameter HDPE pipe, to either a nearby storm drain or to Bishop Brook, as shown on Figure 11. The treated water will be sampled twice per month and monitored for compliance with the Effluent Limitations and Monitoring Requirements established by the NYSDEC, under State Pollutant Discharge Elimination System (SPDES) permit #734052. A copy of the Effluent Limitations and Monitoring Requirements sheets are provided as Appendix E.

Respectfully submitted,

O'BRIEN & GERE ENGINEERS, INC.

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TABLES

TABLE 1
MONITORING WELL SPECIFICATIONS
ACCURATE DIE CASTING
FAYETTVILLE, NY

Well No.	Ground Elevation	Well Casing Elevation	Screened Interval Elevation			GROUND WATER ELEVATIONS 5/28/92	6/26/92	8/7/92	9/26/94	9/27/94	10/18/94
MW-1	99.36	101.11	75.4	-	85.4	DRY	DRY	79.69	NR	NR	DRY
MW-2	91.8	94.68	76.6	-	86.6	83.21	82.81	84.32	83.10	83.28	80.12
MW-3	97.65	99.63	73.7	-	83.7	80.44	80.09	81.63	ABDN	ABDN	ABDN
MW-4	65.62	68.52	46.6	-	56.6	51.08	49.95	50.81	47.22	52.21	46.79
MW-5	88.21	90.42	49.2	-	59.2	60.71	63.76	61.22	59.87	59.91	59.45
MW-6	77.46	79.38	46.4	-	56.4	60.50	60.49	60.46	59.51	59.52	59.05
MW-7(B)	75.66	78.34	34.3	-	44.3	54.59	54.55	54.47	53.90	53.97	53.55
MW-8	88.21	91.78	53.9	-	63.9	66.38	66.38	66.83	61.59	61.65	60.99
MW-9	102.44	104.03	49.7	-	59.7	60.46	60.51	61.83	59.57	59.59	59.08
MW-10(B)	97.51	99.69	43.03	-	53.03	61.15	61.99	61.69	NR	NR	56.02
MW-11(B)	91.48	93.80	43.1	-	53.1	62.34	63.70	63.66	58.41	58.39	57.47
MW-12	93.62	94.14	51.9	-	61.9	62.24	60.74	62.77	59.77	59.79	59.31
MW-13	98.73	100.92	77.7	-	87.7	DRY	80.62	80.92	NR	NR	78.70
MW-14	98.76	100.62	74.6	-	84.6	75.11	79.07	81.54	NR	NR	86.18
MW-15(B)	96.1	98.90	32.7	-	42.7	NI	NI	NI	NR	NR	53.47
MW-16(B)	98.5	100.85	50.8	-	60.8	NI	NI	NI	NR	NR	61.67
MW-17	66.9	69.24	53.7	-	63.7	NI	NI	NI	54.61	54.61	54.08
PZ-1	81.8	83.95	49.8	-	59.8	NI	NI	NI	59.56	59.57	59.10
PZ-2	80.6	83.06	42.8	-	52.8	NI	NI	NI	59.35	59.36	58.89
RW-1	78.4	80.28	29.4-39.4	/	45.4-50.4	NI	NI	NI	56.88	56.89	58.22

Notes: (B) - Bedrock well.
NI - Well not installed at time of monitoring.
NR - Water level not monitored.
ABDN - Abandoned.
MW-1 through MW-16 installed during Remedial Investigation (Stearns & Wheler).

Table 2

Ground Water TCE Concentrations

Accurate Die Casting Facility
Fayetteville, NY

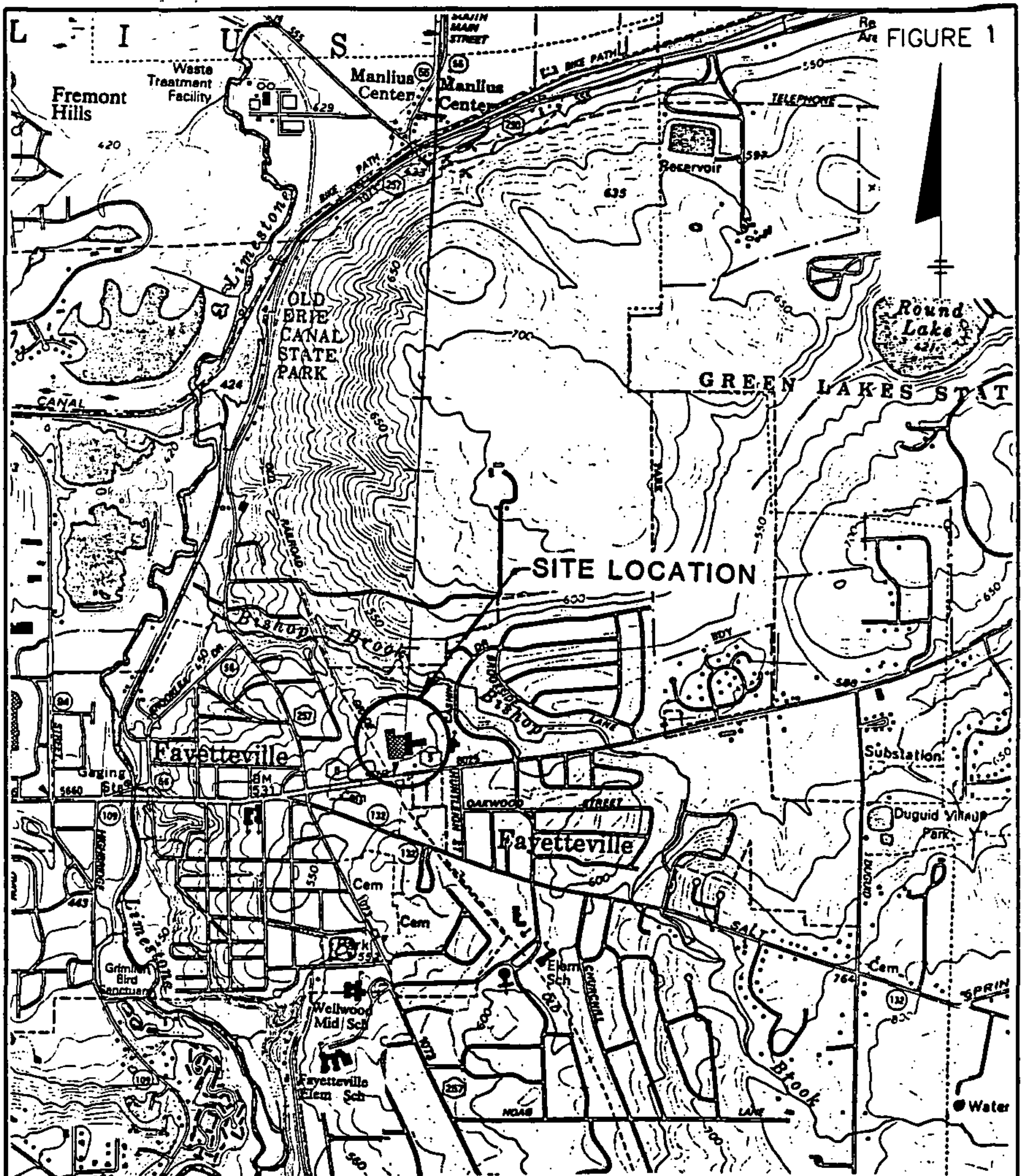
	Trichloroethylene Concentrations (1)					
Date Sampled:	8/30/89	12/4/89	5/20/90	5/28/92	7/22/94	10/18/94
Monitoring Well (3)						
MW-1	112	ND	2	ND	NS	Dry
MW-2	ND	ND	1	ND	NS	ND
MW-3	Free Product	>55,000	440,000	340,000	Abandoned	Abandoned
MW-4	NS	7	43	6	270	23
MW-5	NI	340	344	110	330	410
MW-6	NI	700	454	510	390	360
MW-7 (B)	NI	ND	ND	ND	ND	ND
MW-8	NI	ND	ND	ND	NA	ND
MW-9	NI	109	106	60	72	74
MW-10 (B)	NI	NI	NI	4,500	1,600	1300
MW-11 (B)	NI	NI	NI	5,200	5,500	5300
MW-12	NI	NI	NI	36	44	35
MW-13	NI	NI	NI	110	740	510
MW-14	NI	NI	NI	67	150	120
MW-15 (B)	NI	NI	NI	NI	NS	14
MW-16 (B)	NI	NI	NI	NI	NS	6
MW-17	NI	NI	NI	NI	260	140
Excavation Sump	NI	NI	NI	NI	20,000	NS

Notes: ND - Not detected at concentrations greater than analytical detection limit.
NS - Not sampled.
NI - Well not installed at time of sampling.
NA - Not analyzed.
(1) - Concentrations reported in ug/L (ppb).
(2) - Sample collected 8/19/92 because MW-13 and MW-14 were dry on 5/28/92.
(3) - Monitoring wells MW-1 through MW-16 installed by Stearns & Wheler, monitoring well MW-17 installed by O'Brien & Gere Engineers, wells MW-1, MW-7, MW-10, MW-11, MW-15, and MW-16 are bedrock groundwater monitoring wells.
(B) - Bedrock well.

FIGURES

MHB H:\DIVISION\71\ACCURATE\SITE SF=1 04/15/94

FIGURE 1



ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK

SITE MAP

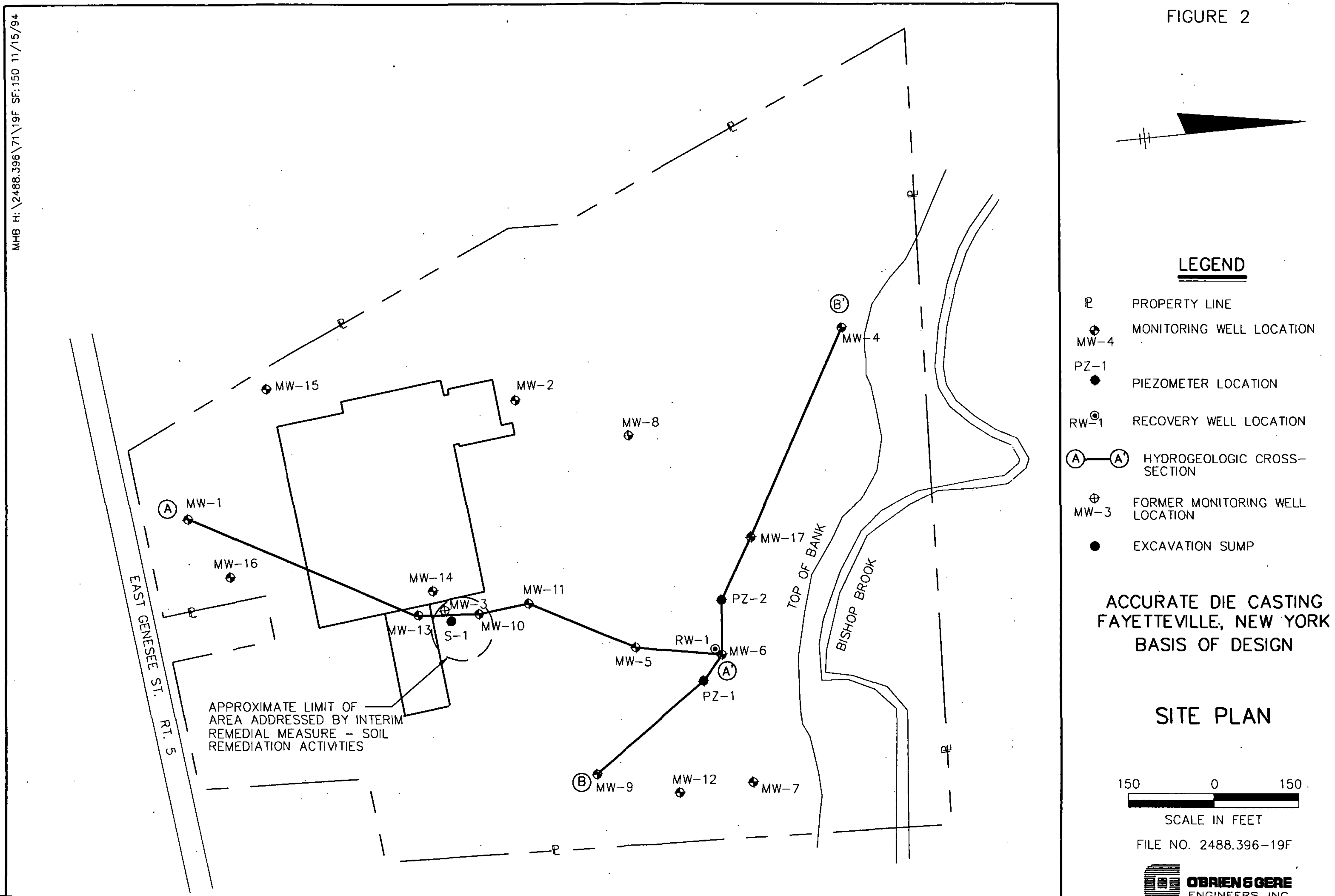
SCALE: 1" = 2,000 FT.

USGS TOPOGRAPHIC 7.5 MIN. QUAD
SYRACUSE EAST, N.Y. QUADRANGLE

FILE NO. 2488.396-

O'BRIEN & GERE ENGINEERS, INC.

FIGURE 2



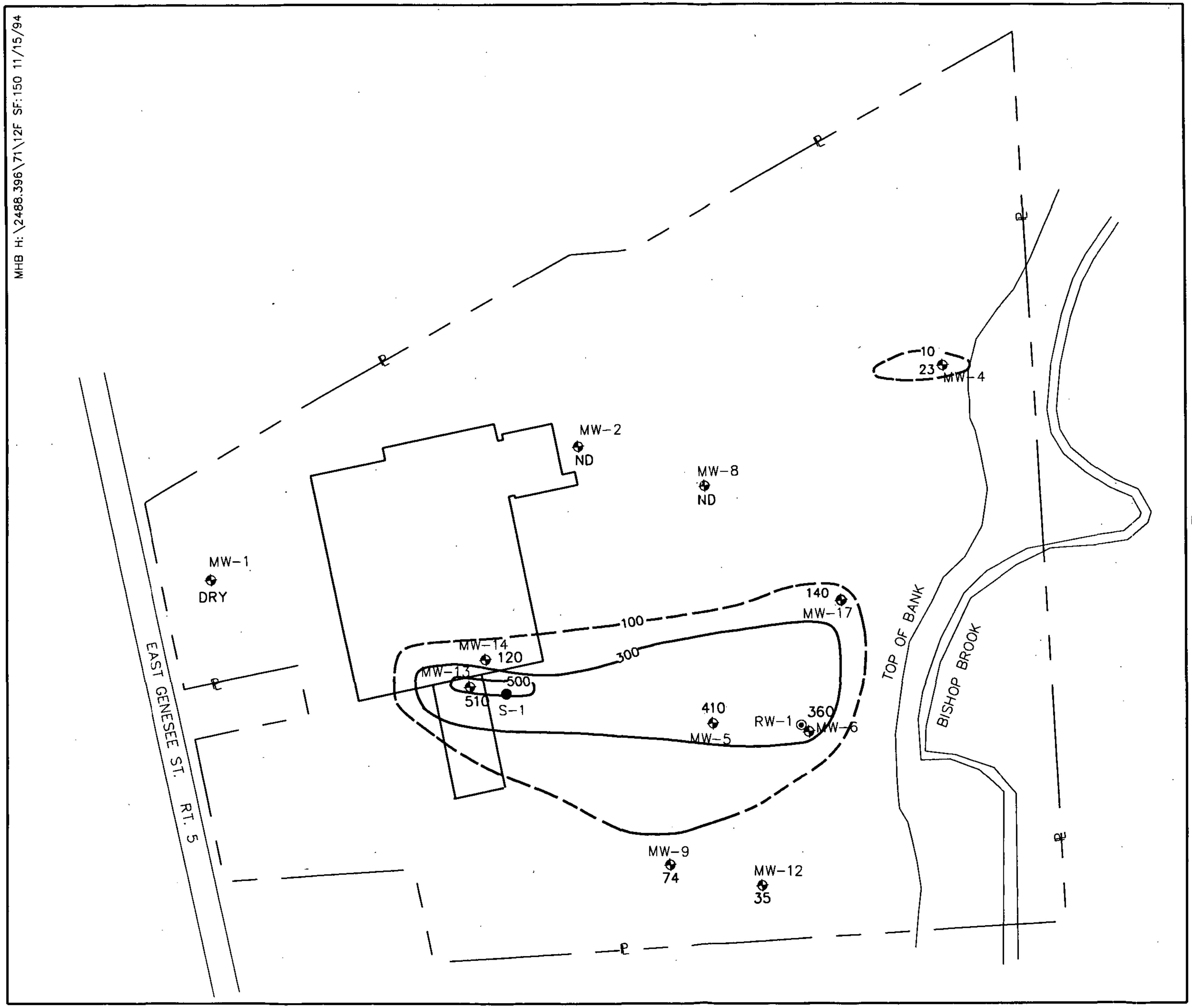
ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK
BASIS OF DESIGN

SITE PLAN

FILE NO. 2488.396-19F

O'BRIEN & GERE ENGINEERS INC.

FIGURE 3



LEGEND

℗	PROPERTY LINE
120 MW-4	MONITORING WELL LOCATION WITH TCE CONCENTRATION (ug/l)
RW-1	RECOVERY WELL LOCATION
ND	NOT DETECTED

NOTE: – CONCENTRATIONS SHOWN AT WELLS WHICH WERE SAMPLED.

ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK
BASIS OF DESIGN

OVERBURDEN AQUIFIER TCE CONCENTRATIONS 10/18/94

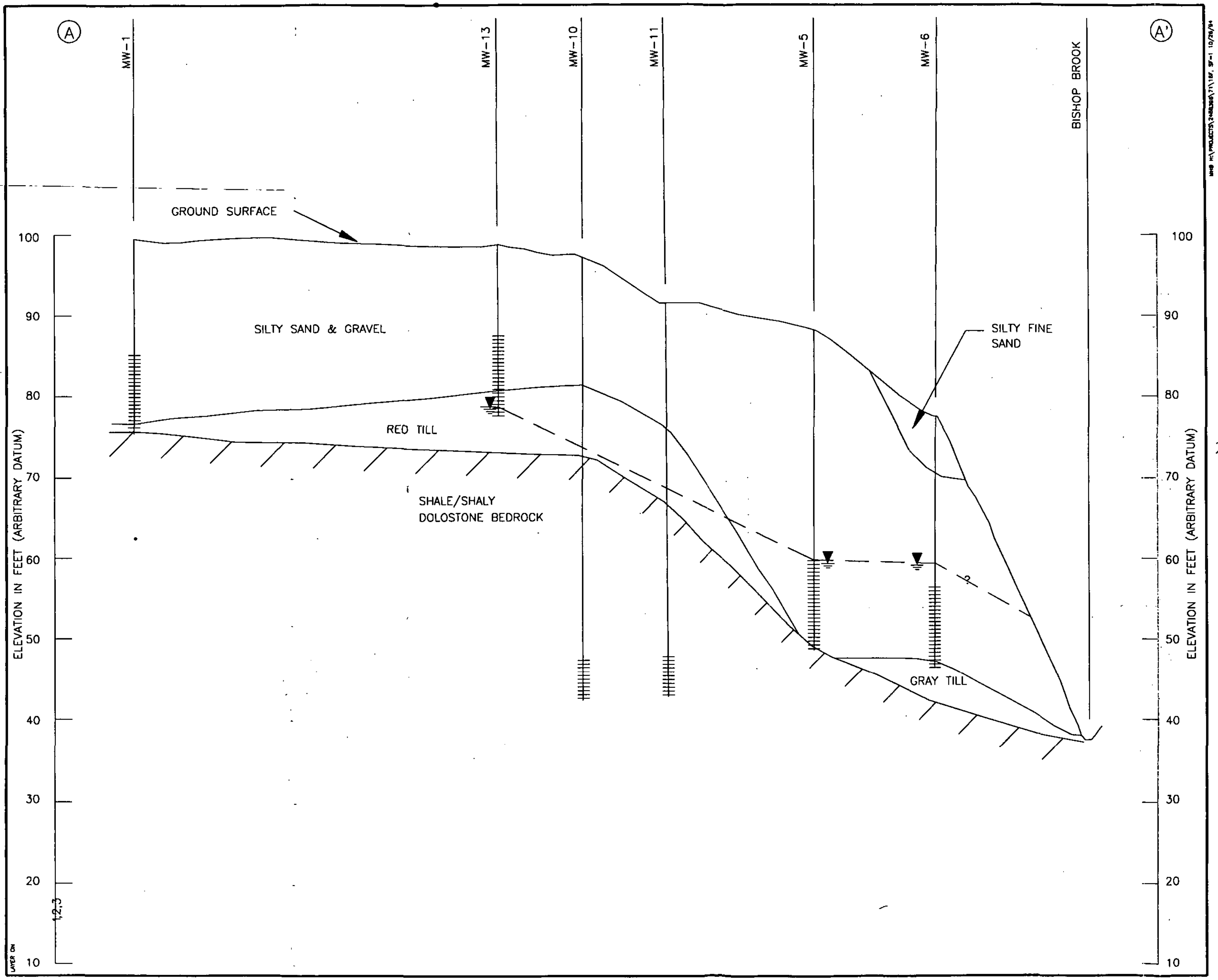
150 0 150

SCALE IN FEET

FILE NO. 2488.396-12F

O'BRIEN & GERE ENGINEERS INC.

FIGURE 4



LEGEND

MONITORING WELL SCREENED INTERVAL

GROUND WATER ELEVATION (10/18/94)

BEDROCK SURFACE

NOTE:
VERTICAL EXAGGERATION IS 12X.

ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK

HYDROGEOLOGIC CROSS SECTION A–A'

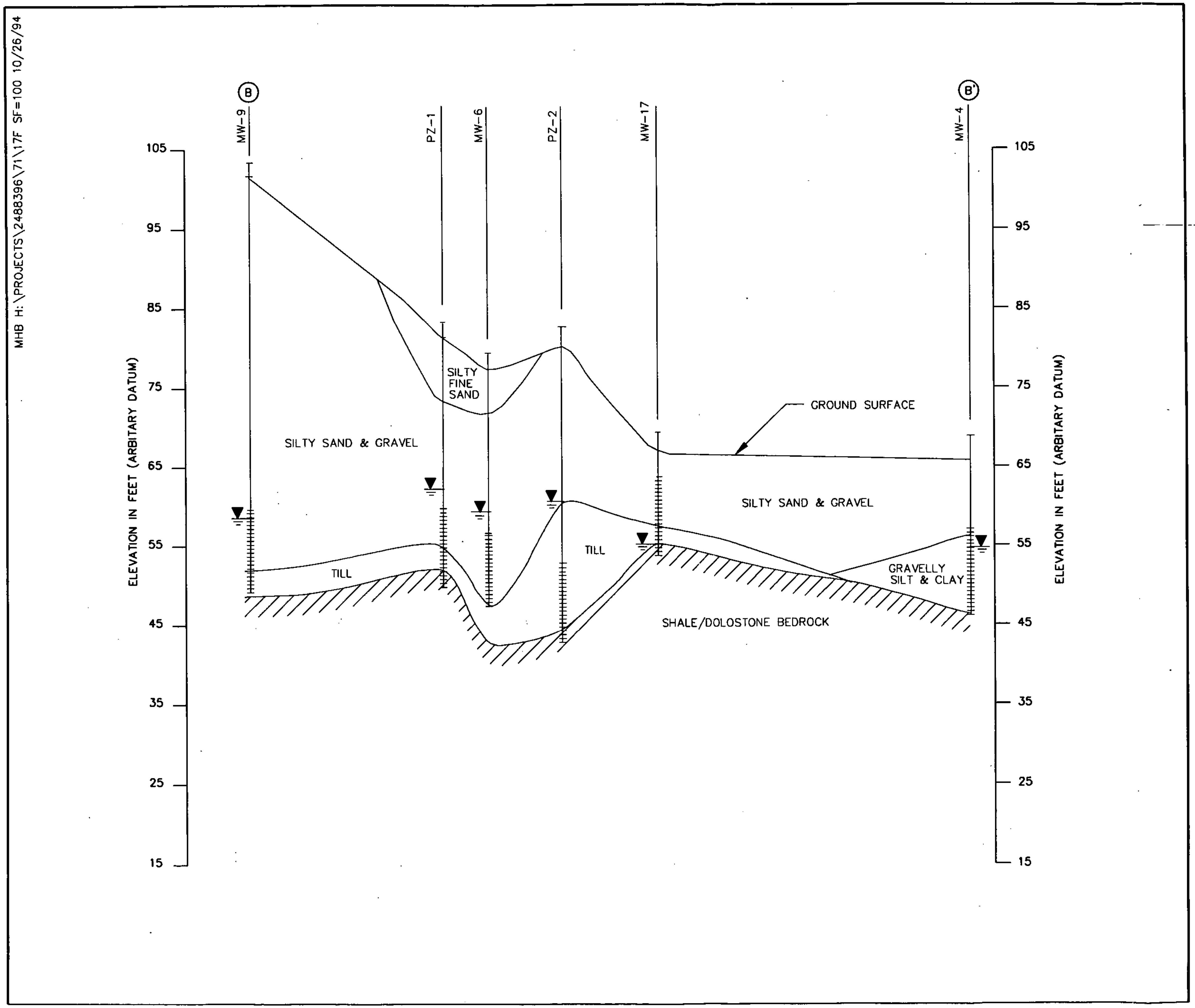
120 0 120

APPROX. HORIZ. SCALE IN FEET

2488.396-16F

O'BRIEN & GERE ENGINEERS, INC.

FIGURE 5



LEGEND

MONITORING WELL SCREENED INTERVAL

GROUND WATER ELEVATION (10/18/94)

BEDROCK SURFACE

NOTE: VERTICAL EXAGGERATION IS 12X.

ACCURATE DIE CASTING
FAYETTE, NEW YORK

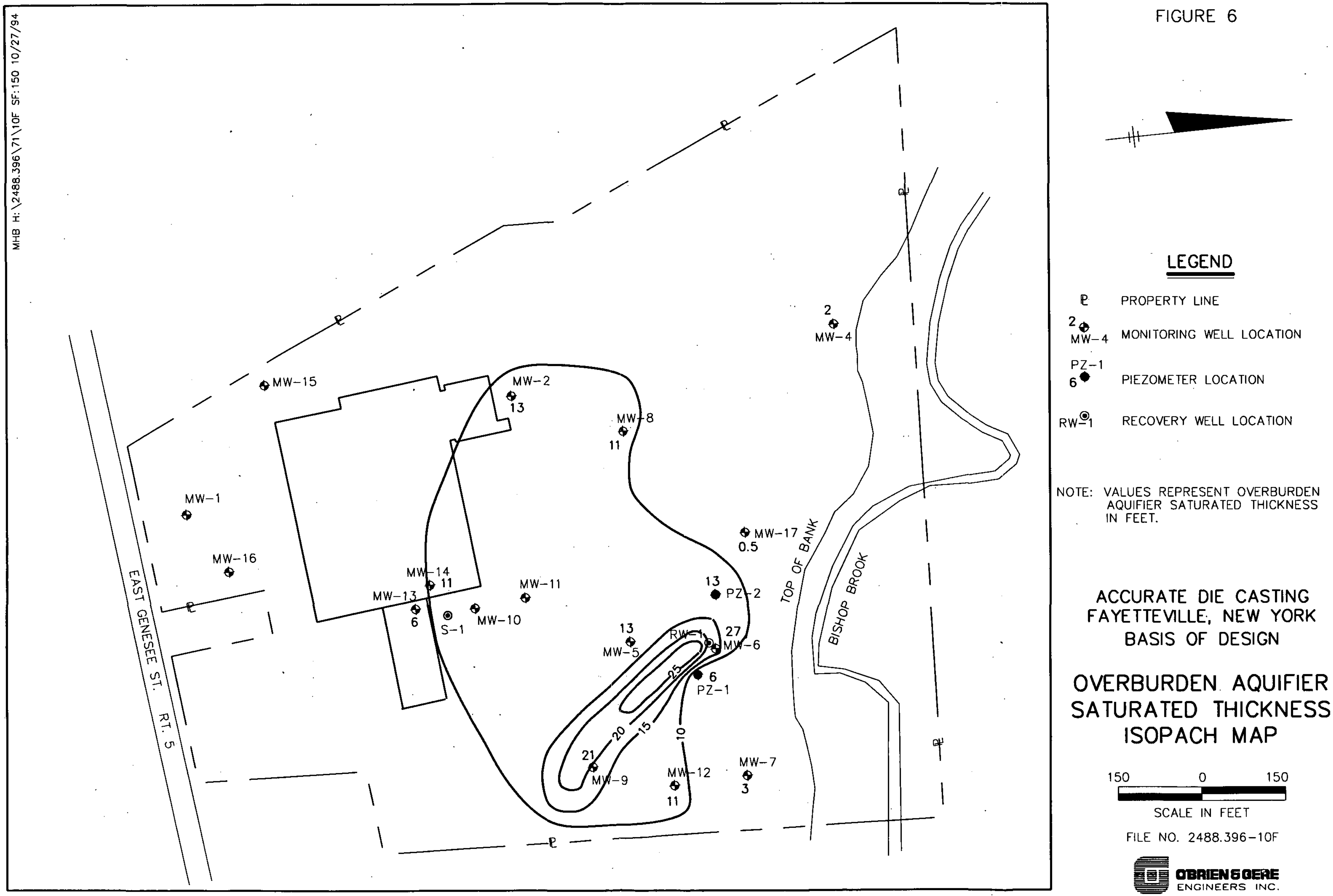
HYDROGEOLOGIC CROSS SECTION B–B'

120 0 120

APPROX. HORIZ. SCALE IN FEET

FILE NO. 2488.396–17F

O'BRIEN & GERE ENGINEERS INC.


MHB H:\2488.396\71\10F SF:150 10/27/94
FIGURE 6
LEGEND
PROPERTY LINE
MONITORING WELL LOCATION
PIEZOMETER LOCATION
RECOVERY WELL LOCATION
NOTE: VALUES REPRESENT OVERBURDEN AQUIFIER SATURATED THICKNESS IN FEET.
ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK
BASIS OF DESIGN
OVERBURDEN AQUIFIER SATURATED THICKNESS ISOPACH MAP
150 0 150
SCALE IN FEET
FILE NO. 2488.396-10F
O'BRIEN & GERE ENGINEERS INC.
EAST GENESEE ST. RT. 5
TOP OF BANK
BISHOP BROOK
MW-1
MW-2 13
MW-4 2
MW-5 13
MW-6 27
MW-7 3
MW-8 11
MW-9 21
MW-10
MW-11
MW-12 11
MW-13 6
MW-14 11
MW-15
MW-16
MW-17 0.5
PZ-1 6
PZ-2 13
RW-1
S-1
10
15
20
25

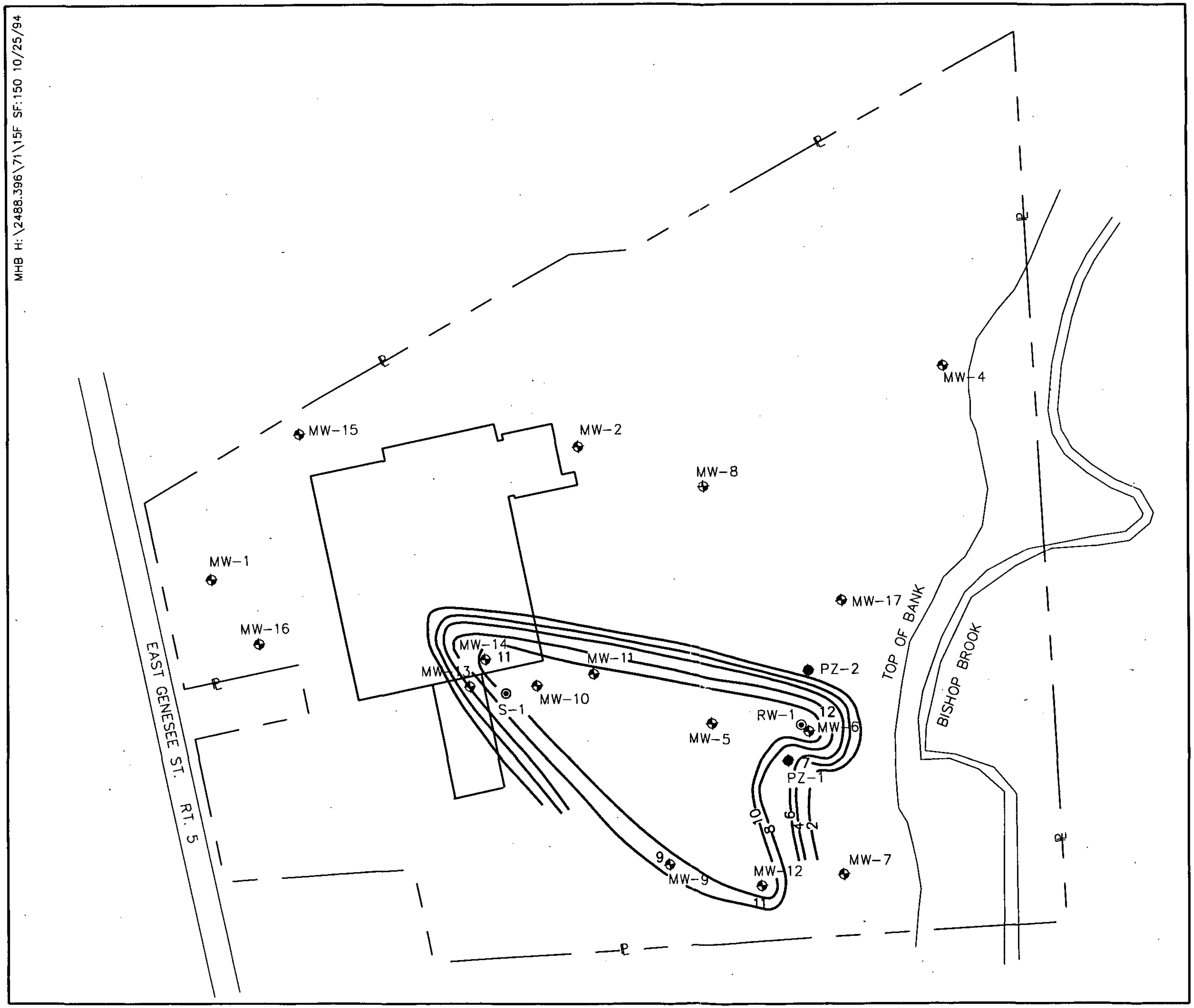


FIGURE 7

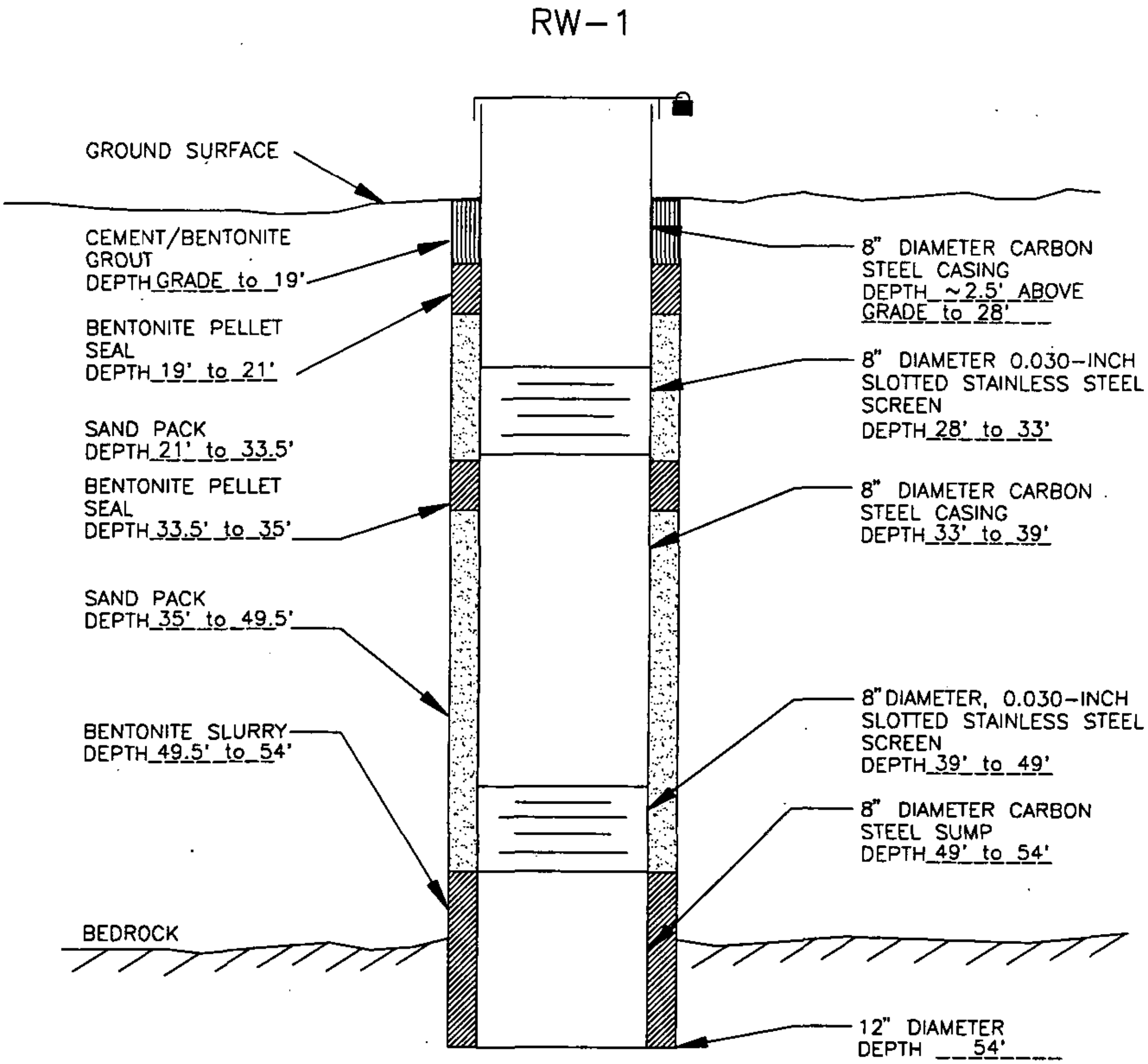
ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK
BASIS OF DESIGN

SATURATED THICKNESS OF SAND AND GRAVEL OVERBURDEN MATERIAL

FILE NO. 2488.396-15F

O'BRIEN & GERE ENGINEERS INC.

FIGURE 8



ACCURATE DIE, CO.
FAYETTEVILLE, NEW YORK

RECOVERY WELL
CONSTRUCTION DIAGRAM

NOT TO SCALE

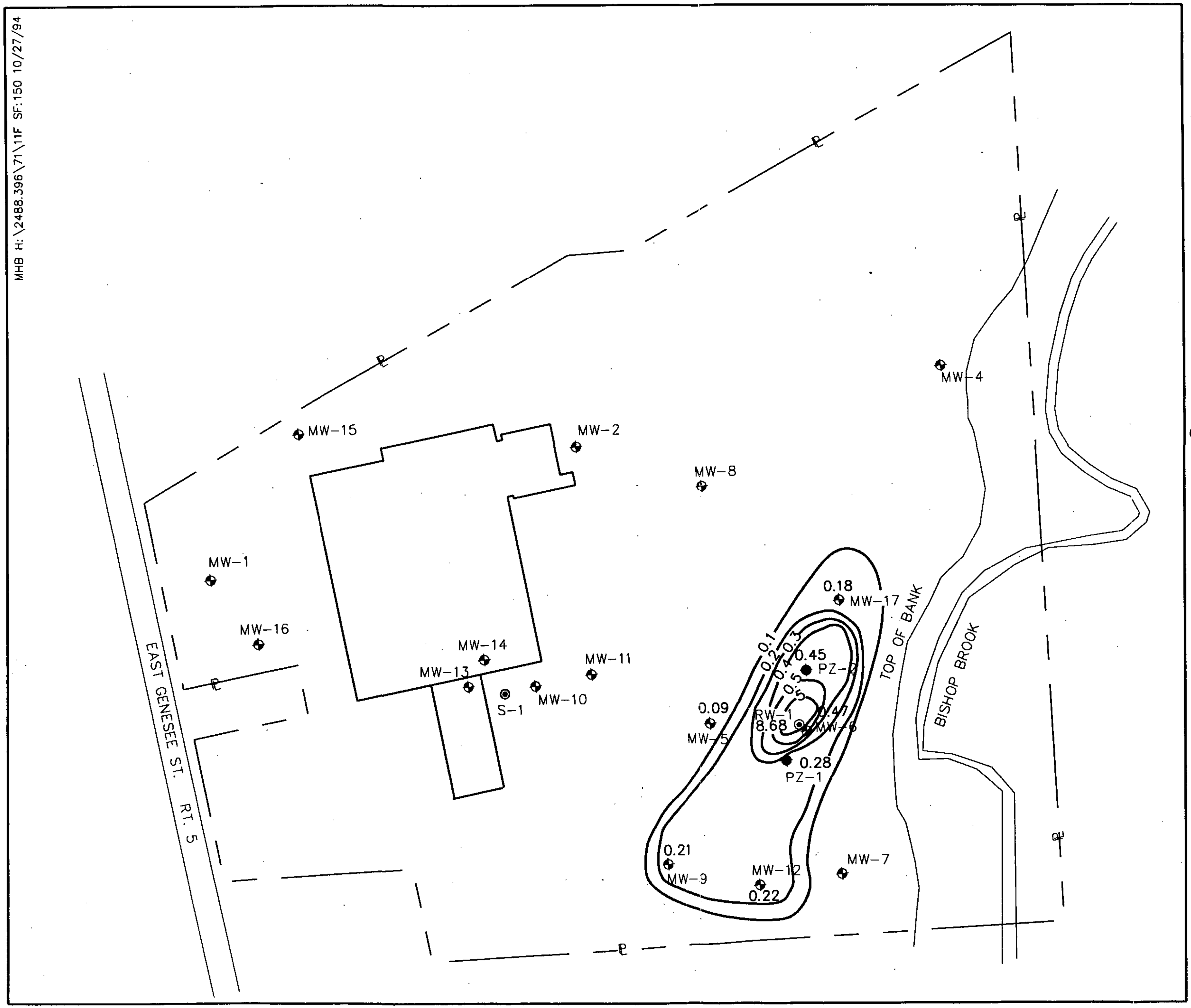
2488.369-18F
Oct/25/94

O'BRIEN & GERE ENGINEERS, INC.

H:\PROJECTS\111111\76\ACCDIWL SF: 1=1

LAYER ON 1,2,3

FIGURE 9



LEGEND

℄	PROPERTY LINE
MW-4	MONITORING WELL LOCATION
PZ-1 0.28	PIEZOMETER LOCATION
RW-1	RECOVERY WELL LOCATION

NOTE: VALUES REPRESENT DRAWDOWN (ft) AT COMPLETION OF 24HR AQUIFIER PERFORMANCE TEST.

ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK
BASIS OF DESIGN

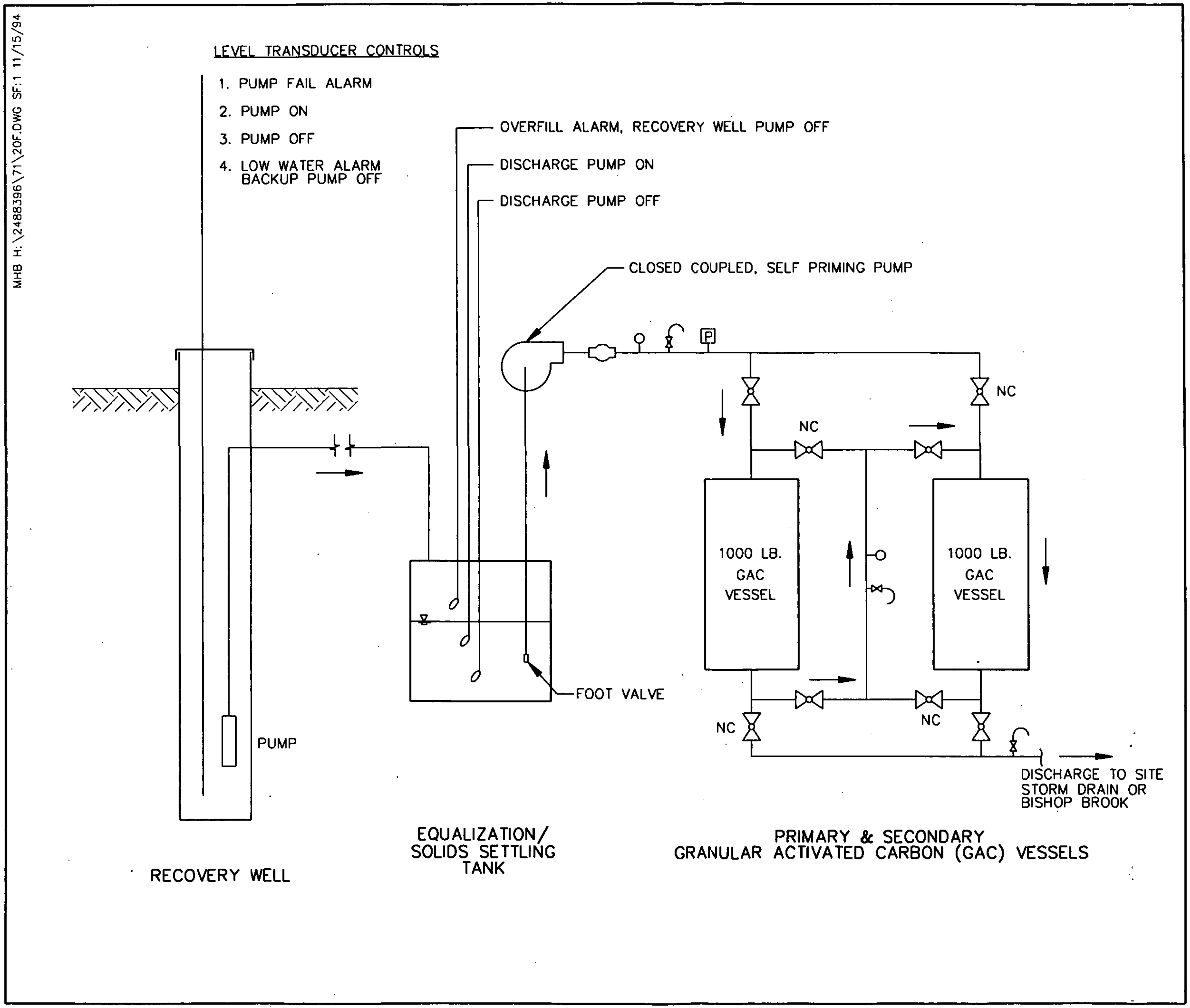
OVERBURDEN AQUIFIER AREA OF INFLUENCE ISOPACH MAP

150 0 150
SCALE IN FEET

FILE NO. 2488.396-11F

O'BRIEN & GERE
ENGINEERS INC.

FIGURE 10



LEGEND

BALL VALVE
NC NORMALLY CLOSED
PRESSURE GAUGE
SAMPLE COLLLECTION TAP
PRESSURE SENSOR
FLOW METER W/ TOTALIZER
FLOW DIRECTION (NORMAL)

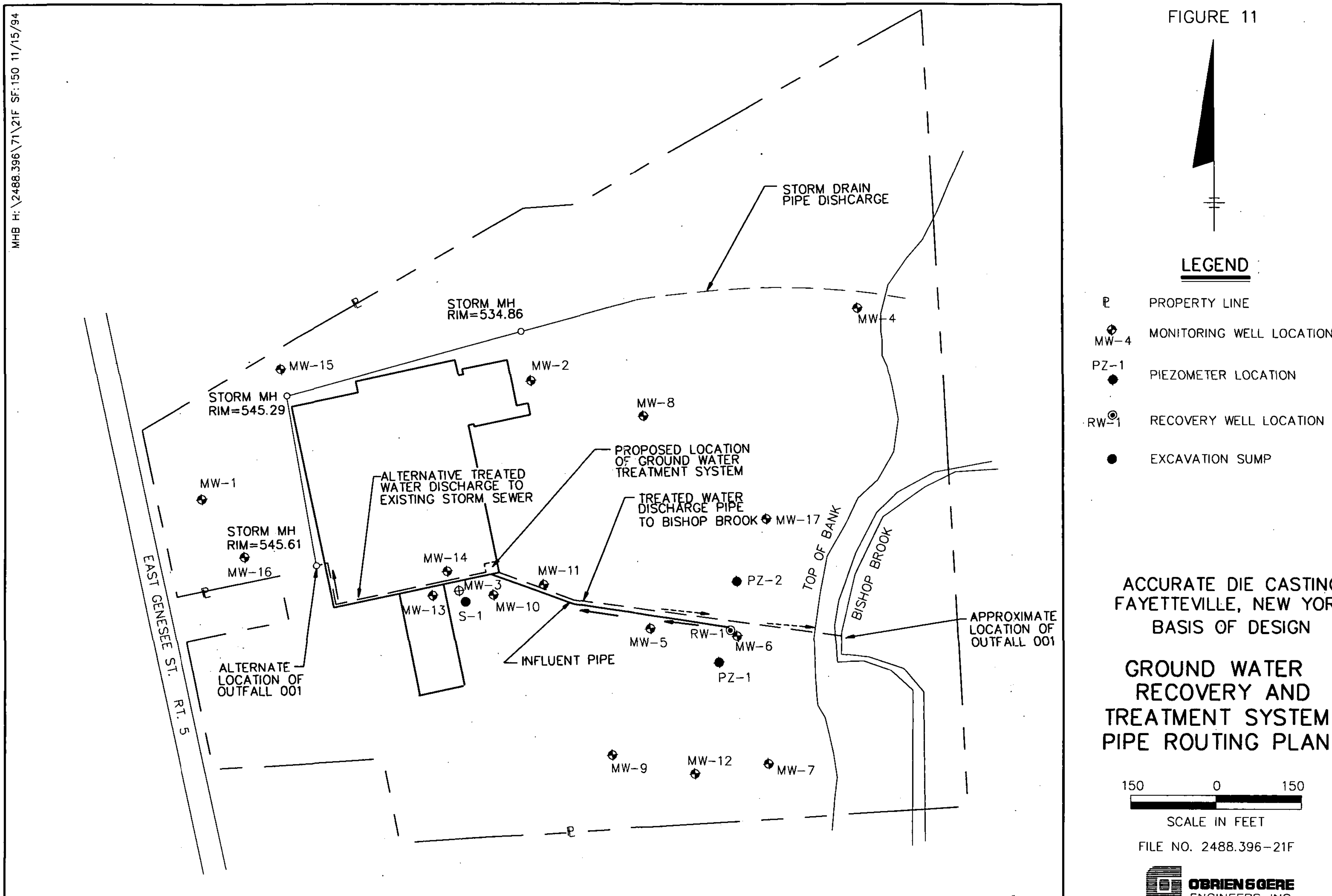
ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK
BASIS OF DESIGN

SYSTEM PROCESS SCHEMATIC

NOT TO SCALE

FILE NO. 2488.396-20F

O'BRIEN & GERE ENGINEERS INC.



ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK
BASIS OF DESIGN

GROUND WATER RECOVERY AND TREATMENT SYSTEM PIPE ROUTING PLAN

150 0 150

SCALE IN FEET

FILE NO. 2488.396-21F

OBRIEN & GERE ENGINEERS INC.

APPENDIX A

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	REPORT OF BORING PZ-1
Client: OBG Tehnical Services	Sampler: 2" Split Spoon	Page 1 of 2
		Location: 50'E of MW-6
Proj. Loc: Accurate Die Casting	Hammer: 140 lbs.	Start Date: 8/1/94
File No.: 2488.396.523	Fall: 30"	End Date: 8/2/94

Boring Company: OP-TECH
Foreman: Steve Laramee
OBG Geologist: DJ Carnevale

Screen = ; Riser ; Grout \ ; Sand Pack ; Bentonite

Depth Below Grade	No.	Depth (feet)	Blows /6"	Penetr/ Recovery	"N" Value	Sample Description	Stratum Change General Descript	Equip. Installed	Field Testing HNU (ppn)
0	1	0-2	2-6	2/2	12	Dry to damp, brown, very fine to fine SAND,			0.6
			6-6	(0920)		little silt, 1 pc gravel in tip of shoe.			
1									
2	2	2-4	2-5	2/1	18	Damp, dark brown SILT, little very fine			1.4
			13-16	(0925)		sand, shaly rock in shoe.			
3									
4	3	4-6	8-11	2/1.5	11	Dry, gray brown fine SAND and SILT, little			13.2
			36/0.5	(0945)		very fine gravel, loose, shaly rock in tip of			
5						shoe, cobbles in cutting.			
6	4	6-8	5-7	2/2	15	Dry to damp, fine to coarse SAND, little silt			10.2
			8-7	(1010)		and fine to medium gravel, cobbles in cutting.			
7									
8	5	8-10	4-7	2/2	14	Damp to moist, as above, trace very			28
			7-7	(1015)		coarse GRAVEL, cobbles in cutting.			
9									
10	6	10-12	5-6	2/2	13	Damp, brown gray medium SAND, some fine			5.8
			7-16	(1100)		sand, little coarse sand, trace fine broken			
11						gravel.			
12	7	12-14	6-9	2/2	15	Damp to moist, brown gray, medium to			11.4
			6-6	(1120)		coarse SAND,some fine sand, little medium to			
13						fine broken gravel.			
14	8	14-16	4-8	2/2	14	Moist, brown gray, fine SAND, some medium			10.6
			6-5	(1145)		sand, trace silt.			
15									
16	9	16-18	3-4	2/2	8	Moist to wet, gray brown fine SAND, some			6.8
			4-4	(1255)		medium sand, little to trace of coarse sand.			
17									
18	10	18-20	5-5	2/2	9	Moist, gray brown, fine to medium SAND,			2.8
			4-4	(1320)		little to trace coarse sand, saturated			
19						at 19.5'			
20	11	20-22	3-4	2/2	9	Wet, gray brown, fine to medium SAND,			3.6
			5-6	(1350)		little coarse sand and silt, some fine gravel			
21						21.5' to 22', brown clayey sand in tip of			
						shoe.			
22	12	22-24	5-5	2/2	12	Wet, gray brown, fine to medium SAND, little			3.2
			7/16	(1425)		fine to medium gravel, coarse sand, silt,			
23						trace to little clay red to brown clay in			
						tip of shoe at 24'			

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	REPORT OF BORING PZ-1
Client: OBG Tehnical Services Proj. Loc: Accurate Die Casting File No.: 2488.396.523	Sampler: 2" Split Spoon Hammer: 140 lbs. Fall: 30"	Page 2 of 2 Location: 50'E of MW-6 Start Date: 8/1/94 End Date: 8/2/94
Boring Company: OP-TECH Foreman: Steve Larance OBG Geologist: DJ Carnevale		Screen = / Riser / Grout / Sand Pack / Bentonite

Depth Below Grade	No.	Depth (feet)	Blows /6"	Penetr/ Recovery	"N" Value	Sample Description	Stratum Change General Descript	Equip. Installed	Field Testing	HNU (ppn)
24	13	24-26	3-1	2/2	6	Wet, gray brown fine to medium SAND, some		=		3.8
			5-7	(1450)		silt, little coarse sand, trace to little		=		
25						clay		=		
								=		
26	14	26-28	9-19	2/2		Wet, as above to 26.5' to red to brown CLAY		=		3.8
			26-60/.5	(1705)		till, very fine gravel to 26.8 ft., to gray		=		
27						fine sand, some medium sand, silt, clay and		=		
						broken gravel shale fragments.		=		
28	15	28-30	27-55	2/2		Wet, brown gray fine SAND, some medium sand,		=		4
			60/.5	(1705)		little coarse sand, to 28.7' to gray green		=		
29						weathered shale to 29.2' to gray brown fine		=		
						sandy silt, some clay, to red silt and fine		=		
						to medium broken faceted rocks fragments.		=		
30	16	30-32	50/6	2/0		No recovery		=		
				(0815)				=		
31								=		
								=		
32	17	32-34	64/0	2/0		No recovery as above				–
33										
						B.O.B = 32'				–
34										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										

2" 0.010-in screen 32- 22 Bentonite 19.6- 17.0
Sandpack 32- 19.6
Cement/ bentonite grout to grade with 4" dia locking guard pipe

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	REPORT OF BORING PZ-2
Client: OBG Tehnical Services	Sampler: 2" Split Spoon	Page 1 of 2 Location: N50'W of MW-6
Proj. Loc: Accurate Die Casting Fayetteville	Hammer: 140 lbs.	Start Date: 8/3/94
File No.: 2488.396.523	Fall: 30"	End Date: 8/4/94

Boring Company: OP-TECH
Foreman: Steve Laramee
OBG Geologist: DJ Carnevale

Screen = / Riser / Grout / Sand Pack / Bentonite

Depth Below Grade	No.	Depth (feet)	Blows /6"	Penetr/ Recovery	"N" Value	Sample Description	Stratum Change General Descript	Equip. Installed	Field Testing HNU (ppn)
0	1	0-2	2-3	2/2	6	Damp, medium brown, and fine SAND.			ND
			3-3	(0705)					
1									
2									
3									
4									
5	2	5-7	2-4	2/2	7	Moist, gray brown fine SAND, trace little silt.			0.6
			3-3	(0720)					
6									
7									
8									
9									
10	3	10-12	5-5	2/2	10	Moist to wet, gray brown, fine to coarse sand			1.2
			5-7	(0735)		and very fine to medium gravel.			
11									
12									
13									
14									
15	4	15-17	6-7	2/2	16	As above			0.6
			9-9	(0800)					
16									
17									
18									
19									
20	5	20-22	2-10	2/2	22	Wet, reddish brown clayey silt matrix till, some			0.8
			12-16	(0830)		fine to medium sand and very fine gravel.			
21									
22	6	22-24	8-22	2/2	53	Wet, gray brown till of claying SILT and fine			3.2
			31-30	(0840)		sand, some medium sand broken shale			
23						fragments to medium gravel.			

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	REPORT OF BORING PZ-2
Client: OBG Tehnical Services Proj. Loc: Accurate Die Casting Fayetteville File No.: 2488.396.523	Sampler: 2" Split Spoon Hammer: 140 lbs. Fall: 30"	 Location: N50'W of MW-6 Start Date: 8/3/94 End Date: 8/4/94
Boring Company: OP-TECH Foreman: Steve Laramee OBG Geologist: DJ Carnevale		Screen = / Riser; Grout / Sand Pack / Bentonite

Depth Below Grade	No.	Depth (feet)	Blows /6"	Penetr/ Recovery	"N" Value	Sample Description	Stratum Change General Descript	Equip. Installed	Field Testing HNU (ppn)
24	7	24-26	25-60/.2	0.5/0.5		As of previous page			3.8
				(90920)					
25									
26	8	26-28	52-85/.3	0.5/0.5		Wet, molted reddish brown to greenish gray brown claying SILT till with fine sand and fine rounded gravel, some little to medium sand and broken shale fragments with medium gravel, wet, as above.			7.8
				(1040)					
27									
								=	
28	9	28-30	55/0.2	0.5/0.5				=	5.8
				(1100)				=	
29								=	
								=	
30	10	30-32	98-135	1/1.0		Wet, brown, fine sandy till with fine rounded gravel, little medium sand, some silt.		=	3.6
				(1145)				=	
31								=	
								=	
32	11	32-34	21-30	2/	63	Wet, gray, very fine sandy till, fine rounded GRAVEL, solvent odor.		=	28
			33-19	(1305)				=	
33								=	
								=	
34	12	34-36	3-10	1.5/1.5	90	Wet, brown very fine SAND and SILT with broken shale fragments to 35.3 to gray broken shale fragments in fine sandy silt with fine rounded gravel, solvent odor, black, moist to wet, weathered shale.		=	22
			80-	(1330)				=	
35								=	
								=	
36	13	36-38	63-80/0.	0.7/0.7				=	3.8
				1550				=	
37								=	
38	14	38-40	53-36	2/	55	Black, weathered SHALE wet			1.8
			19-16	(1615)					
39									
						B.O.B = 40'			
40									
41									
42									
43									
44									
45									
46									
47									

2" 0.010-in slot screen 37.5- 27.5 Bentonite 25- 22

Sandpack 37.5-25

Cement/bentonite grout to grade with 4" dia locking guard pipe

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	REPORT OF BORING MW-17
Client: OBG Tehnical Services Proj. Loc: Accurate Die Casting Fayetteville, N.Y. File No.: 2488.396.523	Sampler: 2" Split Spoon Hammer: 140 lbs. Fall: 30"	Page 1 of 1 Location: Start Date: 8/4/94 End Date: 8/4/94
Boring Company: OP-TECH Foreman: Steve Laramee OBG Geologist: DJ Carnevale		Screen = / Riser / Grout \ / Sand Pack / Bentonite

Depth Below Grade	No.	Depth (feet)	Blows /6"	Penetr/ Recovery	"N" Value	Sample Description	Stratum Change General Descript	Equip. Installed	Field Testing HNU (ppn)
0	1	0-2	1-1	2/2		Moist, brown, fine sand, little silt.			7.2
			2-1	(1245)					
1									
2									
3									
4									
5	2	5-7	3-5	2/2	10	Moist, gray brown, fine to medium SAND, coarse sand, little to trace of very fine rounded gravel.			11.4
			5-11	(1315)					
6									
7									
8									
9									
10	3	10-12	8-19	2/2	47	Wet, grayish purple till (SILT) with fine to medium gravel, rounded to subangular to 11.2', to similar till but brown, moist with some coarse GRAVEL and shale fragments to 12.			9.8
			28-27	(1340)					
11									
12	4	12-14	8-19	2/2	64	Moist to wet, gray green weathered SHALE.			38
			31-70	(1415)					
13									
14	5	14-16	5-45	2/	102	Moist, gray brown weathered SHALE.			56
			57-26	(1450)					
15									
16									
17									
18									
19									
20									
21									
22									
23									

Sand 14- 13.5 Bentonite 4.5- 3.0
2" 0.010-in slot screen 13.5- 5.5
Sandpack 13.5- 4.5 Cement/bentonite grout to grade with 4' dia. locking guard pipe.

APPENDIX B

LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT: OBG TECHNICAL SERVICES, INC. JOB NO. 2488.396.517

DESCRIPTION: Accurate Die Casting

MATRIX: Water

DATE COLLECTED: 7-20-94 DATE RECEIVED: 7-21-94 DATE ANALYZED: 7-25,26-94

DESCRIPTION:	MW-7	MW-12	MW-6	MW-5	MW-9	MW-13
SAMPLE NO.:	U0138	U0139	U0140	U0141	U0142	U0143
BENZENE	<1.	<1.	<10.	<10.	<1.	<10.
BROMODICHLOROMETHANE	<1.	<1.	<10.	<10.	<1.	<10.
BROMOFORM	<10.	<10.	<100.	<100.	<10.	<100.
BROMOMETHANE	<10.	<10.	<100.	<100.	<10.	<100.
CARBON TETRACHLORIDE	<1.	<1.	<10.	<10.	<1.	<10.
CHLOROBENZENE	<1.	<1.	<10.	<10.	<1.	<10.
CHLOROETHANE	<1.	<1.	<10.	<10.	<1.	<10.
2-CHLOROETHYLVINYL ETHER	<10.	<10.	<100.	<100.	<10.	<100.
CHLOROFORM	<1.	<1.	<10.	<10.	<1.	<10.
CHLOROMETHANE	<10.	<10.	<100.	<100.	<10.	<100.
DIBROMOCHLOROMETHANE	<1.	<1.	<10.	<10.	<1.	<10.
1,2-DICHLOROBENZENE	<5.	<5.	<50.	<50.	<5.	<50.
1,3-DICHLOROBENZENE	<5.	<5.	<50.	<50.	<5.	<50.
1,4-DICHLOROBENZENE	<5.	<5.	<50.	<50.	<5.	<50.
DICHLORODIFLUOROMETHANE	<10.	<10.	<100.	<100.	<10.	<100.
1,1-DICHLOROETHANE	<1.	<1.	<10.	<10.	<1.	<10.
1,2-DICHLOROETHANE	<1.	<1.	<10.	<10.	<1.	<10.
1,1-DICHLOROETHYLENE	<1.	<1.	<10.	<10.	<1.	<10.
1,2-DICHLOROETHENE (total)	<1.	<1.	<10.	<10.	<1.	<10.
DICHLOROMETHANE	<1.	<1.	<10.	<10.	<1.	<10.
1,2-DICHLOROPROPANE	<1.	<1.	<10.	<10.	<1.	<10.
cis-1,3-DICHLOROPROPYLENE	<1.	<1.	<10.	<10.	<1.	<10.
trans-1,3-DICHLOROPROPYLENE	<1.	<1.	<10.	<10.	<1.	<10.

Authorized: [signature]

Date: August 4, 1994

OBG Laboratories, Inc., an *O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

OBG
LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT: OBG TECHNICAL SERVICES, INC. JOB NO. 2488.396.517

DESCRIPTION: Accurate Die Casting

MATRIX: Water

DATE COLLECTED: 7-20-94 DATE RECEIVED: 7-21-94 DATE ANALYZED: 7-25,26-94

DESCRIPTION:	MW-7	MW-12	MW-6	MW-5	MW-9	MW-13
SAMPLE NO.:	U0138	U0139	U0140	U0141	U0142	U0143
ETHYLBENZENE	<1.	<1.	<10.	<10.	<1.	<10.
1,1,2,2-TETRACHLOROETHANE	<1.	<1.	<10.	<10.	<1.	<10.
TETRACHLOROETHYLENE	<1.	<1.	<10.	<10.	<1.	<10.
TOLUENE	<1.	<1.	<10.	<10.	<1.	<10.
1,1,1-TRICHLOROETHANE	<1.	<1.	<10.	<10.	<1.	<10.
1,1,2-TRICHLOROETHANE	<1.	<1.	<10.	<10.	<1.	<10.
TRICHLOROETHYLENE	<1.	44.	390.	330.	72.	740.
TRICHLOROFLUOROMETHANE	<1.	<1.	<10.	<10.	<1.	<10.
VINYL CHLORIDE	<1.	<1.	<10.	<10.	<1.	<10.
XYLENE (total)	<3.	<3.	<30.	<30.	<3.	<30.

Comments:

Methodology: USEPA SW-846, November 1986, 3rd Edition

Certification No.: 10155

Units: µg/l

Authorized: [signature]

Date: August 4, 1994

OBG Laboratories, Inc., *an O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT OBG TECHNICAL SERVICES, INC. JOB NO. 2488.396.517

DESCRIPTION Accurate Die Casting

MATRIX: Water

DATE COLLECTED 7-20,21-94 DATE RECEIVED 7-21-94 DATE ANALYZED 7-25,26,27-94

DESCRIPTION:	MW-14	MW-4	MW-11	MW-10	Sump Pump	QC Trip Blank
SAMPLE NO.:	U0144	U0145	U0146	U0147	U0148	U0149
BENZENE	<10.	<10.	<100.	<50.	<500.	<1.
BROMODICHLOROMETHANE	<10.	<10.	<100.	<50.	<500.	<1.
BROMOFORM	<100.	<100.	<1000.	<500.	<5000.	<10.
BROMOMETHANE	<100.	<100.	<1000.	<500.	<5000.	<10.
CARBON TETRACHLORIDE	<10.	<10.	<100.	<50.	<500.	<1.
CHLOROBENZENE	<10.	<10.	<100.	<50.	<500.	<1.
CHLOROETHANE	<10.	<10.	<100.	<50.	<500.	<1.
2-CHLOROETHYLVINYL ETHER	<100.	<100.	<1000.	<500.	<5000.	<10.
CHLOROFORM	<10.	<10.	<100.	<50.	<500.	<1.
CHLOROMETHANE	<100.	<100.	<1000.	<500.	<5000.	<10.
DIBROMOCHLOROMETHANE	<10.	<10.	<100.	<50.	<500.	<1.
1,2-DICHLOROBENZENE	<50.	<50.	<500.	<250.	<2500.	<5.
1,3-DICHLOROBENZENE	<50.	<50.	<500.	<250.	<2500.	<5.
1,4-DICHLOROBENZENE	<50.	<50.	<500.	<250.	<2500.	<5.
DICHLORODIFLUOROMETHANE	<100.	<100.	<1000.	<500.	<5000.	<10.
1,1-DICHLOROETHANE	<10.	<10.	<100.	<50.	<500.	<1.
1,2-DICHLOROETHANE	<10.	<10.	<100.	<50.	<500.	<1.
1,1-DICHLOROETHYLENE	<10.	<10.	<100.	<50.	<500.	<1.
1,2-DICHLOROETHENE (total)	<10.	42.	<100.	<50.	<500.	<1.
DICHLOROMETHANE	<10.	<10.	<100.	<50.	<500.	<1.
1,2-DICHLOROPROPANE	<10.	<10.	<100.	<50.	<500.	<1.
cis-1,3-DICHLOROPROPYLENE	<10.	<10.	<100.	<50.	<500.	<1.
trans-1,3-DICHLOROPROPYLENE	<10.	<10.	<100.	<50.	<500.	<1.

Authorized: Monika Santucci

Date: August 4, 1994

OBG Laboratories, Inc., an O'Brien & Gere Limited Company
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT: OBG TECHNICAL SERVICES, INC. JOB NO. 2488.396.517

DESCRIPTION: Accurate Die Casting

MATRIX: Water

DATE COLLECTED: 7-20,21-94 DATE RECEIVED: 7-21-94 DATE ANALYZED: 7-25,26,27-94

DESCRIPTION:	MW-14	MW-4	MW-11	MW-10	Sump Pump	QC Trip Blank
SAMPLE NO.:	U0144	U0145	U0146	U0147	U0148	U0149
ETHYLBENZENE	<10.	<10.	<100.	<50.	<500.	<1.
1,1,2,2-TETRACHLOROETHANE	<10.	<10.	<100.	<50.	<500.	<1.
TETRACHLOROETHYLENE	<10.	<10.	<100.	<50.	<500.	<1.
TOLUENE	<10.	<10.	<100.	<50.	<500.	<1.
1,1,1-TRICHLOROETHANE	<10.	<10.	<100.	<50.	<500.	<1.
1,1,2-TRICHLOROETHANE	<10.	<10.	<100.	<50.	<500.	<1.
TRICHLOROETHYLENE	150.	270.	5500.	1600.	20,000.	<1.
TRICHLOROFLUOROMETHANE	<10.	<10.	<100.	<50.	<500.	<1.
VINYL CHLORIDE	<10.	<10.	<100.	<50.	<500.	<1.
XYLENE (total)	<30.	<30.	<300.	<150.	<1500.	<3.

Comments:

Methodology: USEPA SW-846, November 1986, 3rd Edition

Certification No.: 10155

Units: µg/l

Authorized: [signature]

Date: August 4, 1994

OBG Laboratories, Inc., *an O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

O'BRIEN & GERE ENGINEERS, INC.

Job No. 2488-396-531
Sheet ___ of ___

Office: Syracuse, NY
Address: 5000 Brittonfield Pkwy
Phone: 437-6100

CHAIN OF CUSTODY

CLIENT: Accurate Die Casting LOCATION: Fayetteville, NY	COLLECTED BY: Pete Loretto (Signature) [signature]

SAMPLE DESCRIPTION	Date	Time	Sample Matrix[1]	Sample Type[2]	No. of Containers	ANALYSIS REQUESTED
mw-7	7/20	0950	water	grab	2	
mw-12	7/20	1030			2	
mw-6	7/20	1050			2	
mw-5	7/20	1115			2	
mw-9	7/20	1235			2	
mw-13	7/20	1255			2	
mw-14	7/20	1315			2	8010/8020
mw-4	7/21	1030			2	
mw-11	7/21	1125			2	
mw-10	7/21	1155			2	
Trip Blank	7/20	—		—	1	8010/8020
Sump Dump	7/20	1345	water	grab	2	8010/8020

[1] Matrix = water, wastewater, air, sludge, sediment, etc.
[2] Type = grab, composite

Relinquished by	Date	Time	Received by	Date	Time
Relinquished by: [signature] of: OBG Engineers	7/21	1340	Received by: Wendy Smith of: OBG Laboratories, Inc.	7/21/94	1340
Relinquished by: of:			Received by: of:		
Relinquished by: of:			Received by: of:		
Use this space if shipped via courier (e.g., Fed Ex) Relinquished by: of:			Courier Name: *Attach delivery/courier receipt to Chain of Custody		
Relinquished by: of:			Received by: of:		

djb/wpC

Cooler temps. @ 3°C + 5°C; rec'd. 2 vials QC Trip Blank. One vial mw10 not labelled - matched w/ time collected. WB

September 17, 1990

LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT ACCURATE DIE CASTING JOB NO. 3435.021.517

DESCRIPTION Fayetteville, NY

MATRIX: Water

DATE COLLECTED 10-18-94 DATE RECEIVED 10-18-94 DATE ANALYZED 10-21,25-94

DESCRIPTION:	MW-8	MW-2	MW-6	MW-17	MW-5	MW-9
SAMPLE NO.:	U4028	U4029	U4030	U4031	U4032	U4033
BENZENE	<1.	<1.	<5.	<2.	<5.	<1.
BROMODICHLOROMETHANE	<1.	<1.	<5.	<2.	<5.	<1.
BROMOFORM	<10.	<10.	<50.	<20.	<50.	<10.
BROMOMETHANE	<10.	<10.	<50.	<20.	<50.	<10.
CARBON TETRACHLORIDE	<1.	<1.	<5.	<2.	<5.	<1.
CHLOROBENZENE	<1.	<1.	<5.	<2.	<5.	<1.
CHLOROETHANE	<1.	<1.	<5.	<2.	<5.	<1.
2-CHLOROETHYLVINYL ETHER	<10.	<10.	<50.	<20.	<50.	<10.
CHLOROFORM	<1.	<1.	<5.	<2.	<5.	<1.
CHLOROMETHANE	<10.	<10.	<50.	<20.	<50.	<10.
DIBROMOCHLOROMETHANE	<1.	<1.	<5.	<2.	<5.	<1.
1,2-DICHLOROBENZENE	<5.	<5.	<25.	<10.	<25.	<5.
1,3-DICHLOROBENZENE	<5.	<5.	<25.	<10.	<25.	<5.
1,4-DICHLOROBENZENE	<5.	<5.	<25.	<10.	<25.	<5.
DICHLORODIFLUOROMETHANE	<10.	<10.	<50.	<20.	<50.	<10.
1,1-DICHLOROETHANE	<1.	<1.	<5.	<2.	<5.	<1.
1,2-DICHLOROETHANE	<1.	<1.	<5.	<2.	<5.	<1.
1,1-DICHLOROETHYLENE	<1.	<1.	<5.	<2.	<5.	<1.
1,2-DICHLOROETHENE (total)	<1.	<1.	6.	<2.	<5.	<1.
DICHLOROMETHANE	<1.	<1.	<5.	<2.	<5.	<1.
1,2-DICHLOROPROPANE	<1.	<1.	<5.	<2.	<5.	<1.
cis-1,3-DICHLOROPROPYLENE	<1.	<1.	<5.	<2.	<5.	<1.
trans-1,3-DICHLOROPROPYLENE	<1.	<1.	<5.	<2.	<5.	<1.

Authorized: [signature]

Date: November 3, 1994

OBG Laboratories, Inc., *an O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT ACCURATE DIE CASTING JOB NO. 3435.021.517

DESCRIPTION Fayetteville, NY

MATRIX: Water

DATE COLLECTED 10-18-94 DATE RECEIVED 10-18-94 DATE ANALYZED 10-21,25-94

DESCRIPTION:	MW-8	MW-2	MW-6	MW-17	MW-5	MW-9
SAMPLE NO.:	U4028	U4029	U4030	U4031	U4032	U4033
ETHYLBENZENE	<1.	<1.	<5.	<2.	<5.	<1.
1,1,2,2-TETRACHLOROETHANE	<1.	<1.	<5.	<2.	<5.	<1.
TETRACHLOROETHYLENE	<1.	<1.	<5.	10.	5.	<1.
TOLUENE	<1.	<1.	<5.	<2.	<5.	<1.
1,1,1-TRICHLOROETHANE	<1.	<1.	<5.	<2.	<5.	<1.
1,1,2-TRICHLOROETHANE	<1.	<1.	<5.	<2.	<5.	<1.
TRICHLOROETHYLENE	<1.	<1.	360.	140.	410.	74.
TRICHLOROFLUOROMETHANE	<1.	<1.	<5.	<2.	<5.	<1.
VINYL CHLORIDE	<1.	<1.	<5.	<2.	<5.	<1.
XYLENE (total)	<3.	<3.	<15.	<6.	<15.	<3.

Comments:

Methodology: USEPA,SW-846, November 1986, 3rd Edition

Certification No.: 10155

Units: µg/1

Authorized: [signature]

Date: November 3, 1994

OBG Laboratories, Inc., *an O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

OBG LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT: ACCURATE DIE CASTING JOB NO. 3435.021.517

DESCRIPTION: Fayetteville, NY

MATRIX: Water

DATE COLLECTED: 10-18-94 DATE RECEIVED: 10-18-94 DATE ANALYZED: 10-21-94

DESCRIPTION:	MW-11	MW-16	MW-13			
SAMPLE NO.:	U4034	U4035	U4036			
BENZENE	<100.	<1.	<5.			
BROMODICHLOROMETHANE	<100.	<1.	<5.			
BROMOFORM	<1000.	<10.	<50.			
BROMOMETHANE	<1000.	<10.	<50.			
CARBON TETRACHLORIDE	<100.	<1.	<5.			
CHLOROBENZENE	<100.	<1.	<5.			
CHLOROETHANE	<100.	<1.	<5.			
2-CHLOROETHYLVINYL ETHER	<1000.	<10.	<50.			
CHLOROFORM	<100.	<1.	<5.			
CHLOROMETHANE	<1000.	<10.	<50.			
DIBROMOCHLOROMETHANE	<100.	<1.	<5.			
1,2-DICHLOROBENZENE	<500.	<5.	<25.			
1,3-DICHLOROBENZENE	<500.	<5.	<25.			
1,4-DICHLOROBENZENE	<500.	<5.	<25.			
DICHLORODIFLUOROMETHANE	<1000.	<10.	<50.			
1,1-DICHLOROETHANE	<100.	<1.	<5.			
1,2-DICHLOROETHANE	<100.	<1.	<5.			
1,1-DICHLOROETHYLENE	<100.	<1.	<5.			
1,2-DICHLOROETHENE (total)	<100.	<1.	<5.			
DICHLOROMETHANE	<100.	<1.	<5.			
1,2-DICHLOROPROPANE	<100.	<1.	<5.			
cis-1,3-DICHLOROPROPYLENE	<100.	<1.	<5.			
trans-1,3-DICHLOROPROPYLENE	<100.	<1.	<5.			

Authorized: Mark J. LaShucci

Date: November 3, 1994

OBG Laboratories, Inc., *an O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT ACCURATE DIE CASTING JOB NO. 3435.021.517

DESCRIPTION Fayetteville, NY

MATRIX: Water

DATE COLLECTED 10-18-94 DATE RECEIVED 10-18-94 DATE ANALYZED 10-21-94

DESCRIPTION:	MW-11	MW-16	MW-13			
SAMPLE NO.:	U4034	U4035	U4036			
ETHYLBENZENE	<100.	<1.	<5.			
1,1,2,2-TETRACHLOROETHANE	<100.	<1.	<5.			
TETRACHLOROETHYLENE	<100.	<1.	<5.			
TOLUENE	<100.	<1.	<5.			
1,1,1-TRICHLOROETHANE	<100.	<1.	<5.			
1,1,2-TRICHLOROETHANE	<100.	<1.	<5.			
TRICHLOROETHYLENE	5300.	6.	510.			
TRICHLOROFLUOROMETHANE	<100.	<1.	<5.			
VINYL CHLORIDE	<100.	<1.	<5.			
XYLENE (total)	<300.	<3.	<75.			

Comments:

Methodology: USEPA,SW-846, November 1986, 3rd Edition

Certification No.: 10155

Units: µg/l

Authorized: [signature]

Date: November 3, 1994

OBG Laboratories, Inc., *an O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

O'BRIEN & GERE ENGINEERS, INC.

Job No. [illegible]

Sheet 1 of 1

Office: SYRACUSE
Address: SYRACUSE, N.Y.
Phone: (315)437-6100

CHAIN OF CUSTODY

CLIENT: ACCURATE DIE CASTING
LOCATION: FAYETTVILLE, N.Y.

COLLECTED BY: (Signature) Chaun O'Dell

SAMPLE DESCRIPTION	Date	Time	Sample Matrix[1]	Sample Type[2]	No. of Containers	ANALYSIS REQUESTED
MW-8	10/18/94	1150	water	grab	2	8010/8020
MW-2	10/18/94	1215	water	grab	2	8010/8020
MW-6	10/18/94	1245	water	grab	2	8010/8020
MW-17	10/18/94	1305	water	grab	2	8010/8020
MW-5	10/18/94	1350	water	grab	2	8010/8020
MW-9	10/18/94	1425	water	grab	2	8010/8020
MW-11	10/18/94	1510	water	grab	2	8010/8020
MW-16	10/18/94	1550	water	grab	2	8010/8020
MW-13	10/18/94	1615	water	grab	2	8010/8020

[1] Matrix = water, wastewater, air, sludge, sediment, etc.
[2] Type = grab, composite

Relinquished by	Date	Time	Received by	Date	Time
Relinquished by: Chaun O'Dell of: O'Brien & Gere Eng. Inc.	10/18/94	5:06pm	Received by: of:		
Relinquished by: of:			Received by: of:		
Relinquished by: of:			Received by: of:		
Use this space if shipped via courier (e.g. Fed Ex) Relinquished by: of:	Date:	Time:	Courier Name: *Attach delivery/courier receipt to Chain of Custody	Date:	Time:
Relinquished by: of:			Received by: Nico Oliver of: OBG Laboratories Inc	10/18/94	5:06pm

djb/woC

September 17, 1993

OBG LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT ACCURATE DIE CASTING JOB NO. 3435.021.517

DESCRIPTION Fayetteville, NY

MATRIX: Water

DATE COLLECTED 10-19-94 DATE RECEIVED 10-19-94 DATE ANALYZED 10-21-94

DESCRIPTION:	MW-7	MW-12	MW-15	MW-10	MW-14	QC Trip Blank
SAMPLE NO.:	U4074	U4075	U4076	U4077	U4078	U4079
BENZENE	<1.	<1.	<1.	<10.	<1.	<1.
BROMODICHLOROMETHANE	<1.	<1.	<1.	<10.	<1.	<1.
BROMOFORM	<10.	<10.	<10.	<100.	<10.	<10.
BROMOMETHANE	<10.	<10.	<10.	<100.	<10.	<10.
CARBON TETRACHLORIDE	<1.	<1.	<1.	<10.	<1.	<1.
CHLOROBENZENE	<1.	<1.	<1.	<10.	<1.	<1.
CHLOROETHANE	<1.	<1.	<1.	<10.	<1.	<1.
2-CHLOROETHYLVINYL ETHER	<10.	<10.	<10.	<100.	<10.	<10.
CHLOROFORM	<1.	<1.	<1.	<10.	<1.	<1.
CHLOROMETHANE	<10.	<10.	<10.	<100.	<10.	<10.
DIBROMOCHLOROMETHANE	<1.	<1.	<1.	<100.	<1.	<1.
1,2-DICHLOROBENZENE	<5.	<5.	<5.	<50.	<5.	<5.
1,3-DICHLOROBENZENE	<5.	<5.	<5.	<50.	<5.	<5.
1,4-DICHLOROBENZENE	<5.	<5.	<5.	<50.	<5.	<5.
DICHLORODIFLUOROMETHANE	<10.	<10.	<10.	<100.	<10.	<10.
1,1-DICHLOROETHANE	<1.	<1.	<1.	<10.	<1.	<1.
1,2-DICHLOROETHANE	<1.	<1.	<1.	<10.	<1.	<1.
1,1-DICHLOROETHYLENE	<1.	<1.	<1.	<10.	<1.	<1.
1,2-DICHLOROETHENE (total)	<1.	<1.	<1.	<10.	<1.	<1.
DICHLOROMETHANE	<1.	<1.	<1.	<10.	<1.	<1.
1,2-DICHLOROPROPANE	<1.	<1.	<1.	<100.	<10.	<1.
cis-1,3-DICHLOROPROPYLENE	<1.	<1.	<1.	<100.	<10.	<1.
trans-1,3-DICHLOROPROPYLENE	<1.	<1.	<1.	<100	<10	<1.

Authorized: Minka Sanfucci

Date: November 3, 1994

OBG Laboratories, Inc., an O'Brien & Gere Limited Company
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT ACCURATE DIE CASTING JOB NO. 3435.021.517

DESCRIPTION Fayetteville, NY

MATRIX: Water

DATE COLLECTED 10-19-94 DATE RECEIVED 10-19-94 DATE ANALYZED 10-21-94

DESCRIPTION:	MW-7	MW-12	MW-15	MW-10	MW-14	QC Trip Blank
SAMPLE NO.:	U4074	U4075	U4076	U4077	U4078	U4079
ETHYLBENZENE	<1.	<1.	<1.	<10.	<1.	<1.
1,1,2,2-TETRACHLOROETHANE	<1.	<1.	<1.	<10.	<1.	<1.
TETRACHLOROETHYLENE	<1.	<1.	<1.	<10.	<1.	<1.
TOLUENE	<1.	<1.	<1.	<10.	<1.	<1.
1,1,1-TRICHLOROETHANE	<1.	<1.	<1.	<10.	<1.	<1.
1,1,2-TRICHLOROETHANE	<1.	<1.	<1.	<100.	<10.	<1.
TRICHLOROETHYLENE	<1.	35.	14.	1300.	120.	<1.
TRICHLOROFLUOROMETHANE	<1.	<1.	<1.	<10.	<1.	<1.
VINYL CHLORIDE	<1.	<1.	<1.	<10.	<1.	<1.
XYLENE (total)	<3.	<3.	<3.	<30.	<3.	<3.

Comments:

Methodology: USEPA,SW-846, November 1986, 3rd Edition

Certification No.: 10155

Units: µg/1

Page 2 of 2

Authorized: Monika Santucci

Date: November 3, 1994

O'BRIEN & GERE ENGINEERS, INC.

Job No. 2488.396
Sheet 1 of 1

Office: Syracuse, NY
Address: 5000 Brittonfield
Phone: 437-6100

CHAIN OF CUSTODY

CLIENT: Accurate Die Casting
LOCATION: Fayetteville, NY

COLLECTED BY: Pete Loretto / Shawn Odell
(Signature) [signature] [signature]

SAMPLE DESCRIPTION	Date	Time	Sample Matrix[1]	Sample Type[2]	No. of Containers	ANALYSIS REQUESTED
MW-7	10/19	0815	water	grab	2	8010/8020
MW-12	10/19	0830	water	grab	2	8010/8020
MW-15	10/19	0930	water	grab	2	8010/8020
MW-10	10/19	1100	water	grab	2	8010/8020
MW-14	10/19	1130	water	grab	2	8010/8020
Trip Blank	10/19	—	water	—	1	8010/8020

@ Cooler temp. @ 3°C (WS) MW-10 description not listed on sample labels - matched by time collected (WS)

[1] Matrix = water, wastewater, air, sludge, sediment, etc.
[2] Type = grab, composite

Relinquished by	Date	Time	Received by	Date	Time
Relinquished by: Shawn P. Odell of: O'Brien & Gere Eng., Inc.	10/19/94	1330	Received by: Wendy Smith of: ABB Labs	10/19/94	1330
Relinquished by: of:			Received by: of:		
Relinquished by: of:			Received by: of:		
Use this space if shipped via courier (e.g. Fed Ex) Relinquished by: of:			Courier Name: *Attach delivery/courier receipt to Chain of Custody		
Relinquished by: of:			Received by: of:		

LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT ACCURATE DIE CASTING JOB NO. 3435.021.517

DESCRIPTION Fayetteville, NY

MATRIX: Water

DATE COLLECTED 10-20-94 DATE RECEIVED 10-20-94 DATE ANALYZED 10-21-94

DESCRIPTION:	MW-4					
SAMPLE NO.:	U4172					
BENZENE	<1.					
BROMODICHLOROMETHANE	<1.					
BROMOFORM	<10.					
BROMOMETHANE	<10.					
CARBON TETRACHLORIDE	<1.					
CHLOROBENZENE	<1.					
CHLOROETHANE	<1.					
2-CHLOROETHYLVINYL ETHER	<10.					
CHLOROFORM	<1.					
CHLOROMETHANE	<10.					
DIBROMOCHLOROMETHANE	<1.					
1,2-DICHLOROBENZENE	<5.					
1,3-DICHLOROBENZENE	<5.					
1,4-DICHLOROBENZENE	<5.					
DICHLORODIFLUOROMETHANE	<10.					
1,1-DICHLOROETHANE	<1.					
1,2-DICHLOROETHANE	<1.					
1,1-DICHLOROETHYLENE	<1.					
1,2-DICHLOROETHENE (total)	38.					
DICHLOROMETHANE	<1.					
1,2-DICHLOROPROPANE	<1.					
cis-1,3-DICHLOROPROPYLENE	<1.					
trans-1,3-DICHLOROPROPYLENE	<1.					

Authorized: Monika SanTucci

Date: November 3, 1994

OBG Laboratories, Inc., *an O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT ACCURATE DIE CASTING JOB NO. 3435.021.517

DESCRIPTION Fayetteville, NY

MATRIX: Water

DATE COLLECTED 10-20-94 DATE RECEIVED 10-20-94 DATE ANALYZED 10-21-94

DESCRIPTION:	MW-4					
SAMPLE NO.:	U4172					
ETHYLBENZENE	<1.					
1,1,2,2-TETRACHLOROETHANE	<1.					
TETRACHLOROETHYLENE	<1.					
TOLUENE	<1.					
1,1,1-TRICHLOROETHANE	<1.					
1,1,2-TRICHLOROETHANE	<1.					
TRICHLOROETHYLENE	23.					
TRICHLOROFLUOROMETHANE	<1.					
VINYL CHLORIDE	<1.					
XYLENE (total)	<3.					

Comments:

Methodology: USEPA,SW-846, November 1986, 3rd Edition

Certification No.: 10155

Units: µg/1

Authorized: [signature]

Date: November 3, 1994

OBG Laboratories, Inc., *an O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

O'BRIEN & GERE ENGINEERS, INC.

Job No. 2400.??? Sheet 1 of 1

Office: SYRACUSE, N.Y.
Address: 5000 Brittonfield Pkwy.
Phone: (315) 437-6100

CHAIN OF CUSTODY

CLIENT: ACCURATE DIE CASTING
LOCATION: FAYETTVILLE, N.Y.

COLLECTED BY: CHAWN O'DELL
(Signature) Chawn O'Dell

SAMPLE DESCRIPTION	Date	Time	Sample Matrix[1]	Sample Type[2]	No. of Containers	ANALYSIS REQUESTED
MW-4	10/20/94	0930	water	grab	1	8010/8020

[1] Matrix = water, wastewater, air, sludge, sediment, etc.
[2] Type = grab, composite

Relinquished by	Date	Time	Received by	Date	Time
Relinquished by: Chawn O'Dell of: O'Brien & Gere Engineers, Inc.	10/20/94	1620	Received by: of:		
Relinquished by: of:			Received by: of:		
Relinquished by: of:			Received by: of:		
Use this space if shipped via courier (e.g., Fed Ex) Relinquished by: of:			Courier Name: *Attach delivery/courier receipt to Chain of Custody		
Relinquished by: of:			Received by: Honey [illegible] of: O'Brien & Gere Laboratories Inc	10/20/94	16:2?

APPENDIX C

Accurate Die-Casting Facility Aquifer Performance Test

Well Number: [redacted] RW-1
Static: 22.88
Well Depth: 56.26
Aquifer Thickness: 29.38

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)	Corrected DD
1	25.69	2.81	2.66
2	28.58	5.70	5.10
3	29.36	[illegible]	5.70
4	29.74	[illegible]	5.99
5	29.98	7.10	6.17
6	30.12	[illegible]	6.27
7	30.26	7.38	6.37 Rec
8	30.34	[illegible]	6.43
9	30.42	7.54	6.49
10	30.48	[illegible]	6.53
15	30.72	7.84	6.70
20	30.73	7.85	6.71
25	30.74	7.86	6.72
[illegible]	30.78	7.90	6.74
35	30.85	7.97	6.79
[illegible]	30.88	8.00	6.81
[illegible]	30.91	[illegible]	6.84
50	30.93	8.05	6.85
55	30.94	8.06	6.86
[illegible]	30.96	8.08	6.87
75	31.00	8.12	6.90
[illegible]	31.03	8.15	6.92
[illegible]	31.05	8.17	6.93
120	31.06	8.17	6.94
180	31.11	8.23	6.98
240	31.18	8.30	7.02
300	31.21	8.33	7.05
[illegible]	31.24	8.36	7.08 9/30
[illegible]	31.27	8.39	7.09 8:45
481	31.29	8.41	7.10
540	31.26	8.38	7.08
600	31.28	8.40	7.09
660	31.30	8.42	7.11
[illegible]	31.31	8.43	7.11
780	31.32	8.44	7.12
840	31.34	8.46	7.13
900	31.36	8.48	7.15
960	31.38	8.50	7.16
1020	31.40	8.52	7.18
1080	31.42	8.54	7.19

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)	
1140	31.46	8.58	7.22
1200	31.47	8.59	7.22
1260	31.50	8.62	7.24
1320	31.54	8.66	7.27
1380	31.56	8.68	7.28
0	31.59	8.71	
1	25.78	2.90	
2	24.42	1.54	
3	24.12	1.24	
4	23.95	1.07	
5	23.84	0.96	
6	23.77	0.89	
7	23.72	0.84	
8	23.69	0.81	
9	23.66	0.78	
10	23.63	0.75	
15	23.54	0.66	
20	23.48	0.60	
25	23.44	0.56	
30	23.40	0.52	
35	23.38	0.50	
45	23.34	0.46	
55	23.32	0.44	
228	22.62	0.26	
394	22.58	0.30	
480	22.58	0.30	
1485	22.57	0.31	

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

673-9399

90% Rec = 23.75

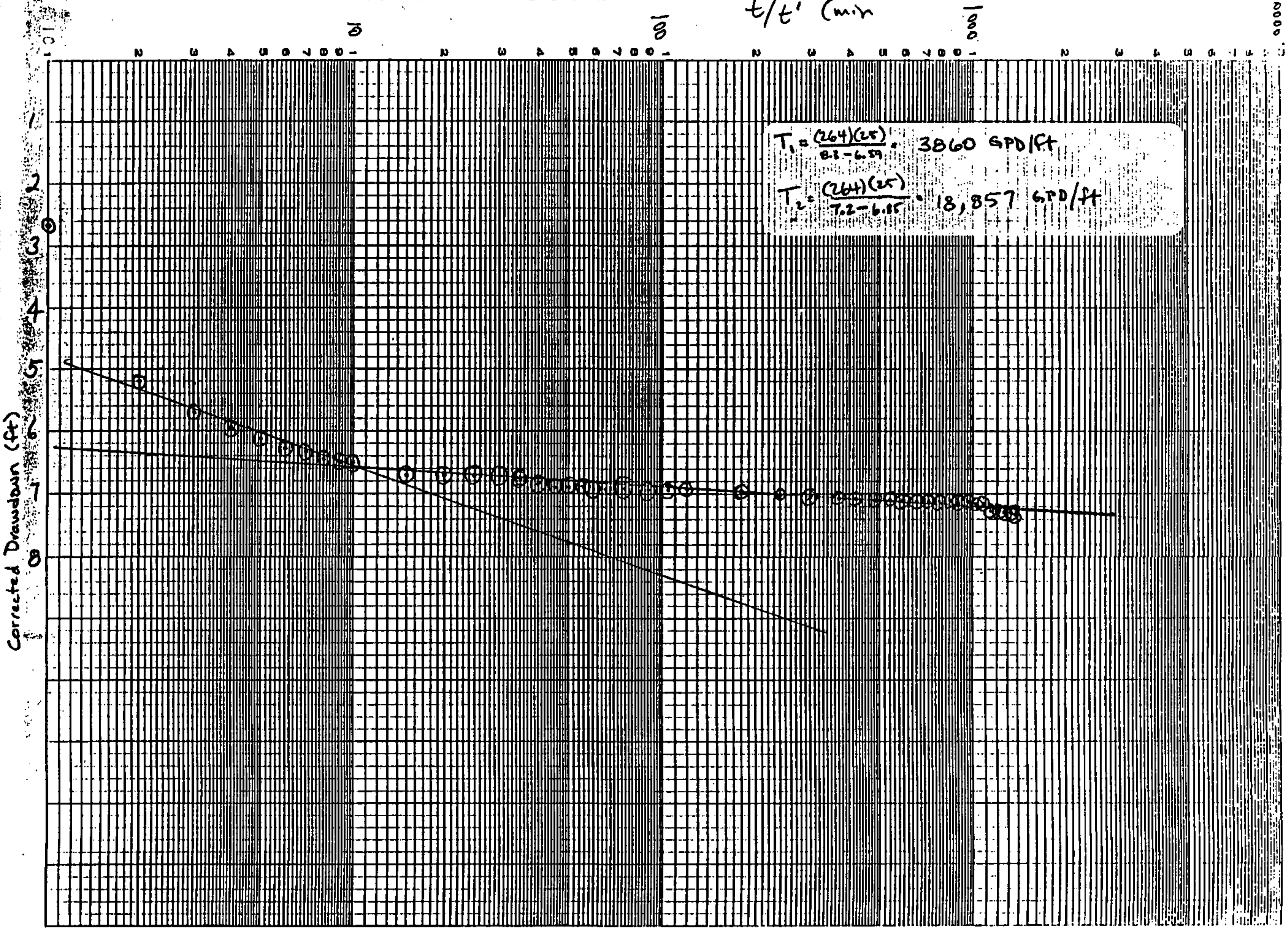
1.85

$6\overline{)108}$ 18 48

NO. 340-L410 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
4 CYCLES X 10 DIVISIONS PER INCH

DIETZGEN CORPORATION
MADE IN U.S.A.

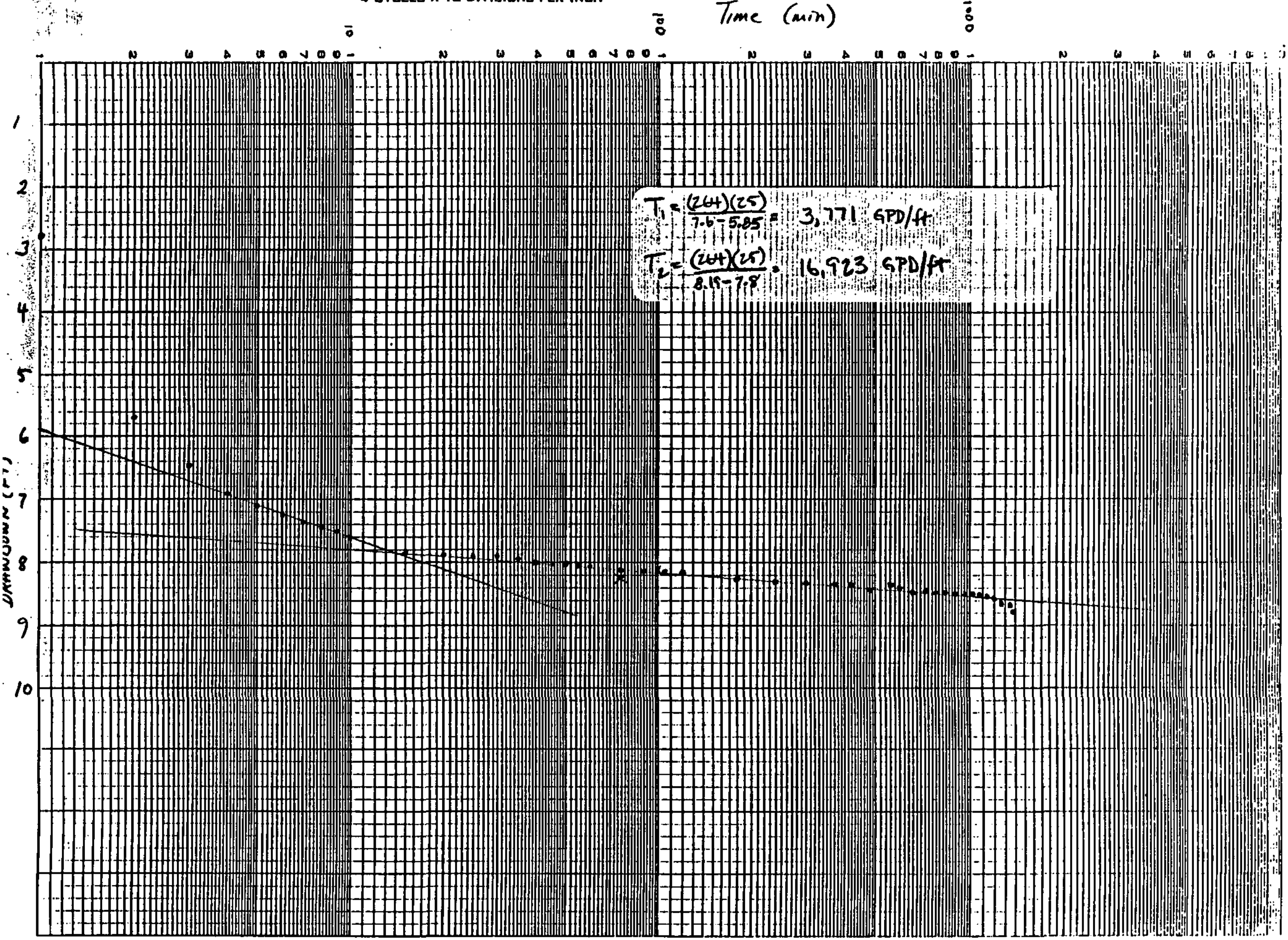
RW-1



[redacted]-1 [redacted] NO. [redacted] 410 [redacted] ZGEN [redacted] APH [redacted] IETZ [redacted] COR [redacted] ATIO [redacted]

SEMI-LOGARITHMIC

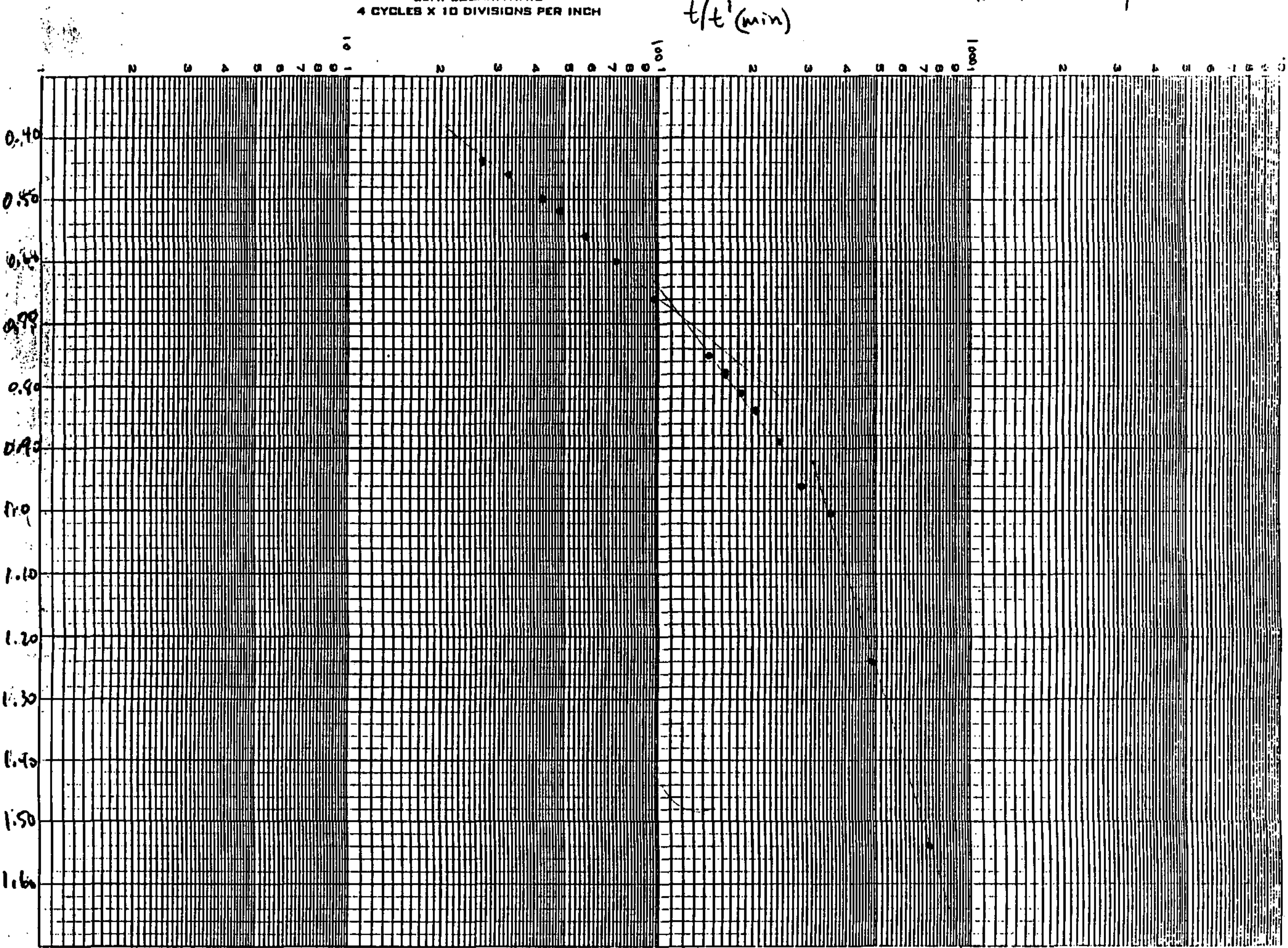
4 CYCLES X 10 DIVISIONS PER INCH



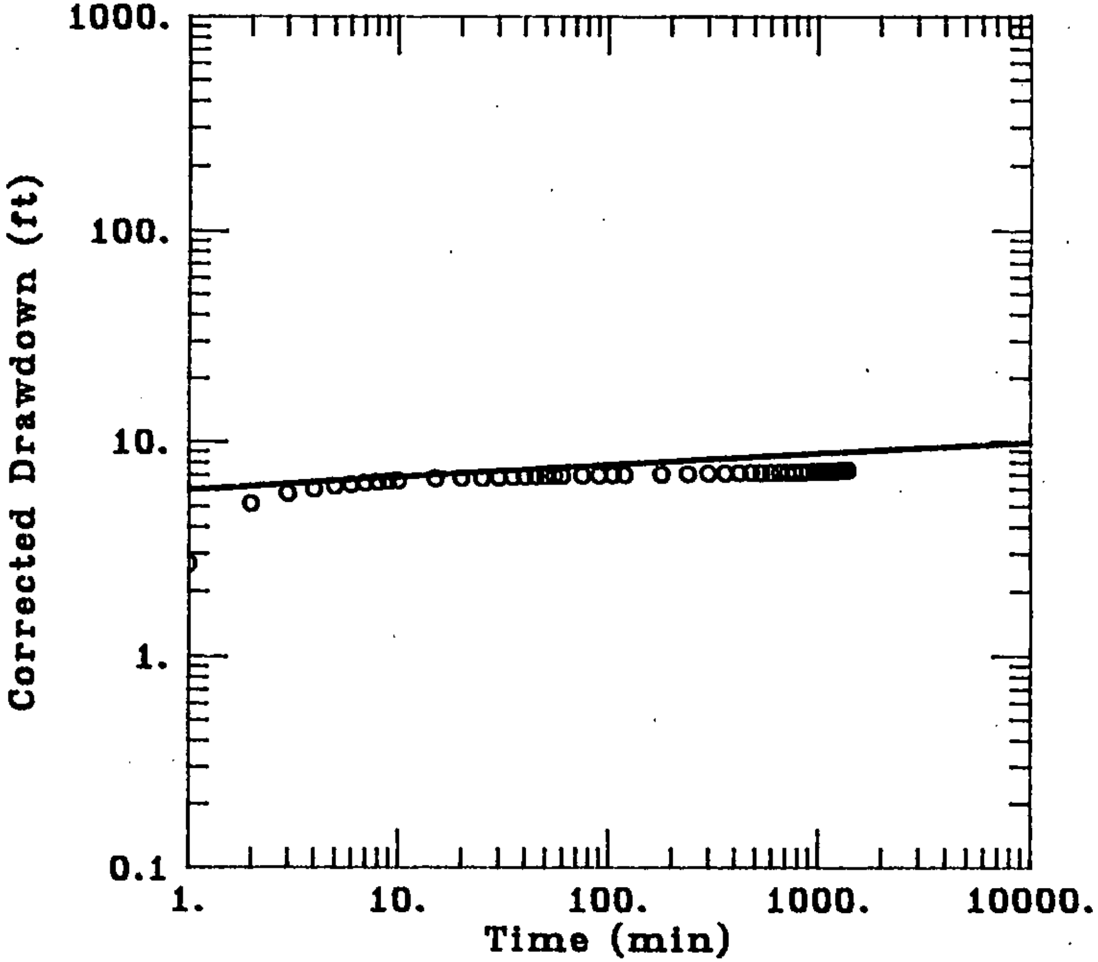
NO. 340-L410 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
4 CYCLES X 10 DIVISIONS PER INCH

DIETZGEN CORPORATION
MADE IN U.S.A.

RW-1 Recovery



RW-1



DATA SET:
a: adcrw1.dat
10/03/94

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Theis

TEST DATE:
9/28/94

TEST WELL:
rw-1

ESTIMATED PARAMETERS:
T = 0.8307 ft^2/min
S = 7.8395E-08

TEST DATA:
Q = 3.3 ft^3/min
r = 1. ft
b = 27. ft

Accurate Die-Casting Facility Aquifer Performance Test

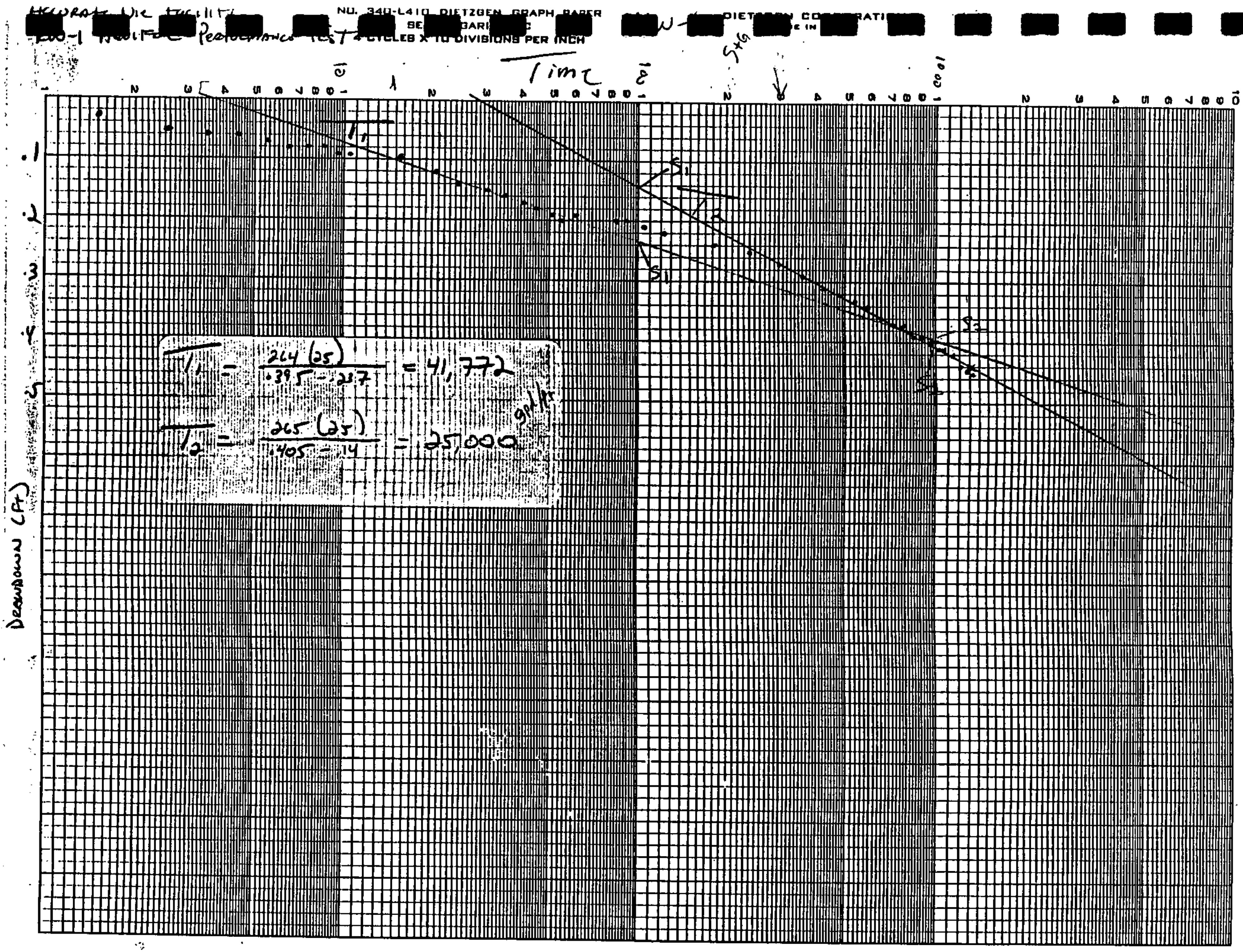
Well Number: [redacted] MW-6
Static: 19.78
Well Depth: 32.98
Aquifer Thickness: 27

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
1.5	19.81	0.03
2.5	19.83	0.05
3.5	19.84	0.06
4.5	19.84	0.06
5.5	19.85	0.07
6.5	19.86	0.08
7.5	19.86	0.08
8.5	19.86	0.08
9.5	19.87	0.09
10.5	19.87	0.09
15.5	19.88	0.10
20.5	19.90	0.12
25.5	19.92	0.14
30.5	19.93	0.15
35.5	19.94	0.16
40.5	19.95	0.17
45.5	19.96	0.18
50.5	19.97	0.19
55.5	19.98	0.20
60.5	19.97	0.19
75.5	19.98	0.20
90.5	19.98	0.20
105.5	19.99	0.21
120.5	20.00	0.22
181	20.02	0.24
240	20.03	~~0.23~~ 0.25
300	20.05	~~0.26~~ 0.27
360	20.07	0.29
420	20.09	0.31
480	20.10	0.32
540	20.11	0.33
600	20.12	0.34
660	20.14	0.36
720	20.15	0.37
780	20.15	0.37
840	20.17	0.39
900	20.17	0.39
960	20.18	0.40
1020	20.19	0.41
1080	20.19	0.41

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
1140	20.20	0.42
1200	20.22	0.44
1260	20.22	0.44
1320	20.23	0.45
1380	20.25	0.47
Rec ↓ 0		
1.5	20.20	0.42
2.5	20.18	0.40
3.5	20.18	0.40
4.5	20.17	0.39
5.5	20.16	0.38
6.5	20.16	0.38
7.5	20.15	0.37
8.5	20.15	0.37
9.5	20.14	0.36
10.5	20.14	0.36
15.5	20.12	0.34
20.5	20.11	0.33
25.5	20.10	0.32
30.5	20.09	0.31
35.5	20.08	0.30
40.5	20.08	0.30
46	20.07	0.29
56	20.07	0.29
104	20.03	0.25
151	20.02	0.24
222	20.00	0.22
~~283~~ ~~333~~ 393	19.97	0.19
~~393~~ 479	19.97	0.19
9/30 8:46am 1486	19.95	0.17

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

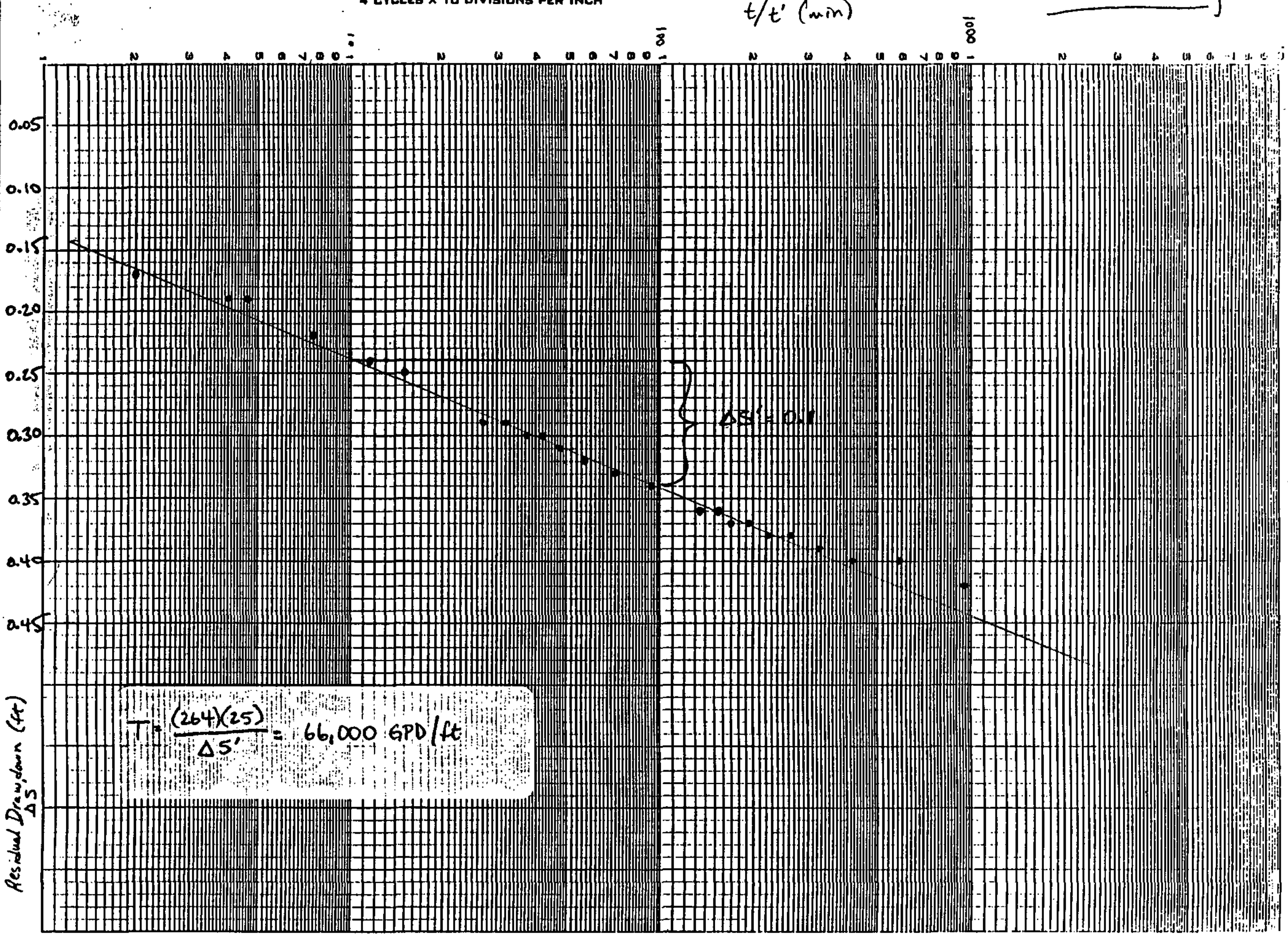
902 = 19.83


NO. 340-L410 DIETZGEN GRAPH PAPER
4 CYCLES X 10 DIVISIONS PER INCH
Performance Test
Time
Drawdown (ft)
T_1
$T_1 = \frac{264 (35)}{.395 - .227} = 41,772$ gpd/ft
$T_2 = \frac{265 (35)}{.405 - .14} = 35,000$

NO. 340-L410 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
4 CYCLES X 10 DIVISIONS PER INCH

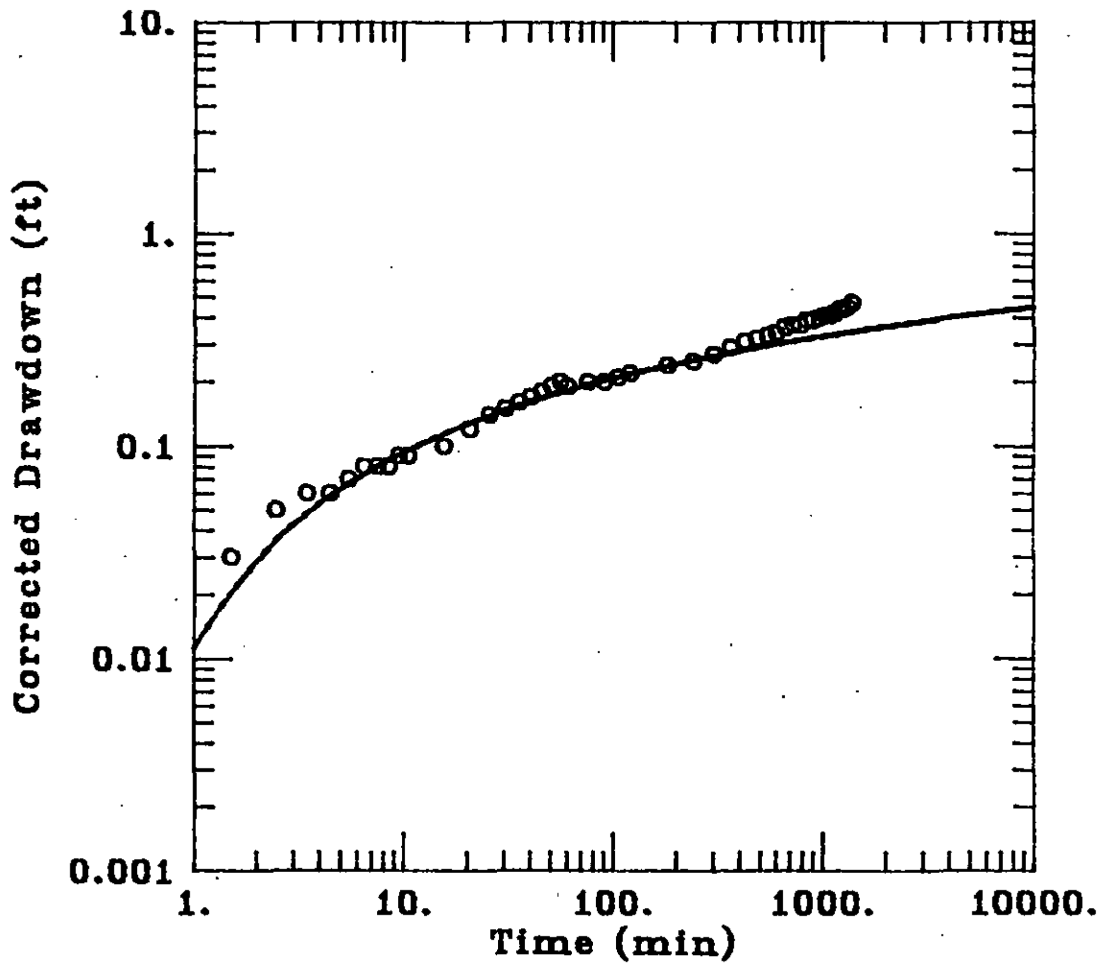
DIETZGEN CORPORATION
MADE IN U.S.A.

MW-6 Recovery



O'BRIEN & GERE ENGINEERS, INC.	Client: OBG TECHNICAL SERVICES, INC.
Project No.: 2488.396	Location: FAYETTEVILLE, NEW YORK

ACCURATE DIE CASTING FACILITY MW-6



DATA SET:
a:adc1.dat
10/03/94

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis
TEST DATE:
9/28/94
TEST WELL:
RW-1
OBS. WELL:
MW-6

ESTIMATED PARAMETERS:
T = 5.163 ft^2/min
S = 0.08404

TEST DATA:
Q = 3.3 ft^3/min
r = 15. ft
b = 27. ft

Accurate Die-Casting Facility Aquifer Performance Test

Well Number: PZ-1
Static: 24.29
Well Depth: 34.22
Aquifer Thickness: 6

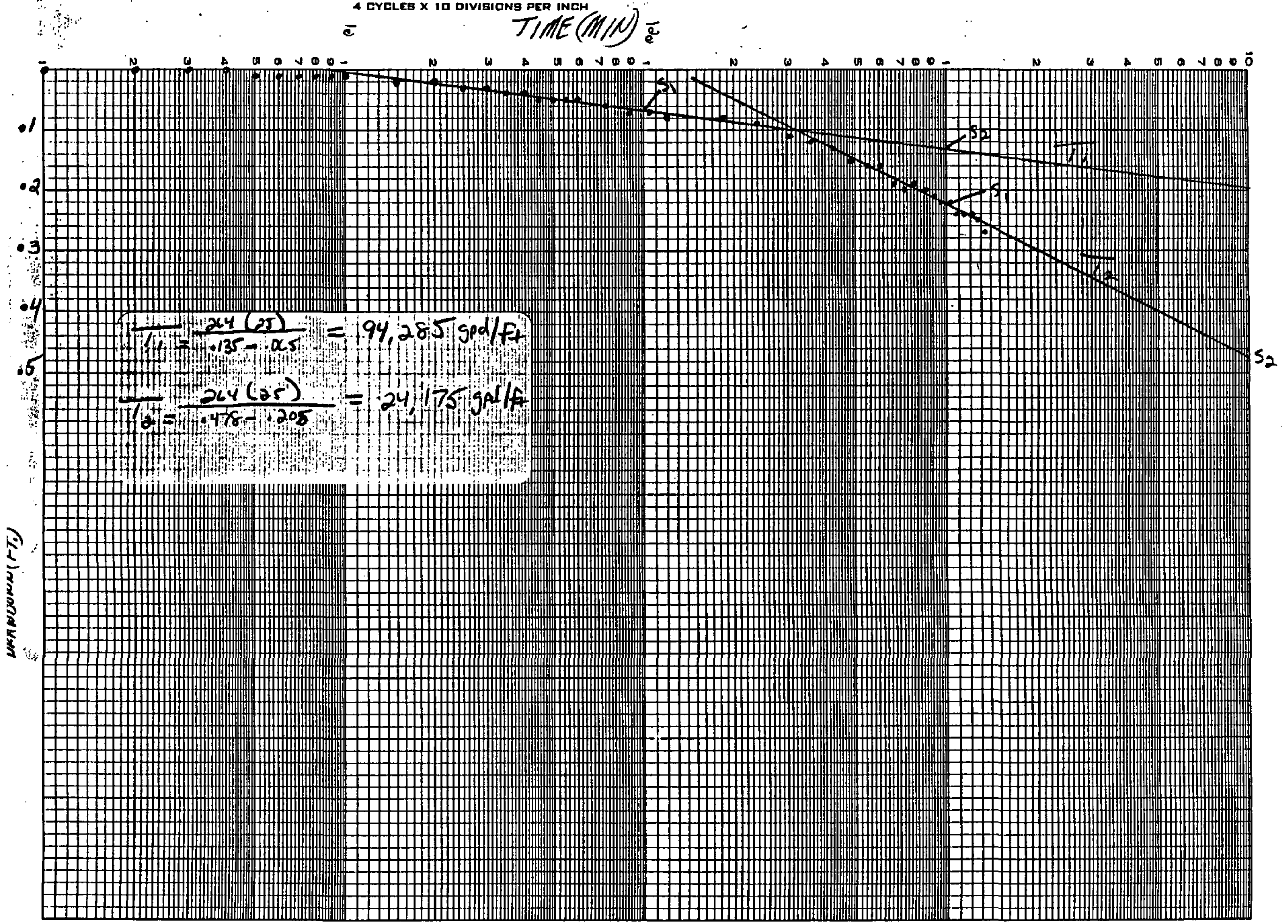
Elapsed	Depth	Drawdown
Time	To	
(Min)	Water	(Feet)
1	24.29	0.00
2	24.29	0.00
3	24.29	0.00
4	24.29	0.00
5	24.30	0.01
6	24.30	0.01
7	24.30	0.01
8	24.30	0.01
9	24.30	0.01
10	24.30	0.01
15	24.31	0.02
20	24.31	0.02
25	24.32	0.03
30	24.32	0.03
35	24.33	0.04
40	24.33	0.04
45	24.34	0.05
50	24.34	0.05
55	24.34	0.05
60	24.34	0.05
75	24.35	0.06
90	24.36	0.07
105	24.36	0.07
120	24.37	0.08
185	24.37	0.08
241	24.38	0.09
304	24.40	0.11
364	24.41	0.12
427	24.42	0.13
485	24.44	0.15
545	24.45	0.16
605	24.45	0.16
668	24.48	0.19
727	24.49	0.20
785	24.48	0.19
845	24.49	0.20
905	24.50	0.21
965	24.51	0.22
1025	24.51	0.22
1085	24.53	0.24

Elapsed	Depth	Drawdown
Time	To	
(Min)	Water	(Feet)
1145	24.53	0.24
1205	24.53	0.24
1265	24.54	0.25
1325	24.56	0.27
1385	24.57	0.28
0	24.57	0.28
1.5	24.57	0.28
2.5	24.56	0.27
3.5	24.56	0.27
4.5	24.56	0.27
5.5	24.56	0.27
6.5	24.56	0.27
7.5	24.56	0.27
8.5	24.56	0.27
9.5	24.56	0.27
10.5	24.56	0.27
16	24.56	0.27
21	24.56	0.27
26.5	24.55	0.26
30.5	24.55	0.26
37	24.55	0.26
43	24.54	0.25
49	24.54	0.25
56	24.54	0.25
62	24.53	0.24
69	24.53	0.24
77	24.53	0.24
109	24.52	0.23
155	24.51	0.22
229	24.50	0.21
400	24.49	0.20
488	24.48	0.19
1495	24.48	0.19

9/30 8:55 am

Elapsed	Depth	Drawdown
Time	To	
(Min)	Water	(Feet)

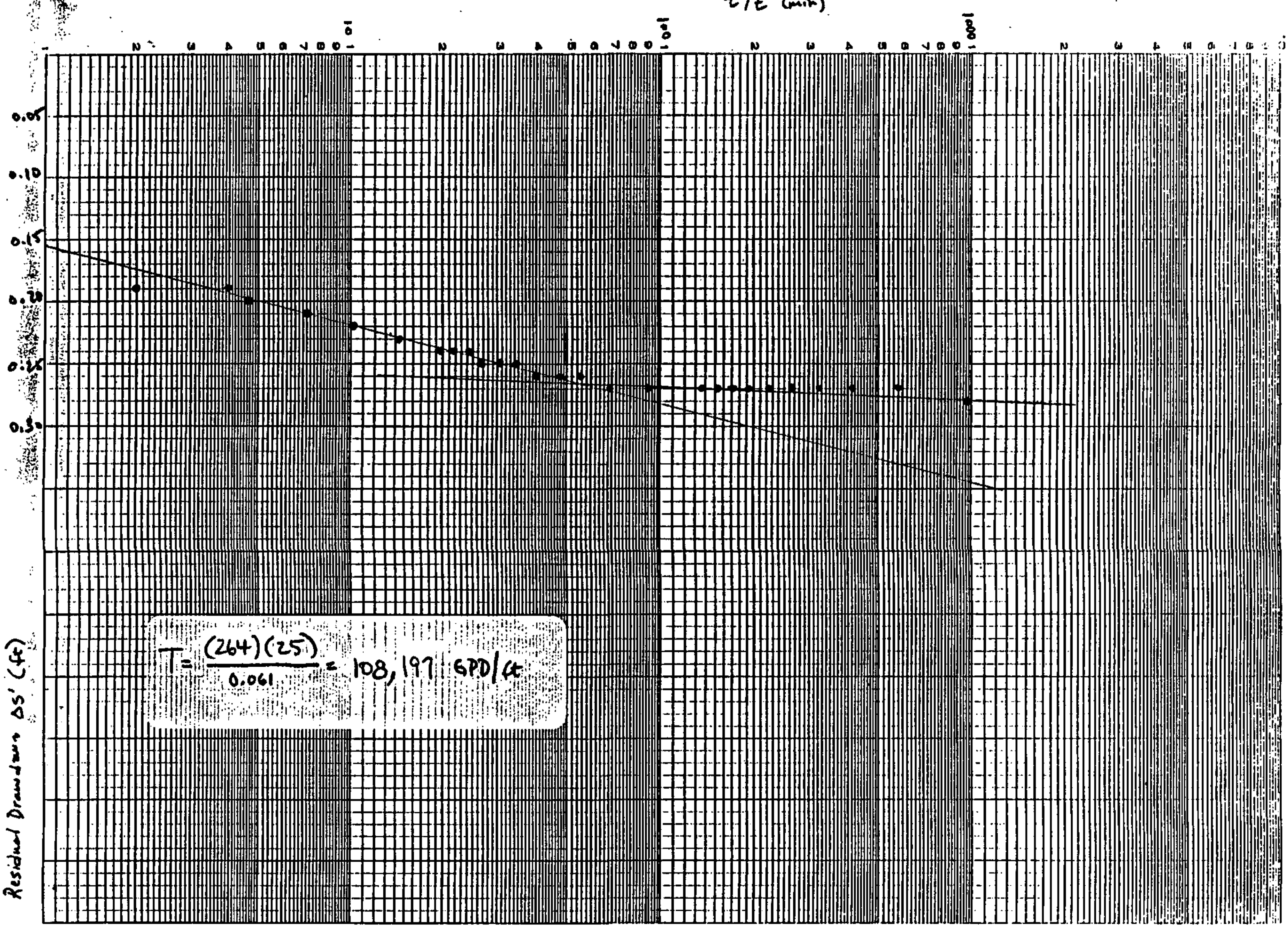
[redacted]D. 3[redacted]10 [redacted]GEN [redacted]H PA[redacted] [redacted] [redacted]TZG[redacted]ORP[redacted]ION [redacted]
SEMI-LOGARITHMIC
4 CYCLES X 10 DIVISIONS PER INCH
MADE IN U.S.A.



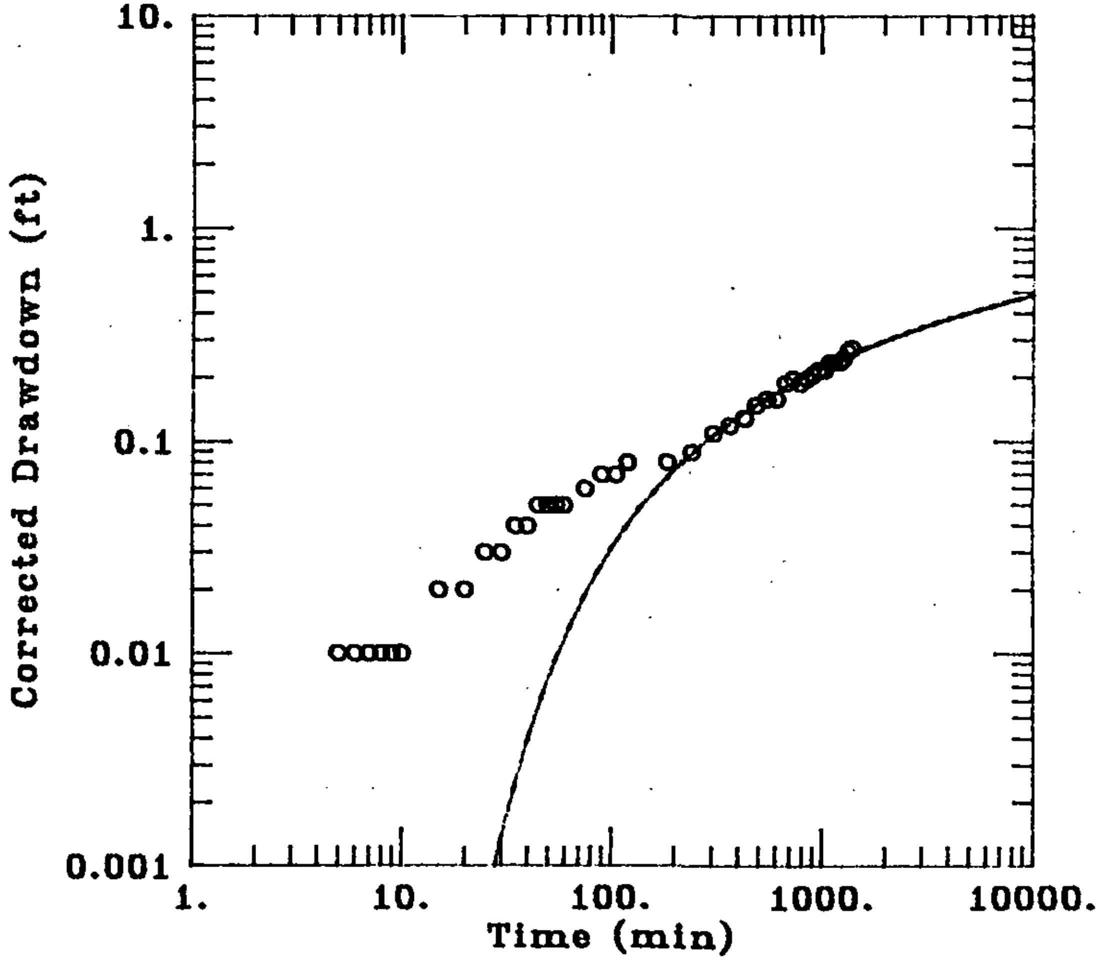
NO. 340-L410 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
4 CYCLES X 10 DIVISIONS PER INCH

DIETZGEN CORPORATION
MADE IN U.S.A.

PZ-1 Recovery



PZ-1



DATA SET:
a: adcpz1.dat
10/07/94

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Theis

TEST DATE:
9/28/94

TEST WELL:
rw-1

OBS. WELL:
mw-4

ESTIMATED PARAMETERS:
T = 2.498 ft^2/min
S = 0.2551

TEST DATA:
Q = 3.3 ft^3/min
r = 50. ft
b = 5.7 ft

Accurate Die-Casting Facility Aquifer Performance Test

Well Number: [redacted] PZ-2
Static: 23.61
Well Depth: 40.30
Aquifer Thickness: 12.5

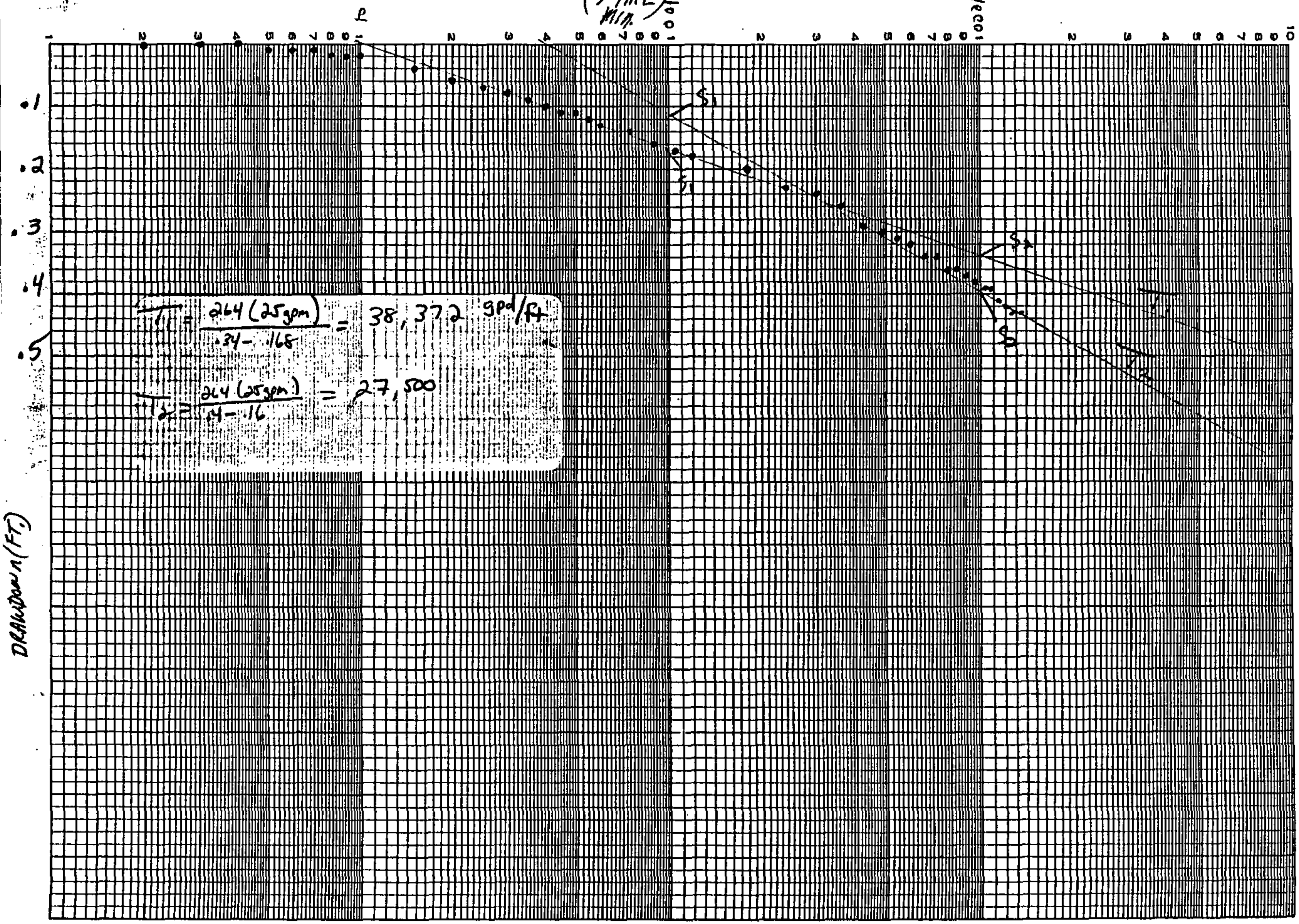
Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
1	23.61	0.00
2	23.61	0.00
3	23.61	0.00
4	23.61	0.00
5	23.62	0.01
6	23.62	0.01
7	23.62	0.01
8	23.63	0.02
9	23.63	0.02
10	23.63	0.02
15	23.65	0.04
20	23.67	0.06
25	23.68	0.07
30	23.69	0.08
35	23.70	0.09
40	23.71	0.10
45	23.72	0.11
50	23.72	0.11
55	23.73	0.12
60	23.74	0.13
75	23.75	0.14
90	23.77	0.16
105	23.78	0.17
120	23.79	0.18
182	23.81	0.20
243	23.84	0.23
302	23.85	0.24
361	23.87	0.26
422	23.90	0.29
482	23.91	0.30
541	23.92	0.31
601	23.93	0.32
665	23.95	0.34
723	23.95	0.34
782	23.97	0.36
841	23.97	0.36
901	23.98	0.37
961	23.99	0.38
1021	24.00	0.39
1081	24.00	0.39

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
1141	24.02	0.41
1201	24.03	0.42
1261	24.04	0.43
1321	24.04	0.43
1381	24.06	0.45
Rec 0	24.06	0.45
1	24.05	0.44
2	24.05	0.44
3	24.04	0.43
4	24.03	0.42
5	24.03	0.42
6	24.03	0.42
7	24.03	0.42
8	24.02	0.41
9	24.02	0.41
10	24.02	0.41
15	24.01	0.40
20	24.00	0.39
25.5	23.99	0.38
30.0	23.98	0.37
35.5	23.98	0.37
40.0	23.97	0.36
46.0	23.96	0.35
53.0	23.96	0.35
63.0	23.95	0.34
71.0	23.94	0.33
106	23.91	0.30
153	23.89	0.28
225	23.86	0.25
396	23.81	0.20
488	23.81	0.20
9/30 8:50 am 1490	23.79	0.18

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

NO. [redacted] L410 [redacted] TZGE [redacted] APH [redacted] IETZ [redacted] COR [redacted] ATIO
SEMI-LOGARITHMIC
4 CYCLES X 10 DIVISIONS PER INCH
MADE IN U.S.A.

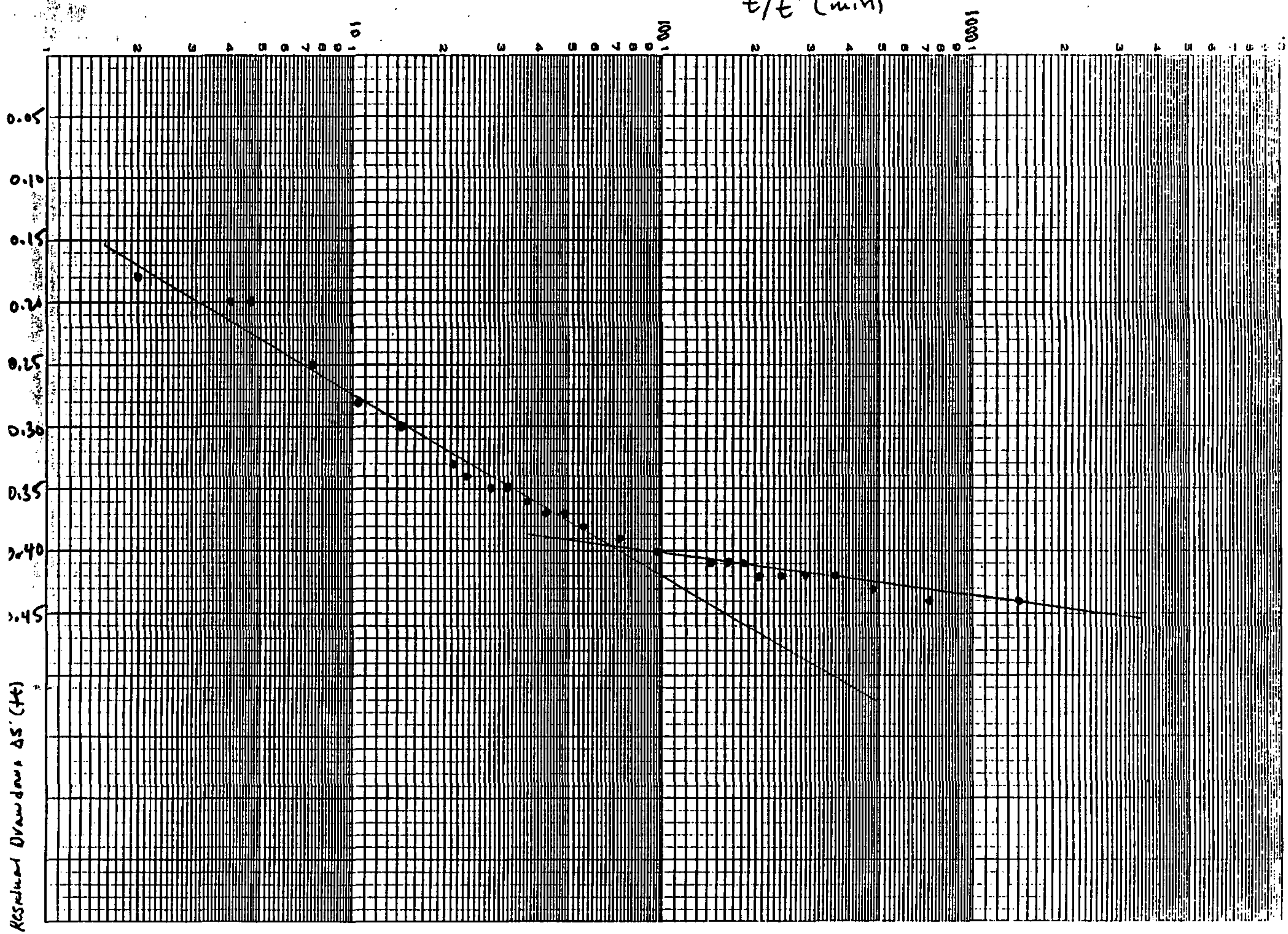
PZ-2



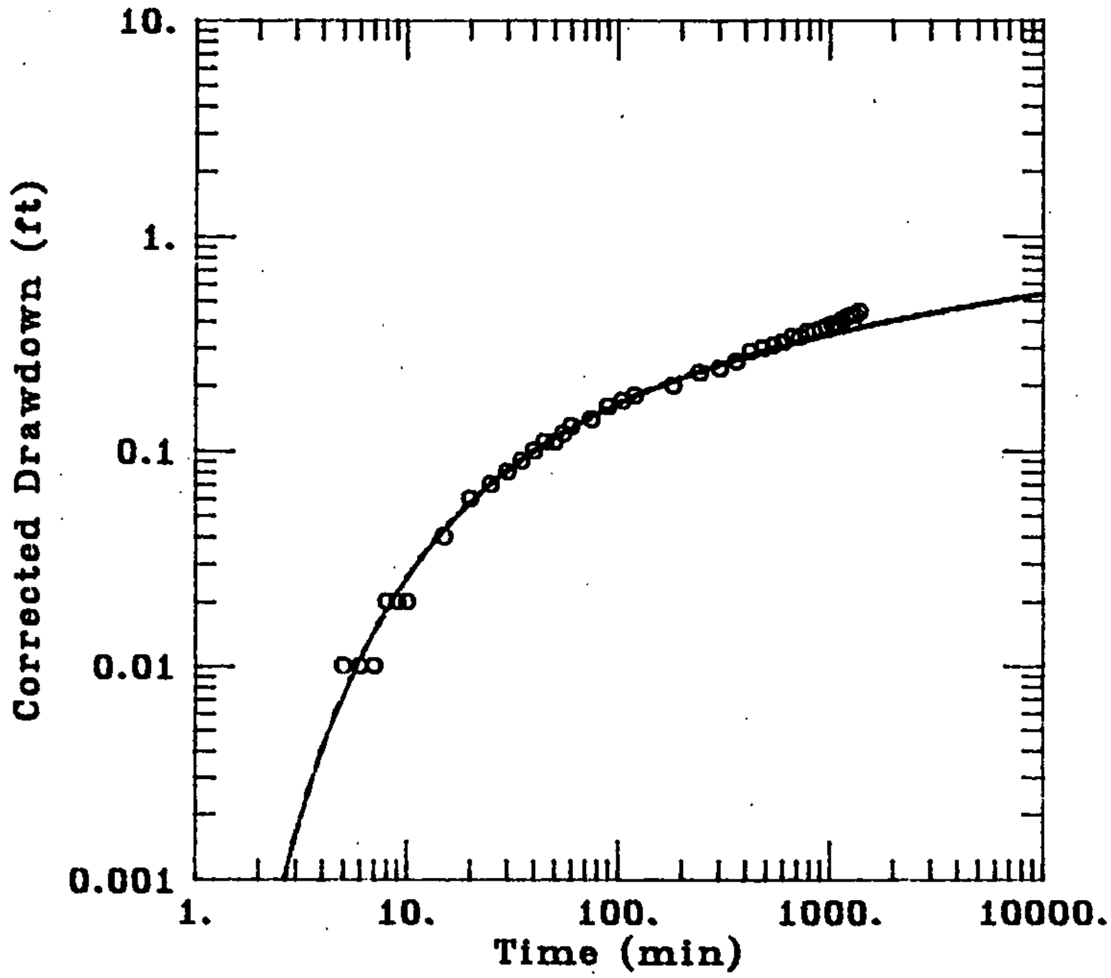
$T_1 = \frac{264\,(25\text{gpm})}{.34 - .168} = 38,372$ gpd/ft

$T_2 = \frac{264\,(25\text{gpm})}{.4 - .16} = 27,500$

PZ-2 Recovery



PZ-2



DATA SET:
a: adcpz2.dat
10/03/94

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis

ESTIMATED PARAMETERS:
T = 3.381 ft^2/min (36,413 gpd/ft)
S = 0.00889

TEST DATA:
Q = 3.3 ft^3/min
r = 100. ft
b = 12.5 ft

Accurate Die-Casting Facility Aquifer Performance Test

Well Number: [redacted] MW-17
Static: 14.63
Well Depth: 15.58
Aquifer Thickness: 0.5

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
21	14.63	0.00
26	14.63	0.00
31	14.63	0.00
36	14.63	0.00
41	14.64	0.01
46	14.65	0.02
51	14.65	0.02
56	14.67	0.04
61	14.67	0.04
76	14.68	0.05
91	14.68	0.05
106	14.70	0.07
121	14.70	0.07
183	14.71	0.08
244	14.71	0.08
303	14.70	0.07
362	14.71	0.08
424	14.71	0.08
483	14.68	0.05
543	14.71	0.08
603	14.70	0.07
666	14.72	0.09
725	14.75	0.12
784	14.72	0.09
843	14.71	0.08
903	14.75	0.12
963	14.75	0.12
1023	14.76	0.13
1083	14.78	0.15
1143	14.78	0.15
1203	14.78	0.15
1263	14.76	0.13
1323	14.75	0.12
1383	14.77	0.14
35	14.76	0.13
41	14.76	0.13
48	14.76	0.13
54	14.76	0.13

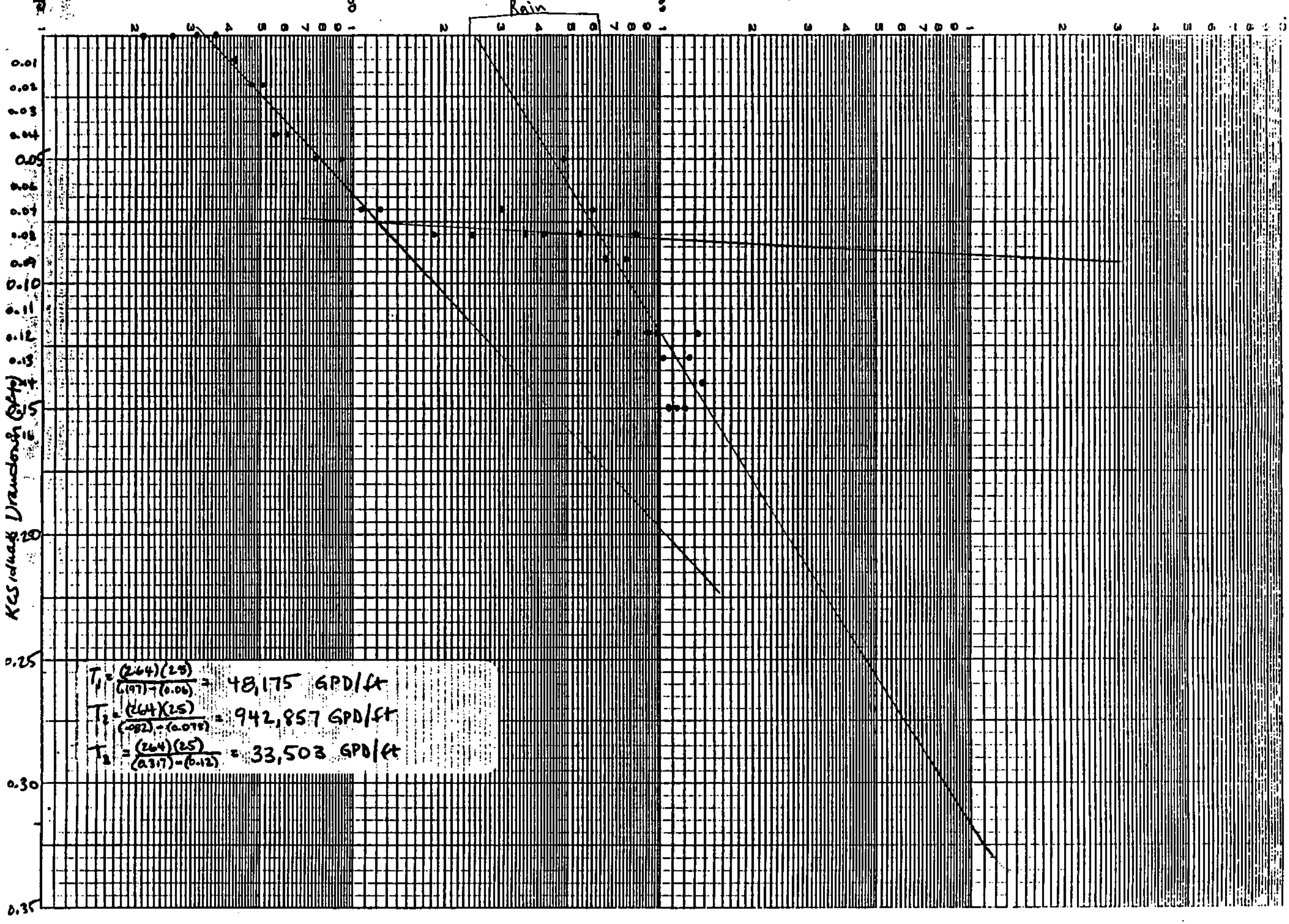
	Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
	72	14.78	0.15
	107	14.81	0.18
	154	14.81	0.18
	225	14.81	0.18
	398	14.81	0.18
4:03pm	483	14.81	0.18
9/30 8:52am	1492	14.81	.18

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

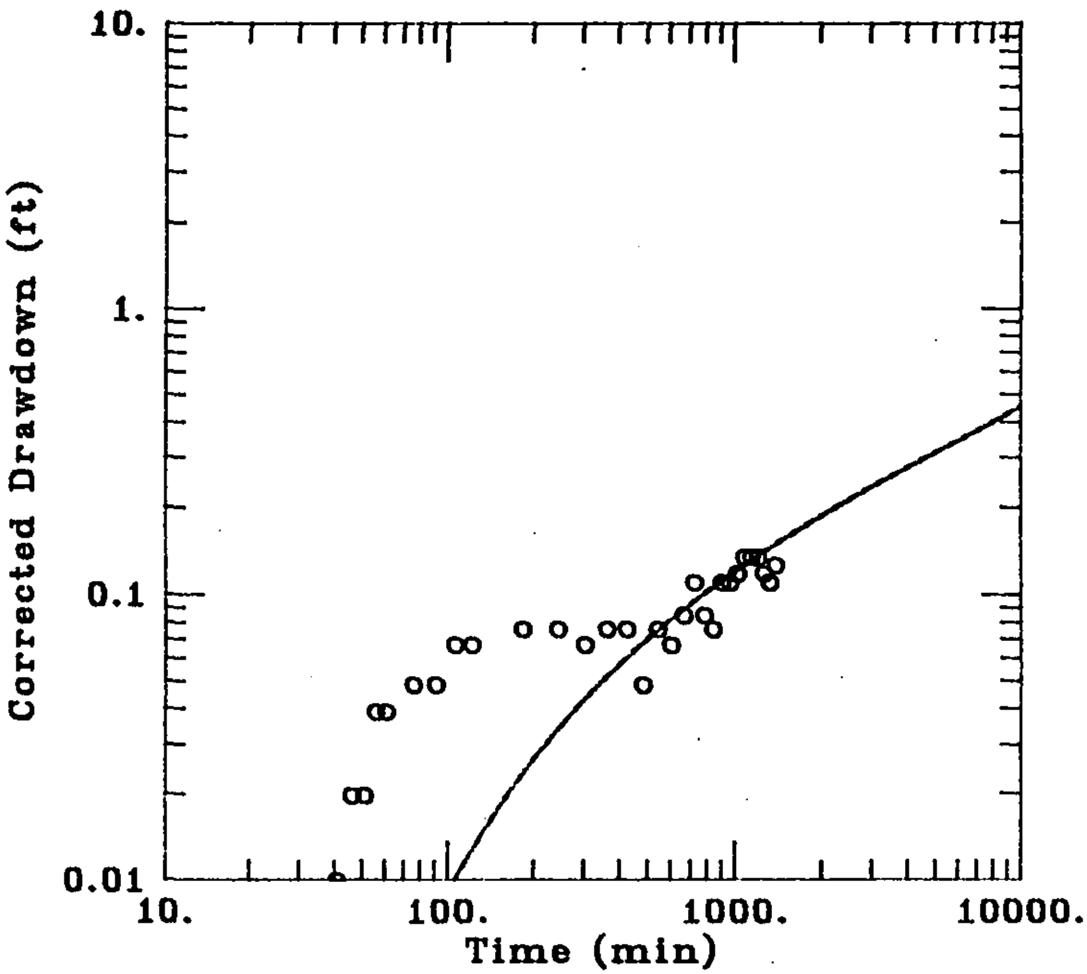
[redacted] NO. [redacted] 410 [redacted] ZGE[redacted]APH [redacted] R [redacted] IETZ[redacted] CO[redacted] ATIC [redacted]
SEMI-LOGARITHMIC
4 CYCLES X 10 DIVISIONS PER INCH
MADE IN U.S.A.

MW-17

t/t' (min)



MW-17



DATA SET:
a: adcmw17.dat
10/07/94

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis
TEST DATE:
9/28/94
TEST WELL:
rw-1
OBS. WELL:
mw-17

ESTIMATED PARAMETERS:
T = 4.523 ft^2/min
S = 0.008394

TEST DATA:
Q = 3.3 ft^3/min
r = 240. ft
b = 0.7 ft

Accurate Die-Casting Facility Aquifer Performance Test

Well Number: [redacted] MW-4
Static: 14.60
Well Depth: 23.03
Aquifer Thickness: 8

	Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
	199	14.70	0.10
	259	14.75	0.15
	319	14.79	0.19
	378	14.82	0.22
	446	14.85	0.25
	502	14.85	0.25
	562	14.88	0.28
	620	14.93	0.33
	686	14.96	0.36
	748	14.99	0.39
	803	15.03	0.43
	862	15.06	0.46
	920	15.11	0.51
	980	15.16	0.56
	1040	15.19	0.59
	1100	15.22	0.62
	1160	15.26	0.66
	1220	15.30	0.70
	1280	15.35	0.75
	1340	15.39	0.79
	1400	15.45	0.85
		~~[illegible]~~	
Rec	73	15.55	0.95
	128	15.58	0.98
	175	15.63	1.03
	245	15.69	1.09
	420	15.89	1.29
4:30pm	510	15.99	1.39
9/30			
9:19AM	1519	17.01	2.41

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

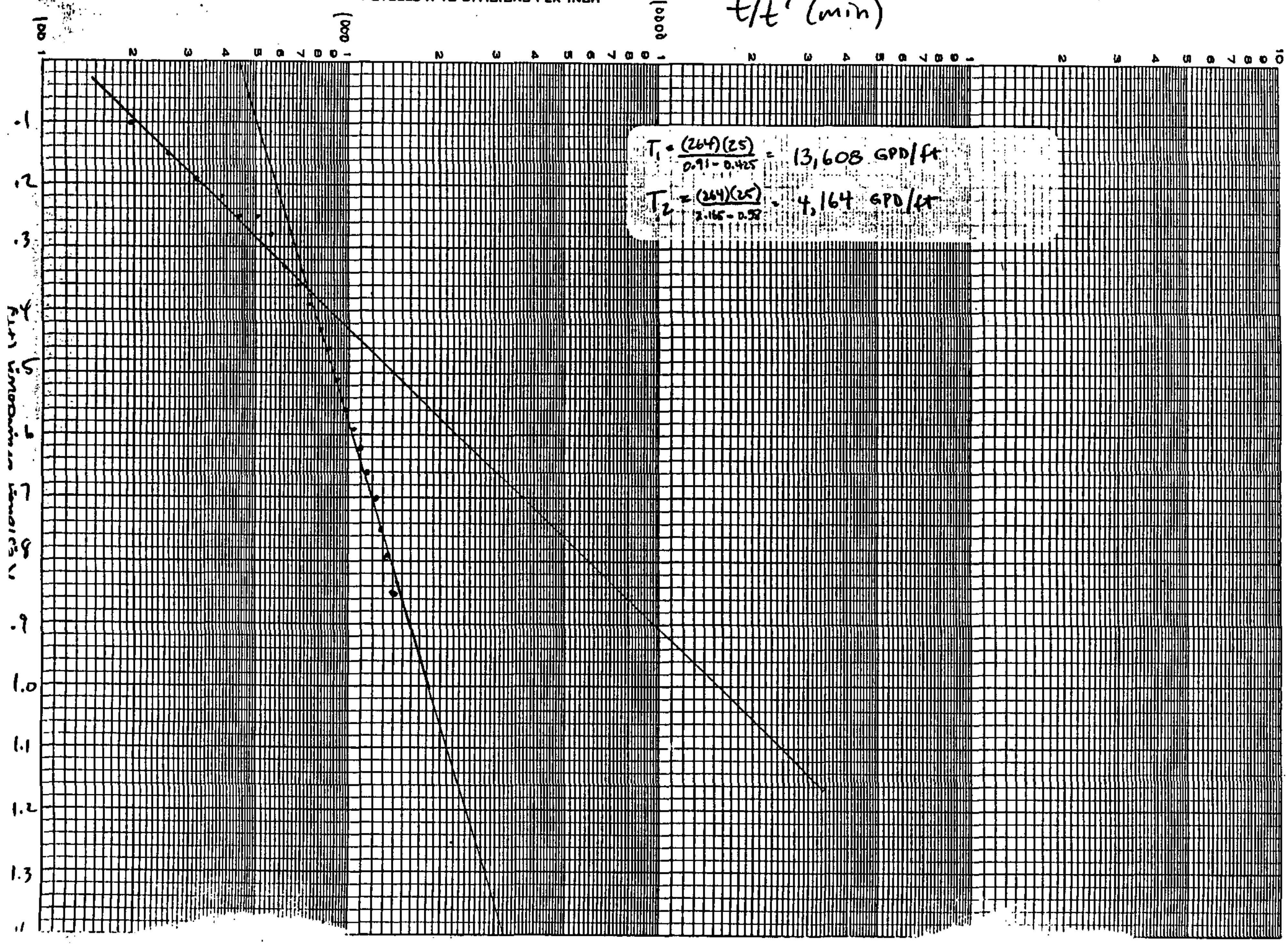
Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

90% Rec = 14.69

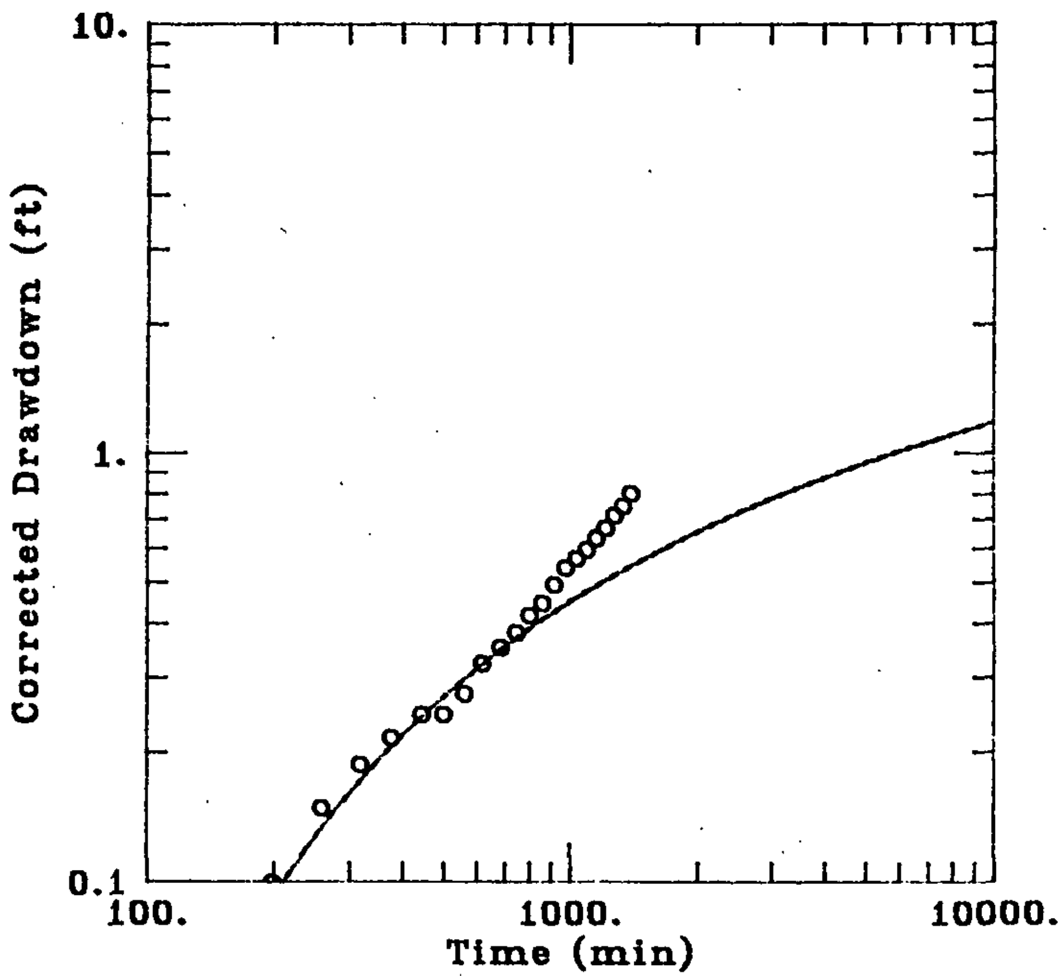
NO. 340-L410 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
4 CYCLES X 10 DIVISIONS PER INCH

DIETZGEN CORPORATION
MADE IN U.S.A.

MW-4



MW-4



DATA SET:
a:adcmw4.dat
10/07/94

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis
TEST DATE:
9/28/94
TEST WELL:
rw-1
OBS. WELL:
mw-4

ESTIMATED PARAMETERS:
T = 0.8894 ft^2/min
S = 0.001354

TEST DATA:
Q = 3.3 ft^3/min
r = 615. ft
b = 7.5 ft

15.5 288

Accurate Die-Casting Facility Aquifer Performance Test

Well Number: [redacted] MW-9
Static: 44.34
Well Depth: 54.38
Aquifer Thickness: 21

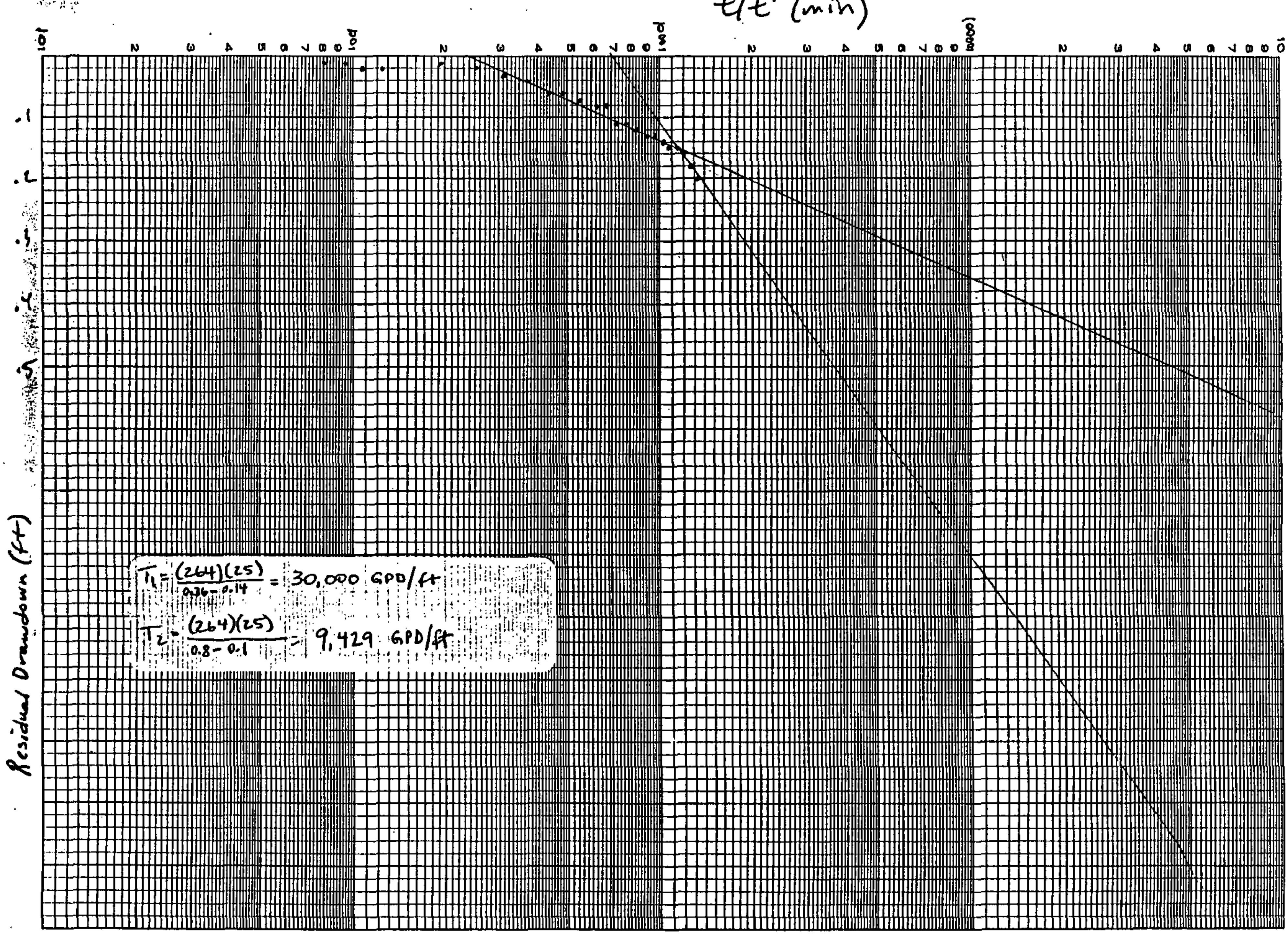
	Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
	80	44.35	0.01
	95	44.35	0.01
	109	44.36	0.02
	124	44.36	0.02
	191	44.35	0.01
	251	44.36	0.02
	311	44.37	0.03
	370	44.38	0.04
	436	44.40	0.06
	492	44.40	0.06
	552	44.41	0.07
	610	44.42	0.08
	674	44.42	0.08
	736	44.45	0.11
	794	44.45	0.11
	851	44.46	0.12
	911	44.47	0.13
	971	44.47	0.13
	1031	44.48	0.14
	1091	44.49	0.15
	1151	44.49	0.15
	1211	44.50	0.16
	1271	44.52	0.18
	1331	44.54	0.20
	1391	44.55	0.21
Rec ↓	52	44.54	0.20
	62	44.55	0.21
	117	44.55	0.21
	162	44.56	0.22
	236	44.55	0.21
	408	44.55	0.21
4:18pm	498	44.55	0.21
9/30			
9:06AM	1506	44.54	0.20

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

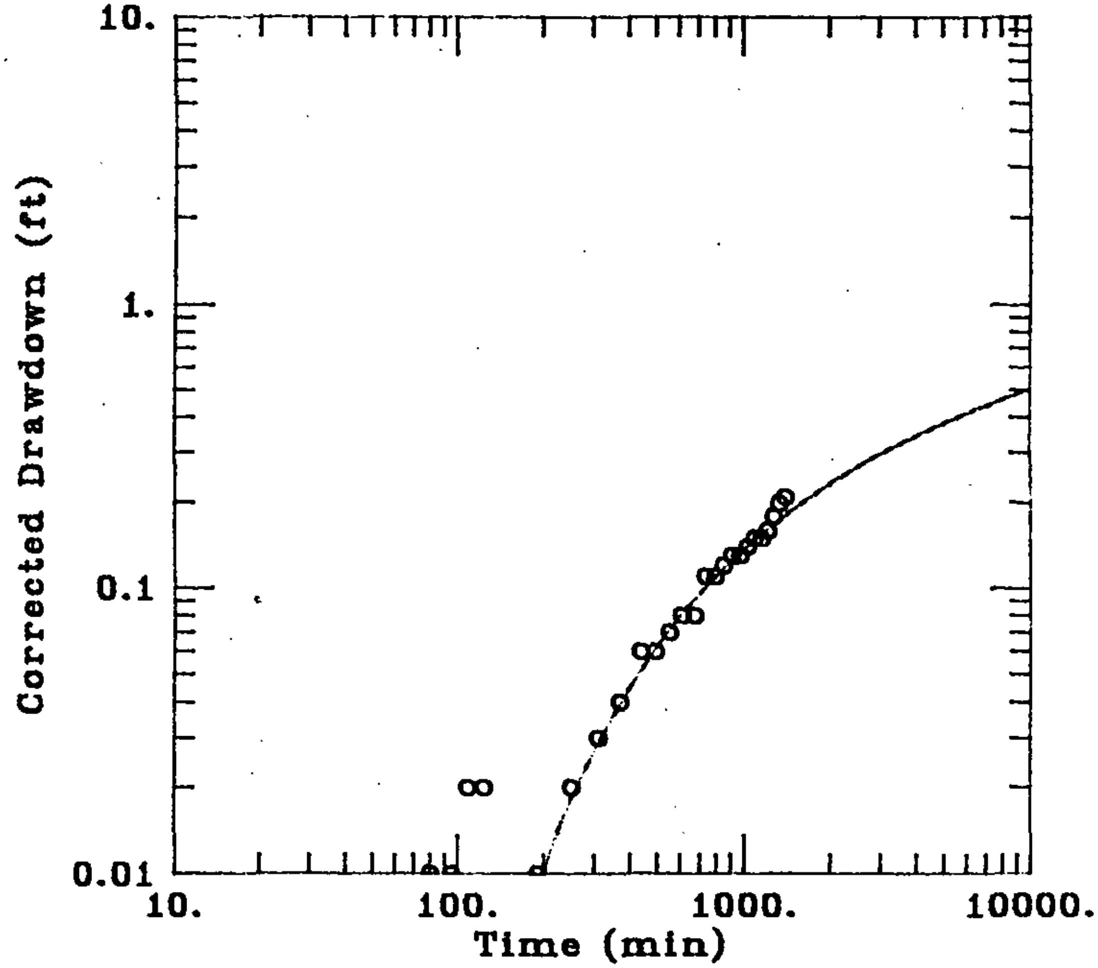
Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

90% Rec = 44.36

[redacted] NO. [redacted] 410 [redacted] ZGEN [redacted] PH [redacted] ETZ [redacted] CORP [redacted] ATION [redacted] ~~[redacted]~~ MW-9 [redacted]
SEMI-LOGARITHMIC
4 CYCLES X 10 DIVISIONS PER INCH
MADE IN U.S.A.



MW-9



DATA SET:
a: adcmw9.dat
10/07/94

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Theis

TEST DATE:
9/28/94

TEST WELL:
rw-1

OBS. WELL:
mw9

ESTIMATED PARAMETERS:
T = 1.514 ft^2/min
S = 0.02437

TEST DATA:
Q = 3.3 ft^3/min
r = 288. ft
b = 15.5 ft

Accurate Die-Casting Facility Aquifer Performance Test

Well Number: [redacted] MW-12
Static: 34.26
Well Depth: 42.20
Aquifer Thickness: 11

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
22.5	34.27	0.01
33.0	34.27	0.01
43	34.28	0.02
53	34.27	0.01
63	34.28	0.02
79	34.29	0.03
93	34.29	0.03
108	34.30	0.04
123	34.30	0.04
188	34.30	0.04
247	34.31	0.05
307	34.33	0.07
367	34.34	0.08
432	34.36	0.10
488	34.37	0.11
548	34.37	0.11
607	34.38	0.12
671	34.39	0.13
731	34.40	0.14
790	34.41	0.15
847	34.42	0.16
907	34.41	0.15
967	34.43	0.17
1027	34.44	0.18
1087	34.44	0.18
1147	34.44	0.18
1207	34.45	0.19
1267	34.46	0.20
1327	34.47	0.21
1387	34.48	0.22
Rec 38	34.49	0.23
48	34.48	0.22
58	34.50	0.24
112	34.49	0.23
159	34.48	0.22
232	34.49	0.23
404	34.47	0.21
4:13 pm 493	34.47	0.21

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
9/30 9:01 AM 1501	34.46	0.20

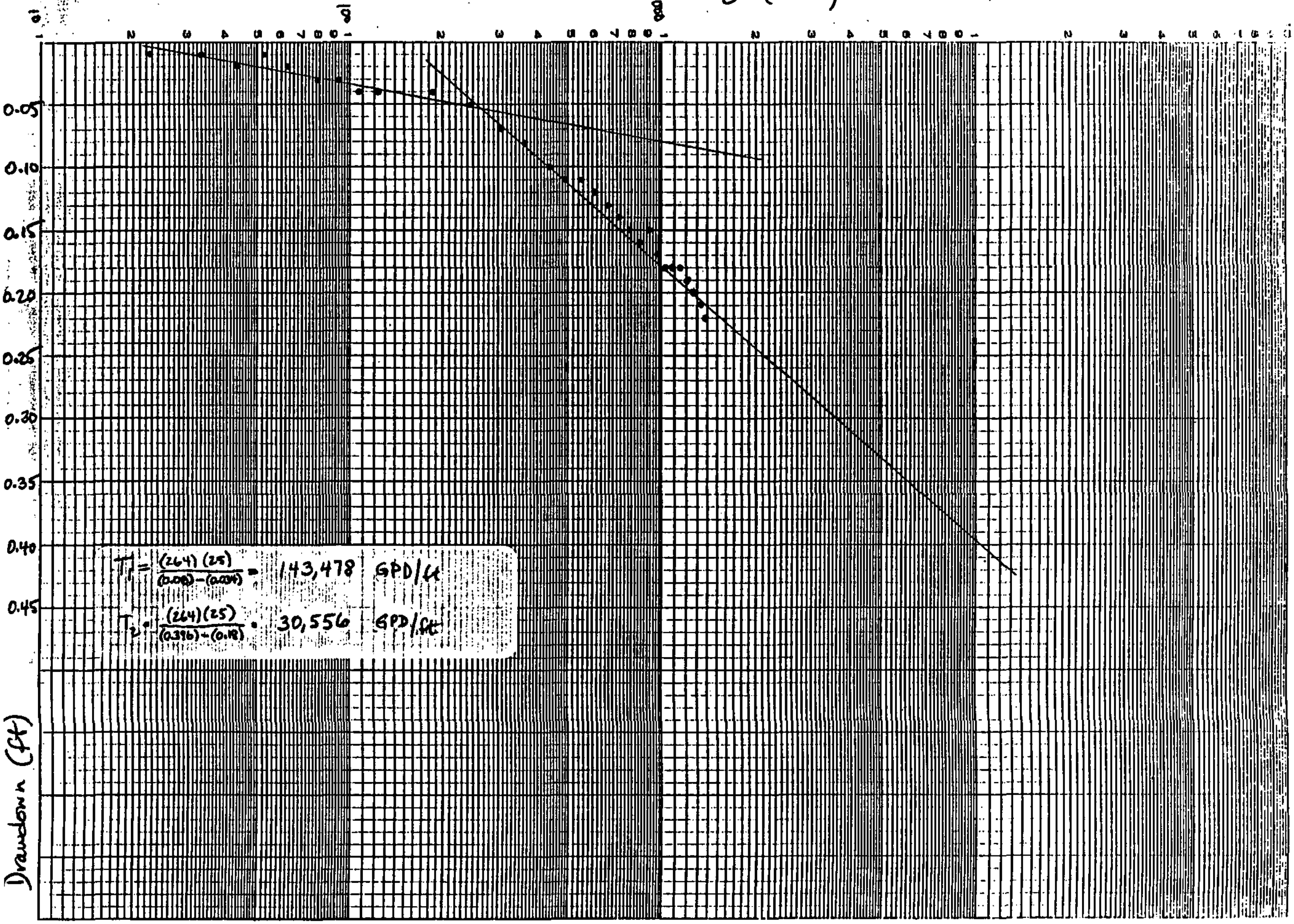
Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

90% Rec = 34.28

NO. 340-L410 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
4 CYCLES X 10 DIVISIONS PER INCH

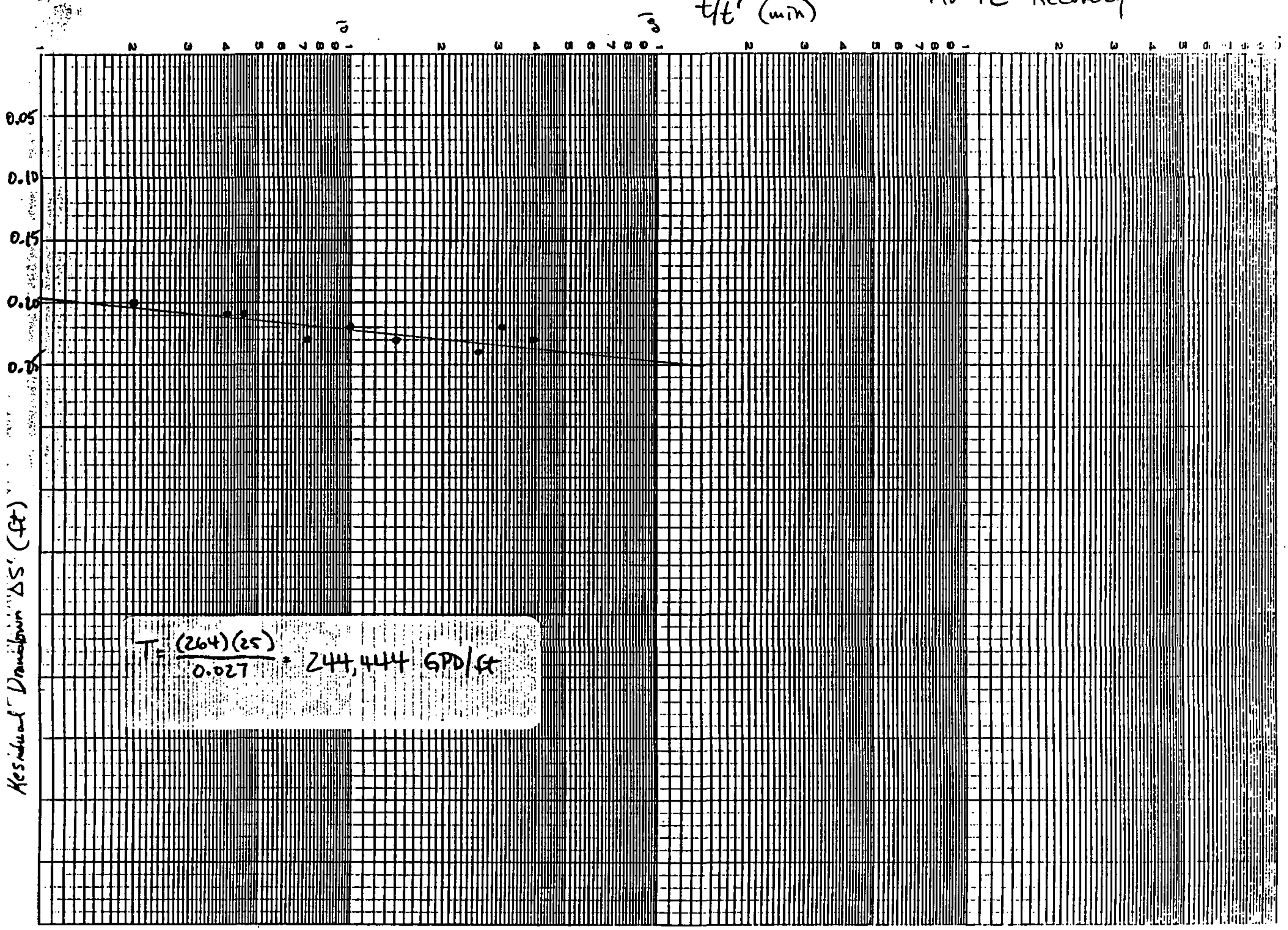
DIETZGEN CORPORATION
MADE IN U.S.A.

MW-12

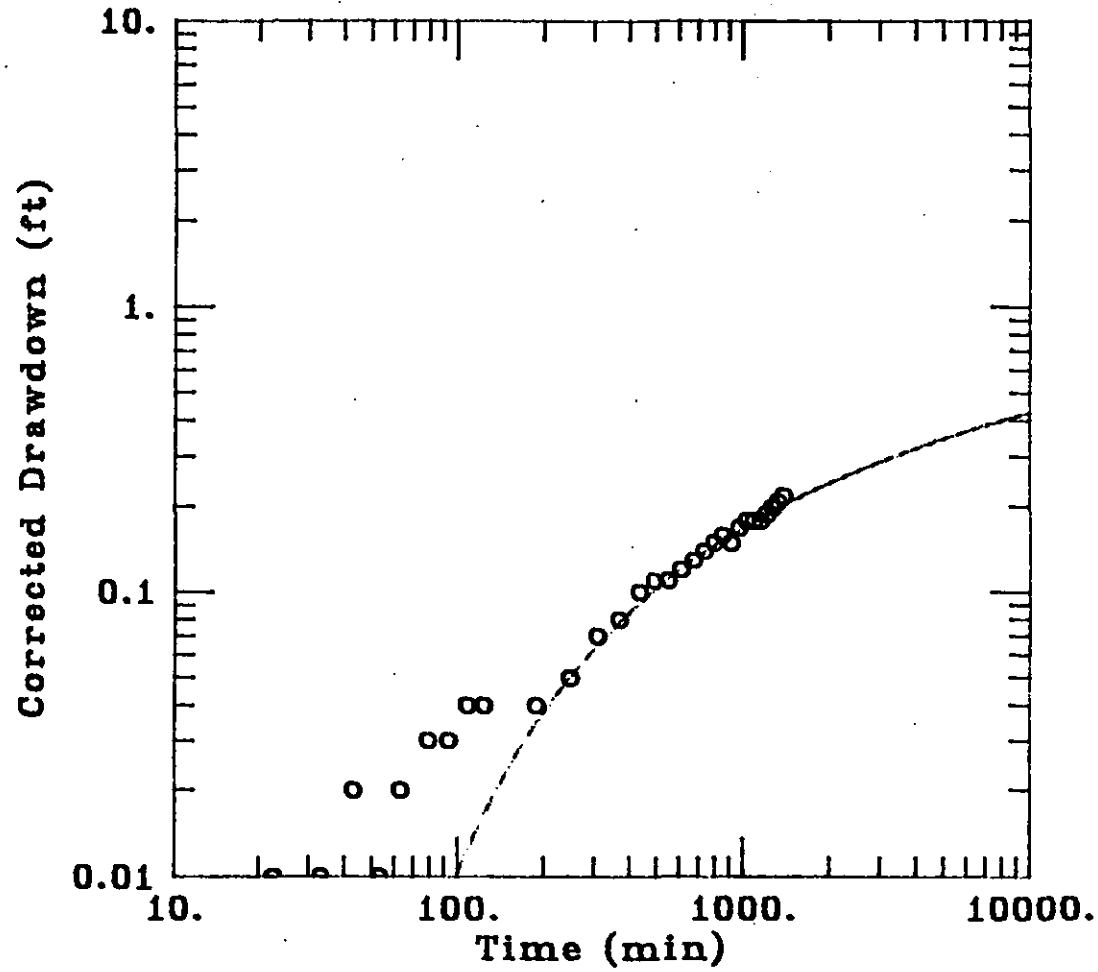


[redacted] NO. [redacted] 410 [redacted] ZGE [redacted] APH [redacted] R [redacted] IETZ [redacted] CO [redacted] ATIO [redacted]
SEMI [redacted] ARIT [redacted]
4 CYCLES X 10 DIVISIONS PER INCH

MW-12 Recovery



MW-12



DATA SET:
a: adcmw12.dat
10/07/94

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Theis

TEST DATE:
9/28/94

TEST WELL:
rw-1

OBS. WELL:
mw-12

ESTIMATED PARAMETERS:
T = 2.349 ft^2/min
S = 0.02388

TEST DATA:
Q = 3.3 ft^3/min
r = 225. ft
b = 9.75 ft

Accurate Die-Casting Facility Aquifer Performance Test

Well Number: [redacted] MW-7
Static: 24.32
Well Depth: 44.0
Aquifer Thickness: 3' in overburden

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
21	24.60	0.28
27	24.70	0.38
32	24.76	0.44
36	24.82	0.50
41	24.88	0.56
51	24.96	0.64
62	25.04	0.72
77	25.12	0.80
91	25.16	0.84
106	25.20	0.88
121	25.24	0.92
186	25.30	0.98
246	25.32	1.00
306	25.35	1.03
365	25.36	1.04
429	25.37	1.05
487	25.39	1.07
547	25.39	1.07
606	25.39	1.07
670	25.40	1.08
729	25.41	1.09
787	25.41	1.09
846	25.41	1.09
906	25.42	1.10
966	~~[illegible]~~	XHL 1.10
1026	25.43	1.11
1086	25.43	1.11
1146	25.44	1.12
1206	25.44	1.12
1266	25.45	1.13
1326	25.46	1.14
1386	25.47	1.15
Rec 38	24.93	0.61
44	24.87	0.55
51	24.82	0.50
57	24.78	0.46
60	24.75	0.43
68	24.71	0.39
75	24.67	0.35

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
111	24.55	0.23
157	24.45	0.13
231	24.40	0.08
402	24.36	0.04
491	24.36	0.04
9/30 8:58 AM 1498	24.38	0.06

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

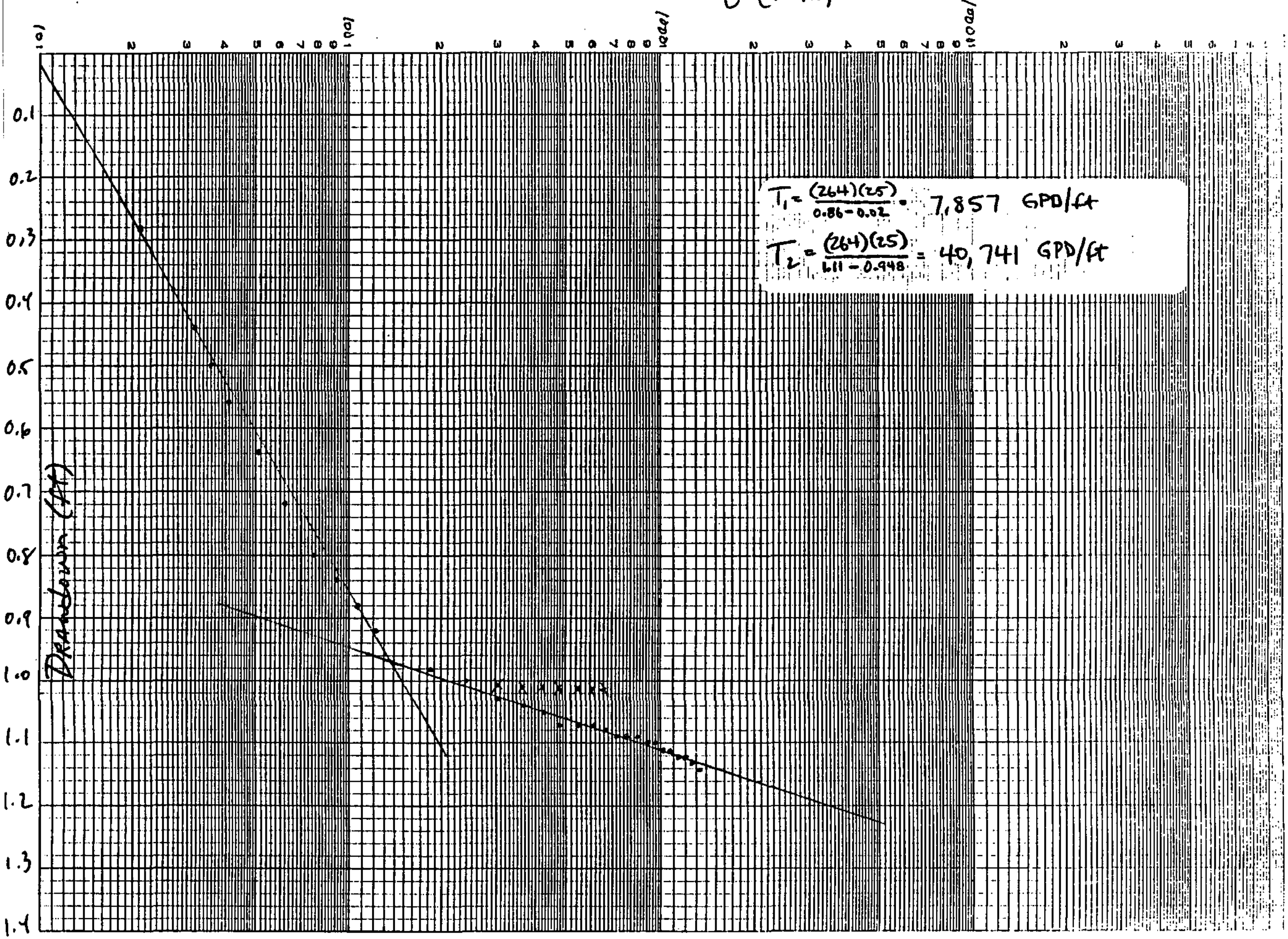
Note: some type of obstruction in well at 24.65' BTOC

NO. 340-L410 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
4 CYCLES X 10 DIVISIONS PER INCH

DIETZGEN CORPORATION
MADE IN U.S.A.

t (min)

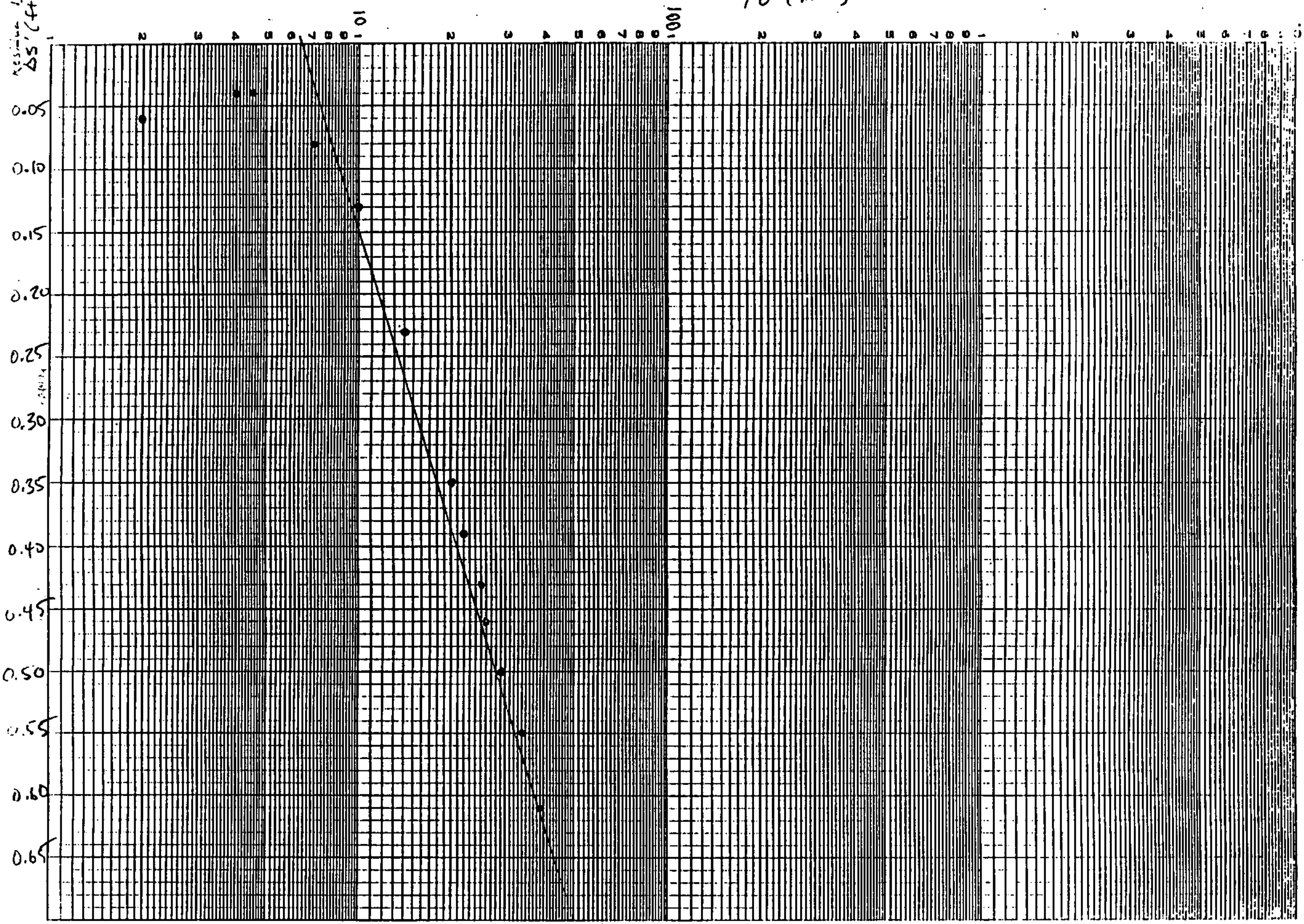
MW-7



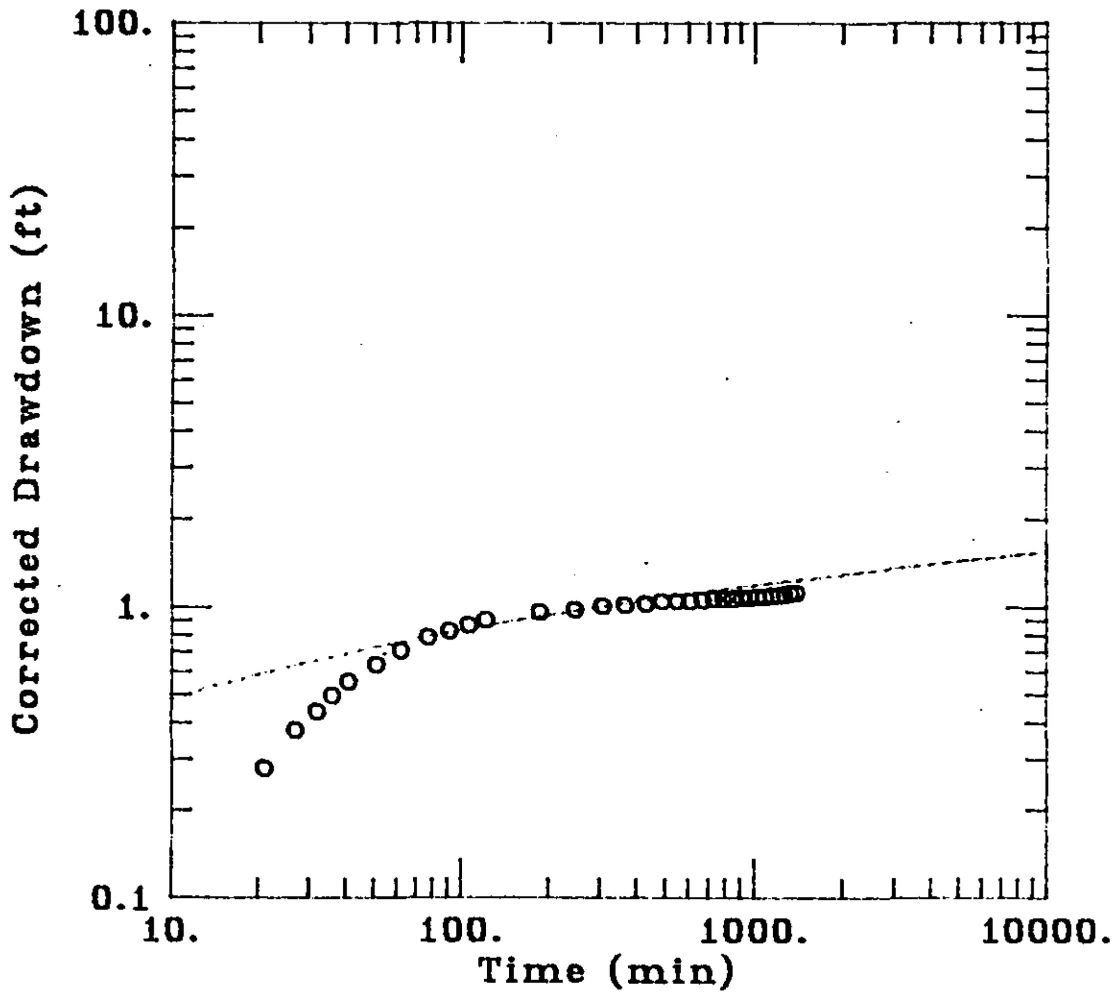
NO. 340-L410 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
4 CYCLES X 10 DIVISIONS PER INCH

DIETZGEN CORPORATION
MADE IN U.S.A.

MW-7 Recovery



MW-7



DATA SET:
a: adcmw7.dat
10/07/94

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Theis

TEST DATE:
9/28/94

TEST WELL:
rw-1

OBS. WELL:
mw-7

ESTIMATED PARAMETERS:
T = 1.786 ft^2/min
S = 2.9985E-05

TEST DATA:
Q = 3.3 ft^3/min
r = 233. ft
b = 20.5 ft

Accurate Die-Casting Facility Aquifer Performance Test

Well Number: [redacted] MW-11
Static: 35.38
Well Depth: 50.67
Aquifer Thickness:

	Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
	80	35.39	0.01
	95	35.38	0.00
	110	35.38	.00
	125	35.38	0.00
	193	35.40	0.02
	252	35.39	0.01
	313	35.40	0.02
	372	35.39	0.01
	438	35.40	0.02
	495	35.40	0.02
	555	35.39	0.01
	613	35.39	0.01
	676	35.39	0.01
	738	35.40	0.02
	796	35.41	0.03
	858	35.40	0.02
	912	35.40	0.02
	972	35.40	0.02
	1032	35.41	0.03
	1092	35.39	0.01
	1152	35.38	0.00
	1212	35.38	0.00
	1272	35.39	0.01
	1332	35.40	0.02
	1392	35.41	0.03
	64	35.41	0.03
	120	35.41	0.03
	165	35.40	0.02
	238	35.39	0.01
	411	35.38	0.00
4:21pm	501	35.38	0.00
9:09AM	1509	35.43	

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

90% Rec = 35.38

Accurate Die-Casting Facility Aquifer Performance Test

Well Number: [redacted] MW-5
Static: 30.48
Well Depth: 41.20
Aquifer Thickness: 13

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
22	30.48	0.00
23	30.48	0.00
38	30.48	0.00
43	30.48	0.00
53	30.48	0.00
63	30.48	0.00
78	30.48	0.00
93	30.48	0.00
108	30.48	0.00
123	30.48	0.00
204	30.48	0.00
249	30.48	0.00
309	30.49	~~0.10~~ 0.01
368	30.49	~~0.10~~ 0.01
424	30.50	0.02
490	30.50	0.02
550	30.50	0.02
609	30.51	0.03
673	30.52	0.04
733	30.52	0.04
792	30.53	0.05
849	30.52	0.04
909	30.53	0.05
969	30.53	0.05
1029	30.54	0.06
1089	30.54	0.06
1149	30.54	0.06
1209	30.54	0.06
1269	30.55	0.07
1329	30.55	0.07
1389	30.57	0.09
Rec ↓ 40	30.57	0.09
50	30.57	0.09
60	30.57	0.09
115	30.58	0.10
160	30.58	0.10
234	30.58	0.10
406	30.59	0.11
4:15pm 495	30.59	0.11

9/30 9:03AM

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
1503	30.59	0.11

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

90% Rec = 30.49

Accurate Die-Casting Facility Aquifer Performance Test

Well Number: [redacted] MW-2
Static: 11.01
Well Depth: 18.03
Aquifer Thickness:

	Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
	83	10.98	-0.03
	96	10.98	-0.03
	111	10.98	-0.03
	126	10.97	-0.04
	196	10.95	-0.06
	256	10.94	-0.07
	316	10.92	-0.09
	375	10.91	-0.10
	443	10.89	-0.12
	499	10.89	-0.12
	559	10.87	-0.14
	616	10.85	-0.16
	683	10.85	-0.16
	745	10.83	-0.18
	799	10.83	-0.18
	859	10.81	-0.20
	916	10.80	-0.21
	976	10.79	-0.22
	1036	10.79	-0.22
	1096	10.77	-0.24
	1156	10.77	-0.24
10.81	1216	10.76	-0.25
	1276	10.76	-0.25
	1336	10.76	-0.25
	1396	10.75	-0.26
	68	10.74	-0.27
	124	10.73	-0.28
	171	10.74	-0.27
	242	10.72	-0.29
56pm	416	10.72	-0.29
25pm	505	10.72	-0.29
9/30 14AM	1514	10.74	-0.27

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

Accurate Die-Casting Facility Aquifer Performance Test

Well Number: [redacted] MW-8
Static: 29.89
Well Depth: 37.83
Aquifer Thickness: 11

	Elapsed Time (Min)	Depth To Water	Drawdown (Feet)
	81.0	29.89	0.00
	96	29.89	0.00
	78111	29.89	0.00
	125	29.89	0.00
	195	29.86	-0.03
	254	29.86	-0.03
	315	29.86	-0.03
	373	29.85	-0.04
	441	29.84	-0.05
	497	29.83	-0.06
	557	29.84	-0.05
	615	29.82	-0.07
	681	29.82	-0.07
	743	29.82	-0.07
	798	29.83	-0.06
	857	29.82	-0.07
	915	29.81	-0.08
	965	29.81	-0.08
	1033	29.81	-0.08
	1093	29.81	-0.08
	1153	29.81	-0.08
	1213	29.80	-0.09
	1273	29.80	-0.09
	1333	29.81	-0.08
	1393	29.81	-0.08
Rec ↓	67	29.81	-0.08
	122	29.80	-0.09
	170	29.81	-0.08
	240	29.80	-0.09
	413	29.80	-0.09
7:23pm	503	29.80	-0.09
9/30 9:12 am	1512	29.81	-0.08

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

Elapsed Time (Min)	Depth To Water	Drawdown (Feet)

APPENDIX D

OBG
LABORATORIES, INC.

Safe Drinking Water Act

CLIENT O'BRIEN & GERE ENGINEERS, INC. JOB NO. 3435.021.076

DESCRIPTION Accurate Die Casting

Recovery Well MATRIX: Water

SAMPLE NO. U3214 DATE COLLECTED 9-29-94 DATE RECEIVED 9-29-94

Primary Inorganic Chemicals	ppm	Secondary Inorganic Chemicals	ppm
Arsenic	<0.005	Chloride	-
Barium	0.2	Copper	<0.01
Cadmium	<0.01	Iron	0.29
Chromium	<0.01	Manganese	-
Fluoride	-	Sulfate	9.
Lead	<0.005	Zinc	0.03
Mercury	<0.0002	Corrosivity	-0.2
Nitrate	-	Calcium	77.
Selenium	<0.005	Total dissolved solids	280.
Silver	<0.01	Total alkalinity	260.
Sodium	8.	pH	7.3
		Temperature	10.°C
		Calcium carbonate	192.

Organic Chemicals	ppb
Endrin	-
Lindane	-
Methoxychlor	-
Toxaphene	-
2,4-D	-
2,4,5-TP (Silvex)	-

Comments:

Certification No.: 10155

Authorized: [signature]

Date: October 24, 1994

LABORATORIES, INC.

Laboratory Report

CLIENT O'BRIEN & GERE ENGINEERS, INC. JOB NO. 3435.021.076

DESCRIPTION Accurate Die Casting

MATRIX: Water

DATE COLLECTED 9-29-94 DATE RECEIVED 9-29-94

Description:	Recovery Well			
Sample #	U3214			
Total Metals:				
ANTIMONY	<0.06			
MAGNESIUM	24.			
NICKEL	<0.05			
Other Analyses:				
HARDNESS	290.			
AMMONIA NITROGEN	<0.05			
5 DAY BIOCHEMICAL OXYGEN DEMAND	<5.			
CHEMICAL OXYGEN DEMAND	<10.			
HEXAVALENT CHROMIUM	<0.01			
NITRITE NITROGEN	<0.05			
SPECIFIC CONDUCTANCE µmho/cm	570.			
TOTAL CYANIDE	<0.01			
TOTAL PHOSPHORUS	<0.05			
TOTAL SUSPENDED SOLIDS	5.			
TOTAL ORGANIC CARBON	2.			
METHYLENE BLUE ACT. SUBSTANCES	<0.1			

Comments:

Certification No.: 10155

Units: mg/l unless otherwise noted

October 24, 1994

LABORATORIES, INC.

Laboratory Report

CLIENT: O'BRIEN & GERE ENGINEERS, INC. JOB NO. 3435.021.076

DESCRIPTION: Accurate Die Casting

MATRIX: Water

DATE COLLECTED: 9-29-94 DATE RECEIVED: 9-29-94

Description:	Recovery Well Filtered
Sample #	U3215
LAB FILTERED IRON	0.15

Comments:

Certification No.: 10155

Units: mg/l

Authorized: [illegible signature]

Date: October 24, 1994

2488.398.517

113

SAMPLE ANALYSIS REPORT

L2433-61
LSL Project No.

Joel Mancuso QDO
Reviewed By

11/1/94
Date

LIFE SCIENCE LABORATORIES, INC.
5854 Butternut Drive, East Syracuse, New York 13057 Telephone: (315) 445-1105 Fax: (315) 445-1301

Life Science Laboratories, Inc
5854 Butternut Drive
East Syracuse, New York 13057
(315) 445-1105
NYS DOH ELAP NO. 10248

** SAMPLE ANALYSIS REPORT ** 11/01/94

OBG Laboratories, Inc
Don Brondou
P.O. Box 4942 Phone: (315) 437-0200
Syracuse, NY 13221

Sample # 41019475 Project #: L2433 -61
Customer ID: U3214
Matrix: NPW Authorization: 2488.396.517

Test Name	Results	Units	Comment	Completed	Initials
TKN as N, EPA 351.2	0.92	mg/l		10/27/94	PP

****

O'BRIEN & GERE ENGINEERS, INC.

Job No. 2400.076.025

Sheet 1 of

Office: SYRACUSE
Address: SYRACUSE, N.Y.
Phone: (315) 437-6100

CHAIN OF CUSTODY

CLIENT: ACCURATE DIE
LOCATION: FAYETTEVILLE, N.Y.

COLLECTED BY: (Signature) Chawn O'Dell

SAMPLE DESCRIPTION	Date	Time	Sample Matrix[1]	Sample Type[2]	No. of Containers	ANALYSIS REQUESTED
RECOVERY WELL	9/27/94	0750	water	grab	6	see the attached sheets and/or contact Dave Towers for analysis required.
Delete phenol and ~~[illegible]~~ chlorine analysis per Dave Towers						

[1] Matrix = water, wastewater, air, sludge, sediment, etc.
[2] Type = grab, composite

Relinquished by	Date	Time	Received by	Date	Time
Chawn O'Dell of: O'Brien & Gere Eng., Inc.	9/29/94	1327	[illegible] of: [illegible] Laboratories Inc.	9-29-94	1327
of:			of:		
of:			of:		
Use this space if shipped via courier (e.g., Fed Ex) Relinquished by: of:			Courier Name: *Attach delivery/courier receipt to Chain of Custody		
of:			of:		

Cooler temp. @ 5°C. [illegible]

djb/wpC

September 17, 1990

OBG LABORATORIES, INC.
CASE FILE FORM

PROGRAM INFORMATION

Client: OBG Div. ______ Ref. No. ______

Program: Accurate Die

Location: City/Town Fayetteville State NY

Date Rec'd: 9-29-94 Time Rec'd: 1327 Sampler: C. O'Dell

Custody Seal: ______ Intact ______ Not Intact ______ X NA

AFTER HOURS CUSTODY

RELINQUISHED BY:	DATE	TIME	RECEIVED BY SECURITY GUARD:	DATE	TIME
RELINQUISHED BY SECURITY GUARD TO COOLER:	DATE	TIME	RECEIVED BY SAMPLE CUSTODIAN:	DATE	TIME

COMMENTS/DISCREPANCY:

Cooler temp @ 5°C. A sample for Filtered Iron was not submitted. As per Dave Travers to Monika Santucci on 9-30-94 - a portion of the unpreserved sample submitted should be filtered and preserved in the lab and analyzed for filtered iron.

RESOLUTION/CLIENT COMMENT:

Signed: Wendy Smith Project Manager Approval: MS

Date: 9-30-94 QA/QC Approval: ______

SAMPLE DISPOSAL

Disposal Procedure: Routine

Signed: Monika Santucci

Date: 10/20/94

APPENDIX E

ACCURATE DIE CASTING SITE, ONONDAGA COUNTY

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning December 1, 1993

and lasting until December 1, 1998

the discharges from the permitted facility shall be limited and monitored by the permittee as specified below:

Outfall Number & Effluent Parameter	*Discharge Limitations* Daily Avg.	Daily Max.	Units	Minimum Monitoring Requirements Measurement Frequency	*Sample* Type
Remedial Discharge to Bishop Brook (0-66-11-P26-37-6-2-4), Class C (TS)					
Flow	Monitor	150,000	GPD	Continuous	Meter
pH	(6.5 - 8.5)		SU	2/week	Grab
Solids, Total Suspended	Monitor	20	mg/l	Weekly	3-hr. comp.
Solids, Total Dissolved	Monitor	500	mg/l	Weekly	3-hr. comp.
$CBOD_5$	Monitor	Monitor	mg/l	Monthly	3-hr. comp.
TKN	Monitor	Monitor	mg/l	Monthly	3-hr. comp.
TOD*	Monitor	15	mg/l	Monthly	Calculated
Dissolved Oxygen	Monitor	7 min.	mg/l	Monthly	Grab
Aluminum, Dissolved	Monitor	200	µg/l	2/month	3-hr. comp.
Antimony, Total	Monitor	100	µg/l	2/month	3-hr. comp.
Chromium, Total	Monitor	500	µg/l	2/month	3-hr. comp.
Cobalt, Total	Monitor	10	µg/l	2/month	3-hr. comp.
Copper, Total	Monitor	100	µg/l	2/month	3-hr. comp.
Iron, Total	Monitor	300	µg/l	2/month	3-hr. comp.
Lead, Total	Monitor	20	µg/l	2/month	3-hr. comp.
Mercury, Total	Monitor	0.8	µg/l	2/month	3-hr. comp.
Nickel, Total	Monitor	200	µg/l	2/month	3-hr. comp.
Silver, Total	Monitor	100	µg/l	2/month	3-hr. comp.
Vanadium, Total	Monitor	30	µg/l	2/month	3-hr. comp.
Zinc, Total	Monitor	300	µg/l	2/month	3-hr. comp.
Cis-1,2-Dichloroethylene	Monitor	10	µg/l	2/month	Grab
Trans-1,2-Dichloroethylene	Monitor	10	µg/l	2/month	Grab
Methylene Chloride	Monitor	50	µg/l	2/month	Grab
1,1,2,2-Tetrachloroethane	Monitor	30	µg/l	2/month	Grab
Tetrachloroethylene	Monitor	20	µg/l	2/month	Grab
Toluene	Monitor	20	µg/l	2/month	Grab
Trichloroethylene	Monitor	10	µg/l	2/month	Grab
Acetone	Monitor	1000	µg/l	2/month	Grab
2-Hexanone	Monitor	1000	µg/l	2/month	Grab
4-Methyl-2-Pentanone	Monitor	1000	µg/l	2/month	Grab

Special Conditions:

Authorization is valid only for the period noted above but may be renewed if appropriate. A request for renewal must be received 6 months prior to the expiration date to allow for a review of monitoring data and reassessment of monitoring requirements.

Only site generated wastewater is authorized for treatment and discharge.

Discharge is not authorized until such time as an engineering report, plans and specifications are submitted detailing the proposed method of treatment and approval is granted by the Department.

*TOD = 1.5 x $CBOD_5$ + 4.5 x TKN.

SPDES PERMIT FACT SHEET

Prepared by: Shayne Mitchell Date: 12/02/93

Company: Accurate Die Casting Permit No.: 734052

Location: Onondaga County, Fayetteville Industrial Code No.: 9511

Industrial Segment: NA Part No.:

Type of Processing & Production Rate:

Site Remediation.

Basis for Technology Effluent Limitations:

Best Professional Judgement (BPJ).

Outfall No.: 001 :Remedial Discharge: Nominal Flow: 0.15 MGD

PARAMETER	BASIS FOR PERMIT CONDITION
Flow	BPJ
pH	WQ
TSS	BPJ
TDS	WQ
CBOD	Monitor
TKN	Monitor
TOD	WQ
DO	WQ
Aluminum	WQ
Antimony	BPJ
Chromium	BPJ
Cobalt	WQ
Copper	BPJ
Iron	WQ
Lead	WQ
Mercury	WQ/Detection Limit
Nickel	BPJ
Silver	BPJ
Vanadium	WQ
Chloride Zinc	WQ
Cis-1,2-DCE	BPJ
Trans-1,2-DCE	BPJ
Methylene Chloride	BPJ
1,1,2,2-PCA	BPJ

PARAMETER	BASIS FOR PERMIT CONDITION
Outfall No.: 001 :Remedial (contd)	Discharge: Nominal Flow: 0.15 MGD
PCE	WQ
Toluene	BPJ
TCE	BPJ
Acetone	BPJ
2-Hexanone	BPJ
4-Methyl-2-Pentanone	BPJ

APPENDIX B

PCB/PAH/VOC SOILS EXCAVATION WORK PLAN
(FEBRUARY 1995 WITH REVISED PAGES DATED MARCH 3, 1995)

WORK PLAN

PCB/PAH/VOC Soils Excavation

Former Accurate Die Casting Facility
Fayetteville, New York

February 1995

O'BRIEN & GERE
ENGINEERS, INC.

2488.396

Work Plan

PCB/PAH/VOC Soils Excavation

Former Accurate Die Casting Facility
Fayetteville, New York

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February 1995

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1. Introduction

1.1. General

This work plan presents the activities that are to be conducted, as a phase of the Remedial Design/Remedial Action (RD/RA) actions required by the Record of Decision (ROD) dated December 1994, to address soils containing polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), and volatile organic compounds (VOCs) at the Accurate Die Casting Site in Fayetteville, New York. This work plan also describes those activities that are to be conducted to address the septic tank and its contents.

1.2. Background

The former Accurate Die Casting site is situated on a 32-acre parcel at 547 East Genesee Street in Fayetteville, New York as shown on Figure 1. The facility, as shown on Figure 2, was constructed in the 1950's and had been used for die casting operations until 1988, when it was abandoned. ITT Commercial Finance Corporation (ITT), which possessed a mortgage on the real property, foreclosed on the premises and was the successful bidder at the auction. Shortly thereafter, an environmental assessment for property transfer was conducted by Stearns & Wheler for ITT, the asset lender. As a result of the site assessment, it was concluded that the potential for environmental contamination existed at the site and that further investigation would be necessary. Stearns & Wheler was subsequently retained to perform a Phase II assessment of the site, completing it in September 1990.

Upon reviewing the Phase II assessment of the former Accurate Die Casting facility, the New York State Department of Environmental

Conservation (NYSDEC) required that a Remedial Investigation be conducted. The investigation was completed in accordance with the Remedial Investigation (RI)/Feasibility Study (FS) Work Plan (Stearns & Wheler, May 1992). As presented in the Final Report - Remedial Investigation (Stearns & Wheler, December 1993), the data obtained during the investigation indicates that:

- Ground water quality has been impacted by trichloroethene (TCE). An overburden TCE plume extends from near the former location of MW-3 north towards Bishop Brook. Bedrock ground water also has been impacted as evidenced by levels of TCE detected in samples obtained from bedrock monitoring wells.

- The highest TCE concentrations were observed at about 20 to 25 feet below grade in MW-3, at the interface between the sand/gravel and till layers.

- A portion of the site, referred as the PCB/PAH/VOC soils area, contains polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), and volatile organic compounds (VOCs) above Technical Administrative Guidance Memorandum (TAGM) soil cleanup objectives for New York State.

- The septic tank on site contains materials that could potentially result in VOC and metal concentrations above TAGM soil cleanup levels.

The area containing TCE in the subsurface soil proximal to MW-3 was remediated in June 1994 as part of an Interim Remedial Measure (IRM). The objective of that IRM was to remediate the subsurface soils in the vicinity of MW-3 to reduce the potential for further migration of TCE from the suspected source area to the ground water. As part of that IRM, a ground water recovery and treatment system will also be installed to address the impacted overburden ground water.

1.3. Purpose

The purpose of this work plan is to describe the activities that are to be completed to address the soils located in the PCB/PAH/VOC soils area and sludges contained in a septic tank on-site. These activities are intended to specifically address two of the five components of the selected remedy identified in the ROD. The activities include development and implementation of an excavation plan for the PCB/PAH/VOC soils area, removal and disposal of septic tank sludges, and restoration of the two areas in an environmentally sound manner.

The objectives of this work phase are:

1. Remediate the surface and subsurface soil in the PCBs/PAH/VOC area near MW-4 to reduce the potential for migration of contaminants from the area.

2. Prevent incidental ingestion of surface soils containing PCBs/PAH/VOC, and prevent dermal adsorption of residues.

3. Remove the residues of PCBs/PAH/VOCs in surface and subsurface soil to achieve the Remedial Action Objectives (RAOs) established by the ROD.

4. Remove the septic tank and its contents to prevent potential release of the tank contents to the surrounding soil.

2. Summary of available information

2.1. General

This section presents select remedial investigation (RI) data that are pertinent to the development of a plan to address the soils containing PCB/PAH/VOC residues and the septic tank located on site.

2.2. Precharacterization data

2.2.1. PCB/PAH/VOC soils area

The PCB/PAH/VOC soils area is located in the northern portion of the site immediately south of MW-4, as shown on Figure 2. Preliminary investigations were conducted in August 1993 by Stearns & Wheler to evaluate the extent of PCB/PAH residuals within this area.

The August 1993 investigation included the collection of grab samples from a depth of 0 to 6 inches below the ground surface at seventeen randomly selected locations shown on Figure 3. From these locations, a total of 20 samples were collected and analyzed in a laboratory for PCBs and PAHs. In addition, the three NYSDEC split-samples out of these 20 samples were analyzed for VOCs. The analytical results are summarized in Table 1 and the laboratory data reports are included in Appendix A. In 14 of the 20 samples obtained, PAH analytes were present in the soils at concentrations ranging from 0.26 to 113 mg/kg. PCB concentrations in 16 of the 20 samples ranged between 0.01 and 2.6 mg/kg, and VOCs (Dichloroethylene) were present in the three split samples collected by NYSDEC at concentrations between .018 and 190 ppm.

2.2.2. Septic tank

During the RI, the sludge from a decommissioned septic tank was also sampled to assess if it was a potential source of ground water contamination on the site. The tank had been decommissioned by filling it with gravel, however, the gravel did not completely fill the tank. Near the top of the tank, a white substance with a soil-like consistency was found. A sample of the white substance was obtained and analyzed for volatile organics and metals. A summary of the results of the analyses is presented in Table 2. No volatile organics were detected in the sample but several metals were detected in the material. Of the metals detected in the material, only zinc was found to be at a concentration significantly above levels exhibited in other soil samples from the site. During implementation of this work plan, additional samples of the septic tank contents will be collected and analyzed to characterize the contents for off-site disposal.

3. Health and safety plan

3.1. General

A site specific Health and Safety Plan, provided as Exhibit A, was prepared to provide guidance for O'Brien & Gere Technical Services, Inc. personnel during the conduct of remedial activities in these two areas. This document is adopted for O'Brien & Gere Engineers on-site personnel during the installation of soil borings, and conduct of soil sampling and excavation activities. The Health and Safety Plan was prepared in accordance with the Federal Occupational Safety and Health Administration guidelines (29 CFR 1910.120) utilizing data generated during the RI, including site history and subsurface conditions.

O'Brien & Gere Technical Services will be responsible for the implementation and enforcement of the Health and Safety Plan (HASP) while activities are conducted on the site.

3.2. Project organization

The HASP includes an organization listing identifying key personnel involved in the proposed activities. The listing identifies the following personnel, and describes their duties as related to health and safety issues:

- Project Officer
- Project Supervisor
- Corporate Safety Coordinator

- Health and Safety Specialist
- Field Supervisor/Site Health and Safety Coordinator

The on-site Health and Safety Coordinator (HSC) will have the following responsibilities:

- The HSC will be available at all times during site operations;
- The HSC will have the authority to enforce the HASP and stop operations if the safety or health of site personnel is jeopardized;
- The HSC will evaluate all monitoring data and make necessary field decisions regarding site health and safety procedures;
- The HSC may order evacuation of the site if necessary to protect the safety and health of workers.

3.3. Hazard identification

Potential health and safety hazards which may be encountered during the execution of the work are identified in the HASP. Examples of anticipated hazards include, but are not limited to, exposure to soil containing polychlorinated biphenyl (PCB), polynuclear aromatic hydrocarbons (PAH), and/or volatile organic compounds (VOCs), and safety hazards inherent in working around excavations and machinery. The HASP includes descriptions of methods to be employed to reduce the risks associated with the identified hazards.

3.4. Work zones

The HASP describes work zones in which specific operations or tasks will take place, and describes specific site entry and decontamination procedures at designated control points in accordance with the provisions of 29 CFR 1910. At a minimum, three work zones (exclusion zone, contamination reduction zone, and clean zone) will be established to perform this work. A map showing the work zones will be provided to the NYSDEC and included in the HASP once the excavation plan, described later in Section 4.4.3, has been prepared.

3.5. Site control

The contractor has a site control program established as part of the HASP. The following information is included in the site control program:

- Site map, with work zones;
- Site entry procedures;
- Description of the use of "buddy" system;
- Site communications, including means of alerting workers to emergencies;
- Locations of nearest medical assistance, and emergency phone numbers.

3.6. Employee training

Employees performing on-site activities and the supervisors responsible for the site are trained to the level required by their assigned function as specified by 29 CFR 1910.120(e). Written certification of the successful completion of the necessary training is required by those regulations.

3.7. Medical surveillance

The contractor will establish and implement a Medical Surveillance Program (MSP) for employees engaged in on-site operations, consistent with 29 CFR 1910.120(f). The MSP includes physical examinations performed by or under the supervision of a licensed physician. The written opinion of the attending physician on the employee's ability to perform the required work is made available to the employee.

The contractor will retain a record of the required medical surveillance information for the appropriate period as specified in 29 CFR 1910.120.

3.8. Personnel protection

Engineering controls, work practices, the use of personal protection equipment (PPE), or a combination of these will be implemented during site operations to protect employees from exposure to hazardous substances and safety hazards as required by 29 CFR 1910.120(g). A written PPE program including the following elements will be incorporated into the HASP:

- PPE inspection prior to, during and after use;
- PPE selection (based on site hazards), use, and limitations, including heat stress and cold injury protection;
- PPE maintenance, storage, decontamination, and disposal;
- PPE training, proper fit, and procedures for donning and doffing PPE;
- Evaluation of the effectiveness of the PPE program.

3.9. Monitoring

The HASP defines a monitoring program in accordance with 29 CFR 1910.120(h) to select and maintain proper engineering controls, work practices, and PPE. Breathing zone air monitoring will be performed to identify levels of airborne particulates and VOCs to determine the necessary level of employee protection.

3.10. Decontamination

The contractor will develop and implement decontamination procedures as required by 29 CFR 1910.120(k) which will minimize employee contact with hazardous substances or equipment and materials that have contacted hazardous substances.

3.11. Emergency response plan

The HASP includes an emergency response plan section meeting the requirements of 29 CFR 1910.120(l). The emergency response plan addresses the following elements:

- Pre-planning of site operations to prevent emergencies;
- Personnel roles, lines of authority, and communications;
- Emergency recognition and prevention;
- Safe distance and places of refuge;
- Evacuation routes and procedures;
- Emergency first aid, medical treatment, alerting, and response procedures;
- Emergency and personnel equipment maintained at the site for emergencies.

3.12. Community air monitoring plan

The HASP includes a Community Air Monitoring Plan prepared in accordance with New York State Department of Health guidance. The plan includes monitoring for VOCs and particulates at the perimeter of the work area, and describes removal actions to be implemented if target levels (5 ppm above background for VOCs, 100 $\mu g/m^3$ for particulates) are exceeded.

4. Plan for addressing PCB/PAH/VOC soils and septic tank

4.1. General

This section presents the plan for addressing the PCB/PAH/VOC soils area and septic tank on-site. The plan consists of the following tasks.

Task 1 - Project Planning
Task 2 - Community Relations
Task 3 - Field Investigation and Implementation of Remedial Measures
Task 4 - Data Evaluation
Task 5 - Construction Management and Reporting

The order in which these tasks are presented is the general order in which they will be performed. However, since some tasks (e.g., Data Evaluation) occur throughout conduct of the work, the order of presentation gives only a general indication of the order the tasks will follow.

4.2. Task 1 - project planning

This task involves the performance of several subtasks to produce the project planning documents and project schedule necessary to execute the work described herein. These subtasks include: field reconnaissance, project meetings, evaluation of existing data, and development of project plans including draft and final revisions of this Work Plan and a Health and Safety Plan.

4.3. Task 2 - community relations

O'Brien & Gere Engineers, Inc., on behalf of O'Brien & Gere Technical Services will provide copies of necessary documents to the local repository, and the NYSDEC offices. O'Brien & Gere will also be available for at least one public informational meeting, as scheduled and coordinated by NYSDEC, to provide technical support if required. O'Brien & Gere will be prepared to present pertinent data and recommendations at the meeting and respond to questions.

4.4. Task 3 - field investigation and implementation of remedial measures

The soil sample analytical data that was collected in August 1993 enabled a preliminary assessment of the PCB/PAH/VOC soils area. However, additional soil characterization is needed to further define the horizontal and vertical extent of the PCB/PAH/VOC compounds in the soils. Further soil characterization will also be conducted to characterize the soils for disposal.

4.4.1. Characterization of soils/areal delineation

Six soil borings will be advanced to a depth of approximately six feet in the PCB/PAH/VOC soils area, at the locations shown on Figure 3, to further delineate the extent of PCBs/PAH/VOCs. Soil samples will be collected from each boring at approximately two foot depth intervals in accordance with the protocols enclosed as Appendix B and will be screened in the field for VOCs using a photoionization detector (PID). The PID, equipped with a 10.2 eV lamp, will be calibrated to correct for the photoionization sensitivity of 8.9 for TCE compared to an isobutylene standard of 7 ppm (v/v). The samples will also be screened for PCBs using an immunoassay sampling kit in accordance with EPA approved analytical method SW846-4020. To provide a correlation between the field screening and "actual" concentrations, one of the samples screened for VOCs using the PID and one of the samples screened for PCBs using the immunoassay test will be analyzed by EPA Method 8010/8020 and EPA Method 8080, respectively. No screening in the field is proposed for PAHs. If the results of the field screening indicate PCBs or VOC levels above the established RAOs in the samples collected from the bottom of the boring, the depth of the boring will be increased, as deemed appropriate by the hydrogeologist on-site, to more accurately delineate the vertical extent of the residues.

Following collection, soil samples will be transported to O'Brien & Gere Laboratories, Inc. using a chain-of-custody form (Appendix D) where, based on field screening results, two samples from each boring will be selected for PCB analyses using EPA Method 8080, PAHs using EPA Method 8270, and VOCs using EPA Method 8010/8020. One sample selected from each boring will be from the interval that exhibited the highest PID reading, and the other sample selected will be from the interval that exhibited the highest PCB concentration. However, if the same interval exhibits both the highest PID reading and PCB concentration, a sample from a second, non-contiguous interval will be selected for laboratory analyses. Also, if several intervals exhibit PID or PCB levels close to the highest values obtained during field screening, the sample selected will be from the interval having the greatest depth. A composite soil sample, mixed in the laboratory using portions of the twelve soil samples selected for laboratory analyses, will also be analyzed for toxicity characteristic leachate procedure (TCLP) metals, volatiles, semi-volatiles, pesticides and herbicides as well as for flashpoint, pH, and cyanide and sulfide reactivity to precharacterize the soils for disposal off-site.

Based on the concentration of PCBs/PAH/VOCs exhibited in the soil samples, and the results of the field screening performed during these and previous soil sampling activities within the area, a plan depicting the approximate limits of the proposed excavation will be prepared for submittal to the NYSDEC. Using the laboratory results of the composite soil sample, a waste characteristic profile sheet also will be completed and submitted to an appropriate off-site disposal facility for acceptance of the soils to be excavated.

4.4.2. Characterization of septic tank contents

In order to characterize the contents of the septic tank for disposal off-site, a grab sample will be obtained and submitted to O'Brien & Gere Laboratories, Inc. for analyses. The sample will be analyzed for TCLP metals, volatiles, semi-volatiles, pesticides and herbicides as well as for flashpoint, pH, and cyanide and sulfide reactivity. Using the laboratory results of the septic tank contents, a waste characteristic profile sheet will then be completed and submitted to an appropriate off-site disposal facility for acceptance of the tank contents.

4.4.3. Excavation of PCB/PAH/VOC soils
A "constructable quality" excavation plan will be prepared and submitted for NYSDEC approval. The excavation plan will include one or more figures showing the approximate extent of the excavation, based on the results of the proposed soil sampling and analyses described in Section 4.4.1; the location of material staging areas; erosion and sediment controls; and the proposed exclusion and decontamination zones. The excavation area will encompass the sample locations containing PCB, PAH, and VOC residuals above the RAOs. The excavation plan submittal also will include performance specifications appropriate to the type of work proposed such as earthwork, backfill and compaction, sedimentation and erosion control, surface water diversion, excavation dewatering, material handling and disposal, and sampling analyses.

Prior to initiating excavation activities, acceptance of the material by an off-site disposal facility will be obtained so that the material need not be staged on-site prior to transport off-site. Also, a temporary construction barrier will be erected on the perimeter of the exclusion zone, established around the area to be excavated, to reduce the potential for unauthorized personnel from inadvertently entering the area. Additional work area controls, such as silt fences and storm water runoff diversions, also will be installed to minimize the amount of storm water runoff entering or leaving the exclusion and contamination reduction zones.

Excavation of the PCB/PAH/VOC soil area will be performed using conventional excavating equipment (backhoe, dump truck, etc.). The extent of excavation will be directed by the on-site environmental technician based upon field screening results which will be compared to soil precharacterization data. Field screening will consist of collecting soil samples from the base and walls of the excavation on a 20 foot grid pattern and testing the samples for VOCs using a portable PID and for PCBs using an immunoassay sampling kit in accordance with EPA approved analytical method SW846-4020. The results of the field screening will be recorded within the field log book.

If necessary, as the soil is removed it will be transported to a designated temporary staging area located on site. In this staging area, the soils will be temporarily stored on top of and be covered by polyethylene to minimize contact with the surface and minimize erosion or contact with precipitation prior to transportation off-site to an appropriate disposal facility.

Upon completion of excavation, based upon field screening, not less than ten confirmatory soil samples will be collected on a 20 foot grid pattern from the floor and walls of the excavation. The samples will be transported to O'Brien & Gere Laboratories, Inc. using appropriate chain-of-custody procedures where they will be analyzed for PCBs using EPA Method 8080, PAHs using EPA Method 8270, and VOCs using EPA Method 8010/8020. The data package submitted to the NYSDEC shall consist of the validated results of these analyses, as well as the results of the:

- Trip blank (1 per container)
- Matrix spike (1 per 20 samples obtained)
- Matrix spike duplicate (1 per 20 samples obtained)
- Equipment blank (1 per 20 samples obtained)
- Method quality assurance/quality control data

Once residual levels in soils remaining in place meet the RAOs presented in the Record of Decision (ROD) the excavated area will be restored.

4.4.4. Removal of septic tank

Prior to removing the septic tank contents, acceptance of the material by an off-site disposal facility will be obtained so that the material need not be staged on-site prior to transport off-site. Removal of the septic tank contents will be performed using conventional equipment (backhoe, vacuum truck, dump truck, etc.). If it is necessary to temporarily stockpile the material, it will be transported to a temporary staging area located on-site. In this staging area, the material will be placed on top of and be covered by polyethylene sheeting to minimize contact with the surface and prevent erosion or contact with precipitation prior to transportation off-site to an appropriate disposal facility.

Once the contents of the septic tank are removed the tank will also be removed. If the tank is constructed of concrete, it will be disposed off-site at an appropriate landfill facility, but if it is a metal tank, it will be cleaned, have holes drilled/cut in its side, and be transported to a metal scrapyard.

4.4.5. Restoration

Once excavation activities have been completed, as concluded based on the results of verification sampling and approved by the NYSDEC, the silt fences will be removed and disposed of off-site, as appropriate. The two excavated areas will then be backfilled with clean granular material and/or graded to prevent ponding of surface water and restored with a grass cover to minimize erosion.

4.4.6. Equipment decontamination

O'Brien & Gere Technical Services shall construct, operate and maintain a temporary equipment decontamination area on-site at a location approved by the Owner. Equipment which has been in contact with the exclusion zone shall be stored at a location approved by Owner or shall be thoroughly decontaminated to the satisfaction of the Owner's on-site representative prior to leaving the contamination reduction area.

Materials taken into the Exclusion Zone will be assumed to be contaminated and therefore be decontaminated before the item leaves the Contamination Reduction Area. Contaminated vehicles, equipment, and materials shall be cleaned prior to leaving the site. Decontamination shall consist of thorough brushing to remove solid materials and pressure steam cleaning or through other equivalent methods. The method of decontamination shall meet the requirements of federal, state, and local authorities and shall be subject to approval by the Owner.

The equipment decontamination area will consist of an impermeable material (sloped to a sump area) with appropriate height curbing. O'Brien & Gere Technical Services shall collect liquid waste material in a temporary tanker or similar device for treatment and or disposal off-site.

Personnel engaged in vehicle decontamination shall wear protective equipment including disposable clothing and respiratory protection as necessary in accordance with the Health and Safety Plan.

4.5. Task 4 - data evaluation

This task includes the data reduction and evaluation effort. O'Brien & Gere Engineers will organize, analyze, interpret, and present the data obtained during implementation of the activities described in this Work Plan, including:

- Evaluation of the soil samples obtained from the five proposed borings to assess the vertical and horizontal extent of PCBs/PAH/VOC residues.

- Evaluation of PCB/PAH/VOC verification sampling and analytical results to document the levels of PCBs/PAH/VOC residuals remaining following completion of this the remedial measures.

- Evaluation and documentation of soil sampling activities and incorporation of the data into a risk assessment, as part of a contingency plan, if necessary.

This information will be submitted to the NYSDEC for review as it becomes available, and will be included, summarized, and interpreted in an PCB/PAH/VOC soils excavation Summary Report.

4.6. Task 5 - construction management and reporting

This task includes the coordination and direction of field activities and the reporting of findings to the NYSDEC. A description of the scheduling and reporting requirements are presented in Section 5 of this Work Plan.

5. Project management

5.1. Project organization and responsibilities

A project management team has been assembled to plan, coordinate, and implement the activities described in this Work Plan. The lead organization in the process is O'Brien & Gere Technical Services, Inc., a full service environmental contracting firm. O'Brien & Gere Engineers, Inc. has been retained by O'Brien & Gere Technical Services to prepare this Work Plan and provide engineering inspection. The roles and responsibilities of the individuals assigned to this program are described below.

5.1.1. Project officer

Terry L. Brown, P.E. of O'Brien & Gere Technical Services will serve as project officer for this program. Mr. Brown is responsible for coordinating the overall management of the project, directing field and office personnel, and managing the administrative aspects of the project.

5.1.2. Engineering manager

David S. Towers, P.E. of O'Brien & Gere Engineers will act as the engineering manager. Mr. Towers will develop the soil excavation plan, review deliverables prior to submittal to NYSDEC, monitor the project progress, and oversee the remedial efforts.

5.1.3. Field operations manager

Mr. Anthony Geiss of O'Brien & Gere Technical Services will serve as field operation manager. Mr. Geiss' responsibility will include overseeing the day-to-day activities necessary in the field to implement the work described in this Work Plan.

5.2. Project schedule

The project schedule for the activities described in this Work Plan is presented as Table 3. As shown on the table, it is anticipated that NYSDEC review and approval of this work plan will be completed within four weeks of its submittal. Following NYSDEC review and approval, field investigation activities will be initiated within three weeks (pending availability of drilling subcontractors) and completed within six weeks.

Upon completion of the field activities and evaluation of the data, an excavation plan will be developed. It is estimated that excavation activities including restoration of the area will take approximately six weeks to complete once initiated. Within 30 business days following completion of excavation backfilling and receipt of validated laboratory reports, a Summary Report documenting the work completed will be prepared and submitted to NYSDEC.

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TABLES

Table 1
PAH, VOC and Total PCB Concentrations in Soil from Former Waste Oil Spill Area

Former Accurate Die Casting Site
Fayetteville, New York

Analyte	S-1	S-2	S-3	S-4	S-5	S-5s	S-6	S-8	S-9	S-10	S-11	S-12	S-13	S-13s	S-14	S-14s	S-15	S-16	S-17	S-18
Naphthalene						N/A								N/A		N/A				1.3
Acenaphthylene						N/A								N/A		N/A				
Acenaphtene		0.12				N/A						2	3.5	N/A	2.8	N/A		0.18		3.6
Fluorene		0.11				N/A								N/A	2.6	N/A		0.15		3.3
Phenanthrene	0.19	1.6		1.7		N/A	3.8	0.27	0.82	6.1	0.27	15	10	N/A	24	N/A	1.7	1.8	0.92	25
Anthracene	0.19	0.19				N/A	1.2		0.79	4.8		6		N/A	3.3	N/A	1.3	0.31	0.13	4.4
Fluoranthene	0.16	1.7			0.82	N/A	3.2	0.26	0.68	7.3		17	9.3	N/A	20	N/A	1.3	1.9	1.3	24
Pyrene	0.43	1.1	0.044	1.5	0.89	N/A	3.5	0.68	0.78	7.3	0.22	11	7.7	N/A	13	N/A	1.4	4.2	1.3	15
Benzo(a)anthracene		0.38				N/A	2.1	0.1	0.74	7.1		13	7.4	N/A	12	N/A	2.5	0.71	0.34	5.7
Chrysene	0.11	0.66			4.8	N/A	5.1	0.16	1.2	14		17	16	N/A	17	N/A	10	1.2	0.66	8.4
Benzo(b)fluoranthene		0.46				N/A				6.4		8.9	5.7	N/A	7.7	N/A		0.73	0.47	4.6
Benzo(k)fluoranthene		0.47				N/A			0.27	5.4		8.4	5.1	N/A	6.7	N/A		0.74	0.51	5.1
Benzo(a)pyrene		0.38			1.7	N/A				6.2		9.6	5.4	N/A	7.7	N/A	1.3	0.81	0.49	5.3
Indeno(1,2,3-cd)pyrene						N/A								N/A		N/A		0.61		3.1
Dibenzo(a,h)anthracene						N/A								N/A		N/A				
Benzo(g,h,i)perylene						N/A								N/A		N/A				3
Total PAH compounds	1.08	7.17	0.044	3.2	8.21	N/A	18.9	1.47	5.28	64.6	0.49	107.9	70.1	N/A	116.8	N/A	19.5	13.34	6.12	111.8
Total PCBs				0.32	1.9	N/A	0.7		0.37	2.6	0.24	1.7	1.43	N/A	1.5	N/A	1.5			
Methylene chloride	N/A	N/A	N/A	N/A	N/A	0.052B	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A		N/A	N/A	N/A	N/A
Dichloroethylene	N/A	N/A	N/A	N/A	N/A	0.018B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	190	N/A	19	N/A	N/A	N/A	N/A
Trichloroethylene	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A		N/A	N/A	N/A	N/A

al\pahtab1

Notes:
(1) Blank spaces indicate that the analyte was not detected.
(2) Samples designated with an "s" represent split sampling data performed by the NYSDEC in July 1993.
(3) N/A indicates that the analyte was not analyzed for.

Table 2

Septic Tank Sludge Precharacterization Analysis

Former Accurate Die Casting Facility
Fayetteville, New York

Analyte (ppm)	NYSDEC TAGM Level	Septic Tank Sludge
Aluminum	30 or SB	15,100
Antimony	30 or SB	19 J
Arsenic	7.5 or SB	6.7
Barium	300 or SB	83.5
Beryllium	0.14	0.87
Cadmium	1 or SB	ND
Calcium	SB	55,500
Chromium	10 or SB	27
Cobalt	30 or SB	12.3
Copper	25 or SB	65.7 J
Iron	2,000 or SB	24,600
Lead	30 or SB	23.3
Magnesium	SB	28,000
Manganese	SB	891
Mercury	0.10	ND
Nickel	13 or SB	28.2
Potassium	4,000 or SB	2,200
Selenium	2 or SB	ND
Silver	200 or SB	ND
Sodium	3,000 or SB	126
Thallium	20 or SB	ND
Vanadium	150 or SB	31.9
Zinc	20 or SB	644

Notes: SB means Site Background
ND indicates the analyte was not detected

Table 3
Project Schedule

Former Accurate Die Casting Site
Fayetteville, New York

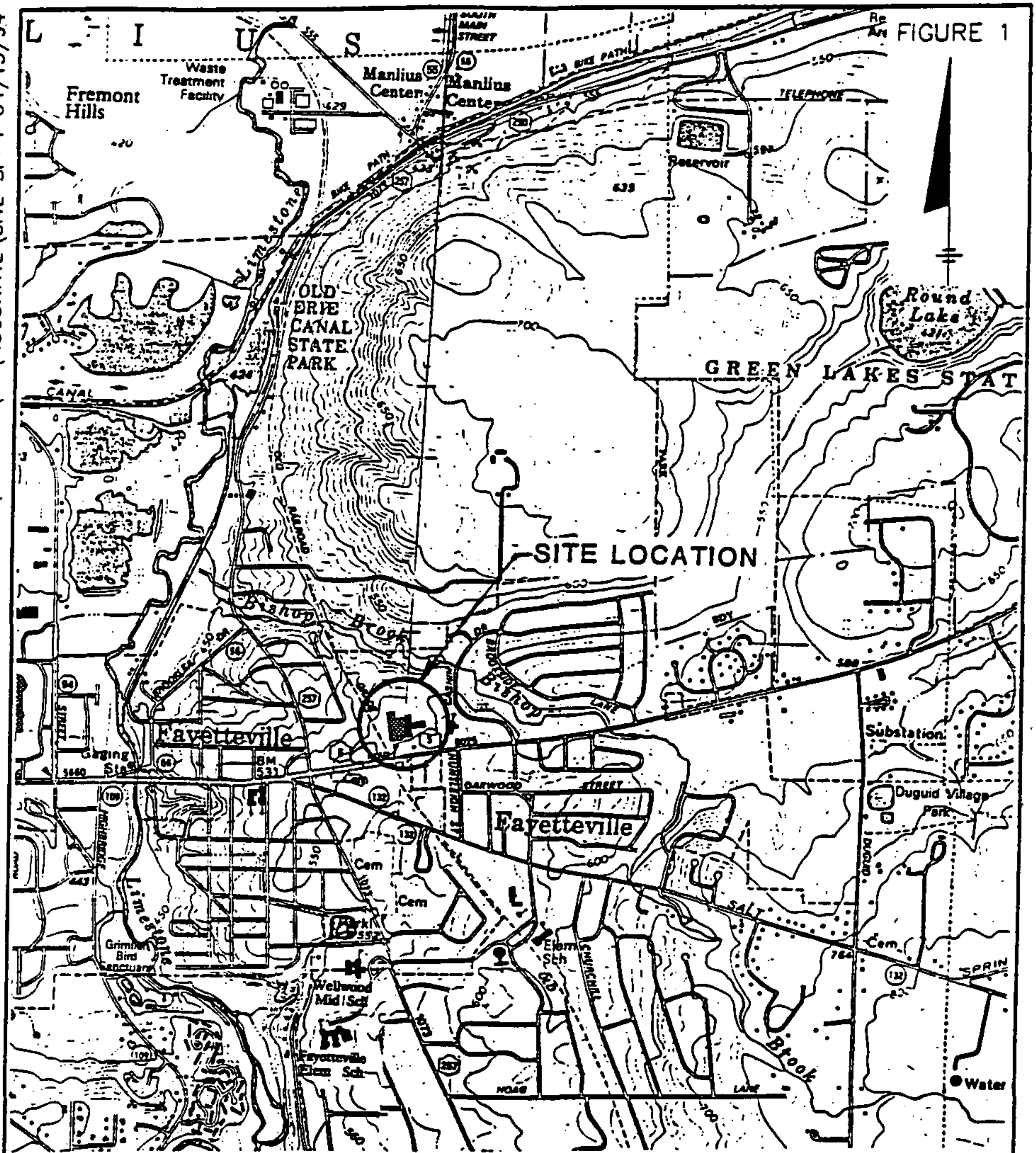
Description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Project Planning																													
– Work Plan approved by the NYSDEC	■																												
Precharacterization Investigations																													
– Additional soil boring/sampling and septic tank sampling			■	■																									
– Laboratory analyses					■	■																							
– Prepare waste profile sheets and obtain disposal facility acceptance							■	■	■																				
Excavation Plan Development																													
– Excavation area survey							■																						
– Submittal of excavation plan to the NYSDEC								■																					
– NYSDEC review of the excavation plan									■																				
– Comment response										■																			
– Excavation Plan approved											■																		
Material Excavation, Removal, and Disposal																													
– mobilization and site controls installed												■																	
– Excavation/transportation/disposal													■	■	■	■													
– Verification soil sampling and analyses																■													
– Laboratory analyses																	■												
– Preliminary verification results to DEC																		■											
– Backfilling & Restoration																			■										
Summary Report																													
– Verification data validation																			■	■	■	■	■	■	■	■	■	■	
– Report preparation																									■	■	■	■	
– Report submittal to the NYSDEC																													■

al\irmtab3

FIGURES

MHB H:\DIVISION\71\ACCURATE\SITE SF=1 04/15/94

FIGURE 1



ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK

SITE MAP

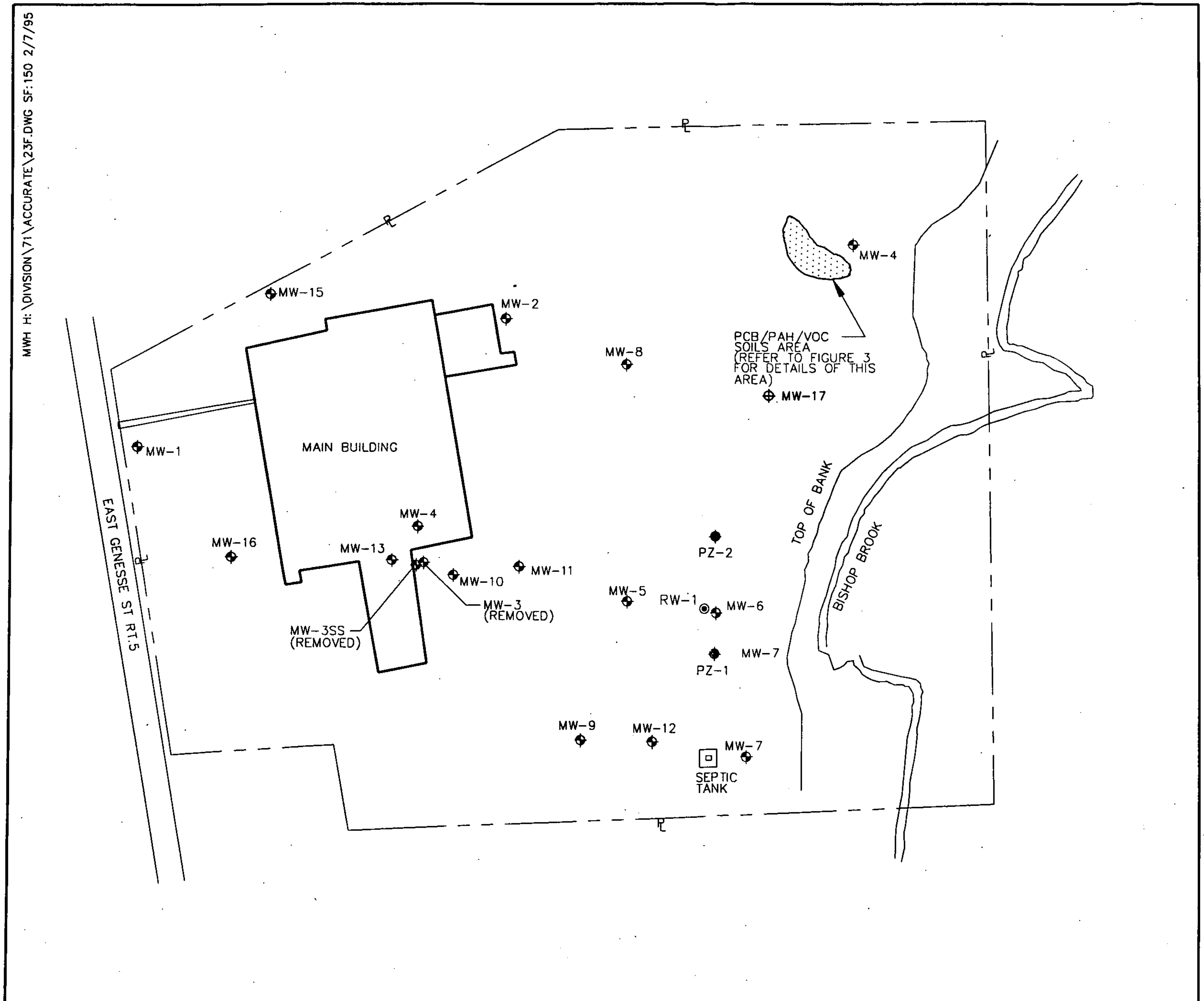
SCALE: 1" = 2,000 FT.

USGS TOPOGRAPHIC 7.5 MIN. QUAD
SYRACUSE EAST, N.Y. QUADRANGLE

FILE NO. 2488.396-

O'BRIEN & GERE ENGINEERS INC.

FIGURE 2



LEGEND

PROPERTY LINE
MW-4 MONITORING WELL
PZ-1 PIEZOMETER LOCATION
RW-1 OVERBURDEN AQUIFER RECOVERY WELL

ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK
SOIL EXCAVATION,
PCB/PAH/VOC SOILS

SITE PLAN

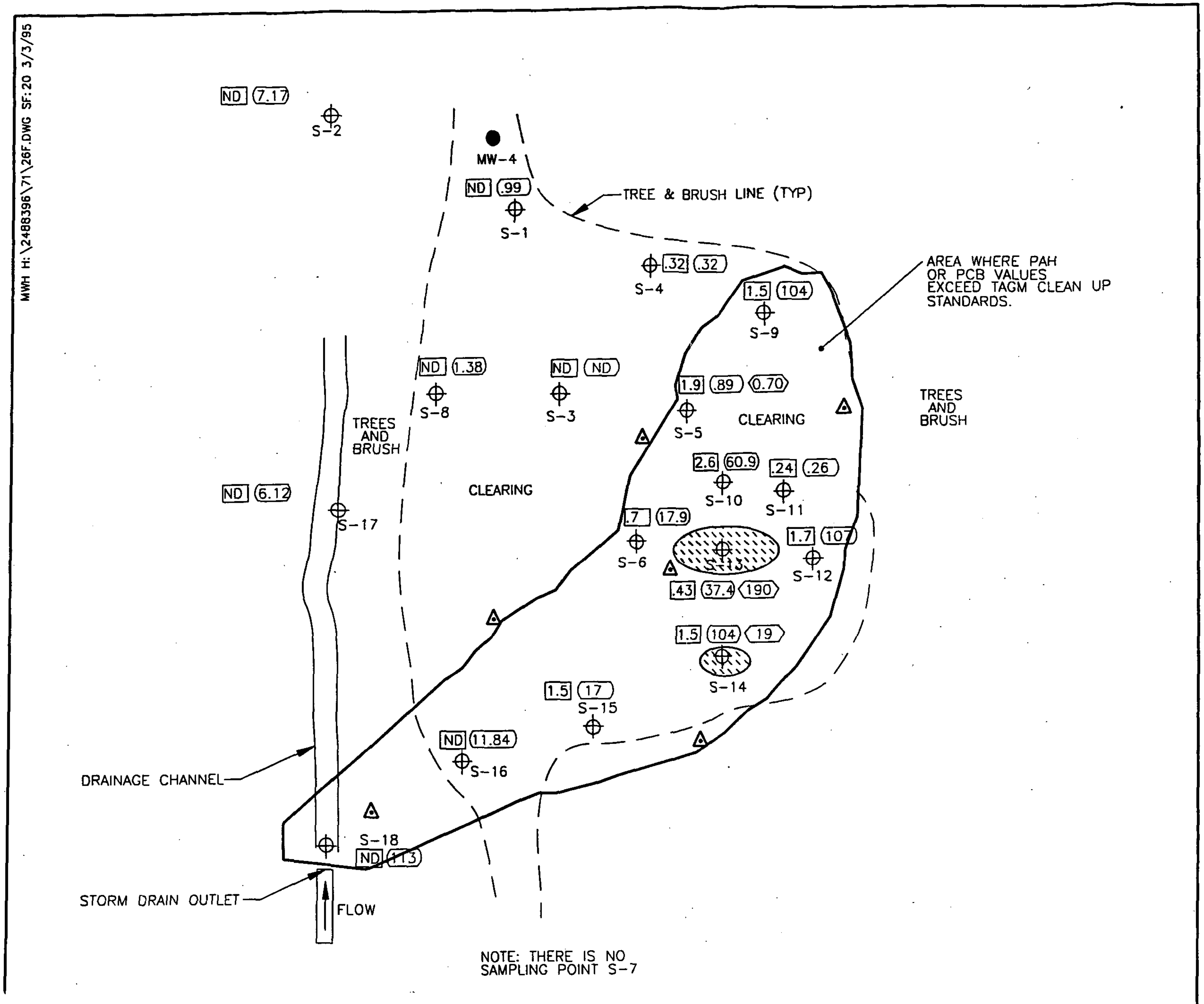
150 0 150

APPROX. SCALE IN FEET

FILE NO. 2488.396-23F

O'BRIEN & GERE ENGINEERS INC.

FIGURE 3



LEGEND

- APPROXIMATE LIMITS OF PROPOSED EXCAVATION
- 0.70 TOTAL VOC CONCENTRATION (F
- 1.9 PCB CONCENTRATION (PPM)
- .89 PAH CONCENTRATION (PPM)
- APPROX. SAMPLING POINT
- PROPOSED SOIL BORING LOCATION (APPROXIMATE)
- APPROX. LOCATION OF OBSERVED SOIL STAINING

ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORI
SOIL EXCAVATION,
PCB/PAH/VOC SOILS

SAMPLING LOCATION
/ANALYTICAL RESUL

20 0 20

APPROX. SCALE IN FEET

2488.396-26F

OBRIEN & GERE

APPENDIX A

LABORATORY REPORTS

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX:	SOIL	SAMPLE ID:	S-1
CONC. LEVEL:	LOW	LAB ID:	1765104
EXTRACTION DATE:	8/2/93	DIL FACTOR:	2.00
ANALYSIS DATE:	8/14/93	% MOISTURE:	17

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	800.0 U.
2	208-96-8	Acenaphthylene	800.0 U.
3	83-32-9	Acenaphthene	800.0 U.
4	86-73-7	Fluorene	800.0 U.
5	85-01-8	Phenanthrene	180.0 J.
6	120-12-7	Anthracene	800.0 U.
7	206-44-0	Fluoranthene	150.0 J.
8	129-00-0	Pyrene	430.0 J.
9	56-55-3	Benzo(a)Anthracene	800.0 U.
10	218-01-9	Chrysene	800.0 U.
11	205-99-2	Benzo(b)Fluoranthene	800.0 U.
12	207-08-9	Benzo(k)Fluoranthene	800.0 U.
13	50-32-8	Benzo(a)Pyrene	800.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	800.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	800.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	800.0 U.

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX:	SOIL	SAMPLE ID:	S-1RE
CONC. LEVEL:	LOW	LAB ID:	1765104
EXTRACTION DATE:	8/2/93	DIL FACTOR:	2.00
ANALYSIS DATE:	8/18/93	% MOISTURE:	17

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	800.0 U.
2	208-96-8	Acenaphthylene	800.0 U.
3	83-32-9	Acenaphthene	800.0 U.
4	86-73-7	Fluorene	800.0 U.
5	85-01-8	Phenanthrene	190.0 J.
6	120-12-7	Anthracene	190.0 J.
7	206-44-0	Fluoranthene	160.0 J.
8	129-00-0	Pyrene	340.0 J.
9	56-55-3	Benzo(a)Anthracene	800.0 U.
10	218-01-9	Chrysene	110.0 J.
11	205-99-2	Benzo(b)Fluoranthene	800.0 U.
12	207-08-9	Benzo(k)Fluoranthene	800.0 U.
13	50-32-8	Benzo(a)Pyrene	800.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	800.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	800.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	800.0 U.

1 D-T

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX:	SOIL	SAMPLE ID:	S-1
CONC. LEVEL:	LOW	LAB SAMPLE ID:	1765104
EXTRACTION DATE:	8/02/93	DIL FACTOR:	1.00
ANALYSIS DATE:	8/15/93	% MOISTURE:	17

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	100.000 U.
22	11104-28-2	Aroclor-1221	100.000 U.
23	11141-16-5	Aroclor-1232	100.000 U.
24	53469-21-9	Aroclor-1242	100.000 U.
25	12672-29-6	Aroclor-1248	100.000 U.
26	11097-69-1	Aroclor-1254	190.000 U.
27	11096-82-5	Aroclor-1260	190.000 U.

1B PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/13/93

SAMPLE ID: S-2
LAB ID: 1765101
DIL FACTOR: 2.00
% MOISTURE: 22

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	800.0 U.
2	208-96-8	Acenaphthylene	800.0 U.
3	83-32-9	Acenaphthene	120.0 J.
4	86-73-7	Fluorene	110.0 J.
5	85-01-8	Phenanthrene	1600.0
6	120-12-7	Anthracene	190.0 J.
7	206-44-0	Fluoranthene	1700.0
8	129-00-0	Pyrene	1100.0
9	56-55-3	Benzo(a)Anthracene	380.0 J.
10	218-01-9	Chrysene	660.0 J.
11	205-99-2	Benzo(b)Fluoranthene	460.0 J.
12	207-08-9	Benzo(k)Fluoranthene	470.0 J.
13	50-32-8	Benzo(a)Pyrene	380.0 J.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	800.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	800.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	800.0 U.

1 D-T

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX:	SOIL	SAMPLE ID:	S-2
CONC. LEVEL:	LOW	LAB SAMPLE ID:	1765101
EXTRACTION DATE:	8/02/93	DIL FACTOR:	1.00
ANALYSIS DATE:	8/14/93	% MOISTURE:	22

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	100.000 U.
22	11104-28-2	Aroclor-1221	100.000 U.
23	11141-16-5	Aroclor-1232	100.000 U.
24	53469-21-9	Aroclor-1242	100.000 U.
25	12672-29-6	Aroclor-1248	100.000 U.
26	11097-69-1	Aroclor-1254	210.000 U.
27	11096-82-5	Aroclor-1260	210.000 U.

18 PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/13/93

SAMPLE ID: S-3
LAB ID: 1765102
DIL FACTOR: 1.00
% MOISTURE: 19

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	400.0 U.
2	208-96-8	Acenaphthylene	400.0 U.
3	83-32-9	Acenaphthene	400.0 U.
4	86-73-7	Fluorene	400.0 U.
5	85-01-8	Phenanthrene	400.0 U.
6	120-12-7	Anthracene	400.0 U.
7	206-44-0	Fluoranthene	400.0 U.
8	129-00-0	Pyrene	400.0 U.
9	56-55-3	Benzo(a)Anthracene	400.0 U.
10	218-01-9	Chrysene	400.0 U.
11	205-99-2	Benzo(b)Fluoranthene	400.0 U.
12	207-08-9	Benzo(k)Fluoranthene	400.0 U.
13	50-32-8	Benzo(a)Pyrene	400.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	400.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	400.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	400.0 U.

1B PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/16/93

SAMPLE ID: S-3RE
LAB ID: 1765102
DIL FACTOR: 1.00
% MOISTURE: 19

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	400.0 U.
2	208-96-8	Acenaphthylene	400.0 U.
3	83-32-9	Acenaphthene	400.0 U.
4	86-73-7	Fluorene	400.0 U.
5	85-01-8	Phenanthrene	400.0 U.
6	120-12-7	Anthracene	400.0 U.
7	206-44-0	Fluoranthene	400.0 U.
8	129-00-0	Pyrene	44.0 J.
9	56-55-3	Benzo(a)Anthracene	400.0 U.
10	218-01-9	Chrysene	400.0 U.
11	205-99-2	Benzo(b)Fluoranthene	400.0 U.
12	207-08-9	Benzo(k)Fluoranthene	400.0 U.
13	50-32-8	Benzo(a)Pyrene	400.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	400.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	400.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	400.0 U.

1 D-T

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/14/93

SAMPLE ID: S-3
LAB SAMPLE ID: 1765102
DIL FACTOR: 1.00
% MOISTURE: 19

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	100.000 U.
22	11104-28-2	Aroclor-1221	100.000 U.
23	11141-16-5	Aroclor-1232	100.000 U.
24	53469-21-9	Aroclor-1242	100.000 U.
25	12672-29-6	Aroclor-1248	100.000 U.
26	11097-69-1	Aroclor-1254	200.000 U.
27	11096-82-5	Aroclor-1260	200.000 U.

1B PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/13/93

SAMPLE ID: S-4
LAB ID: 1765120
DIL FACTOR: 20.00
% MOISTURE: 44

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	12000.0 U.
2	208-96-8	Acenaphthylene	12000.0 U.
3	83-32-9	Acenaphthene	12000.0 U.
4	86-73-7	Fluorene	12000.0 U.
5	85-01-8	Phenanthrene	1700.0 J.
6	120-12-7	Anthracene	12000.0 U.
7	206-44-0	Fluoranthene	12000.0 U.
8	129-00-0	Pyrene	1500.0 J.
9	56-55-3	Benzo(a)Anthracene	12000.0 U.
10	218-01-9	Chrysene	12000.0 U.
11	205-99-2	Benzo(b)Fluoranthene	12000.0 U.
12	207-08-9	Benzo(k)Fluoranthene	12000.0 U.
13	50-32-8	Benzo(a)Pyrene	12000.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	12000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	12000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	12000.0 U.

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX:	SOIL	SAMPLE ID:	S-4RE
CONC. LEVEL:	LOW	LAB ID:	1765120
EXTRACTION DATE:	8/2/93	DIL FACTOR:	20.00
ANALYSIS DATE:	8/16/93	% MOISTURE:	44

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	12000.0 U.
2	208-96-8	Acenaphthylene	12000.0 U.
3	83-32-9	Acenaphthene	12000.0 U.
4	86-73-7	Fluorene	12000.0 U.
5	85-01-8	Phenanthrene	1500.0 J.
6	120-12-7	Anthracene	12000.0 U.
7	206-44-0	Fluoranthene	12000.0 U.
8	129-00-0	Pyrene	12000.0 U.
9	56-55-3	Benzo(a)Anthracene	12000.0 U.
10	218-01-9	Chrysene	12000.0 U.
11	205-99-2	Benzo(b)Fluoranthene	12000.0 U.
12	207-08-9	Benzo(k)Fluoranthene	12000.0 U.
13	50-32-8	Benzo(a)Pyrene	12000.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	12000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	12000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	12000.0 U.

1 D-T
NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/14/93

SAMPLE ID: S-4
LAB SAMPLE ID: 1765120
DIL FACTOR: 5.00
% MOISTURE: 44

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	710.000 U.
22	11104-28-2	Aroclor-1221	710.000 U.
23	11141-16-5	Aroclor-1232	710.000 U.
24	53469-21-9	Aroclor-1242	710.000 U.
25	12672-29-6	Aroclor-1248	710.000 U.
26	11097-69-1	Aroclor-1254	1400.000 U.
27	11096-82-5	Aroclor-1260	320.000 J.

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/18/93

SAMPLE ID: DUPDL
LAB ID: 1765118
DIL FACTOR: 24.00
% MOISTURE: 30

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	2700.0 DJ
2	208-96-8	Acenaphthylene	11000.0 U.
3	83-32-9	Acenaphthene	11000.0 DJ
4	86-73-7	Fluorene	8800.0 DJ
5	85-01-8	Phenanthrene	47000.0 D.
6	120-12-7	Anthracene	15000.0 D.
7	206-44-0	Fluoranthene	49000.0 D.
8	129-00-0	Pyrene	49000.0 D.
9	56-55-3	Benzo(a)Anthracene	19000.0 D.
10	218-01-9	Chrysene	24000.0 D.
11	205-99-2	Benzo(b)Fluoranthene	12000.0 D.
12	207-08-9	Benzo(k)Fluoranthene	13000.0 D.
13	50-32-8	Benzo(a)Pyrene	15000.0 D.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	11000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	11000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	11000.0 U.

1B PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/17/93

SAMPLE ID: DUP
LAB ID: 1765118
DIL FACTOR: 5.00
% MOISTURE: 30

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	2500.0
2	208-96-8	Acenaphthylene	2400.0 U.
3	83-32-9	Acenaphthene	9500.0
4	86-73-7	Fluorene	6700.0
5	85-01-8	Phenanthrene	18000.0
6	120-12-7	Anthracene	11000.0
7	206-44-0	Fluoranthene	21000.0
8	129-00-0	Pyrene	60000.0 E.
9	56-55-3	Benzo(a)Anthracene	18000.0
10	218-01-9	Chrysene	24000.0 E.
11	205-99-2	Benzo(b)Fluoranthene	10000.0
12	207-08-9	Benzo(k)Fluoranthene	12000.0
13	50-32-8	Benzo(a)Pyrene	15000.0
14	193-39-5	Indeno(1,2,3-cd)Pyrene	8800.0
15	53-70-3	Dibenz(a,h)Anthracene	2400.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	8000.0

1 D-T

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: WATER
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/14/93

SAMPLE ID: WASH BLK
LAB SAMPLE ID: 1765121
DIL FACTOR: 1.43
% MOISTURE: NA

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/L
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	0.700 U.
22	11104-28-2	Aroclor-1221	0.700 U.
23	11141-16-5	Aroclor-1232	0.700 U.
24	53469-21-9	Aroclor-1242	0.700 U.
25	12672-29-6	Aroclor-1248	0.700 U.
26	11097-69-1	Aroclor-1254	1.000 U.
27	11096-82-5	Aroclor-1260	1.000 U.

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX:	SOIL	SAMPLE ID:	S-5
CONC. LEVEL:	LOW	LAB ID:	1765107
EXTRACTION DATE:	8/2/93	DIL FACTOR:	10.00
ANALYSIS DATE:	8/13/93	% MOISTURE:	34

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	5000.0 U.
2	208-96-8	Acenaphthylene	5000.0 U.
3	83-32-9	Acenaphthene	5000.0 U.
4	86-73-7	Fluorene	5000.0 U.
5	85-01-8	Phenanthrene	5000.0 U.
6	120-12-7	Anthracene	5000.0 U.
7	206-44-0	Fluoranthene	5000.0 U.
8	129-00-0	Pyrene	890.0 J.
9	56-55-3	Benzo(a)Anthracene	5000.0 U.
10	218-01-9	Chrysene	4800.0 J.
11	205-99-2	Benzo(b)Fluoranthene	5000.0 U.
12	207-08-9	Benzo(k)Fluoranthene	5000.0 U.
13	50-32-8	Benzo(a)Pyrene	5000.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	5000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	5000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	5000.0 U.

1B PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/17/93

SAMPLE ID: S-5RE
LAB ID: 1765107
DIL FACTOR: 10.00
% MOISTURE: 34

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	5000.0 U.
2	208-96-8	Acenaphthylene	5000.0 U.
3	83-32-9	Acenaphthene	5000.0 U.
4	86-73-7	Fluorene	5000.0 U.
5	85-01-8	Phenanthrene	5000.0 U.
6	120-12-7	Anthracene	5000.0 U.
7	206-44-0	Fluoranthene	820.0 J.
8	129-00-0	Pyrene	630.0 J.
9	56-55-3	Benzo(a)Anthracene	5000.0 U.
10	218-01-9	Chrysene	2800.0 J.
11	205-99-2	Benzo(b)Fluoranthene	5000.0 U.
12	207-08-9	Benzo(k)Fluoranthene	5000.0 U.
13	50-32-8	Benzo(a)Pyrene	1700.0 J.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	5000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	5000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	5000.0 U.

1 D-T

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/25/93

SAMPLE ID: S-5
LAB SAMPLE ID: 1765107
DIL FACTOR: 5.00
% MOISTURE: 34

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	610.000 U.
22	11104-28-2	Aroclor-1221	610.000 U.
23	11141-16-5	Aroclor-1232	610.000 U.
24	53469-21-9	Aroclor-1242	610.000 U.
25	12672-29-6	Aroclor-1248	1900.000
26	11097-69-1	Aroclor-1254	1200.000 U.
27	11096-82-5	Aroclor-1260	1200.000 U.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

MOBILE LABORATORY VOLATILE ANALYSIS

SITE NAME:ACCURATE DIE CASTING

FIELD ID:S-5

SITE CODE: 734052 PERCENT SOLIDS: 69.0

SAMPLE NUMBER:793-211-01 MATRIX:SOIL

SUBMISSION DATE:07/30/93 ARCHIVE NO.:V21101

ANALYSIS DATE:08/03/93 DATA FILE NO.:9304C24A.D

COMPOUND	CONC (PPB)	NON TARGET COMPOUNDS:
Chloromethane	ND	
Bromomethane	ND	
Vinyl chloride	ND	
Chloroethane	ND	
Methylene chloride	52B	
Acetone	ND	
Carbon disulfide	ND	
1,1-Dichloroethene	ND	
1,1-Dichloroethane	ND	
trans-1,2-Dichloroethene	ND	
Chloroform	ND	
1,2-Dichloroethane	ND	
2-Butanone	ND	
1,1,1-Trichloroethane	ND	
Carbontetrachloride	ND	
Vinyl acetate	ND	
Bromodichloromethane	ND	
1,1,2,2-Tetrachloroethane	ND	
1,2-Dichloropropane	ND	
trans-1,3-Dichloropropene	ND	
Trichloroethene	18B	
Dibromochloromethane	ND	
1,1,2-Trichloroethane	ND	
Benzene	ND	
cis-1,3-Dichloropropene	ND	
2-Chloroethylvinylether	ND	
Bromoform	ND	
2-Hexanone	ND	
4-Methyl-2-pentanone	ND	
Tetrachloroethene	ND	
Toluene	ND	
Chlorobenzene	ND	ND = LESS THAN 5 PPB
Ethylbenzene	ND	
Styrene	ND	ALL CONCENTRATIONS LESS THAN
Total Xylenes	ND	5 PPB ARE ESTIMATES
Total Chlorotoluene	ND	
Total Dichlorobenzene	ND	

1B PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX:	SOIL	SAMPLE ID:	S-6
CONC. LEVEL:	LOW	LAB ID:	1765109
EXTRACTION DATE:	8/2/93	DIL FACTOR:	20.00
ANALYSIS DATE:	8/14/93	% MOISTURE:	31

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	10000.0 U.
2	208-96-8	Acenaphthylene	10000.0 U.
3	83-32-9	Acenaphthene	10000.0 U.
4	86-73-7	Fluorene	10000.0 U.
5	85-01-8	Phenanthrene	3800.0 J.
6	120-12-7	Anthracene	1100.0 J.
7	206-44-0	Fluoranthene	3200.0 J.
8	129-00-0	Pyrene	3500.0 J.
9	56-55-3	Benzo(a)Anthracene	10000.0 U.
10	218-01-9	Chrysene	10000.0 U.
11	205-99-2	Benzo(b)Fluoranthene	10000.0 U.
12	207-08-9	Benzo(k)Fluoranthene	10000.0 U.
13	50-32-8	Benzo(a)Pyrene	10000.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	10000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	10000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	10000.0 U.

1B PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/18/93

SAMPLE ID: S-6RE
LAB ID: 1765109
DIL FACTOR: 20.00
% MOISTURE: 31

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	10000.0 U.
2	208-96-8	Acenaphthylene	10000.0 U.
3	83-32-9	Acenaphthene	10000.0 U.
4	86-73-7	Fluorene	10000.0 U.
5	85-01-8	Phenanthrene	3600.0 J.
6	120-12-7	Anthracene	1200.0 J.
7	206-44-0	Fluoranthene	3000.0 J.
8	129-00-0	Pyrene	2900.0 J.
9	56-55-3	Benzo(a)Anthracene	2100.0 J.
10	218-01-9	Chrysene	5100.0 J.
11	205-99-2	Benzo(b)Fluoranthene	10000.0 U.
12	207-08-9	Benzo(k)Fluoranthene	10000.0 U.
13	50-32-8	Benzo(a)Pyrene	10000.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	10000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	10000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	10000.0 U.

0000042

1 D-T

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/25/93

SAMPLE ID: S-6
LAB SAMPLE ID: 1765109
DIL FACTOR: 5.00
% MOISTURE: 31

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	580.000 U.
22	11104-28-2	Aroclor-1221	580.000 U.
23	11141-16-5	Aroclor-1232	580.000 U.
24	53469-21-9	Aroclor-1242	580.000 U.
25	12672-29-6	Aroclor-1248	580.000 U.
26	11097-69-1	Aroclor-1254	700.000 J.
27	11096-82-5	Aroclor-1260	1200.000 U.

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX:	SOIL	SAMPLE ID:	S-8
CONC. LEVEL:	LOW	LAB ID:	1765103
EXTRACTION DATE:	8/2/93	DIL FACTOR:	2.00
ANALYSIS DATE:	8/14/93	% MOISTURE:	17

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	1000.0 U.
2	208-96-8	Acenaphthylene	1000.0 U.
3	83-32-9	Acenaphthene	1000.0 U.
4	86-73-7	Fluorene	1000.0 U.
5	85-01-8	Phenanthrene	270.0 J.
6	120-12-7	Anthracene	1000.0 U.
7	206-44-0	Fluoranthene	260.0 J.
8	129-00-0	Pyrene	680.0 J.
9	56-55-3	Benzo(a)Anthracene	1000.0 U.
10	218-01-9	Chrysene	1000.0 U.
11	205-99-2	Benzo(b)Fluoranthene	1000.0 U.
12	207-08-9	Benzo(k)Fluoranthene	1000.0 U.
13	50-32-8	Benzo(a)Pyrene	1000.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	1000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	1000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	1000.0 U.

1B PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/18/93

SAMPLE ID: S-8RE
LAB ID: 1765103
DIL FACTOR: 2.00
% MOISTURE: 17

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	1000.0 U.
2	208-96-8	Acenaphthylene	1000.0 U.
3	83-32-9	Acenaphthene	1000.0 U.
4	86-73-7	Fluorene	1000.0 U.
5	85-01-8	Phenanthrene	260.0 J.
6	120-12-7	Anthracene	1000.0 U.
7	206-44-0	Fluoranthene	260.0 J.
8	129-00-0	Pyrene	600.0 J.
9	56-55-3	Benzo(a)Anthracene	100.0 J.
10	218-01-9	Chrysene	160.0 J.
11	205-99-2	Benzo(b)Fluoranthene	1000.0 U.
12	207-08-9	Benzo(k)Fluoranthene	1000.0 U.
13	50-32-8	Benzo(a)Pyrene	1000.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	1000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	1000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	1000.0 U.

1 D-T

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/14/93

SAMPLE ID: S-8
LAB SAMPLE ID: 1765103
DIL FACTOR: 1.00
% MOISTURE: 17

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	100.000 U.
22	11104-28-2	Aroclor-1221	100.000 U.
23	11141-16-5	Aroclor-1232	100.000 U.
24	53469-21-9	Aroclor-1242	100.000 U.
25	12672-29-6	Aroclor-1248	100.000 U.
26	11097-69-1	Aroclor-1254	190.000 U.
27	11096-82-5	Aroclor-1260	190.000 U.

1B PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX:	SOIL	SAMPLE ID:	S-9
CONC. LEVEL:	LOW	LAB ID:	1765106
EXTRACTION DATE:	8/2/93	DIL FACTOR:	4.00
ANALYSIS DATE:	8/14/93	% MOISTURE:	42

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	2000.0 U.
2	208-96-8	Acenaphthylene	2000.0 U.
3	83-32-9	Acenaphthene	2000.0 U.
4	86-73-7	Fluorene	2000.0 U.
5	85-01-8	Phenanthrene	780.0 J.
6	120-12-7	Anthracene	280.0 J.
7	206-44-0	Fluoranthene	660.0 J.
8	129-00-0	Pyrene	780.0 J.
9	56-55-3	Benzo(a)Anthracene	2000.0 U.
10	218-01-9	Chrysene	800.0 J.
11	205-99-2	Benzo(b)Fluoranthene	2000.0 U.
12	207-08-9	Benzo(k)Fluoranthene	2000.0 U.
13	50-32-8	Benzo(a)Pyrene	2000.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	2000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	2000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	2000.0 U.

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX:	SOIL	SAMPLE ID:	S-9RE
CONC. LEVEL:	LOW	LAB ID:	1765106
EXTRACTION DATE:	8/2/93	DIL FACTOR:	4.00
ANALYSIS DATE:	8/18/93	% MOISTURE:	42

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	2000.0 U.
2	208-96-8	Acenaphthylene	2000.0 U.
3	83-32-9	Acenaphthene	2000.0 U.
4	86-73-7	Fluorene	2000.0 U.
5	85-01-8	Phenanthrene	820.0 J.
6	120-12-7	Anthracene	790.0 J.
7	206-44-0	Fluoranthene	680.0 J.
8	129-00-0	Pyrene	760.0 J.
9	56-55-3	Benzo(a)Anthracene	740.0 J.
10	218-01-9	Chrysene	1200.0 J.
11	205-99-2	Benzo(b)Fluoranthene	2000.0 U.
12	207-08-9	Benzo(k)Fluoranthene	270.0 J.
13	50-32-8	Benzo(a)Pyrene	2000.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	2000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	2000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	2000.0 U.

1 D-T
NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/25/93

SAMPLE ID: S-9
LAB SAMPLE ID: 1765106
DIL FACTOR: 5.00
% MOISTURE: 42

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	690.000 U.
22	11104-28-2	Aroclor-1221	690.000 U.
23	11141-16-5	Aroclor-1232	690.000 U.
24	53469-21-9	Aroclor-1242	690.000 U.
25	12672-29-6	Aroclor-1248	690.000 U.
26	11097-69-1	Aroclor-1254	1400.000 U.
27	11096-82-5	Aroclor-1260	370.000 J.

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: WATER
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/14/93

SAMPLE ID: WASH BLK
LAB ID: 1765121
DIL FACTOR: 1.00
% MOISTURE: NA

CMPD #	CAS Number	PAH COMPOUNDS	UG/L
1	91-20-3	Naphthalene	10.0 U.
2	208-96-8	Acenaphthylene	10.0 U.
3	83-32-9	Acenaphthene	10.0 U.
4	86-73-7	Fluorene	10.0 U.
5	85-01-8	Phenanthrene	10.0 U.
6	120-12-7	Anthracene	10.0 U.
7	206-44-0	Fluoranthene	10.0 U.
8	129-00-0	Pyrene	10.0 U.
9	56-55-3	Benzo(a)Anthracene	10.0 U.
10	218-01-9	Chrysene	10.0 U.
11	205-99-2	Benzo(b)Fluoranthene	10.0 U.
12	207-08-9	Benzo(k)Fluoranthene	10.0 U.
13	50-32-8	Benzo(a)Pyrene	10.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	10.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	10.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	10.0 U.

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/17/93

SAMPLE ID: S-10
LAB ID: 1765110
DIL FACTOR: 30.00
% MOISTURE: 22

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	13000.0 U.
2	208-96-8	Acenaphthylene	13000.0 U.
3	83-32-9	Acenaphthene	13000.0 U.
4	86-73-7	Fluorene	13000.0 U.
5	85-01-8	Phenanthrene	5900.0 J.
6	120-12-7	Anthracene	4000.0 J.
7	206-44-0	Fluoranthene	7300.0 J.
8	129-00-0	Pyrene	6700.0 J.
9	56-55-3	Benzo(a)Anthracene	7100.0 J.
10	218-01-9	Chrysene	10000.0 J.
11	205-99-2	Benzo(b)Fluoranthene	6100.0 J.
12	207-08-9	Benzo(k)Fluoranthene	5400.0 J.
13	50-32-8	Benzo(a)Pyrene	6000.0 J.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	13000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	13000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	13000.0 U.

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/18/93

SAMPLE ID: S-10RE
LAB ID: 1765110
DIL FACTOR: 30.00
% MOISTURE: 22

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	13000.0 U.
2	208-96-8	Acenaphthylene	13000.0 U.
3	83-32-9	Acenaphthene	13000.0 U.
4	86-73-7	Fluorene	13000.0 U.
5	85-01-8	Phenanthrene	6100.0 J.
6	120-12-7	Anthracene	4800.0 J.
7	206-44-0	Fluoranthene	7300.0 J.
8	129-00-0	Pyrene	7300.0 J.
9	56-55-3	Benzo(a)Anthracene	4400.0 J.
10	218-01-9	Chrysene	14000.0
11	205-99-2	Benzo(b)Fluoranthene	6400.0 J.
12	207-08-9	Benzo(k)Fluoranthene	4400.0 J.
13	50-32-8	Benzo(a)Pyrene	6200.0 J.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	13000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	13000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	13000.0 U.

1 D-T

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX:	SOIL	SAMPLE ID:	S-10
CONC. LEVEL:	LOW	LAB SAMPLE ID:	1765110
EXTRACTION DATE:	8/02/93	DIL FACTOR:	5.00
ANALYSIS DATE:	8/25/93	% MOISTURE:	22

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	510.000 U.
22	11104-28-2	Aroclor-1221	510.000 U.
23	11141-16-5	Aroclor-1232	510.000 U.
24	53469-21-9	Aroclor-1242	510.000 U.
25	12672-29-6	Aroclor-1248	2600.000
26	11097-69-1	Aroclor-1254	1000.000 U.
27	11096-82-5	Aroclor-1260	1000.000 U.

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/17/93

SAMPLE ID: S-11
LAB ID: 1765119
DIL FACTOR: 5.00
% MOISTURE: 28

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	2000.0 U.
2	208-96-8	Acenaphthylene	2000.0 U.
3	83-32-9	Acenaphthene	2000.0 U.
4	86-73-7	Fluorene	2000.0 U.
5	85-01-8	Phenanthrene	270.0 J.
6	120-12-7	Anthracene	2000.0 U.
7	206-44-0	Fluoranthene	2000.0 U.
8	129-00-0	Pyrene	220.0 J.
9	56-55-3	Benzo(a)Anthracene	2000.0 U.
10	218-01-9	Chrysene	2000.0 U.
11	205-99-2	Benzo(b)Fluoranthene	2000.0 U.
12	207-08-9	Benzo(k)Fluoranthene	2000.0 U.
13	50-32-8	Benzo(a)Pyrene	2000.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	2000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	2000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	2000.0 U.

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/18/93

SAMPLE ID: S-11RE
LAB ID: 1765119
DIL FACTOR: 5.00
% MOISTURE: 28

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	2000.0 U.
2	208-96-8	Acenaphthylene	2000.0 U.
3	83-32-9	Acenaphthene	2000.0 U.
4	86-73-7	Fluorene	2000.0 U.
5	85-01-8	Phenanthrene	260.0 J.
6	120-12-7	Anthracene	2000.0 U.
7	206-44-0	Fluoranthene	2000.0 U.
8	129-00-0	Pyrene	2000.0 U.
9	56-55-3	Benzo(a)Anthracene	2000.0 U.
10	218-01-9	Chrysene	2000.0 U.
11	205-99-2	Benzo(b)Fluoranthene	2000.0 U.
12	207-08-9	Benzo(k)Fluoranthene	2000.0 U.
13	50-32-8	Benzo(a)Pyrene	2000.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	2000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	2000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	2000.0 U.

1 D-T

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/25/93

SAMPLE ID: S-11
LAB SAMPLE ID: 1765119
DIL FACTOR: 5.00
% MOISTURE: 28

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	560.000 U.
22	11104-28-2	Aroclor-1221	560.000 U.
23	11141-16-5	Aroclor-1232	560.000 U.
24	53469-21-9	Aroclor-1242	560.000 U.
25	12672-29-6	Aroclor-1248	560.000 U.
26	11097-69-1	Aroclor-1254	1100.000 U.
27	11096-82-5	Aroclor-1260	240.000

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/17/93

SAMPLE ID: S-12
LAB ID: 1765114
DIL FACTOR: 30.00
% MOISTURE: 17

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	12000.0 U.
2	208-96-8	Acenaphthylene	12000.0 U.
3	83-32-9	Acenaphthene	12000.0 U.
4	86-73-7	Fluorene	12000.0 U.
5	85-01-8	Phenanthrene	14000.0
6	120-12-7	Anthracene	2300.0 J.
7	206-44-0	Fluoranthene	15000.0
8	129-00-0	Pyrene	11000.0 J.
9	56-55-3	Benzo(a)Anthracene	9900.0 J.
10	218-01-9	Chrysene	13000.0
11	205-99-2	Benzo(b)Fluoranthene	8400.0 J.
12	207-08-9	Benzo(k)Fluoranthene	7900.0 J.
13	50-32-8	Benzo(a)Pyrene	9600.0 J.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	12000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	12000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	12000.0 U.

1B PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/18/93

SAMPLE ID: S-12RE
LAB ID: 1765114
DIL FACTOR: 30.00
% MOISTURE: 17

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	12000.0 U.
2	208-96-8	Acenaphthylene	12000.0 U.
3	83-32-9	Acenaphthene	2000.0 J.
4	86-73-7	Fluorene	12000.0 U.
5	85-01-8	Phenanthrene	15000.0
6	120-12-7	Anthracene	6000.0 J.
7	206-44-0	Fluoranthene	17000.0
8	129-00-0	Pyrene	11000.0 J.
9	56-55-3	Benzo(a)Anthracene	13000.0
10	218-01-9	Chrysene	17000.0
11	205-99-2	Benzo(b)Fluoranthene	8900.0 J.
12	207-08-9	Benzo(k)Fluoranthene	8400.0 J.
13	50-32-8	Benzo(a)Pyrene	9000.0 J.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	12000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	12000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	12000.0 U.

1 D-T

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/25/93

SAMPLE ID: S-12
LAB SAMPLE ID: 1765114
DIL FACTOR: 5.00
% MOISTURE: 17

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	480.000 U.
22	11104-28-2	Aroclor-1221	480.000 U.
23	11141-16-5	Aroclor-1232	480.000 U.
24	53469-21-9	Aroclor-1242	480.000 U.
25	12672-29-6	Aroclor-1248	1700.000
26	11097-69-1	Aroclor-1254	960.000 U.
27	11096-82-5	Aroclor-1260	960.000 U.

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/16/93

SAMPLE ID: S-13
LAB ID: 1765111
DIL FACTOR: 30.00
% MOISTURE: 20

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	12000.0 U.
2	208-96-8	Acenaphthylene	12000.0 U.
3	83-32-9	Acenaphthene	12000.0 U.
4	86-73-7	Fluorene	12000.0 U.
5	85-01-8	Phenanthrene	12000.0 U.
6	120-12-7	Anthracene	12000.0 U.
7	206-44-0	Fluoranthene	8100.0 J.
8	129-00-0	Pyrene	3900.0 J.
9	56-55-3	Benzo(a)Anthracene	4100.0 J.
10	218-01-9	Chrysene	14000.0
11	205-99-2	Benzo(b)Fluoranthene	3100.0 J.
12	207-08-9	Benzo(k)Fluoranthene	2400.0 J.
13	50-32-8	Benzo(a)Pyrene	1800.0 J.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	12000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	12000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	12000.0 U.

1B PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/18/93

SAMPLE ID: S-13RE
LAB ID: 1765111
DIL FACTOR: 30.00
% MOISTURE: 20

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	12000.0 U.
2	208-96-8	Acenaphthylene	12000.0 U.
3	83-32-9	Acenaphthene	3500.0 J.
4	86-73-7	Fluorene	12000.0 U.
5	85-01-8	Phenanthrene	10000.0 J.
6	120-12-7	Anthracene	12000.0 U.
7	206-44-0	Fluoranthene	9300.0 J.
8	129-00-0	Pyrene	7700.0 J.
9	56-55-3	Benzo(a)Anthracene	7400.0 J.
10	218-01-9	Chrysene	16000.0
11	205-99-2	Benzo(b)Fluoranthene	5700.0 J.
12	207-08-9	Benzo(k)Fluoranthene	5100.0 J.
13	50-32-8	Benzo(a)Pyrene	5400.0 J.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	12000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	12000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	12000.0 U.

1 D-T

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/25/93

SAMPLE ID: S-13
LAB SAMPLE ID: 1765111
DIL FACTOR: 5.00
% MOISTURE: 20

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	430.000 J.
22	11104-28-2	Aroclor-1221	500.000 U.
23	11141-16-5	Aroclor-1232	500.000 U.
24	53469-21-9	Aroclor-1242	1000.000
25	12672-29-6	Aroclor-1248	500.000 U.
26	11097-69-1	Aroclor-1254	1000.000 U.
27	11096-82-5	Aroclor-1260	1000.000 U.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

MOBILE LABORATORY VOLATILE ANALYSIS

SITE NAME:ACCURATE DIE CASTING

FIELD ID:S-13

SITE CODE: 734052 PERCENT SOLIDS: 83.0

SAMPLE NUMBER:793-211-02 MATRIX:SOIL

SUBMISSION DATE:07/30/93 ARCHIVE NO.:V21102

ANALYSIS DATE:08/04/93 DATA FILE NO.:9304C31A.D

COMPOUND	CONC (PPB)	NON TARGET COMPOUNDS:
Chloromethane	ND	
Bromomethane	ND	
Vinyl chloride	ND	
Chloroethane	ND	
Methylene chloride	ND	
Acetone	ND	
Carbon disulfide	ND	
1,1-Dichloroethene	ND	
1,1-Dichloroethane	ND	
trans-1,2-Dichloroethene	190,000 J	
Chloroform	ND	
1,2-Dichloroethane	ND	
2-Butanone	ND	
1,1,1-Trichloroethane	ND	
Carbontetrachloride	ND	
Vinyl acetate	ND	
Bromodichloromethane	ND	
1,1,2,2-Tetrachloroethane	ND	
1,2-Dichloropropene	ND	
trans-1,3-Dichloropropene	ND	
Trichloroethene	ND	
Dibromochloromethane	ND	
1,1,2-Trichloroethane	ND	
Benzene	ND	
cis-1,3-Dichloropropene	ND	
2-Chloroethylvinylether	ND	
Bromoform	ND	
2-Hexanone	ND	
4-Methyl-2-pentanone	ND	
Tetrachloroethene	ND	
Toluene	ND	
Chlorobenzene	ND	ND = LESS THAN 5 PPB
Ethylbenzene	ND	
Styrene	ND	ALL CONCENTRATIONS LESS THAN
Total Xylenes	ND	5 PPB ARE ESTIMATES
Total Chlorotoluene	ND	
Total Dichlorobenzene	ND	

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/14/93

SAMPLE ID: S-14
LAB ID: 1765105
DIL FACTOR: 30.00
% MOISTURE: 29

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	14000.0 U.
2	208-96-8	Acenaphthylene	14000.0 U.
3	83-32-9	Acenaphthene	14000.0 U.
4	86-73-7	Fluorene	14000.0 U.
5	85-01-8	Phenanthrene	24000.0
6	120-12-7	Anthracene	3300.0 J.
7	206-44-0	Fluoranthene	20000.0
8	129-00-0	Pyrene	13000.0 J.
9	56-55-3	Benzo(a)Anthracene	8300.0 J.
10	218-01-9	Chrysene	17000.0
11	205-99-2	Benzo(b)Fluoranthene	6300.0 J.
12	207-08-9	Benzo(k)Fluoranthene	5400.0 J.
13	50-32-8	Benzo(a)Pyrene	6400.0 J.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	14000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	14000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	14000.0 U.

nytest environmental inc

1B PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/18/93

SAMPLE ID: S-14RE
LAB ID: 1765105
DIL FACTOR: 30.00
% MOISTURE: 29

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	14000.0 U.
2	208-96-8	Acenaphthylene	14000.0 U.
3	83-32-9	Acenaphthene	2800.0 J.
4	86-73-7	Fluorene	2600.0 J.
5	85-01-8	Phenanthrene	22000.0
6	120-12-7	Anthracene	2300.0 J.
7	206-44-0	Fluoranthene	17000.0
8	129-00-0	Pyrene	12000.0 J.
9	56-55-3	Benzo(a)Anthracene	12000.0 J.
10	218-01-9	Chrysene	14000.0
11	205-99-2	Benzo(b)Fluoranthene	7700.0 J.
12	207-08-9	Benzo(k)Fluoranthene	6700.0 J.
13	50-32-8	Benzo(a)Pyrene	7700.0 J.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	14000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	14000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	14000.0 U.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

MOBILE LABORATORY VOLATILE ANALYSIS

SITE NAME:ACCURATE DIE CASTING

FIELD ID:S-14

SITE CODE: 734052 PERCENT SOLIDS: 69.0

SAMPLE NUMBER:793-211-03 MATRIX:SOIL

SUBMISSION DATE:07/30/93 ARCHIVE NO.:V21103

ANALYSIS DATE:08/05/93 DATA FILE NO.:9304C36A.D

COMPOUND	CONC (PPB)	NON TARGET COMPOUNDS: YES
Chloromethane	ND	UNKNOWN HYDROCARBON 145,000 J
Bromomethane	ND	
Vinyl chloride	ND	
Chloroethane	ND	
Methylene chloride	ND	
Acetone	ND	
Carbon disulfide	ND	
1,1-Dichloroethene	ND	
1,1-Dichloroethane	ND	
trans-1,2-Dichloroethene	19,000 J	
Chloroform	ND	
1,2-Dichloroethane	ND	
2-Butanone	ND	
1,1,1-Trichloroethane	ND	
Carbontetrachloride	ND	
Vinyl acetate	ND	
Bromodichloromethane	ND	
1,1,2,2-Tetrachloroethane	ND	
1,2-Dichloropropane	ND	
trans-1,3-Dichloropropene	ND	
Trichloroethene	ND	
Dibromochloromethane	ND	
1,1,2-Trichloroethane	ND	
Benzene	ND	
cis-1,3-Dichloropropene	ND	
2-Chloroethylvinylether	ND	
Bromoform	ND	
2-Hexanone	ND	
4-Methyl-2-pentanone	ND	
Tetrachloroethene	ND	
Toluene	ND	
Chlorobenzene	ND	ND = LESS THAN 2500 PPB
Ethylbenzene	ND	
Styrene	ND	ALL CONCENTRATIONS LESS THAN
Total Xylenes	ND	2500 PPB ARE ESTIMATES
Total Chlorotoluene	ND	
Total Dichlorobenzene	ND	

1 D-T

.NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX:	SOIL	SAMPLE ID:	S-14
CONC. LEVEL:	LOW	LAB SAMPLE ID:	1765105
EXTRACTION DATE:	8/02/93	DIL FACTOR:	5.00
ANALYSIS DATE:	8/25/93	% MOISTURE:	29

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	560.000 U.
22	11104-28-2	Aroclor-1221	560.000 U.
23	11141-16-5	Aroclor-1232	560.000 U.
24	53469-21-9	Aroclor-1242	560.000 U.
25	12672-29-6	Aroclor-1248	1500.000
26	11097-69-1	Aroclor-1254	1100.000 U.
27	11096-82-5	Aroclor-1260	1100.000 U.

1B PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/13/93

SAMPLE ID: S-15
LAB ID: 1765108
DIL FACTOR: 10.00
% MOISTURE: 68

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	10000.0 U.
2	208-96-8	Acenaphthylene	10000.0 U.
3	83-32-9	Acenaphthene	10000.0 U.
4	86-73-7	Fluorene	10000.0 U.
5	85-01-8	Phenanthrene	1700.0 J.
6	120-12-7	Anthracene	1300.0 J.
7	206-44-0	Fluoranthene	1300.0 J.
8	129-00-0	Pyrene	1400.0 J.
9	56-55-3	Benzo(a)Anthracene	10000.0 U.
10	218-01-9	Chrysene	10000.0
11	205-99-2	Benzo(b)Fluoranthene	10000.0 U.
12	207-08-9	Benzo(k)Fluoranthene	10000.0 U.
13	50-32-8	Benzo(a)Pyrene	1300.0 J.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	10000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	10000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	10000.0 U.

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/17/93

SAMPLE ID: S-15RE
LAB ID: 1765108
DIL FACTOR: 10.00
% MOISTURE: 68

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	10000.0 U.
2	208-96-8	Acenaphthylene	10000.0 U.
3	83-32-9	Acenaphthene	10000.0 U.
4	86-73-7	Fluorene	10000.0 U.
5	85-01-8	Phenanthrene	10000.0 U.
6	120-12-7	Anthracene	10000.0 U.
7	206-44-0	Fluoranthene	10000.0 U.
8	129-00-0	Pyrene	1400.0 J.
9	56-55-3	Benzo(a)Anthracene	2500.0 J.
10	218-01-9	Chrysene	9600.0 J.
11	205-99-2	Benzo(b)Fluoranthene	10000.0 U.
12	207-08-9	Benzo(k)Fluoranthene	10000.0 U.
13	50-32-8	Benzo(a)Pyrene	10000.0 U.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	10000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	10000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	10000.0 U.

1 D-T

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/25/93

SAMPLE ID: S-15
LAB SAMPLE ID: 1765108
DIL FACTOR: 5.00
% MOISTURE: 68

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	1300.000 U.
22	11104-28-2	Aroclor-1221	1300.000 U.
23	11141-16-5	Aroclor-1232	1300.000 U.
24	53469-21-9	Aroclor-1242	1300.000 U.
25	12672-29-6	Aroclor-1248	1300.000 U.
26	11097-69-1	Aroclor-1254	2500.000 U.
27	11096-82-5	Aroclor-1260	1500.000 J.

18 PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/17/93

SAMPLE ID: S-16
LAB ID: 1765116
DIL FACTOR: 2.00
% MOISTURE: 20

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	1000.0 U.
2	208-96-8	Acenaphthylene	1000.0 U.
3	83-32-9	Acenaphthene	180.0 J.
4	86-73-7	Fluorene	150.0 J.
5	85-01-8	Phenanthrene	1800.0
6	120-12-7	Anthracene	310.0 J.
7	206-44-0	Fluoranthene	1900.0
8	129-00-0	Pyrene	4200.0
9	56-55-3	Benzo(a)Anthracene	710.0 J.
10	218-01-9	Chrysene	1200.0
11	205-99-2	Benzo(b)Fluoranthene	650.0 J.
12	207-08-9	Benzo(k)Fluoranthene	740.0 J.
13	50-32-8	Benzo(a)Pyrene	780.0 J.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	610.0 J.
15	53-70-3	Dibenz(a,h)Anthracene	1000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	1000.0 U.

1B PAH

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/18/93

SAMPLE ID: S-16RE
LAB ID: 1765116
DIL FACTOR: 2.00
% MOISTURE: 20

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	1000.0 U.
2	208-96-8	Acenaphthylene	1000.0 U.
3	83-32-9	Acenaphthene	170.0 J.
4	86-73-7	Fluorene	140.0 J.
5	85-01-8	Phenanthrene	1700.0
6	120-12-7	Anthracene	280.0 J.
7	206-44-0	Fluoranthene	1600.0
8	129-00-0	Pyrene	3800.0
9	56-55-3	Benzo(a)Anthracene	670.0 J.
10	218-01-9	Chrysene	1200.0
11	205-99-2	Benzo(b)Fluoranthene	730.0 J.
12	207-08-9	Benzo(k)Fluoranthene	740.0 J.
13	50-32-8	Benzo(a)Pyrene	810.0 J.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	1000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	1000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	1000.0 U.

1 D-T

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/18/93

SAMPLE ID: S-16
LAB SAMPLE ID: 1765116
DIL FACTOR: 5.00
% MOISTURE: 20

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	500.000 U.
22	11104-28-2	Aroclor-1221	500.000 U.
23	11141-16-5	Aroclor-1232	500.000 U.
24	53469-21-9	Aroclor-1242	500.000 U.
25	12672-29-6	Aroclor-1248	500.000 U.
26	11097-69-1	Aroclor-1254	1000.000 U.
27	11096-82-5	Aroclor-1260	1000.000 U.

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/17/93

SAMPLE ID: S-17
LAB ID: 1765117
DIL FACTOR: 2.00
% MOISTURE: 25

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	1000.0 U.
2	208-96-8	Acenaphthylene	1000.0 U.
3	83-32-9	Acenaphthene	1000.0 U.
4	86-73-7	Fluorene	1000.0 U.
5	85-01-8	Phenanthrene	920.0 J.
6	120-12-7	Anthracene	130.0 J.
7	206-44-0	Fluoranthene	1300.0
8	129-00-0	Pyrene	1300.0
9	56-55-3	Benzo(a)Anthracene	340.0 J.
10	218-01-9	Chrysene	660.0 J.
11	205-99-2	Benzo(b)Fluoranthene	470.0 J.
12	207-08-9	Benzo(k)Fluoranthene	510.0 J.
13	50-32-8	Benzo(a)Pyrene	490.0 J.
14	193-39-5	Indeno(1,2,3-cd)Pyrene	1000.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	1000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	1000.0 U.

1 D-T

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/25/93

SAMPLE ID: DUP
LAB SAMPLE ID: 1765118
DIL FACTOR: 5.00
% MOISTURE: 30

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	570.000 U.
22	11104-28-2	Aroclor-1221	570.000 U.
23	11141-16-5	Aroclor-1232	570.000 U.
24	53469-21-9	Aroclor-1242	570.000 U.
25	12672-29-6	Aroclor-1248	570.000 U.
26	11097-69-1	Aroclor-1254	1100.000 U.
27	11096-82-5	Aroclor-1260	1100.000 U.

NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/17/93

SAMPLE ID: S-17
LAB SAMPLE ID: 1765117
DIL FACTOR: 1.00
% MOISTURE: 25

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	110.000 U.
22	11104-28-2	Aroclor-1221	110.000 U.
23	11141-16-5	Aroclor-1232	110.000 U.
24	53469-21-9	Aroclor-1242	110.000 U.
25	12672-29-6	Aroclor-1248	110.000 U.
26	11097-69-1	Aroclor-1254	210.000 U.
27	11096-82-5	Aroclor-1260	210.000 U.

1B PAH
NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/17/93

SAMPLE ID: S-18
LAB ID: 1765115
DIL FACTOR: 4.00
% MOISTURE: 23

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	1200.0 J.
2	208-96-8	Acenaphthylene	2000.0 U.
3	83-32-9	Acenaphthene	3300.0
4	86-73-7	Fluorene	3000.0
5	85-01-8	Phenanthrene	12000.0
6	120-12-7	Anthracene	3600.0
7	206-44-0	Fluoranthene	12000.0
8	129-00-0	Pyrene	24000.0 E
9	56-55-3	Benzo(a)Anthracene	5600.0
10	218-01-9	Chrysene	8200.0
11	205-99-2	Benzo(b)Fluoranthene	3900.0
12	207-08-9	Benzo(k)Fluoranthene	4300.0
13	50-32-8	Benzo(a)Pyrene	5000.0
14	193-39-5	Indeno(1,2,3-cd)Pyrene	3100.0
15	53-70-3	Dibenz(a,h)Anthracene	2000.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	3000.0

NYTEST ENVIRONMENTAL INC.

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/2/93
ANALYSIS DATE: 8/18/93

SAMPLE ID: S-180L
LAB ID: 1765115
DIL FACTOR: 16.00
% MOISTURE: 23

CMPD #	CAS Number	PAH COMPOUNDS	UG/KG (DRY BASIS)
1	91-20-3	Naphthalene	1300.0 DJ
2	208-96-8	Acenaphthylene	6900.0 U.
3	83-32-9	Acenaphthene	3600.0 DJ
4	86-73-7	Fluorene	3300.0 DJ
5	85-01-8	Phenanthrene	25000.0 D
6	120-12-7	Anthracene	4400.0 DJ
7	206-44-0	Fluoranthene	24000.0 D
8	129-00-0	Pyrene	15000.0 D
9	56-55-3	Benzo(a)Anthracene	5700.0 DJ
10	218-01-9	Chrysene	8400.0 D
11	205-99-2	Benzo(b)Fluoranthene	4600.0 DJ
12	207-08-9	Benzo(k)Fluoranthene	5100.0 DJ
13	50-32-8	Benzo(a)Pyrene	5300.0 DJ
14	193-39-5	Indeno(1,2,3-cd)Pyrene	6900.0 U.
15	53-70-3	Dibenz(a,h)Anthracene	6900.0 U.
16	191-24-2	Benzo(g,h,i)Perylene	6900.0 U.

1 D-T
. NYTEST ENVIRONMENTAL INC.

TCL PESTICIDE/PCB ORGANICS ANALYSIS DATA SHEET

SAMPLE MATRIX: SOIL
CONC. LEVEL: LOW
EXTRACTION DATE: 8/02/93
ANALYSIS DATE: 8/25/93

SAMPLE ID: S-18
LAB SAMPLE ID: 1765115
DIL FACTOR: 5.00
% MOISTURE: 23

CMPD #	CAS Number	PESTICIDE/PCB COMPOUND	UG/KG (DRY BASIS)
1	319-84-6	alpha-BHC	NA
2	319-85-7	beta-BHC	NA
3	319-86-8	delta-BHC	NA
4	58-89-9	gamma-BHC(Lindane)	NA
5	76-44-8	Heptachlor	NA
6	309-00-2	Aldrin	NA
7	1024-57-3	Heptachlor Epoxide	NA
8	959-98-8	Endosulfan I	NA
9	60-57-1	Dieldrin	NA
10	72-55-9	4,4'-DDE	NA
11	70-20-8	Endrin	NA
12	33213-65-9	Endosulfan II	NA
13	72-54-8	4,4-DDD	NA
14	1031-07-8	Endosulfan Sulfate	NA
15	50-29-3	4,4'-DDT	NA
16	72-43-5	Methoxychlor	NA
17	53494-70-5	Endrin Ketone	NA
18	7421-36-3	Endrin Aldehyde	NA
19	57-74-9	Chlordane	NA
20	8001-35-2	Toxaphene	NA
21	12674-11-2	Aroclor-1016	520.000 U.
22	11104-28-2	Aroclor-1221	520.000 U.
23	11141-16-5	Aroclor-1232	520.000 U.
24	53469-21-9	Aroclor-1242	520.000 U.
25	12672-29-6	Aroclor-1248	520.000 U.
26	11097-69-1	Aroclor-1254	1000.000 U.
27	11096-82-5	Aroclor-1260	1000.000 U.

APPENDIX B

SOIL BORING PROTOCOLS

SOIL BORING PROCEDURES

Soil borings shall be completed using hollow stem augers and/or other applicable drilling methods (i.e. air rotary, spun casing) to a depth of approximately 6 feet. If the hollow stem auger drilling method is utilized for monitoring well completion, the minimum inside diameter of the augers shall be 4-1/4 inches.

Samples of the encountered subsurface materials will be collected continuously to provide physical descriptions of the material at each location. The sampling method employed will be the ASTM Method D-1586-84 using either a standard 2-foot long, 2-inch outside diameter split-barrel sampler with a 140 lb. hammer or a 3-inch outside diameter sampler with a 300 lb. hammer. Upon retrieval of the sampling barrel, the collected sample shall be described, labelled, and placed in a glass jar.

A hydrogeologist will be on-site during the drilling and sampling operations to fully describe each soil sample including but not limited to: 1) soil type, 2) color, 3) percent recovery, 4) moisture content, 5) odor and other observations, such as organic content and cohesiveness. The Wentworth Soil Classification System will be used to describe the soil samples. The hydrogeologist will be responsible for retaining a representative portion of each sample in a glass jar labeled at a minimum with: 1) site name; 2) boring number; 3) sample interval; 4) date; and, 5) time of sample collection. Split-spoon soil samples will be field screened for volatile organic compounds (VOC) for Polychlorinated Biphenyls (PCBs) using an immunoassay PCB sampling kit as described within Appendix C. Field screening readings will be recorded in the field log.

The VOC screening procedure will be performed by placing a portion of each soil samples into a plastic self-sealing baggie or a glass drilling jar sealed with aluminum foil. The sample will be retained until it equilibrates with ambient temperature. The sample will then be gently agitated to volatilize potential VOCs and the headspace will be monitored with a PID.

The drilling contractor will be responsible for obtaining accurate and representative samples, informing the supervising hydrogeologist of changes in drilling pressure, and keeping a separate general log of soils encountered. Included in this log will be a record of blow counts (i.e. the number of blows from a 140 or 300 pound soil sampling drive weight required to drive the split barrel sampler 6 inches).

Soil sampling equipment, including split spoon samplers, will be decontaminated prior to the initial boring and following advancement of each successive boring in accordance with the decontamination protocol provided below:

Equipment Decontamination

Decontamination procedures will be followed for drilling and sampling activities. The split barrel sampling equipment will be decontaminated after each use. Drilling equipment mobilized to the site will receive an initial decontamination. Decontamination will consist of steam cleaning of the entire rig and associated equipment to the satisfaction of the hydrogeologist. The rear portion of the drill rig will be decontaminated as necessary by steam cleaning between soil boring installations. In addition, equipment used for sample collection will be decontaminated using a high pressure steam cleaner to remove soil and volatilize organics. Drilling equipment will be decontaminated prior to removing the equipment from the site.

The field sampling equipment cleaning and decontamination procedures will be as follows:

1. Non-phosphate detergent wash.

2. Tap water rinse.

3. Distilled water rinse

If necessary, sampling equipment should be numbered in a manner that will not affect their integrity and wrapped in a material that will prevent them from becoming contaminated. Information concerning decontamination methodology, date, time, and personnel will be recorded in the field log book. Field decontamination wastes will be contained in 55-gallon drums for subsequent treatment or disposal off-site.

APPENDIX C

IMMUNOASSAY SAMPLING PROTOCOL
EPA METHOD SW846-4020

DRAFT

METHOD 4020

SOIL SCREENING FOR POLYCHLORINATED BIPHENYLS BY IMMUNOASSAY

1.0 SCOPE AND APPLICATION

1.1 Method 4020 is a procedure for screening soils to determine when total polychlorinated biphenyls (PCBs) are present at concentrations above 5 mg/Kg. Method 4020 provides an estimate for the concentration of PCBs by comparison with a standard.

1.2 Using the test kit from which this method was developed, 95 % of samples containing 0.625 ppm or less of PCBs will produce a negative result in the 5 ppm test configuration.

1.3 In cases where the exact concentrations of PCBs are required, quantitative techniques (i.e., Methods 8080/8081) should be used.

2.0 SUMMARY OF METHOD

2.1 Test kits are commercially available for this method. The manufacturer's directions should be followed. In general, the method is performed using an extract of a soil sample. Sample and an enzyme conjugate reagent are added to immobilized antibody. The enzyme conjugate "competes" with PCBs present in the sample for binding to immobilized anti-PCB antibody. The test is interpreted by comparing the response produced by testing a sample to the response produced by testing standard(s) simultaneously.

3.0 INTERFERENCES

3.1 Chemically similar compounds and compounds which might be expected to be found in conjunction with PCB contamination were tested to determine the concentration required to produce a positive test result. These data are shown in Table 1.

4.0 APPARATUS AND MATERIALS

4.1 PCB RIS<u>c</u> Test Kits (EnSys, Inc.), or equivalent. Each commercially available test kit will supply or specify the apparatus and materials necessary for successful completion of the test.

5.0 REAGENTS

5.1 Each commercially available test kit will supply or specify the reagents necessary for successful completion of the test.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 See the introductory material to this chapter, Organic Analytes, Section 4.1.

6.2 Soils samples may be contaminated, and should therefore be considered hazardous and handled accordingly.

7.0 PROCEDURE

7.1 Follow the manufacturer's instructions for the test kit being used. Those test kits used must meet or exceed the performance indicated in Tables 2-4.

8.0 QUALITY CONTROL

8.1 Follow the manufacturer's instructions for the test kit being used for quality control procedures specific to the test kit used. Additionally, guidance provided in Chapter One should be followed.

8.2 Use of replicate analyses, particularly when results indicate concentrations near the action level, is recommended to refine information gathered with the kit.

8.3 Do not use test kits past their expiration date.

8.4 Do not use tubes or reagents designated for use with other kits.

8.5 Use the test kits within their specified storage temperature and operating temperature limits.

8.6 Method 4020 is intended for field or laboratory use. The appropriate level of quality assurance should accompany the application of this method to document data quality.

9.0 METHOD PERFORMANCE

9.1 A study was conducted using fourteen standard soils and three soil samples whose PCB concentration had been established by Method 8080. Replicates were performed on seven of the standard soils and on one of the soil samples for a total of 25 separate analyses. Each of two different analysts ran the 25 analyses. Results indicated that "<" assignments are accurate with almost 99% certainty at the 50 ppm level while ">" assignments can be up to about 96% inaccurate as the sample concentration approaches that of the testing level. Corresponding certainties at the 5 ppm level are 92% and 82% respectively. Tables 2 and 3 summarize these results.

10.0 REFERENCES

1. J.P. Mapes, T.N. Stewart, K.D. McKenzie, L.R. McClelland, R.L. Mudd, W.B. Manning, W.B. Studabaker, and S.B. Friedman, "PCB-RISc™ - An On-Site Immunoassay for Detecting PCB in Soil", Ensys Inc., Research Triangle Park, NC 27709

2. PCB RISc™ Users Guide, Ensys Inc.

3. R.W. Counts, R.R. Smith, J.H. Stewart, and R.A. Jenkins, "Evaluation of PCB Rapid Immunoassay Screen Test System", Oak Ridge National Laboratory, Oak Ridge, TN 37831, April 1992, unpublished

Table 1
Possible Soil Interferences[a]

Compound	Soil Equivalent Concentration (ppm) Required to Yield a Positive Result
1-Chloronaphthalene	10,000
1,2,4-Trichlorobenzene	10,000
2,4-Dichlorophenyl-benzenesulfonate	1000
2,4-Dichloro-1-naphthol	>10,000
Bifenox	500
Diesel fuel	>10,000
Pentachlorobenzene	>10,000
2,5-Dichloroaniline	>10,000
Hexachlorobenzene	>10,000
Gasoline	>10,000
Dichlorofenthion	10,000
Tetradifon	125

[a] Ensys, Inc. publication

Table 2 Estimated Error Rates for 5 ppm Dilution												
True Value (ppm)	0	1	2	3	4	5	6	7	8	9	10	20
Estimated Rate of False Positives (%)	1.3	13.2	39.2	65.2	82.3	-	-	-	-	-	-	-
Estimated Rate of False Negatives (%)	-	-	-	-	-	8.5	4.1	2.0	1.0	0.5	0.3	<0.1

Table 3 Estimated Error Rates for 50 ppm Dilution												
True Value (ppm)	0	5	10	15	20	30	40	50	60	70	80	100
Estimated Rate of False Positives (%)	1.0	7.9	24.5	46.0	65.0	87.3	95.6	-	-	-	-	-
Estimated Rate of False Negatives (%)	-	-	-	-	-	-	-	1.7	0.7	0.3	0.2	<0.1

Table 4
Comparison of Immunoassay[a] with GC

Sample ID	Screening Test Results	GC Results	Does screening test agree with GC/MS determination?
101	<5 ppm	<0.5 ppm	yes
284	<5 ppm	<0.5 ppm	yes
292	<5 ppm	<0.5 ppm	yes
199	<5 ppm	0.5 ppm	yes
264	<5 ppm	1 ppm	yes
257	<5 ppm	1.8 ppm	yes
259	<5 ppm	4 ppm	yes
265	<5 ppm	4.5 ppm	yes
200	<5 ppm	5 ppm	yes
170	5-50	5.8 ppm	yes
198	<5 ppm	2.2-5.8 ppm	yes
172	5-50	6.2 ppm	no
169	5-50	7.2 ppm	yes
171	5-50	7.2 ppm	yes
202	<5 ppm, 5-50	1.3-7.2 ppm	yes
163	5-50	8.7 ppm	yes
165	5-50	9 ppm	yes
168	5-50	9 ppm	yes
166	5-50	9.3 ppm	yes
164	5-50	11.9 ppm	yes
204	5-50	12.8 ppm	yes
253	5-50	13 ppm	yes
203	5-50	13.5 ppm	yes
258	5-50	15 ppm	yes
106	5-50	15-19 ppm	yes
161	5-50	15.3 ppm	yes
167	5-50	16.2 ppm	yes
247	5-50	18 ppm	yes

Table 4 Continued			
Sample ID	Screening Test Results	GC Results	Does screening test agree with GC/MS determination?
148	>50	18-34 ppm	no
205	5-50	20 ppm	yes
162	5-50	20.4 ppm	yes
175	5-50	21.2 ppm	yes
176	5-50	21.6 ppm	yes
197	5-50	32 ppm	yes
243	5-50	32 ppm	yes
252	5-50	32 ppm	yes
178	5-50	43.7 ppm	yes
201	5-50	43 ppm	yes
254	5-50, >50	56 ppm	yes
238	>50	46-60 ppm	yes
248	5-50	44-60 ppm	yes
250	>50	68 ppm	yes
242	5-50	30-69 ppm	yes
256	>50	73 ppm	yes
249	>50	96 ppm	yes
245	>50	102 ppm	yes
241	5-50	154 ppm	no
246	>50	154 ppm	yes
261	>50	204 ppm	yes
240	>50	251 ppm	yes
267	>50	339 ppm	yes
239	>50	460 ppm	yes
104	>50	200-3772 ppm	yes
108	>50	531-1450 ppm	yes

* for PENTA RIS<u>c</u> Test Kit (EnSys, Inc.)

Rev. 5 9/1/93

ENSYS INC
ENVIRONMENTAL PRODUCTS

PCB RISc® SOIL TEST SYSTEM

RAPID IMMUNOASSAY SCREEN

User's Guide

IMPORTANT NOTICE

This method correctly identifies 95% of samples that are PCB-free and those containing 1 ppm or greater of PCBs. A sample that develops less color than the standard is interpreted as positive. It contains PCBs. A sample that develops more color than the standard is interpreted as negative. It contains less than 1 ppm PCBs.

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of polychlorinated biphenyls. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

TROUBLE SHOOTER GUIDE

Wash Step- lack of vigorous washing may result in false positives or negatives depending on whether the wash error was committed on standard or sample tubes. *Solution*: make sure that the operator washes four times vigorously.

Pipette Calibration- an out-of-calibration pipette may result in false positives or negatives depending on whether the amount is greater or less than the specified transfer volume. *Solution*: check the calibration at least daily and after any extreme mechanical shock (such as dropping). An indication that the pipette is out of calibration is if the gold barrel is loose and will turn. (When set on 30 ml there should be about 1/4 of an inch between the white plunger and the end of the clear pipette tip.)

Air bubbles in the pipette or diluter- the presence of air bubbles in the pipette tip when transfering extracts may result in false positives or negatives depending on whether the error was committed on standard or sample tubes. *Solution*: quickly examine the pipette tip each time an aliquot is withdrawn and go back to the source and take another aliquot to displace the bubble if neccessary. Bubbles in the diluter can be in the tip or plunger assembly.

Mixing- lack of thorough mixing, when instructed, can cause inconsistent results. *Solution*: observe the mixing times in the instructions and to mix with sufficient force to ensure that the liquid is mixed.

Timing- it important to follow the timing steps in the instructions carefully. The incubation step in the antibody tubes can vary a bit without harm to the test (± 5 minutes). The color development step timing is critical and should be no less than 2 minutes and no greater than 3 minutes.

Addition of Drops- it is important to carefully count the drops added in the color development steps. The addition of ±1 drop to the instructed 5 drops can cause variability in the results RIGHT AROUND THE DETECTION LEVELS OF INTEREST. One drop less would result in a darker color (a less dilute solution) which could result in a false negative. One drop more could result in a lighter color (a more dilute solution) and result in a false positive.

Wiping the Tubes- wiping of the tubes should be done before they are read in the spectrophotometer because smudges and fingerprints on the tubes can give potentially false negative readings.

Mixing Lot #'s- never mix lots! Each kit's components are QC'd together for optimal performance and may give inaccurate results with the components from other kits, that are not of the same lot #. Also, the user must NEVER mix components from different types of kits (ex: Petro kit buffer tubes can't be used with a PAH kit).

Storage and Operating Temperatures- temperature requirements are very important and should be strictly adhered to. This information can be found in the kit User's Guide.

Shelf-life- each kit label contains the kit expiration date. To achieve accurate results, kits must be used prior to expiration.

WORKSTATION SET-UP

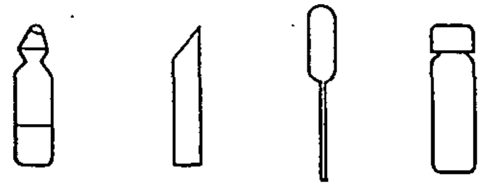
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Follow diagram below to setup workstation.
- Items that you will need that are not provided in the test kit include: a permanent marking pen, laboratory tissue (or paper towels), a liquid waste container, disposable gloves.
- Do not expose reagents to direct sunlight.
- Do not attempt to run more that 12 tubes, two of which must be Standard tubes.
- Operate test at temperatures greater than 4°C / 40°F and less than 32°C /90°F.
- See table on page 9 for sensitivity to various aroclors.

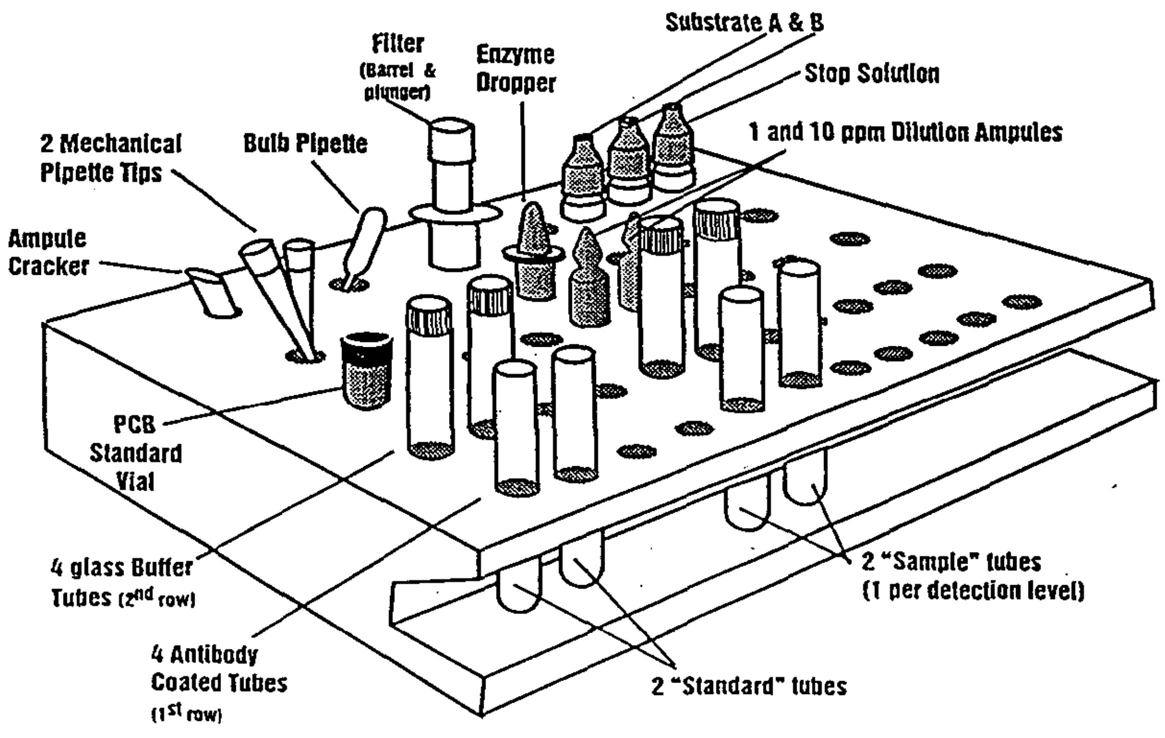
TEST PREPARATION

- Label amber vial "PCB Standard", and the current date, Standard is usable for up to 2 weeks from this date. Open PCB Standard ampule by slipping ampule cracker over top, and then breaking tip at scored neck. Transfer to empty amber vial with bulb pipette. Always cap tightly when finished using Standard.



WORKSTATION SET-UP (Workstation shows components for 1 sample tested at 2 levels)

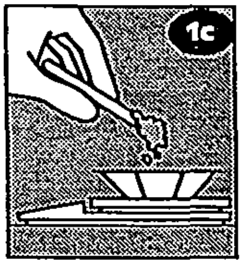
- ☐ Mechanical pipette tips
- ☐ Enzyme dropper
- ☐ PCB standard vial
- ☐ Substrate A
- ☐ Filtration barrel & plunger
- ☐ 1 and 10 ppm dilution ampules
- ☐ Substrate B
- ☐ Bulb pipette
- ☐ 4 glass buffer tubes
- ☐ Stop solution
- ☐ Ampule cracker
- ☐ 4 antibody coated tubes



PHASE 1 EXTRACTION & PREPARATION OF THE SAMPLE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WEIGH SAMPLE

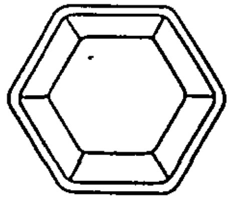


1a Place unused weigh boat on pan balance.

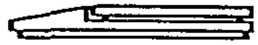
1b Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

1c Weigh out 10 ± 0.1 grams of soil.

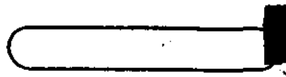
1d If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.



Weigh Boat



Pan balance



Wooden spatula

EXTRACT PCBS

2a Uncap extraction jar and place on a flat surface. Without contacting solvent puncture foil seal with ampule cracker or sharp object. Peel the remainder of the seal off extraction jar.

2b Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

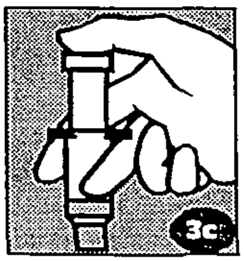
2c Recap extraction jar tightly and shake vigorously for one minute.

2d Allow to settle for one minute.

Repeat steps 1a - 2c for each sample to be tested.

Extraction Jar

FILTER SAMPLE

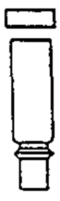


3a Disassemble filtration plunger from filtration barrel.

3b Insert bulb pipette into top (liquid) layer in extraction jar and draw up sample. Transfer at least ½ bulb capacity into filtration barrel. Do not use more than one full bulb.

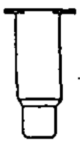
3c Press plunger firmly into barrel until adequate filtered sample is available (place on table and press if necessary).

Repeat steps 3a - 3c for each sample to be tested.



Filtration plunger

Bulb pipette



Filtration barrel

READ TO AVOID COSTLY MISTAKES

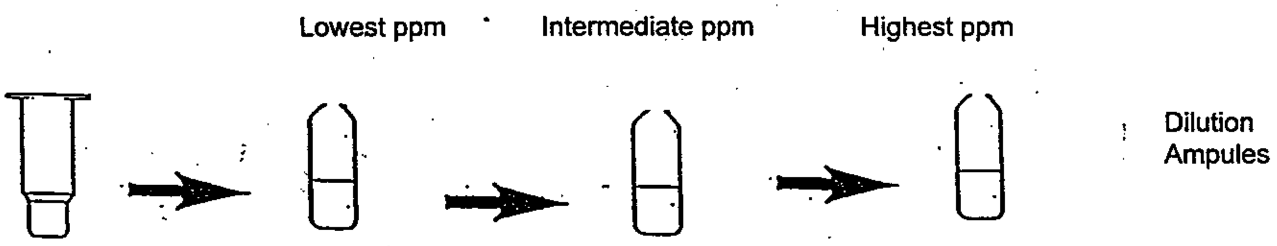
SAMPLE DILUTION DIAGRAM

1. The sample dilution procedure on the next page is for standard detection levels. The following diagram represents the sample dilution procedure for all other detection levels
2. Your kit may include extra dilution ampules to reach high detection levels.
3. **EVERY AMPULE PROVIDED MUST BE USED!**

If there are any questions concerning the dilution procedure **please call Technical Services before running the samples to help avoid costly mistakes.**

1-800-242-7472 or 919-941-5509 (X144, 148 or 149).

EXAMPLE:



NOTE: YOUR ORDER MAY INCLUDE ADDITIONAL AMPULES IN ORDER TO ACHIEVE YOUR TEST LEVELS. ALWAYS TRANSFER FILTERED SAMPLE TO THE DILUTION AMPULE LABELLED WITH THE LOWEST PPM LEVEL AND THEN TRANSFER FROM IT TO THE NEXT HIGHER LEVEL DILUTION AMPULE .

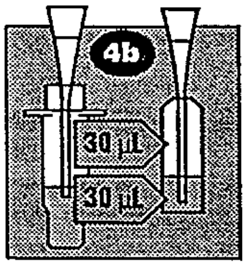
PHASE 2 SAMPLE & STANDARD PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

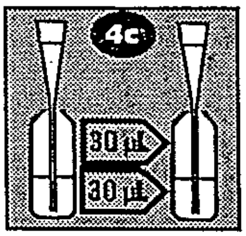
READ BEFORE PROCEEDING

- Tap glass buffer tubes vigorously on hard surface to release buffer trapped in cap.
- Label the glass buffer and plastic antibody coated tubes with a permament marking pen. Uncap glass buffer tubes.
- When using the mechanical pipette always withdraw and dispense below the liquid level.
- "Shake tubes" means to thoroughly mix the contents with special care not to spill or splash.

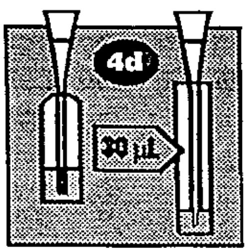
DILUTE SAMPLES AND STANDARDS

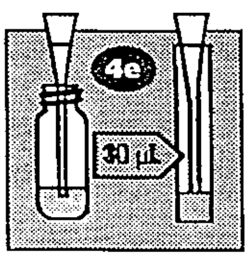


1 ppm



1 ppm 10 ppm





PCB Standard

4a Open 1 and 10 ppm* dilution ampules by slipping ampule cracker over top, and then breaking top at scored neck.

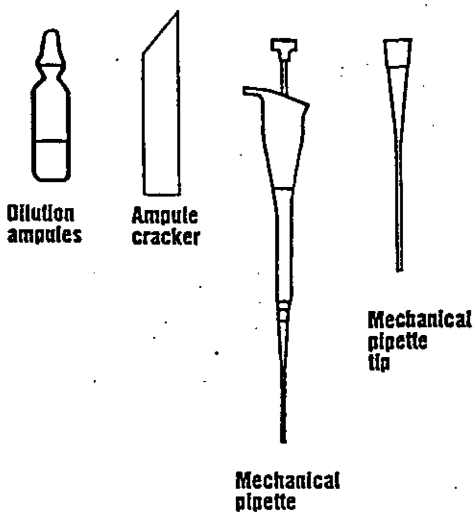
4b Withdraw 30 µL of filtered sample using mechanical pipette and dispense below the liquid level in "1 ppm" dilution ampule. Repeat to transfer a total of 60 µL; gently shake ampule from side to side for 5 seconds to mix thoroughly.

4c Withdraw 30 µL from the "1 ppm" dilution ampule using mechanical pipette and dispense below the liquid level in "10 ppm" dilution ampule. Repeat to transfer a total of 60 µL; gently shake ampule from side to side for 5 seconds to mix thoroughly.

4d Transfer 30 µL from each dilution ampule into a glass buffer tube. Always wipe tip after dispensing into buffer tube.

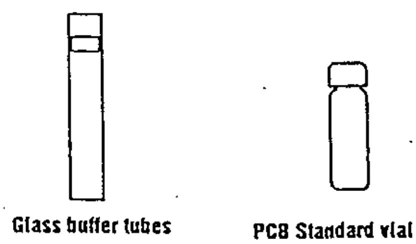
4e Assemble new pipette tip on mechanical pipette and transfer 30 µL from Standard vial into two glass buffer tubes. Immediately replace cap on PCB Standard vial.

4f Shake all glass buffer tubes for 5 seconds.



* For other test concentrations, follow steps 4b - 4d, transferring from lowest level dilution ampule to higher level dilution ampules. You may be provided with additional dilution ampules to achieve higher test concentrations.

If you need assistance call technical support 1-800-242-7472



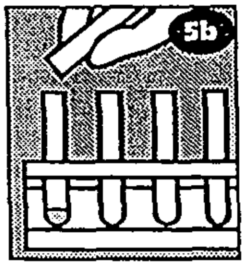
PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- This phase of the procedure requires critical timing and care in handling the antibody coated tubes.

INCUBATION 1



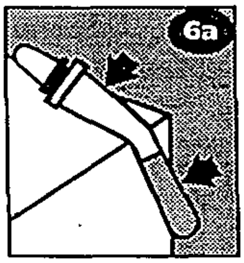
5a Set timer for exactly 10 minutes.

5b Start timing and immediately pour solution from each glass buffer tube into appropriate antibody coated tube. Tap glass tube on antibody coated tube to remove solution.

5c Shake all tubes for 5 seconds.

Antibody coated tubes (contained in resealable "zip-seal" aluminized pouch)

PREPARE ENZYME DROPPER

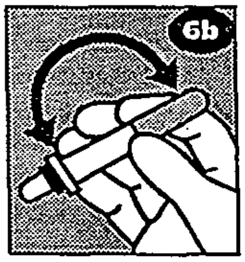


6a Crush glass ampule contained within enzyme dropper by pressing tube against hard edge.

6b Mix enzyme by turning dropper end-over-end 5 times. Do not shake.

6c Remove seal from enzyme dropper.

Repeat steps 6a - 6c to prepare one enzyme dropper for every 5 antibody coated tubes.

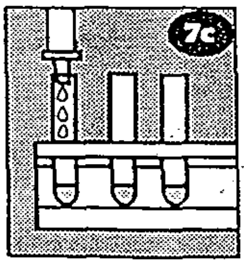


Enzyme dropper

INCUBATION II

7a Dispense first drop from enzyme dropper into liquid waste container.

Note: before dispensing drops, tap capped tip on hard surface to avoid dispensing air bubbles.



7b After the 10 minute incubation, set timer for 5 minutes.

7c Immediately dispense 3 drops of enzyme into each antibody coated tube by squeezing the dropper.

7d Shake antibody coated tubes for 5 seconds.

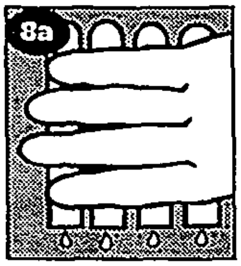
PHASE 3 THE IMMUNOASSAY

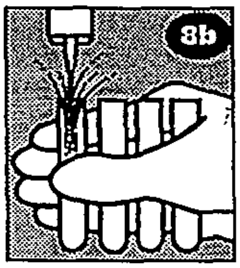
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING
WASH PROCEDURE

- An accurate test requires a virgorous wash accomplished by directing a strong stream into the antibody coated tubes.
- The wash solution is a harmless, dilute solution of detergent.

WASH



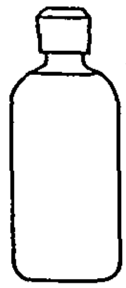


8a After the 5 minute incubation (a total of 15 minutes), empty antibody coated tubes into liquid waste container.

8b Wash antibody coated tubes by vigorously filling and emptying a total of 4 times.

8c Tap antibody coated tubes upside down on paper towels to remove excess liquid. Residual foam in the tubes will not interfere with test results.

Note: When running up to 12 antibody coated tubes, tubes can be washed in two groups - one group immediately following the other group.



Wash bottle

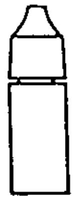
READ BEFORE PROCEEDING

- Keep Substrate dropper bottles vertical and direct each drop to bottom of antibody coated tubes. Addition of more or less than 5 drops may give inaccurate results.
- This phase requires accurate timing.

PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

COLOR DEVELOPMENT



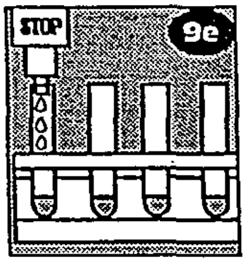
Substrate bottles (A, B, & Stop Solution)

9a Add 5 drops of Substrate A (yellow cap) to each antibody coated tube.

9b Set timer for exactly 2 ½ minutes.

9c Start timer and immediately add 5 drops of Substrate B (green cap) to each antibody coated tube.

9d Shake all tubes for 5 seconds. Solution will turn blue in some or all antibody coated tubes.

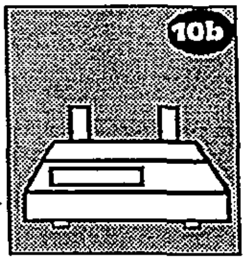


9e Stop reaction at end of 2 ½ minutes by adding 5 drops of Stop Solution (red cap).

Note: Blue solution will turn yellow when Stop Solution is added.

SELECT STANDARD

10a Wipe outside of all antibody coated tubes.



10b Place both Standard tubes in photometer.

10c Switch tubes until the photometer reading is negative or zero. Record reading.

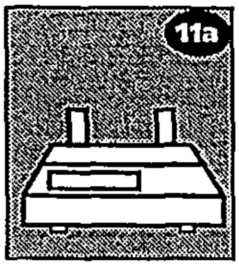
If reading is greater than 0.3 in magnitude (+ or -), results are outside QC limits. Retest the sample(s).

10d Remove and discard tube in right well. The tube in the left well is the darker standard.

PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

MEASURE SAMPLE



11a Place 1 ppm tube in right well of photometer and record reading.

If photometer reading is negative or zero, PCBs are present.

If photometer reading is positive, concentration of PCBs is less than 1 ppm.

11b Place 10 ppm tube in right well of photometer and record reading.

If photometer reading is negative or zero, PCBs are present.

If photometer reading is positive, concentration of PCBs is less than 10 ppm.

AROCLOR SENSITIVITY

Aroclor	Lowest Detection Level
1248	1.0 ppm
1254	0.4 ppm
1260	0.4 ppm
1242	2.0 ppm
1232	4.0 ppm
1016	4.0 ppm

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

System Description

Each PCB RISc Soil Test System contains enough material to perform four complete tests, each at two detection levels, if desired.

The PCB RISc Soil Test is divided into three phases. The instructions and notes should be reviewed before proceeding with each phase.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-242-RISC (7472).

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

PCB-free soil and soil containing 1 ppm or greater of PCBs were tested with the EnSys PCB RISc analytical method. The method correctly identified 95% of these samples. A sample that has developed less color than the standard is interpreted as positive. It contains PCBs. A sample that has developed more color than the standard is interpreted as negative. It contains less than 1 ppm PCBs.

The company does not guarantee that the results with the PCB RISc Soil Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

EnSys, Inc. warrants that this product conforms to the descriptions contained herein. No other warranties, whether expressed or implied, including warranties of merchantability and of fitness for a particular purpose shall apply to this product.

EnSys, Inc. neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than such as is expressly set forth herein.

Under no circumstances shall EnSys, Inc. be liable for incidental or consequential damages resulting from the use or handling of this product.

How It Works

Standards, Samples, and color-change reagents are added to test tubes, coated with a chemical specific to PCBs. The concentration of PCBs in an unknown Sample is determined by comparing its color intensity with that of a Standard.

Note: PCB concentration is inversely proportional to color intensity; the lighter the color development of the sample, the higher the concentration of PCBs.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or test tubes from one Test System with reagents or test tubes from another Test System.
- Do not use the Test System after any portion has passed its expiration date.
- Do not attempt the test using more than 12 antibody coated tubes (two of which are **Standards**) at the same time.
- Do not exceed incubation periods prescribed by the specific steps.
- Always dispense correct number of drops and wash the number of times indicated in this guide.
- Use EPA Method 8080 or Code of Federal Regulations Title 40, Part 136, Appendix A, Method 680 to confirm results.

Storage and Handling Precautions

- Wear protective gloves and eyewear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- Keep aluminized pouch (containing unused antibody coated tubes) sealed when not in use.
- If Stop Solution or liquid from the extraction jar comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Standard Solution contains PCBs. Test samples may contain PCBs. Handle with care.

MECHANICAL PIPETTE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

HOW TO OPERATE THE MECHANICAL PIPETTE

To Set Or Adjust Volume

Remove push-button cap and use it to loosen volume lock screw. Turn lower part of push-button to adjust volume up or down. Meter should read "030". Tighten volume lock screw and replace push-button cap.

To Assemble Pipette Tip

Slide larger mounting end of pipette tip onto end of pipette. Holding tip in place, press push-button until plunger rod enters pipette tip. Ensure no gap exists between piston and plunger rod (see illustration).

To Withdraw Sample

With tip mounted in position on pipette, press push-button to first stop and hold it.

Place tip at bottom of liquid sample and slowly release push-button to withdraw measured sample. Ensure that no bubbles exist in liquid portion of sample. If bubbles exist, dispense sample and re-withdraw sample.

To Dispense Sample

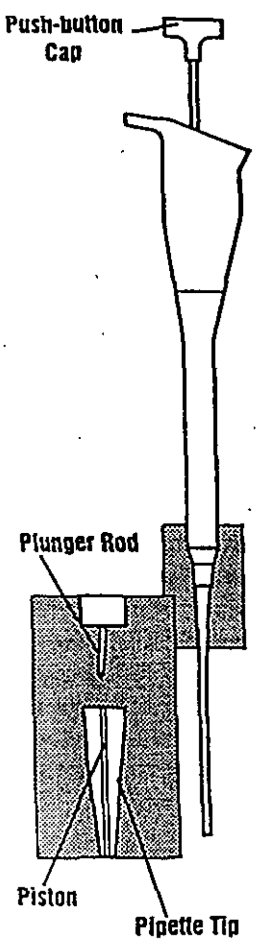
Place tip into dispensing vessel (immersing end of the tip if vessel contains liquid) and slowly press push-button to first stop. (Do not push to second stop or tip will eject).

Remove tip from vessel and release push-button.

To Eject Tip

Press push-button to second stop. Tip is ejected.

For additional information regarding operation and use of pipette, please refer to your pipette manual.



On-Site Quality Control/Quality Assurance Recommendations
EnSys RIS©® Test System

Please read the following before proceeding with field testing!

Sampling

The result of your screening test is only as valid as the sample that was analyzed. Samples should be homogenized thoroughly to ensure that the 10 grams you remove for field testing is representative of the sample as a whole. All other applicable sample handling procedures should be followed, as well.

Prior to Testing Samples

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

Internal Test QC

Two standards are analyzed with each sample to provide internal test system quality control. With both standards inserted in the photometer, a valid test is indicated when the magnitude of the displayed number (irrespective of the sign, + or -) is less than the value given in the User's Guide. Test runs resulting in a greater number should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. EnSys recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the US Environmental Protection Agency.

A. Sample documentation
   1. Location, depth
   2. Time and date of collection and field analysis

B. Field analysis documentation - provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)

C. Method calibration - this is an integral part of EnSys RIS©® immunoassay tests; a duplicate calibration is performed for each set of samples tested (see the instructions in the User's Guide)

D. Method blank - field analyze the contents of an unused extraction jar

E. Site-specific matrix background field analysis - collect and field analyze uncontaminated sample from site matrix to document matrix effect

F. Duplicate sample field analysis - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. Confirmation of field analysis - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; choose at least two representative samples testing below the action level or lowest test level and at least two representative samples testing above the action level; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. Performance evaluation sample field analysis (optional, but strongly recommended) - field analyze performance evaluation sample daily to document method/operator performance

I. Matrix spike field analysis (optional) - field analyze matrix spike to document matrix effect on analyte measurement

Further Questions?

EnSys technical support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives.

Data Sheet for PCB RISc® Soil Test

Operator: ____________________ Date: ______ Location: ______________________________

Sample ID	ΔOD standards	OD sample ___ ppm	Interpretation	OD sample ___ ppm	Interpretation	Comments

APPENDIX D

CHAIN OF CUSTODY FORM

CHAIN OF CUSTODY RECORD

O'BRIEN & GERE
LABORATORIES, INC.

SURVEY:	SAMPLED BY:
LOCATION:	ORGANIZATION:

STATION NUMBER	SAMPLE LOCATION	DATE COLLECTED	TIME COLLECTED	SAMPLE MATRIX	COMP. OR GRAB	NO. OF CONTAINERS	ANALYSIS REQUIRED

Relinquished By:	DATE	TIME	Received By:	DATE	TIME
Relinquished By:	DATE	TIME	Received By:	DATE	TIME
Relinquished By:	DATE	TIME	Received by Laboratory:	DATE	TIME

COMMENTS:

METHOD OF SHIPMENT:

O'BRIEN & GERE LABORATORIES, INC. an O'Brien & Gere Company
5000 Brittonfield Parkway / P.O. Box 4942 / Syracuse, NY 13221 / (315) 437-0200 FAX (315) 463-7554

EXHIBIT A

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

PCB/PAH/VOC Soils Excavation

Prepared for:
Former Accurate Die Casting Site
Fayetteville, NY

February 1995

O'BRIEN & GERE
TECHNICAL SERVICES

O'Brien & Gere Technical Services, Inc.
5000 Brittonfield Pkwy.
E. Syracuse, NY 13057
(315) 437-6400

O'BRIEN & GERE
TECHNICAL SERVICES

This Health and Safety Plan has been prepared to meet the requirements of 29 CFR 1926.65, Hazardous Waste Operatons and Emergency Response.

Signed,

OBG TECHNICAL SERVICES, INC.

Jeffrey R. Parsons, CIH
Corporate Safety Coordinator

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TABLE OF CONTENTS cont.

EXHIBITS

ATTACHMENTS

APPENDICES

SECTION 1 - INTRODUCTION

The following Health and Safety Plan (HSP) has been developed in accordance with the requirements set forth in 29 CFR Part 1926.65, *Hazardous Waste Operations and Emergency Response*, and in conjunction with the O'Brien & Gere Technical Services (OBG Tech) Hazardous Waste Operations Standard Operating Procedures for OBG Technical Services' on-site activities. OBG Tech's Hazardous Waste Operations Standard Operating Procedures are in Section 4.05 of OBG Technical Services' Corporate Health and Safety Manual (see Appendix E). Section 4.05 as well as other pertinent Sections are appended to this HSP (Appendices A through I).

The purpose of this HSP is to assign site-specific responsibilities, site-specific training requirements, establish site-specific personnel protective requirements, and to provide guidance for site-specific contingencies that may arise for OBG Technical Services' and subcontracted employees. In addition to this site-specific HSP, a copy of the OBG Technical Services Corporate Health and Safety Manual will be kept on site for reference purposes. All OBG Tech personnel and subcontractor personnel must be familiar with this site specific HSP and the OBG Tech Corporate Health and Safety Manual prior to participation in site activities.

The front portion of this HSP is designed to include site-specific information, so that it can be separated from the Corporate protocols in the Appendices and distributed and posted as necessary.

This HSP may be provided to interested parties for informational purposes, however, the HSP is specifically intended for the conduct of activities within the scope of work for OBG Technical Services.

1.1 Corporate Protocols

The following are the sections required by 29 CFR 1926.65 that can be found in the Corporate Health & Safety Manual and are appended to this HSP.

1.1.1 Employee Training Assignments

The employee training assignments are found in Section 2.02 of the Corporate Health and Safety Manual and are included in Appendix A. The description for the hazardous waste pre-entry briefing can be found in the hazardous waste protocols in Section 4.05 of the Corporate Health and Safety Manual. The hazardous waste protocols are included in Appendix E. There are no additions to these protocols.

1.1.2 Personal Protective Equipment (PPE)

The EPA definitions of personal protective equipment (PPE) and donning and decontamination procedures are found in Section 5.01 of the Corporate Health and Safety Manual, which is included in Appendix B. The site-specific personal protective equipment can be found in Section 4.

1.1.3 Medical Surveillance

The Corporate Medical Surveillance program can be found in Section 2.04 and is included in Appendix C. There are no site-specific additions to these protocols.

1.1.4 Air Monitoring

The corporate air monitoring program and calibration and maintenance procedures for air monitoring equipment is found in Section 4.03 of the Corporate Health and Safety Manual and is attached in Appendix D. The site-specific air monitoring program is found in Section 5.

1.1.5 Site Control

The Corporate Site Control Program is found in the Hazardous Waste Protocols, attached in Appendix E. The site-specific site control program can be found in Section 6.

1.1.6 Confined Space Entry Procedures

The Corporate Confined Space Entry Procedures are found in Section 3.05 of the Corporate Health and Safety Manual and are attached in Appendix I. Site-specific confined space entry information is included in Section 6.1.

1.2 Site-Specific Protocols

The following are the sections required by 29 CFR 1910.120 that can be found in this HSP. Section 2 is the project background and Scope of Work. Personnel involved in the project can be found in Section 3. Section 4 includes the hazard evaluation and hazard control. Air monitoring procedures are included in Section 5. Section 6 outlines the site-specific site control measures. Section 7 includes the emergency response and spill control procedures.

SECTION 2 - BACKGROUND AND SCOPE OF WORK

2.1 Background

The former Accurate Die Casting Facility located in Fayetteville, New York is situated on a 32-acre parcel at 547 East Genesee Street (Figure 1). Refer to Figure 2 for an overview of site features. The facility was constructed in the 1950's and had been used as a die casting operation until 1988, when it was abandoned. ITT Commercial Finance Company ("ITT"), which possessed a mortgage on the real property, foreclosed on the premises and was the sole and successful bidder at the auction. Shortly thereafter, an environmental assessment for property transfer was conducted by Stearns & Wheler for ITT, the asset lender. As a result of the site assessment, it was concluded that potential for environmental contamination existed at the site and that further investigation would be necessary. Stearns & Wheler was subsequently retained to perform a Phase II assessment of the site, completing it in September 1990.

Upon review of the work completed to date at the former Accurate Die Casting facility, the NYSDEC has required additional investigation activities which have been completed in accordance with the Remedial Investigation/Feasibility Study Work Plan (Stearns & Wheler, May 1992). The Draft Report - Remedial Investigation (Stearns & Wheler, January 1993) concluded that:

1. Ground water quality, both overburden and bedrock, has been impacted by trichloroethene (TCE). The overburden TCE plume extends from near MW-3 north towards Bishop Brook.

2. TCE in soils is limited to the vicinity of MW-3, with concentrations ranging from 0.39 mg/kg at MW-10 to 7,500 mg/kg at MW-3. The highest TCE concentrations were observed at about 20 to 25 feet below grade, at the interface between the sand/gravel and till layers.

3. The PCB/PAH/VOC soils area contains polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), and volatile organic hydrocarbons (VOCs) above Technical Administrative Guidance Memorandum (TAGM) soil cleanup objectives for New York State.

4. The septic tank contains materials that if released could result in VOC and metal concentrations above TAGM soil cleanup levels.

The area containing TCE in subsurface soil outside the Northeast corner of the building was remediated in June 1994 as part of an Interim Remedial Measure (IRM). The objective of that IRM was to remediate the subsurface soils in the vicinity of MW-3 to reduce the potential for further migration of TCE from the source to the ground water.

2.02 Scope of Work

This site-specific Health and Safety Plan (HSP) addresses activities that are to be conducted in association with the characterization and removal of soils located in the PCB/PAH/VOC soils area and sludges contained in a septic tank. The activities include excavation of PCB/PAH/VOC contaminated soils, removal and disposal of septic tank sludge, and restoration of the two areas in an environmentally sound manner.

1. Five soil borings will be completed in the PCB/PAH/VOC soils areas located in the northern portion of the site immediately south of MW-4, as shown in Figure 3. Soil borings will be advanced to a depth of approximately six feet, and up to two samples from each boring will be taken for PCBs, PAHs, and VOCs.

2. Excavation of contaminated soil from the PCB/PAH/VOC soils area.

3. Removal of sludges from the septic tank

4. Excavation and disposal of the septic tank

5. Site restoration (backfilling, grading, etc.)

6. Equipment decontamination

SECTION 3 - PROJECT PERSONNEL

Section 4.05 of OBG Technical Services' Corporate Health and Safety Manual (see Appendix E) contains the specific responsibilities for the below personnel.

Project Officer:	Terry L. Brown, PE
Sr. Project Supervisor:	Anthony J. Geiss
Corporate Safety Coordinator:	Jeffrey R. Parsons, CIH
Health and Safety Specialist:	Kelly L. Fisher
Field Supervisor/Site Safety and Health Coordinator:	To Be Determined

SECTION 4 - HAZARD EVALUATION AND HAZARD CONTROL

4.1 Potential Health and Safety Hazards

Previous soil analysis in the PCB/PAH/VOC soils area has shown the following:

1. PCBs present at concentrations up to 2.6 milligrams of PCBs per kilogram of soil (mg/kg)
2. PAHs present at concentrations up to 113 mg/kg.
3. Dichloroethylene (VOCs) at concentrations up to 190 parts per million (ppm)

Septic tank sludge analysis detected the presence of several metals, but only zinc was elevated when compared to other soil samples taken from the site. No VOCs were detected.

Health and safety information for PCBs, PAHs, and VOCs (trichloroethylene and dichloroethylene) are included in Table 1. Because metals concentrations are low, they are not considered a hazard for this project.

The exposure pathways of concern are inhalation of materials volatilized from the soil and groundwater; inhalation of dusts containing the contaminants; accidental ingestion of soil and groundwater containing contaminants; and dermal exposure to soil and groundwater containing contaminants. Based upon anticipated site activities and prudent safety practices during site work, ingestion of site contaminants is unlikely. Due to the use of personal protective equipment, direct contact with site contaminants poses a low health hazard. Direct-reading air monitoring equipment will be used to monitor the airborne volatile organic compounds and dusts, thus minimizing the inhalation of VOCs and dust from the soil and sludge.

4.2 Operations and Tasks to be performed

OBG Technical Services employees are required to use personal protective equipment appropriate to their work task and potential exposures, as detailed in Section 5 of the OBG Technical Services' Corporate Health and Safety Manual. Specific sections related to this site include "EPA Levels of Protection for Hazardous Waste Sites" and "Respiratory Protection."

In addition, the soil amendment material(s) used during the soils aeration activities have the potential to cause health effects. All hazard information regarding the soil amendment material(s) should be reviewed by site personnel prior to initiating site treatment activities. The SSHC is responsible for administering the Hazard Communication program (Appendix H), including informing all employees about the amendment material(s) and the location of the material safety data sheet (MSDS) for the amendment material(s), as well as all other MSDS's for materials brought on-site.

The levels of protection assigned to each activity below are based on available information and represent an estimate of exposure potential and appropriate protective equipment. The SSHC may revise these levels in accordance with Section 4.05 of OBG Technical Services' Corporate Health & Safety Manual.

When dry and/or dusty conditions are observed by the SSHC or dust levels are above the action level specified in Section 5.3, a water spray will be applied to the contaminated soils. In addition, excavated materials will be covered.

TABLE 1 - SUMMARY OF POTENTIAL HEALTH EFFECTS

Chemical	Location	PEL[1]	IDLH	Characteristics	Routes of Exposure	Symptoms of Exposure
Trichloroethylene	Soil Groundwater	100 ppm TWA 200 ppm Ceiling (1989 - 50 ppm TWA 200 ppm STEL)	1000 ppm	Colorless liquid with a chloroform-like odor. Lowest reported odor threshold is 0.2 ppm.	Inhalation Ingestion Contact	Headache, vertigo; visual disturbances, tremors, somnolence, nausea, vomiting; irritated eyes; dermatitis; cardiac arrhythmia, paresthesia; potential carcinogen.
Dichloroethylene	Soil	200 ppm TWA	4000 ppm	Colorless liquid with a slightly acrid, chloroform-like odor. Lowest reported odor threshold is 0.1 ppm	Inhalation Ingestion Contact	Irritation of the eyes and respiratory tract. Central nervous system depression (i.e. alcohol-like effects)
Polychlorinated Biphenyls (PCBs)	Soil	1 mg/m^3	10 mg/m^3	Colorless to light colored, viscous liquid with a mild hydrocarbon odor.	Inhalation Absorption Ingestion Contact	Eye irritation, Chloracne, liver damage, carcinogen
Polynuclear Aromatic Hydrocarbons (PAHs)[2]	Soil	0.2 mg/m^3	700 mg/m^3	Black or dark brown amorphous residue.	Inhalation Contact	Skin dermatitis, bronchitis, kidney damage, carcinogen

1 An appeals court decision forced OSHA to revert the PELs published in 1989 to the PELs published in 1971. The PELs listed here reflect the 1971 PELs with 1989 PELs listed in parentheses.

2 Exposure limits for PAHs are referenced by OSHA as coal tar pitch volatiles, benzene soluble fraction. This includes the following compounds: anthracene, benzo-a-pyrene, phenanthrene, acridine, chrysene, and pyrene.

TABLE 2 - HAZARD EVALUATION AND CONTROL

Operation/Task	Hazards	Hazard Control
MOBILIZATION		
General Site Workers performing non-intrusive activities including mobilization, equipment set-up	1. Safety/Physical Hazards -Noise -Use of Heavy Equipment -Overhead Utilities -Heat or cold stress -Exposure to toxic plants, insects, and reptiles	1. Level D PPE 2. Hearing protection when necessary 3. Eye protection when necessary 4. Review hazard recognition and prevention at toolbox safety meeting 5. Stay 20 feet from overhead utility lines
EXCAVATION AND HANDLING OF CONTAMINATED SOILS		
Operator	1. Contact with contaminated materials 2. Inhalation of contaminated materials 3. Safety/Physical Hazards -Noise -Use of heavy equipment -Overhead utilities -Underground utilities -Exposure to excavations -Heat or cold stress -Confined space entry for excavations greater than 4 feet deep.	1. Modified Level D PPE (includes skin protection - coveralls, gloves, boots, eye protection) 2. Hearing Protection is required while operating equipment. 3. Use trained operators 4. Review hazard recognition and prevention at toolbox safety meeting 5. Follow excavation safety rules and inspection forms found in Appendix G 6. Call utilities before breaking ground 7. Review hand signals with laborer 8. Follow confined space entry procedure. 9. Air monitor as detailed in Section 5
Laborer	1. Contact with contaminated materials 2. Inhalation of contaminated materials 3. Safety/Physical Hazards -Slip/trip/fall hazards -Exposure to heavy equipment -Noise -Exposure to toxic plants, insects, and reptiles -Exposure to excavations -Heat or cold stress -Confined space entry for excavations greater than 4 feet.	1. Modified Level D PPE 2. Hearing Protection 3. Review hand signals with operators 4. Review hazard recognition and prevention at toolbox safety meeting 5. Follow excavation safety procedures (see Appendix G) when entering an excavation 6. Follow confined space entry procedure 7. Air monitor as detailed in Section 5
REMOVAL OF SOIL AND SLUDGES FROM SEPTIC TANK		
Laborer	1. Contact with contaminated materials 2. Inhalation of contaminated materials 3. Safety/Physical Hazards -Noise -Slip/trip/fall hazards -Exposure to heavy equipment -Exposure to toxic plants, flying insects, and reptiles -Exposure to excavations -Heat or cold stress -Confined space entry	1. Modified Level D PPE 2. Hearing protection 3. Review hand signals with operators 4. Review hazard recognition and prevention at toolbox safety meeting 5. Follow excavation safety procedures (see Appendix G) 6. Follow confined space entry procedures found in Appendix I 7. Air monitor as detailed in Section 5

Operation/Task	Hazards	Hazard Control
SOIL BORING & SAMPLING CONTAMINATED SOIL		
Sampler	1. Contact with contaminated materials 2. Inhalation of contaminated materials 3. Safety/Physical Hazards -Exposure to heavy equipment -Noise -Pinch points -Heat or cold stress	1. Modified Level D PPE 2. Hearing protection 3. Review hazard recognition and prevention at toolbox safety meeting 4. Collect sample using excavator bucket 5. Air monitor as detailed in Section 5
DECONTAMINATION ACTIVITIES		
Decontamination of Equipment	1. Contact with contaminated tools and equipment 2. Safety/Physical Hazards -Noise -Exposure to Heavy Equipment -Heat or cold stress -Burns from steam decon equip.	1. Level C PPE 2. Hearing protection 3. Review SOPs/operating instructions for decontamination equipment

4.3 Site-specific Personal Protection

The site-specific personal protective equipment is to be used in accordance with the protocols in Section 5.01 of the Corporate Health and Safety Manual. These protocols include the definitions of the EPA levels of protection for Level B, Level C and Level D to be used on-site, as well as donning and decontamination procedures. The site-specific personal protective equipment is as follows:

Coveralls: Poly-coated Tyvek® when exposed to dirt/dusts
Saranex®-coated Tyvek® when exposed to site waters/liquids

Outer Gloves: Viton Gloves
(Note: Work gloves dedicated to the exclusion zone may be used over the viton gloves)

Respirator: Level C: Full-face air purifying respirator with organic vapor cartridges and high efficiency particulate (HEPA) filters

Level B: Positive pressure, full-facepiece Self-Contained Breathing Apparatus (SCBA) or Positive pressure, supplied-air respirator with escape SCBA

Hard hats, steel-toed boots, and safety glasses are mandatory on-site.

SECTION 5 - AIR MONITORING AND ACTION LEVELS

Air monitoring is to be performed in accordance with Appendix D (Section 4.03 of the Corporate Health and Safety Manual - Airborne Materials Exposure) and Appendix E (Section 4.05 of the Corporate Health and Safety Manual - Hazardous Waste Operations). Presented below is the site-specific information.

5.1 Wind Indicator

Wind direction will be monitored each day of on-site activities by using a portable wind indicator.

5.2 Air Monitoring Equipment to be used

Photoionization Detector (PID) with 10.2 eV lamp

Combustible gas/oxygen meter

Direct-Reading Dust Monitor

5.3 Work Zone Air Monitoring Procedures and Action Levels

The following describes the methods and parameters to be used on-site for PPE upgrades and work cessation. The action levels are based upon total organic vapors detected by a photoionization detector (PID) calibrated to isobutylene. PID readings will be adjusted in accordance with manufacturer's guidelines to read in ppm of dichloroethylene.

TABLE 3 - WORK ZONE ACTION LEVELS

Type	Frequency	Action Level	Action
Volatile Organic Compounds (VOCs) (Using PID)	1. Initially when a new task begins and hourly thereafter 2. When obvious contamination is encountered 3. Prior to and continuously during entry into excavations over 4 feet	25 ppm above background in breathing zone for 5 minutes	Increase to Level C PPE
		200 ppm above background in breathing zone for 5 minutes	1. Notify SSHC 2. Increase to Level B PPE 3. Consider engineering controls.
		500 ppm above background in breathing zone for 5 minute	1. Stop work - consult SSHC; 2. use engineering controls (e.g. ventilation) to decrease concentrations
Combustible Gases (Lower Explosive Limit - LEL)	Prior to and continuously during entry into an excavation over 4 feet	10 %	Stop work - increase ventilation to bring below 10 % LEL

Type	Frequency	Action Level	Action
Oxygen	Prior to and continuously during entry into an excavation over 4 feet	19.5 %	Stop work - increase ventilation to bring above 19.5 % oxygen

5.4 Community Air Monitoring Plan

Real-time monitoring for volatile compounds and particulate levels at the perimeter of the work area will be performed.

TABLE 4 - COMMUNITY ACTION LEVELS

Type	Frequency	Action Level	Action
VOCs (using PID)	Initially when a new task begins, every fifteen minutes for the first hour and every two hours thereafter	5 ppm above background sustained for one minute in breathing zone at downwind perimeter of work area	1. Stop work until emission controls (covering excavated areas) are in place and the concentrations detected by the PID are reduced to below 5 ppm at the downwind perimeter of the work area. 2. Air monitor as directed below. 3. When work continues monitoring at the downwind perimeter of the work area will be performed at least every one-half hour.
	Monitoring will be performed within 20 feet of the perimeter of the nearest residential or commercial structure when 5 ppm above background sustained for one minute in breathing zone at downwind perimeter of work area	1 ppm above background sustained for one minute	1. Stop work and continue to monitor. 2. Contact Corporate Safety Coordinator for appropriate action. 3. Work may continue when concentrations detected by the PID are reduced to below 1 ppm. 4. Monitor with pumps and charcoal tubes following NIOSH 1022 (see below)
VOCs (pumps and charcoal tubes following NIOSH 1022)	1. Daily for the first week of excavation actives in contaminated area - one upwind and two downwind 2. When 5 ppm above background sustained for one minute in breathing zone at downwind perimeter of work area is detected using PID	1/2 of PEL after subtracting upwind from downwind	The SSHC and Project Supervisor will re-evaluate vapor suppression techniques
Particulates	Continuously downwind during excavation of contaminated materials integrated over 15 minute periods	100 ug/m³	1. Measure the upwind background level. 2. Implement dust suppression techniques (e.g. using water sprays, covering excavated materials and areas) 3. Notify the SSHC
		150 ug/m³	1. STOP WORK 2. Measure upwind background level immediately 3. Implement additional dust suppression techniques

SECTION 6 - SITE CONTROL

The elements of site control include site work zones (exclusion zone, contamination reduction zone, and support zone), the "buddy" system, site communication, and site security. Protocols for site control can be found in Section 4.04 of the Corporate Health and Safety Manual (see Appendix E).

Only approved, trained personnel will be allowed to enter the exclusion zone and contamination reduction zone. Personnel must understand this HSP and the potential on-site hazards before being allowed on site.

6.1 Potential Confined Space Areas

The excavations (greater than 4 feet) do pose a potential confined space entry area. When entry occurs then the confined space procedures in the Corporate Health & Safety Manual will be followed (section 3.05 - see Appendix I). Specifically, the following precautions will apply:

1. Confined Space Entry permit will be filled out by the SSHC.
2. Air monitoring will be performed continuously for oxygen deficiency and LEL.
3. Personal protective equipment as outlined previously will be used.
4. Barriers and signs will be used to protect opening.
5. Provisions will be made for confined space rescue.

Specific procedures, such as coordination with Owner, training, entrant responsibilities. attendant responsibilities, supervisor/foreman responsibilities, and atmospheric testing can be found in Section 3.05 of the Corporate Health & Safety Manual (see Appendix I).

In addition, the safety requirements for excavations will be followed, as outlined in Section 10.06 of the Corporate Health and Safety Manual (See Appendix G).

6.2 Work Area

A map of the work areas depicting the exclusion and contamination reduction zones will be prepared and submitted with the Excavation plan and performance specifications.

SECTION 7 - EMERGENCY RESPONSE AND CONTINGENCY PLAN

Sections 3.01, Medical Services and First Aid, 3.03, Emergency Action, and 4.05, Hazardous Waste Operations, of the Corporate Health and Safety Manual provide guidance on emergency response. This section provides the site-specific emergency response information.

7.1 Directions to Hospital - To be posted in all site trailers (See Figure 4).

Genesee Street West to I-481 North.
I-481 to I-690 West
I-690 West to Townsend Street
Left onto Townsend Street
Turn left onto Genesee Street
Turn right onto Irving Ave
The hospital on right.

7.2 Location of Nearest Available Telephone

The telephone will be located in the site field office.

7.3 Emergency Telephone numbers - To be posted in site office

Police	911
Crouse Irving Memorial Hospital	470-7111
Fire Department	911
OBG Technical Services, Inc.	437-6400

7.4 Safe Refuge

The field office will serve as point of safe refuge. An air horn will be kept in the field office. If the air horn is sounded, all on-site personnel must return to the office.

7.5 Spill Control

A major spill is not anticipated at the site. Should a spill of any type occur, the personnel present at the spill should report it immediately to the SSHC and/or the OBG Tech emergency contacts, who will make arrangements for the proper clean-up of the spill and contact the appropriate local emergency groups and regulatory agencies. On-site personnel should immediately secure the area to prevent unauthorized entry into the spill area. On-site personnel must evaluate the extent of the hazard(s) and if available, utilize engineering controls and proper safety equipment to contain the spill until response personnel are on site. The emergency response personnel will be contacted immediately by SSHC in the event that the spill can not be immediately contained by on-site materials.

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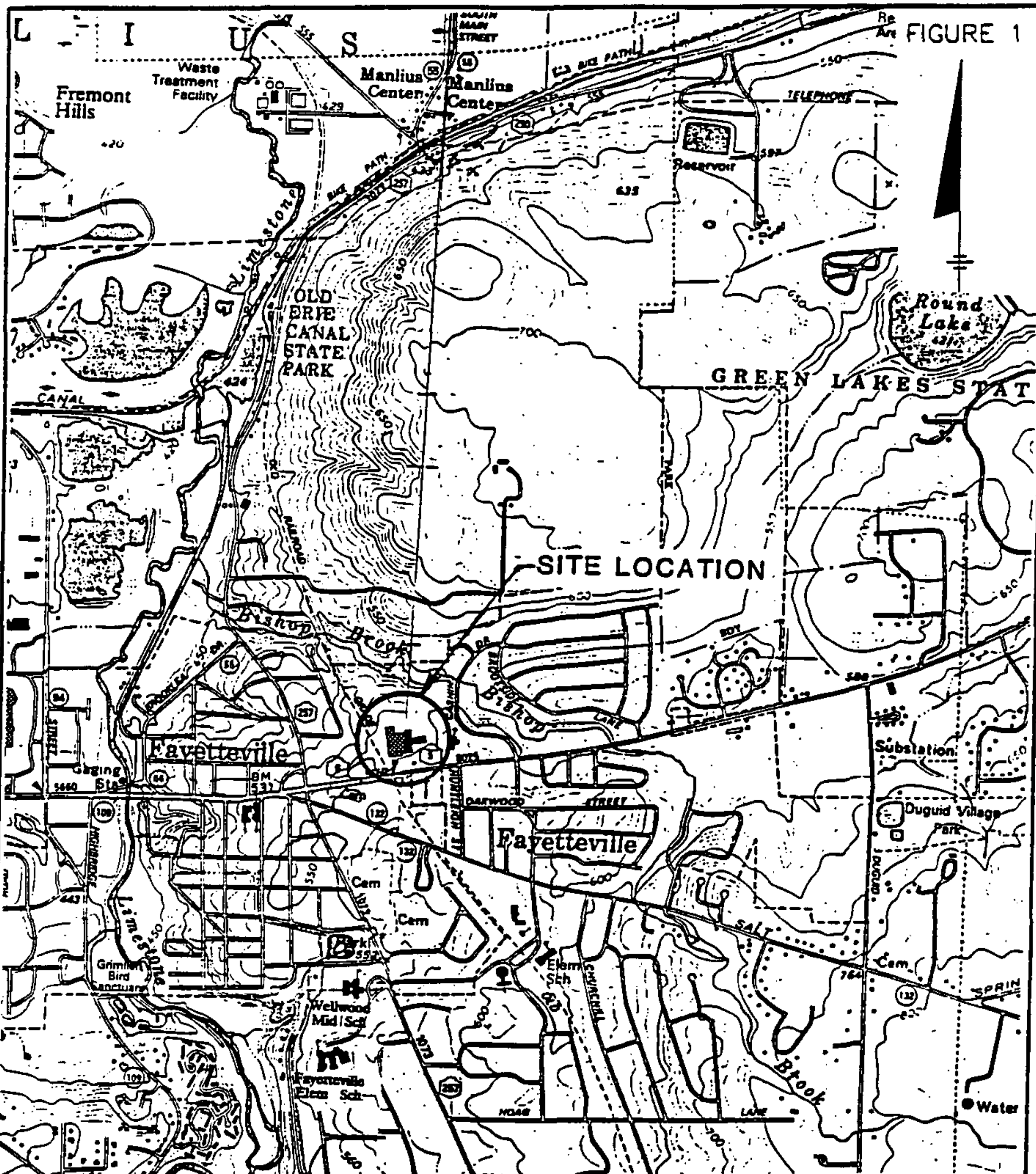
FIGURE 1



ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK

SITE MAP

SCALE: 1" = 2,000 FT.

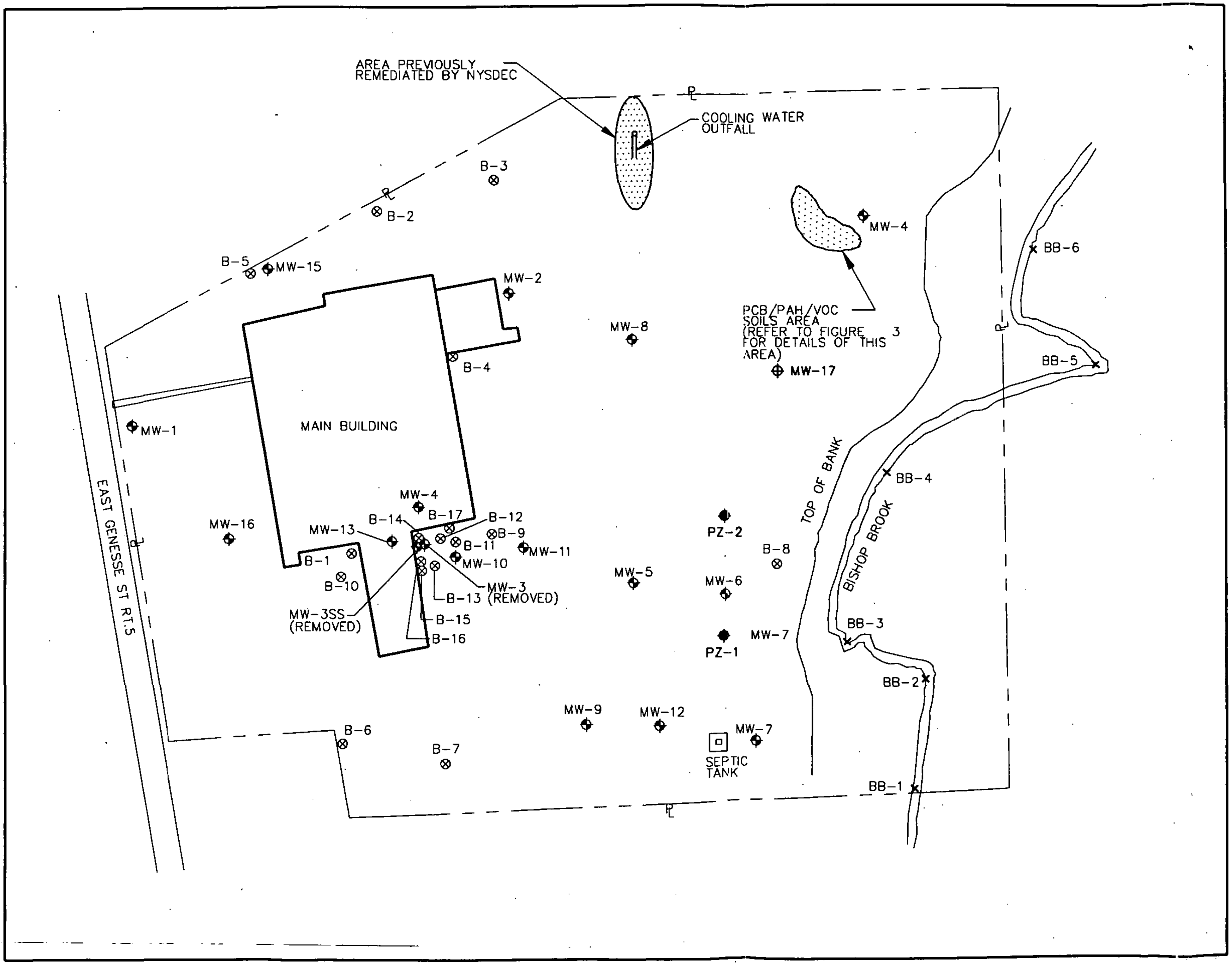
USGS TOPOGRAPHIC 7.5 MIN. QUAD
SYRACUSE EAST, N.Y. QUADRANGLE

FILE NO. 2488.396–

O'BRIEN & GERE ENGINEERS INC.

MHB H:\DIVISION\71\ACCURATE\ACCUSP1 SF=150' 8/17/94

FIGURE 2



LEGEND

PL	PROPERTY LINE
MW-4	MONITORING WELL
B-2	BORING SAMPLE LOCATION
×	SEDIMENT SAMPLE LOCATION
PZ-1	LOCATION

ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK

SITE PLAN

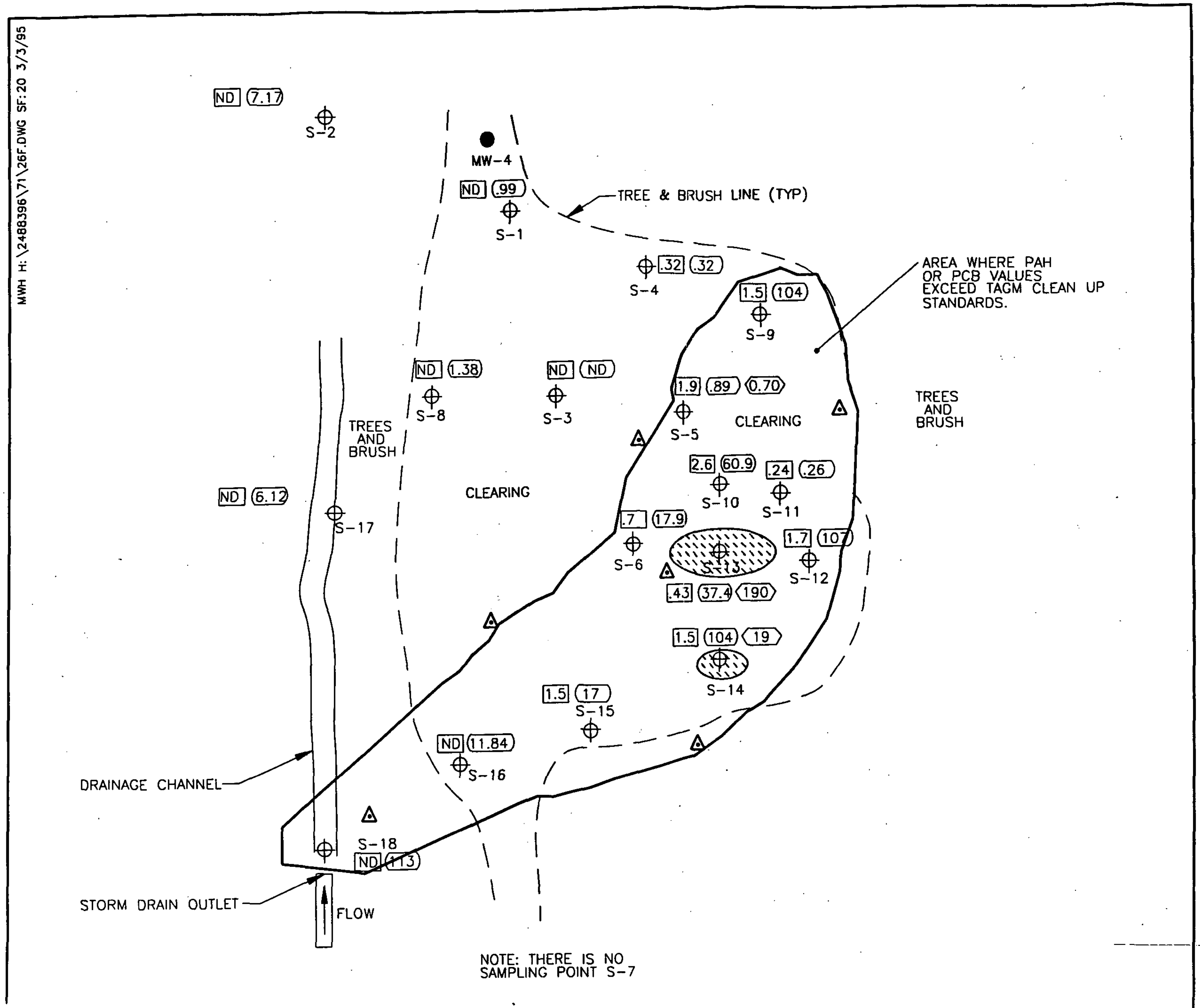
150 0 150

APPROX. SCALE IN FEET

FILE NO. 2488.396-03F

O'BRIEN & GERE
ENGINEERS INC.
Syracuse, New York

FIGURE 3



LEGEND

- APPROXIMATE LIMITS OF PROPOSED EXCAVATION
- 0.70 TOTAL VOC CONCENTRATION (F
- 1.9 PCB CONCENTRATION (PPM)
- .89 PAH CONCENTRATION (PPM)
- APPROX. SAMPLING POINT
- PROPOSED SOIL BORING LOCATION (APPROXIMATE)
- APPROX. LOCATION OF OBSERVED SOIL STAINING

ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORI
SOIL EXCAVATION,
PCB/PAH/VOC SOILS

SAMPLING LOCATION
/ANALYTICAL RESUL

20 0 20
APPROX. SCALE IN FEET

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O'BRIEN & GERE ENGINEERS INC.

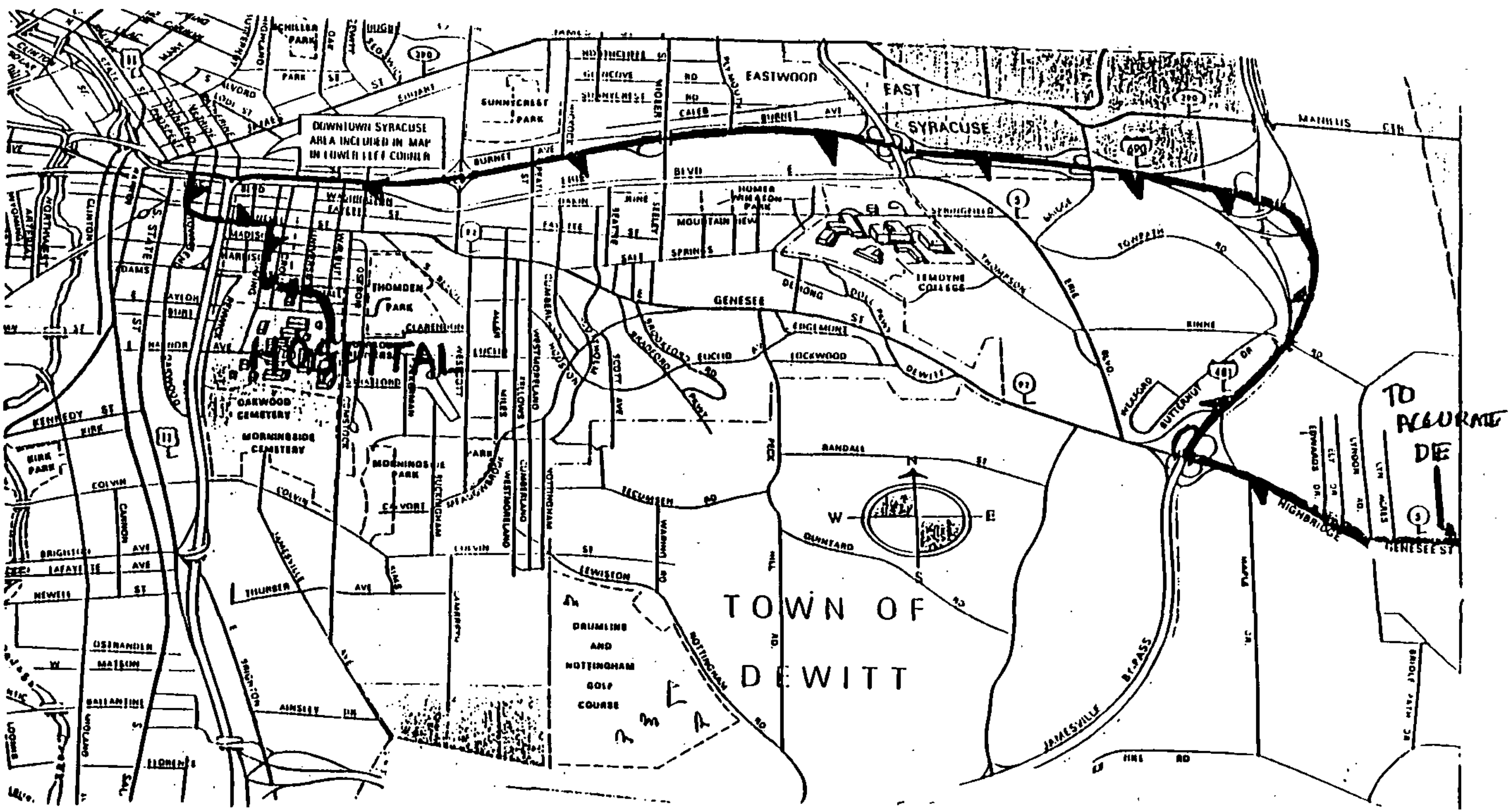


FIGURE 4

HOSPITAL ROUTE MAP

Health and Safety Plan Compliance

TECHNICAL SERVICES

Project Name: ______________________________

This is to certify that I have read, fully understand, and agree to comply fully with the attached Health and Safety Plan furnished to me by OBG TECHNICAL SERVICES, INC.

NAME	SIGNATURE	COMPANY	DATE

Appendix A

2.02 Health and Safety Training

A. Introduction

All employees must recognize and understand the potential hazards to health and safety associated with the tasks that they perform. The objectives of safety training programs are:

1. To make employees aware of the potential hazards they may encounter;

2. To provide employees with the knowledge and skill necessary to perform the work with minimal risk to employee health and safety;

3. To make employees aware of the purpose and limitations of equipment; and

4. To provide employees with information to avoid or procedures to follow in the event of an emergency.

B. New Employee

All new employees to OBG Technical Services, Inc. will receive training that will provide an introduction to the Safety Program, employees rights and responsibilities on safety, electrical safety, minimizing back strain on the job, Hazard Communication, and substance abuse-free workplace policy.

C. Job specific

Field Supervisors/Foreman will be responsible for training new employees on site-specific information, such as safe work practices and procedures to follow in the event of an emergency.

D. Haz Com

All OBG Tech employees will receive training on the OSHA Hazardous Communication Standard ("Right-to-Know"). Each employee receives a copy of the written program with their job offer letter. However, formal training is conducted to verify that all employees have been made aware of the plan, its requirements, and be informed of their right to receive information about hazardous materials.

Each supervisor is responsible for training employees on new materials introduced on specific jobs.

E. Other Safety Training

1. "Toolbox" Safety Meetings

There are a number of OSHA regulations which require training. Many of these are specific to jobs and should be documented by "tool box" meetings. These include: medical services and emergency action, fire protection, accident prevention, and power-operated and woodworking hand tools, stairways and ladders, guardrails and handrails, welding and cutting, scaffolds, concrete and masonry construction, and demolition.

Supervisors/Foreman review the applicable topics in weekly "tool box" safety meetings on every project. Names of employees attending the meeting and topics covered are forwarded to the Safety Coordinator for recordkeeping purposes.

2. Quarterly Staff and Safety Meetings

Staff and safety meetings are held quarterly for all employees. These meetings cover staff and personnel issues, as well as selected topics related to safety.

3. Haz Waste Training

Employees who are assigned to perform duties on hazardous waste sites will receive the OSHA initial 40-hour health and safety training prior to on-site activities at a hazardous waste site. Applicable employees will receive yearly 8-hour refresher courses. In addition, Foreman, Supervisors, and Project Managers will receive the OSHA 8-hour health and safety supervisors training.

4. Other Safety Training

Periodically, employees will be sent to safety training courses relevant to their duties, such as confined space entry.

F. Records

The Safety Coordinator will maintain safety training records on each individual.

Appendix B

Section 5.01 EPA Levels of Personal Protective Equipment

A. Introduction

Due to the nature of the business of OBG Tech, employees may be required to work on hazardous waste sites. Use of personal protective equipment (PPE) is required by OSHA. EPA has defined four Levels of Protection: Levels A, B, C, and D. These levels are defined below and may be used as a starting point for PPE on sites, but must be tailored to the specific situation.

B. Levels of Personal Protection

Level A

Level A protection provides the highest available level of respiratory, skin and eye protection. The material in the suit, gloves, and boots must be compatible with the substances involved.

1. Positive pressure, full-facepiece SCBA or positive pressure supplied-air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH).
2. Fully-encapsulating, chemical-resistant suit.
3. Outer chemical-resistant gloves.
4. Inner chemical-resistant gloves.
5. Chemical-resistant safety boots.
6. Two-way communications.

   Options:

   1. Cooling unit.
   2. Coveralls.
   3. Long-underwear.
   4. Other PPE as required in Section 5.02 through 5.09 of this Health and Safety Manual.

Level B

Level B protection provides the highest level of respiratory protection but less skin protection than Level A. Use only when airborne chemicals are not hazardous to the skin or not capable of being absorbed through the intact skin.

1. Positive-pressure, full-facepiece SCBA or positive-pressure supplied-air respirator

with escape SCBA (NIOSH approved).

2. Chemical-resistant suit.

3. Inner and outer chemical-resistant gloves.

4. Chemical-resistant safety boots.

5. Two-way communications.

Options:

1. Cooling unit.

2. Coveralls.

3. Long-underwear.

4. Other PPE as required in Section 5.02 through 5.09 of this Health and Safety Manual.

Level C

Level C protection provides less skin protection as Level A and a lower level of respiratory protection than Levels A and B.

1. Full-facepiece, air-purifying, canister-equipped respirator (NIOSH approved).

2. Chemical-resistant suit.

3. Inner and outer chemical-resistant gloves.

4. Chemical-resistant safety boots or chemical-resistant boot covers.

5. Two-way communications.

Options:

1. Cooling unit.

2. Coveralls.

3. Long underwear.

4. Other PPE as required in Sections 5.02 through 5.09 of this Health and Safety Manual.

Level D

Level D protection provides minimal skin protection and no respiratory protection.

1. Coveralls or long pants and long-sleeved shirt.

2. Safety boots.

Options:

1. Other PPE as required in Sections 5.02 through 5.09 of this Health and Safety Manual.

C. PPE donning procedures

1. Inspect the PPE before donning with the procedures outlined in Sections 5.02 through 5.09.
2. Make adjustments to hard hat to fit user's head, if necessary.
3. Standing or sitting, step into legs of the suit; evaluate proper placement of feet within the suit; then gather suit and pull sleeves over arms and secure suit front.
4. Put on chemical-resistant safety boots over the feet of the suit. Tape the leg cuff over the tops of the boots.
5. Put on air tanks and harness assembly of the SCBA (if applicable). Don the facepiece or respirator and adjust it to be secure, but comfortable. Do *not* connect the breathing hose of the SCBA. Open valve on the air tank (if applicable).
6. Perform negative and positive respirator facepiece seal test procedures.
7. Put on inner gloves.
8. Put on other PPE (e.g hard hat, hearing protectors).
9. Raise hood over head carefully so that the face seal of the respirator is not disrupted.
10. Connect the breathing hose while opening the main valve (if applicable).
11. Have assistant observe the wearer for a period of time to evaluate whether the wearer is comfortable, stable, and that the PPE is functioning properly.

D. PPE Decontamination Procedures

Station 1: Equipment Drop

Deposit equipment used on-site (tools, sampling devices, clipboards, etc) onto plastic drop cloths. During hot weather a cool down station may be set up within this area.

Station 2: Outer Garment, Boots, and Gloves Wash and Rinse

Scrub outer boots, outer gloves and chemical-resistant splash suit with decontamination solution or detergent water. Rinse off using large amounts of water.

Station 3: Outer Boot and Glove Removal

Remove outer boots and gloves. Deposit in appropriate area.

Station 4: Tank, Canister, or Mask Change

If worker leaves exclusion zone to change air tank, canister, filters, or mask, this is the last step in the decontamination procedure. Worker's air tank, canister, filters, or mask is exchanged, new outer gloves and boots are donned, joints taped, and worker returns to duty.

Station 5: Boot, Gloves, and Outer Garment Removal

Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.

Station 6: SCBA or Face-piece Removal

SCBA backpack and/or facepiece is removed. Avoid touching face with finger. SCBA deposited on plastic sheets.

Station 7: Field Wash

Hands and face are thoroughly washed. Shower if appropriate.

E. Upgrading/Downgrading of PPE Levels

The PPE used and the overall level of protection should be reevaluated periodically as the amount of information on the site increases, and as workers as required to perform different tasks.

Reasons to upgrade the level of PPE may include:

- Known or suspected presence of skin contact hazards.
- Occurance or likely occurance of gas or vapor emission.
- Change in work task that will increase contact or potential contact with hazardous materials.

Appendix C

2.04 Medical Surveillance

A. Introduction

OBG Technical Services provides medical and environmental surveillance of the health of those individuals exposed to materials or work conditions which are associated with adverse health conditions or who participate in the Health & Exercise Program.

B. Medical Examinations

1. Warehouse Employees

The examination for warehouse employees, for the purposes of medical examinations, includes any employee who works on regular basis at the warehouse, and is not covered under another examination (e.g. hazardous waste examination). This is the examination for DOT driver certification. This examination is required every two years. This examination fulfills the requirement for employee participation in the Firm's Health & Exercise Program.

The examination includes the Medical Questionnaire, a Medical Examination. Sudiology Test, DOT Driver Certification, and testing for complete bilod count and chemistry profile.

2. Field Employees

The examination for field employees, for the purposes of medical examinations, is any employee who visits or works at a job site on a regular basis. Field employees, for the purpose of medical examination, includes some Supervisors, Foreman, and Laborers. This examinations is required by OSHA in 29 CFR 1910.120, the Hazardous Waste Operations regulations. This examination fulfills the requirement for employee participation in the Firm's Health & Exercise Program.

The examination includes the OSHA required Medical Questionnaire, Respirator Suitability Form, a Medical Examination, Audiology Test, Pulmonary Function Test, DOT Driver Certification, and testing for complete blood count and chemistry profile, and phenols (quantitative).

3. Supervisor/Managerment Employees

A Supervisor/Management employee is any employee who periodically visits a job site (less than 30 days a year). Supervisors/Management employees, for the purpose of medical examinations, includes Officers, Project Managers, and all levels of Supervisor not covered elsewhere (i.e. hazardous waste examination). This examination is required at a frequency based on the individuals age. This examination fulfills the requirement for employee participation in the Firm's Health & Exercise Program.

The examination includes the Medical Questionaire, a Medical Examination, Audiology Test, and testing for complete blood count, and chemistry profile.

4. Office Personnel

Office personnel, for the purposes of medical examinations, include administrative and office personnel. This examination fulfills the requirement for employee participation in the Firm's Health & Exercise Program.

The examination includes a Medical Examination, and testing for complete blood count and chemistry profile.

5. Drug Screen

The drug screen is mandatory for all newly hire, "regular status" employees. Temporary status employees may also require a drug screen, based upon a variety of factors. Please refer to OBG Technical Services' "Substance Abuse-Free Workplace" policy for more information.

C. Frequency

1. Baseline examinations

Individuals who are assigned temporarily or permanently to field work will receive a baseline examination prior to job assignment.

2. Periodic Examinations

Individuals who are assigned temporarily or permanently to field work will receive periodic examinations yearly.

3. Termination Examinations

Field employees permanently leaving the company will receive an exit examination.

4. Possible Exposure Examinations

As soon as possible upon notification by an employee that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that employee has been injured or exposed above the permissible exposure limits in an emergency situation, that employee will be required to receive medical attention.

D. Examination Results

OBG Tech must receive a letter from the attending physician stating the parameters of the examination and whether or not the individual is able to work with or without restriction. This letter will be filed by the Office Administrator and a copy is distributed to the employee.

Appendix D

Section 4.03 Airborne Materials Exposure

A. Introduction

OSHA, in 29 CFR 1910.1000, specifies that an employee's exposure to substances listed in Table Z-1-A, Z-2, or Z-3 shall be limited in accordance with the requirements of the section. OSHA, in 29 CFR 1926.55, specifies that an employee's exposure to those specified in the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) for Airborne Contaminants for 1970 shall be avoided. Where the requirements of the two standards overlap, the most stringent of the two will be enforced.

B. Administrative and Engineering Controls

To achieve compliance with airborne materials exposure, administrative or engineering controls must first be implemented to achieve compliance.

C. Respirator Use

When effective engineering or administrative controls are not feasible to control airborne exposures, or while they are being instituted, appropriate respirators will be used. Training, selection, issuance, and standard operating procedures are outlined in Section 5.06 of this Health and Safety Manual.

D. Action Specific Hazards

As specified in 29 CFR 1910 Subpart Z, action specific hazards, i.e. lead, asbestos, and formaldehyde, have certain requirements. Such material will be monitored as directed under specific regulatory requirements.

E. Monitoring

1. Monitoring for IDLH and other dangerous conditions

During confined space entry and other situations where the quality of the air is unknown, air monitoring will be conducted for combustible or oxygen deficient atmospheres, as well as for volatile organics. Calibration and maintenance procedures for direct-reading equipment are included as Appendix A.

2. General On-site Monitoring

Site conditions may change during site activities. Air monitoring will be conducted when:

a. Work begins on a different portion of the site.
b. A different type of operation is initiated.
c. Employees are working in obvious contamination.

3. Personal Monitoring

Personal monitoring will be performed on high-risk workers who are closest to the source of contaminant generation. This approach is based upon the rationale that the probability of significant exposure varies directly with distance from the source. If workers who are closest to the source are not significantly exposed, then all other workers are, presumably, also not significantly exposed and probably do not need to be monitored.

However, any employee may request personal monitoring be performed if a potential risk exists.

Personal air monitoring methodology will be determined by the Safety Coordinator using the appropriate National Institute for Occupational Safety and Health (NIOSH) or other appropriate methods.

F. Notification

Employees will be notified of the results of the monitoring performed in accordance with the procedures specified in Section 2.05.

Appendix A

Calibration and Maintenance Procedures

A. Loan of Equipment

1. Sign-out Procedures

The health and safety monitoring equipment can be obtained from the Warehouse Supervisor or the Safety Coordinator. The information that will be required prior to a piece of equipment leaving the warhouse equipment room will be:

- Serial Number of equipment
- Name of Person responsible for equipment
- Job Number and Location
- Expected Return Date

2. Equipment Return

Never use carrying cases as shipping cases.

Should a piece of equipment be damaged or in need of maintenance, it should be tagged with appropriate instructions.

Upon return, the piece of equipment will be checked to see if it is in the same condition as it left in. If it is broken, an assessment will be made to determine whether it was broken by mishandling or by normal wear and tear. It will also be determined whether the repair can be performed in-house or must be sent to the manufacturer. If the equipment was determined to be broken due to mishandling and the equipment must be sent to the manufacturer, the Project Manager in charge will be contacted to determine if the project can absorb the cost of the repair.

B. Photoionization Detectors (PIDs)

1. Calibration Procedures

This is to be performed, at a minimum, on a daily basis or whenever the detector is used.

a. Turn on photoionization detector (PID) and allow to warm up.

b. Zero instrument in "clean" air. (Note: "Clean" air refers to upwind of a waste site).

c. Connect Span Gas cylinder to PID with a piece of clean tubing.

d. Open the valve on the cylinder until a steady reading is obtained.

e. Adjust the SPAN control, if necessary, until reading is the same as the Span Gas concentration.

f. Close the valve on the Span Gas cylinder. Disconnect the cylinder from the PID.

g. Sample again in "clean" air. Adjust the zero, if necessary.

2. Maintenance Procedures

Keeping the PID in top operating shape means charging the battery, cleaning the lamp window, and replacing filters. The exterior of the PID can be wiped clean with a damp cloth and mild detergent, if necessary.

B. Combustible Gas and Oxygen Meters (CGI/O_2 Meters)

1. Calibration Procedures

a. Combustible Gas Meter

i. Turn on the instrument and allow to warm up.
ii. Zero % LEL meter in "clean" air.
iii. Connect calibration gas with clean piece of tubing to meter.
iv. Open the valve on the cylinder until a steady reading is obtained.
v. Adjust the combustible gas calibration control, if necessary, until reading is the same as the calibration gas concentration.
vi. Close the valve on the calibration gas cylinder. Disconnect the cylinder from the meter.
vii. Sample again in "clean" air. Adjust the zero, if necessary.

b. Oxygen Meter

i. Turn on the instrument in "clean" air and allow to warm up.
ii. If the % oxygen stabilizes at a value other than 20.3%, adjust the oxygen calibration control until the reading is 20.3%.

2. Maintenance Procedures

Keeping the meter in top operating shape means charging the battery and replacing worn parts. The exterior of the meter can be wiped clean with a damp cloth and mild detergent, if necessary.

C. Flame Ionization Detector (FID)

1. Calibration Procedures

This is to be performed on a daily basis or, at a minimum, whenever the instrument is used.

a. Place instrument in normal operation with CALIBRATE Switch set to X10). Allow 20 minutes for warm up and stabilization.

b. Introduce a methane sample of known concetration (between 90 and 100 ppm) and adjust the GAS SELECT dial so the meter reading corresponds to the known sample.

Periodically (once a month), the FID should be calibrated over the full range using the trimpots. Please refer to the Operations and Maintenance Manual for further instructions.

2. Maintenance Procedures

a. The battery pack can be recharged overnight; however care should be taken to completely discharge tha batery prior to recharging.

b. A supply of analytical grade hydrogen is needed to recharge the 75 cc hydrogen tank in the OVA.

3. Shipping

Compressed hydrogen cannot be shipped by air. A supply of compressed hydrogen must be available locally.

D. Air Sampling Pumps

1. Calibration Procedures

Calibrate personal air sampling pumps before and after each day of use using a primary calibrator. If it is not feasible to use a primary calibrator, a precision rotameter may be used.

a. Allow the pump to run 5 minutes prior to calibration.

b. Check the battery charge.

c. Connect the collection device in the same manner in which the sample will be collected. Please note that the sampling media used for calibration is not to be used for sample collection.

d. Wet the inside of the glass tube with soap solution.

e. Turn on the pump and adjust the pump rotameter to the appropriate flow rate setting.

f. Draw two or three bubbles up the glass tube.

g. If the flowrate is not within the range of accuracy, adjust the flowrate and draw more bubbles up the glass tube.

h. Record the average of three runs on the sample data sheet.

i. Repeat the procedures for all pumps to be used. The same sampling media may be used for all calibrations.

2. Maintenance

a. Battery

The NiCad battery pack should be completely discharged from time to time to minimize the potential for "memory effect" which occurs frequently with rechargeable batteries. "Memory effect" would prevent a pump from running a full eight-hour period in some cases. The "Full Cycle" mode on the batery charger will fully discharge the battery pack, then recharge it and switch to a trickle automatically. A status lamp on the battery charger shows the status of the attached battery pack.

b. Pump Inlet Filter

A filter/trap inside the clear plastic intake port housing prevents particulates and liquids from being drawn into the pump mechanism. Replace the filter as needed.

E. Dust Monitor

1. **Zero**

a. Inlet should be in clear position.
b. Selector switch should be in 0-2 position, and the letter "m" should appear to the right of the display reading, indicating that the instrument is set to read concentration measurements.
c. Place time constant switch in 2-second position.
d. Allow 1-minute warm-up period.
e. If required, slowly adjust the ZERO control (while lifting its protective spring loaded cap) until an average reading of 0.000 m is obtained.

2. **Calibration**

a. Keep inlet in clear position.
b. Unlock hinged flow chamber and place it in the horizontal position.
c. Push reference scatterer knob (REF SCAT) inwards until a positive stop is reached. It is important to ensure the plunger has been fully inserted to the limit of its travel. Insertion of the reference scatter will automatically shut off the pump.
d. The letter "K" should be flashing at the upper right side of the digital display indicating that the reference scatterer has been inserted in the sensing beam.

e. Place the time constant in the 2-second position.
f. Move range selector switch to its 0-20 position and allow about 30 seconds for the reading to fully stabilize. The display should read approximately the calibration number indicated on the RAM-1 calibration serial number label within the flow chamber.
g. If the indicated readings differ substantially (i.e. by more than 5%) from the factory-labelled value, unlock the CAL control and adjust until the desired reading obtained. Relock CAL control.
h. Pull reference scatterer knob completely out of sensing region until the "X" indicator on the display ceases to flash.
i. Close flow chamber cover by tightening two thumb-screws at its upper corner.

F. <u>Drager Pump</u>

1. Pump Leak Test

a. Insert unopened tube into socket.
b. Squeeze pump completely and release.
c. Pump is adequately leak-proof if the end of stroke indicator has not appeared after 15 minutes.
d. Remove tube from socket.
e. Press button to reset counter to zero; button is recessed to prevent accidental resetting.

2. To clean or replace the exhaust valve

a. Lift lower pump plate up with a coin or screwdriver.
b. Pull valve disc from its seating.
c. Wipe valve seating with a damp cloth.
d. Moisten the stem on a new valve disc and push ti firmly into the center hole of the valve seat.
e. Check correct seating by pulling on valve disc lightly.
f. Put back lower pump plate and press it into place.
g. Perform leak test discribed above.

3. Replacing the socket and the membrane

a. Press spring hook down with a suitable tool (e.g. screwdriver).
b. Take out cover plate.
c. Press spring flanges together and remove socket.
d. Insert new socket.
e. Using a new End-of-Stroke Indicator Membrane, place parts into the housing.
f. Insert spring hook of cover plate and push on firmly.
g. Perform leak test described above.

Appendix E

Section 4.05 Hazardous Waste Operations

A. Introduction

Due to the nature of the business conducted by OBG Tech, employees may be working on hazardous waste sites. OSHA has requirements for such things as air monitoring, health and safety plans, site control, and emergency response. This section is to define OBG Tech's Standard Operating Procedures (SOPs) for hazardous waste sites and to outline the elements for inclusion in the Site-specific Health and Safety Plan.

B. Other Pertinent Sections of OBG Tech's Health and Safety Manual

Section	Topic
1.01	Safety Policy
2.01	Health and Safety Records
2.02	Health and Safety Training
2.03	Injury/Illness and Accident Report Process
2.04	Medical Surveillance
2.05	Exposure Monitoring
2.09	General Safety Rules
3.01	Medical Services and First Aid
3.02	Sanitation
3.03	Emergency Action
3.04	Confined Space Entry
4.01	Occupational Noise Exposure
4.02	Radiation Exposure
4.03	Airborne Materials Exposure
5	Personal Protective and Life Saving Equipment
6	Fire Protection and Prevention
8	Materials, Handling, Storage, Use, and Disposal

C. Hazardous Waste Standard Operating Procedures

1. Contractors and Sub-contractors

All contractors and sub-contractors retained by OBG Tech for work in hazardous waste will be informed of emergency response procedures and any potential fire, explosion, health, safety, or other hazards of the hazardous waste operation that have been identified by OBG Tech.

2. Program Availability

The written safety and health program will be made available to: any contractor or sub-contractor; OBG Tech employees; OSHA personnel; and to personnel of other Federal, State, or local agencies.

3. Project Personnel

Certain individuals have specifically designated responsibilities on hazardous waste sites.

Project Manager - The Project Manager is responsible for the over-all management of the project. The Project Manager manages administrative requirements.

Project Supervisor - The Project Supervisor is responsible for coordinating between office and field personnel. The Project Supervisor is responsible for the day-to-day activities of the project. The Project Supervisor will oversee field and related activities.

Site Safety and Health Coordinator - The Site Safety and Health Coordinator (SSHC) will establish operating standards and coordinate overall project safety and health activities for the site. The SSHC will review project plans and revisions to plans to determine that safety and health procedures are maintained throughout the project. The specific responsibilities of the SSHC are outlined in Part 16, below.

4. Pre-entry Briefing

Pre-entry briefings will be held prior to initiating any site activity and at other times as necessary to inform employees of the site-specific health and safety plan. In situations covered by OBG Tech's Haz Com Program or the 40-hour Hazardous Waste Operations Health and Safety Training, training required by that program need not be duplicated.

5. Effectiveness of site-specific health and safety plan

Inspections will be made by the Site Health and Safety Coordinator or the Project Supervisor to determine the effectiveness of the site safety and health plan.

6. Personal Protective Equipment

Personal protective equipment (PPE) will be provided in accordance with Section 5 of this Health and Safety Manual. PPE will be selected and used which will provide protection against known or suspected hazardous substances and health hazards.

7. Initial Site Entry Monitoring

When information on the site shows that the potential for ionizing radiation, for IDLH conditions, or when site information is not sufficient to reasonably eliminate the following conditions:

a. Monitoring with direct-reading instruments for hazardous levels of ionizing radiation (See Section 4.02).
b. Monitoring the air with direct-reading instruments for IDLH conditions (See Section 4.03).
c. Visually observing for signs of actual of potential IDLH or other dangerous conditions.

8. On-going Air Monitoring Program

An on-going monitoring program will be established for every site where there is a potential for employee exposure to hazardous concentrations of hazardous substances. This on-going monitoring is to evaluate proper selection engineering controls, work practices, and PPE, so that employees are not exposed above OSHA PELs and published exposure levels. Specifically the on-going monitoring will be conducted:

- when work begins on a different part of the site;
- when contaminants other than those previously identified are being handled;
- when a different type of operation is initiated;
- when employees are handling leaking drums or containers or working in areas with obvious liquid contamination (e.g. spill or lagoon)

Personal monitoring will be performed on those employees likely to have the highest exposures to airborne materials in accordance with Section 4.03 of this Health and Safety Manual.

9. Site Control

The elements of the site control program will include a site map; site work zones; site communications, including alerting means for emergencies; and identification of nearest medical assistance. OSHA also requires the use of the "buddy" system, which is defined below and standard operating procedures, which are encompassed into this Health and Safety Manual. These need not be repeated in the site-specific health and safety plan when this Health and Safety Manual is on-site.

a. Site Work Zones

- *Exclusion Zone*: The exclusion zone or the Hot Zone is the area where contamination does or could occur. The exclusion zone boundary should be clearly marked by lines, placards, hazard tape and/or signs or enclosed by physical barriers, such as chains, fences, or ropes. Access control points should be established at the periphery of the exclusion zone to regulate the flow of personal and equipment into an out of the zone and to help verify that proper procedures for entering and exiting are followed.

The required level of PPE in the exclusion zone can vary according to job assignment. This will allow a flexible, effective, and less costly operation, while still maintaining a high degree of safety.

- *Contamination Reduction Zone*: The contamination reduction zone or the decontamination zone is the transition area between the contaminated area and the clean area. At least two lines of decontamination stations should be set up within the contamination reduction zone: one for personnel and one for heavy equipment. Personnel entering the contamination reduction zone should be required to wear PPE prescribed for working in the contamination reduction zone. To reenter the support zone, workers must remove any PPE. Personnel stationed in the contamination reduction zone includes the Site Health and Safety Coordinator, the Project Supervisor, personnel assisting in decontamination procedures, and emergency response personnel.

The contamination reduction zone should be designed to facilitate: decontamination, emergency response, equipment resupply, sample packaging, and temporary work rest area.

- *Support Zone*: The support zone is the location of the administrative and other support functions needed to keep the operations in the exclusion and contamination reduction zone running smoothly. Any function that need not or cannot be performed in a hazardous atmosphere is performed here. Personnel may wear normal work clothes within this zone. Any potentially contaminated clothing, equipment and samples must remain in the contamination reduction zone until decontaminated. All emergency telephone numbers, change for the telephone (if necessary), evacuation route maps, and vehicle keys should be kept in the support zone.

b. "Buddy" System

Most activities in a contaminated or otherwise hazardous areas should be conducted with a buddy who is able to:

- Provide his or her partner with assistance.
- Observe his or her partner for signs of chemical or heat exposure.
- Periodically check the integrity of his or her partner's protective clothing.
- Notify the Project Supervisor or the Site Health and Safety Coordinator if emergency help is needed.

c. Site Communication

Internal communication among personnel on site and external communication between on site and off-site personnel should be established.

Verbal communication at a site can be impeded by on-site background noise and the use of personal protective equipment. In the absence of site-specific communication signals, the following will be used for emergencies:

Hand clutching throat: Out of air/can't breathe

Thumbs up: OK/I'm alright/I understand

Thumbs down: No, negative

Grip partner's wrist or both hands around partner's waist: Leave area immediately

Hands on top of head: Need assistance

10. Site Security

Site security is necessary to prevent the exposure of unauthorized, unprotected people to the site, to avoid the increased hazards of vandals, to prevent theft, and to avoid interference with safe working procedures.

A physical barrier will be constructed to help prevent exposure of unauthorized and unprotected people to site hazards.

The Site-specific health and safety plan will include any other provisions for maintaining security at the Site.

11. Engineering Controls, work practices, and personal protective equipment for employee protection

Engineering controls and work practices must be first instituted to reduce and maintain employee exposure to or below the OSHA PELs, except to the extent that such controls and work practices are not feasible.

Engineering controls which may be feasible include the use of remotely operated material handling equipment. Work practices which may be feasible include wetting down dusty operations and locating employees upwind of possible hazards.

Whenever engineering controls and work practices are not feasible, PPE will be used in accordance with Section 5 of this Health and Safety Manual to reduce employee exposure to or below the OSHA PELs.

Engineering controls, work practices, and personal protective equipment will be used to reduce and maintain employee exposure to or below published exposure levels not regulated by OSHA. PPE will be used in accordance with Section 5 of this Health and Safety Manual to reduce employee exposure to or below the published exposure levels.

Guidance for PPE selection can be obtained from 29 CFR 1910.120 Appendix B or the NIOSH/OSHA/USCG/EPA document "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities." The guidance document is usually handed out in the OSHA 40-hour course. However, should an employee desire a copy of 29 CFR 1910.120 Appendix B or the guidance document, the safety coordinator can provide one.

12. Levels of Protection

OBG Tech often employs the use of PPE based upon the EPA Levels of Protection. They are listed in Section 5 as a starting point, however site-specific PPE may be required. Site-specific PPE will be addressed in the site-specific health and safety plan. The type of equipment used and the overall level of protection should be re-evaluated periodically as the amount of information about the site increases and as workers as required to perform different tasks.

13. PPE Decontamination Procedures

General PPE decontamination procedures are outlined in Section 5.01. Site-specific decontamination procedures, if any, will be included in the Site-specific Health and Safety Plan.

14. Emergency Response Procedures

The nature of hazardous waste work makes emergencies a continuous potential, no matter how infrequently they occur. The communications network, as outlined in Section 4.05, part 9.c, must be conveyed to all workers so that emergency information may quickly distributed. Equipment will be necessary for emergency situations. At a minimum each site will be equipped with a fire extinguisher, eye wash bottle, and first aid kit. Other equipment, which should be considered on a project by project basis, are emergency showers, safety harnesses, and spill-containment equipment.

Follow-up procedures, as follows, must be implemented before activities resume on-site:

- Appropriate governmental agencies must be notified as required.
- Restock, replace, and/or clean all equipment and supplies.
- The Site Health and Safety Coordinator, the Project Supervisor, and the employee affected should fill out an accident report, as outlined in Section 2.03.

15. Hazards of hazardous waste sites

Chemical

Most sites contain a variety of chemicals that may be in a gaseous, liquid, or solid form. These substances can be hazardous through inhalation, skin absorption, ingestion, or through injection (a puncture wound).

Acute chemical exposures usually occur during or shortly after exposure to a high concentration of a chemical. *Chronic* usually refers to exposures to low concentrations of a chemical over a long period of time. Both of these are dependant on the chemical and may be temporary or reversible or may be permanent. Some chemicals may exhibit warning signs, while other chemicals are odorless, colorless, and tasteless.

Inhalation is the primary route of exposure at a hazardous waste site. Therefore the selection and use of the proper respiratory protection is extremely important where there is a potential for inhalation of hazardous materials. Direct skin and eyes contact is also a potential route of exposure, therefore proper selection and use of PPE is extremely important. Ingestion and injection are the least significant routes of exposure at a hazardous waste site. However, personal habits such as eating, drinking, or smoking, and safety hazards such as puncture wounds can be potential routes, therefore following SOPs and use of PPE can reduce the hazards from both of these routes of exposure.

Further information is presented in OBG-Tech's Haz Com and OSHA 40-hour hazardous waste operations health and safety training.

Explosion and Fire

Due to the nature of activities at hazardous waste sites, there is a potential for explosions and fires. To minimize the hazards from fire and explosion: monitor for explosive and flammable atmospheres following the procedures in Section 4.03; keep all potential ignition sources away from an explosive or flammable environment; use non-sparking, explosion-proof equipment; and follow safe work practices.

Oxygen Deficiency

Oxygen deficiency may result from the displacement of oxygen by another gas, or the consumption of oxygen by another chemical reaction. Confined spaces and low-lying areas are particularly vulnerable and should always be monitored prior to entry following the procedures in Section 3.04.

Ionizing Radiation

Monitoring for ionization radiation is required to be performed when there is not sufficient information to eliminate the possibility of it being present on-site (e.g. uncontrolled hazardous waste sites, where little or no information is available on past history). The procedure in Section 4.02 will be followed for monitoring.

Biological Hazards

Wastes from hospitals and research facilities may contain biological materials that may cause infections to site personnel. Other biological hazards that may be present at hazardous waste sites include poisonous plants, insects, and animals. PPE can reduce the potential for exposure. The Safety Coordinator can assist in determining the correct PPE for the hazard present.

Safety Hazards

Hazardous waste sites contain numerous potential safety hazards such as: holes, ditches, drums, boards, nails, broken glass, slippery surfaces, steep grades, and uneven terrains. The work itself may be a potential safety hazard. Site personnel should constantly look out for potential safety hazards and should immediately inform the Project Supervisor or the Site Health and Safety Coordinator of any new hazards.

Electrical Hazards

As in all construction work, overhead power lines, electrical wires and cables, site electrical equipment, and lightning also pose a potential hazard to site workers. Section 10.02 provides guidance on safe electrical practices.

Heat Stress

Heat stress is potentially a major hazard for workers wearing protective clothing. Due to the impervious nature of the PPE to keep chemicals away from the skin, body heat and moisture are trapped within the PPE. Careful training and frequent monitoring of personal who wear protective clothing, scheduling of work and rest periods, and the frequent replacement of fluids can protect against this hazard.

Heat stress can be minimized by taking the following steps:

- Adjusting work schedules
- Provided air conditioned or shaded rest areas
- A total of 1 to 1.6 gallons of fluid intake recommended, but more may be necessary to maintain body weight
- Acclimatize workers to site work conditions
- Provide cooling devices to aid natural body heat exchange during prolonged work or

severe heat exposure

- Review recognition and treatment of heat stress with workers

For workers wearing semi-permeable or impermeable PPE and when the temperature in the work area is above 70°F, measure:

- Heart Rate: count the radial pulse during a 30-second period as early as possible in the rest period.

  If heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the work cycle by one-third and keep the rest period the same.

  If the heart rate exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.

- Oral Temperature: use a clinical thermometer or similar device to measure the oral temperature at the end of the work period (before intake of fluids).

  If the oral temperature exceeds 99.6°F, shorten the next work cycle by one-third without changing the rest period.

  If the oral temperature still exceeds 99.6°F at the beginning of the next rest cycle, shorten the following work cycle by one-third.

- Body Water Loss, if possible: measure weight on a scale accurate to +/- 0.25 lb at the beginning and end of each work day to see if enough fluids are being taken in to prevent dehydration. Weights should taken while the employee is wearing similar clothing each day. The body water loss should not exceed 1.5 percent total body weight loss in a work day.

The frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work. The suggested frequency of physiological monitoring for fit and acclimatized workers.

Adjusted Temp.	Normal Work Ensemble	Impermeable Ensemble
90°F and above	45 minutes	15 minutes
87.5°F to 90°F	60 minute	30 minutes
82.5°F to 87.5°F	90 minutes	60 minutes
77.5°F to 82.5°F	120 minutes	90 minutes
72.5°F to 77.5°F	150 minutes	120 minutes

Cold Exposure

Cold stress and impaired ability to work are dangers at low temperatures and when the wind-chill factor is low. To guard against cold stress: wear appropriate clothing; have warm clothing and warm shelter readily available; and carefully monitor workers' physical conditions.

Noise

Work around large equipment often creates excess noise. The procedures set forth in Section 4.01 for occupational noise exposure and Section 5.04 for hearing protection should be followed.

16. Responsibilities of Site Health and Safety Coordinator

The Site Health and Safety Coordinator advises the Project Manager and the Project Supervisor on the matters of health and safety on the site. Specifically the responsibilities of the Site Health and Safety Coordinator include:

a. Aiding the selection of protective clothing and equipment.
b. Periodically inspecting protective clothing and equipment.
c. Maintaining proper storage of protective clothing and equipment.
d. Monitors the workers for signs of heat stress, cold stress, and fatigue.
e. Monitors on-site hazards and conditions.
f. Conducts periodic surveillance to evaluate effectiveness of Site-specific Health and Safety Plan.
g. Has knowledge of emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
h. Posts the directions to the hospital and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
i. Notifies, when necessary, local public emergency officials.
j. Coordinates emergency medical care.

17. Safe Work Practices

a. No eating, smoking, eating, drinking, or application of cosmetics in the Contamination Reduction Zone or the Exclusion Zone.
b. No matches or lighters in the Contamination Reduction Zone or the Exclusion Zone.
c. Enter and exit following procedures in the Site-specific Health and Safety Plan.
d. Wear the PPE specified in the site-specific Health and Safety Plan in the Exclusion Zone.
e. Use the "buddy" system.
f. Report any unusual conditions to the Project Supervisor or the Site Health and Safety Coordinator immediately.

D. Requirements for Site-Specific Health and Safety Plans

As a company policy, site-specific health and safety plans are required on projects. The following site-specific information must be included in the health and safety plan, as well as this manual attached as an appendix. The Safety Coordinator will prepare and/or review each site-specific health and safety plan.

1. Organizational structure of site program

The following information, at a minimum, will be included in the site-specific health and safety plan:

- Project Manager's name and telephone number
- Project Supervisor's name and telephone number
- Site Safety and Health Coordinator's name and telephone number
- Other personnel needed for emergency response

This organizational structure will be reviewed and updated as necessary to reflect the current status of the hazardous waste site operations.

2. Workplan Summary

A summary of the workplan, including location and approximate size of the site, will be included in the site-specific health and safety plan addressing the anticipated activities.

3. Safety and Health Hazard Analysis

A safety and health hazard analysis will be prepared for the site-specific health and safety plan, including pathways for hazardous substance dispersion. The safety and health hazard analysis will include hazardous substances and health hazards involved or expected at the site, and their chemical and physical properties.

Information to consider to include in the site-specific health and safety plan:

- Exposures exceeding the permissible exposure limits and published exposure levels
- IDLH situations
- Potential skin absorption and irritation sources
- Potential eye irritation sources
- Explosion sensitivity and flammability ranges
- Oxygen deficiency

4. Site-specific Training Assignments

Initial 40-hour worker, Supervisor, and Refresher training are addressed in Section 2.02, Health and Safety Training. Hazard Communication training is also addressed in this section. Training specific to the site will be addressed in the site-specific health and safety plan.

5. Personal Protective Equipment

Personal protective equipment to be used by employees for each of the site tasks and operations being conducted will be addressed in the site-specific health and safety plan. The following information will be included in the site-specific plan: PPE selection based upon site hazards; work mission duration; site-specific information on PPE decontamination and disposal;

6. Frequency and types of air monitoring

Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used will be addressed in the site-specific health and safety plan. Methods of maintenance and calibration of monitoring equipment can be found in Section 4.03.

7. Site Control Program

The site-specific site control program will include a site map and the identification of the nearest medical assistance.

8. Site Security

Site-specific information for maintaining security will be included in the site-specific health and safety plan.

9. Emergency Response Plan

Site-specific information such as safe distances and places of refuge, evacuation routes and procedures, and procedures for reporting incidents to local, state, and federal agencies not covered in OBG Tech's SOPs will be covered in the site-specific health and safety plan. The nearest telephone for emergency communication will be identified in the site-specific emergency response plan.

10. Spill Containment Program

A spill containment program unique to the site will be developed for the site-specific health and safety plan, if applicable.

11. Site-specific information other than in SOPs

a. Medical surveillance requirements unique to the site, other than what is covered in OBG Tech's SOP in Section 2.04.
b. Employee training assignments unique to the site other than what is covered in OBG Tech's SOP in Section 2.02.
c. Decontamination procedures which are unique to the site other than what is covered in OBG Tech's SOP in Section 4.04 (E).
d. Safe work practices unique to the site, other than what is covered in OBG Tech's SOP in this section.

4.06 Process Safety

A. Introduction

Releases of toxic, reactive, or flammable liquids and gases in processes involving highly hazardous chemicals have been reported for many years. In an effort to control these releases, OSHA has published a regulation, 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals. In that regulation is a section on contract employer (such as OBG Tech) responsibilities. This section has been developed in compliance with the regulation.

B. Requirements

1. Each employee is provided health and safety training, as outlined in Section 2.02 of this Health and Safety Manual. Specific training required at a jobsite regarding the known potential fire, explosion, or toxic release hazards related to his/her job and the process, and the applicable provisions of the emergency action plan will be the responsibility of the Project Manager.

2. Each employee will sign a document stating that they have received and understood the training that is outlined above.

3. Each employee is expected to follow the safety rules of the facility.

4. In addition to the training required above, employees will be informed of unique hazards presented by the project or any of the hazards found by the work.

Appendix F

5.06 Respiratory Protection

A. Introduction

OSHA in 29 CFR 1910.134, specifies that "when effective engineering controls are not feasible, or while they are being instituted, appropriate respirators will be used." OSHA references exposure to air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors.

Due to the nature of the business conducted by the company, respiratory protection may be necessary for specific activities performed by our employees. This section will serve as the respiratory protection program and is adopted by the company in an effort to assist ensuring a safer working environment for our employees during work activities requiring respiratory protection as dictated in the site-specific Health and Safety Plan. In order to comply with regulatory requirements, this program is developed pursuant to 29 CFR 1910.134 and 29 CFR 1926.103. This program and use of respirators are instituted according to the site-specific Health and Safety Plan and only after exhausting all feasible engineering controls.

B. Employer and Employee Responsibility

1. Employer Responsibilities

The Safety Coordinator will see that approved respirators, cartridges, and spare parts will be provided by the company. The Safety Coordinator will also be responsible for the establishment and maintenance of this respiratory protection program and the upkeep of records for fit testing, medical surveillance, and training.

2. Employee Responsibilities

It is the responsibility of the employee to use the respiratory protection in accordance with instructions and training received. The employee will maintain the respirator to insure that cartridges and parts are replaced when necessary. The employee will report any problems with his respirator to his supervisor or the Safety Coordinator.

C. Training of Employees

All employees required to wear respirators on the job will be trained prior to the use of respirators. That training will cover the topics required by 29 CFR 1910.120 (Hazardous waste operations and emergency response) and 29 CFR 1910.134 (Respiratory Protection), and include the following:

- basics of respiration
- basics of respiratory hazards
- capabilities and limitations of respirators
- inspection of respirators
- how a respirator should be worn
- cleaning and disinfecting respirators
- storage of respirators
- respirator-specific training
- fit-checking procedures

All employees will be given the opportunity to wear their respirator in an uncontaminated atmosphere and a test atmosphere for a period of time to become familiar with the use of respirators.

All training is documented and is filed in the Syracuse office.

D. Physician's Approval

All employees required to wear a respirator will have a physician's written approval to wear a respirator prior to being required to wear one. The respirator user's medical status will be reviewed annually.

The local physician will determine which health and physical conditions are pertinent. A description of the respiratory hazards, specifics of employee's job functions while wearing a respiratory and copies of all applicable regulations will be provided to the physicians to further aid the decision process.

The physical will be provided at no cost to the employee. A copy of the written report will be made to the employee upon request.

All medical examinations are recorded and are filed in the Syracuse office.

E. Selection of Respirators

Respirators will be selected on the basis of the following:

- chemical and physical hazards
- characteristics of the hazardous operation of process
- face piece to face fit
- comfort
- utilization of NIOSH recommendations
- utilization of manufacturer's recommendations
- the guidance of American National Standard Practices for Protection Z88.2-1969.

All respirators selected will be NIOSH/MSHA approved for the hazards encountered.

The Safety Coordinator will be adequately instructed to insure that the correct respirator is selected and that the appropriate personal modifications are made such as corrective lens for full-face masks.

F. Issuance of Respirators

The Warehouse Supervisor will be responsible for the issuance of a properly selected respirator to each employee. Each employee will be given his own respirator and will be responsible for bringing it to the jobsite. Employees should mark his respirator so that it will not be confused with others.

G. Fit-Testing of Respirators

To insure a proper fit of negative pressure respirators, respirator fit-testing will be performed. Where fit-testing is not required by specific hazard regulation, as it is with lead or asbestos, the qualitative irritant vapor or smoke protocol of the asbestos standard will be adopted (29 CFR 1910.1001, Appendix C). Fit-testing will be performed to select respirators and be performed at the discretion of the Safety Coordinator thereafter unless required by law to be performed more often or unless there is sufficient need to do so (i.e., denture replacement, scarring of face, weight change).

Fit-test failure will result in selection of a different size respirator. Continued test failure will result in selection of a different manufacturer's respirator.

All fit-testing information such as the employee, the date, and the type of respirator is recorded and filed in the Syracuse office.

H. Inspection of Respirators

Respirators will be inspected for damage before and after each use. Each employee, after training, will responsible for inspection. The following areas will be inspected:

- tightness of connections
- face piece
- headbands
- inhalation valve
- exhalation valve
- cartridge or filter fittings
- pliability of rubber or elastomer parts
- signs of deterioration

Any malformation, distortion, missing parts, cracks, etc. will be sufficient to issue replacement parts or if necessary, a new respirator.

I. Standard Operating Procedures

Before entering any potentially contaminated environment, each employee will:

1. Carefully inspect the respirator following the procedures specified in Section 8.

2. Duct tape should be removed from cartridges (if applicable).

3. The respirator should be donned and checked for a proper fit using the following tests:

   a. Positive Pressure Test - close off the exhalation valve with your hand. Breathe into the mask. The face-to-facepiece seal is satisfactory if some pressure can be built up inside the mask and sustained.

b. Negative Pressure Test - close off the inlet openings of the cartridge with the palm of your hand. Inhale gently so that a vacuum occurs inside the mask. Hold your breath for 10 seconds. If the vacuum is sustained, and no inward leakage is detected, the respirator fits properly.

4. Inside the contaminated environment respirators will not be removed except in a medical emergency such as a suspected heart attack.

5. Respirators will be worn with straps inside the disposable garment allowing a worker to maintain respiratory protection while removing contaminated garments.

J. Cleaning and Disinfecting of Respirators

Respirators will be cleaned after each use. Manufacturers may have specific recommendations for cleaning and those should be followed. In absence of manufacturers recommendations, the following procedures should be used:

1. Remove the cartridges and headbands

2. Disassemble all respirator parts

3. Wash all respirator parts (except cartridges and headbands) in a cleaner - disinfectant solution or use soap and hot water

4. Rinse completely in clean, warm water

5. Air dry in a clean area

6. Re-assemble the respirator

No alcohol will be used to clean the respirator. If a disinfecting solution is not used, a disinfecting spray will be used at least weekly, but preferably after each use.
Respirator wipes will be provided to employees in order to clean respirators during work shifts between uses. The employee will be allowed to leave work area and remove respirator to wash face in order to prevent rashes and discomfort. The respirators will be wiped out at each of these times.

K. Storage of Respirators

Respirators will be stored in clean plastic bags and protected against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Respirator cartridges will have the inhalation holes covered with duct tape (or acceptable substitute tape) immediately after leaving a contaminated area. The tape will be left on until the respirator is donned for the nest entry into a contaminated area. This tape will prevent any contaminants from being dislodged from the cartridge.

Respirators should be packed or stored so that the facepiece and exhalation valve will rest in a normal position and function will not be impaired by the elastomer setting in an abnormal position.

L. Periodic Surveillance

Work areas will be monitored as required by specific hazard regulations or on a periodic timetable as set by the site-specific Health and Safety Officer and the site-specific Health and Safety Plan. This surveillance is required to ensure that the proper level of protection is provided to employees. Whenever new hazards are encountered or a substantial change in magnitude of the existing hazard occurs, then additional monitoring will take place.

M. Evaluation of Respiratory Protection Program

In order to maintain an effective program, the respiratory protection program will be re-evaluated on at least an annual basis. This evaluation will address:

- employee acceptance of program and respirators
- methods of surveillance of hazards and results
- regulatory compliance
- changing job functions
- changes in hazards

Employees are encouraged to express any concerns about respirator protection, such input is critical for evaluating the program.

Each employee will be made aware of this written program and any annual changes.

Frequent random inspections will be conducted by the Safety Coordinator to assure that respirators are properly selected, used, cleaned, and maintained.

N. Hazard Specific Respiratory Protection

As specified in 29 CFR Parts 1910, action specific hazards, i.e. lead, asbestos, and formaldehyde, require specific respiratory protection. Any such material will be monitored as directed under specific regulatory requirements, and respiratory protection will issued pursuant to specific regulatory requirement.

Appendix G

10.06 Excavations

A. Introduction

This section applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

B. General Requirements

1. All surface encumbrances that are located so as to create a hazard to employees will be removed or supported, as necessary, to safeguard employees.
2. Underground installations.
   a. The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, will be determined prior to opening an excavation.
   b. Utility companies or owners will be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the work may proceed, provided caution is taken, and provided detection equipment or other acceptable means to locate utility installations are used.
   c. When excavation operations approach the estimated location of underground installations, the exact location of the installations will be determined by safe and acceptable means.
   d. While the excavation is open, underground installations will be protected, supported or removed as necessary to safeguard employees.

C. Access and egress

1. Structural ramps.
   a. Structural ramps that are used solely by employees as a means of access or egress from excavations will be designed by a competent person. Structural ramps used for access or egress of equipment will be designed by a competent person qualified in structural design, and will be constructed in accordance with the design.
   b. Ramps and runways constructed of two or more structural members will have the structural members connected together to prevent displacement.
   c. Structural members used for ramps and runways will be of uniform thickness.
   d. Cleats or other appropriate means used to connect runway structural members will be attached to the bottom of the runway or will be attached in a manner to prevent tripping.
   e. Structural ramps used in lieu of steps will be provided with cleats or other surface treatments on the top surface to prevent slipping.

2. Means of egress from trench excavations. A stairway, ladder, ramp or other safe means of egress will be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

D. Exposure to vehicular traffic

Employees exposed to public vehicular traffic will be provided with, and will wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

E. Exposure to falling loads

No employee will be permitted underneath loads handled by lifting or digging equipment. Employees will be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped to provide adequate protection for the operator during loading and unloading operations.

F. Warning system for mobile equipment

When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system will be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

G. Hazardous atmospheres

1. Testing and controls

In addition to the procedures set forth in Sections 3 and 4 of this Health and Safety Manual to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements will apply:

a. Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation will be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.
b. Adequate precautions will be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation.
c. Adequate precaution will be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.
d. When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, the testing will be conducted as often as necessary to ensure that the atmosphere remains safe.

2. Emergency rescue equipment

a. Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, will be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment will be attended when in use.

b. Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, will wear a harness with a life-line securely attached to it. The lifeline will be separate from any line used to handle materials, and will be individually attended at all times while the employee wearing the lifeline is in the excavation.

H. Protection from hazards associated with water accumulation

1. Employees will not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.
2. If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations will be monitored by a competent person to ensure proper operation.
3. If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means will be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person.

I. Stability of adjacent structures

1. Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operation, support systems such as shoring, bracing, or underpinning will be provided to ensure the stability of such structures for the protection of employees.
2. Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees will not be permitted except when:
   a. A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or
   b. The excavation is in stable rock; or
   c. A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.
   d. Sidewalks, pavements, and appurtenant structure will not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

J. Protection of employees from loose rock or soil

1. Adequate protection will be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection will consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.
2. Employees will be protected from excavated or other materials of equipment that could pose a hazard by falling or rolling into excavations. Protection will be provided by

placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

K. Inspections

1. Daily inspections of excavations, the adjacent areas, and protective systems will be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection will be conducted by conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections will also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.
2. Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees will be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

L. Fall protection

1. Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails will be provided.
2. Adequate barrier physical protection will be provided at all remotely located excavations. All wells, pits, shafts, etc., will be barricaded or covered. Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc., will be backfilled.

M. Requirements for protective systems

1. Protection of employees in excavations.
   a. Each employee in an excavation will be protected from cave-ins by an adequate protective system designed in accordance with paragraph 2 or 3 of this section except when:
      1. Excavations are made entirely in stable rock; or
      2. Excavations are less than 5 feet (1.52 m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.
   b. Protective systems will have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

2. Design of sloping and benching systems. The slopes and configurations of sloping and benching systems will be in accordance with the requirements of option 1; or, in the alternative, option 2; or, in the alternative, option 3, or, in the alternative, option 4, as follows:

Option (1) - Allowable configurations and slopes.

1. Excavations will be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless one of the other options listed below is used.
2. Slopes specified in paragraph 1 of this section, will be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this subpart.

Option (2) - Determination of slopes and configurations using 29 CFR 1926 Subpart P Appendices A and B

Maximum allowable slopes, and allowable configurations for sloping and benching systems, will be determined in accordance with the conditions and requirements set forth in appendices A and B to this subpart.

Option (3) - Designs using other tabulated data

1. Designs of sloping or benching systems will be selected from and be in accordance with tabulated data, such as tables and charts.
2. The tabulated data will be in written form and will include all of the following:
   A. Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;
   B. Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;
   C. Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.
3. At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, will be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data will be made available to the Secretary upon request.

Option (4) - Design by a registered professional engineer

1. Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under paragraph 2 of this section will be approved by a registered professional engineer.
2. Designs will be in written form and will include at least the following:
   A. The magnitude of the slopes that were determined to be safe for the particular project;
   B. The configurations that were determined to be safe for the particular project; and
   C. The identity of the registered professional engineer approving the design.
3. At least one copy of the design will be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy will be made available to OSHA upon request.

3. Design of support systems, shield systems, and other protective systems. Designs of support systems shield systems, and other protective systems will be in accordance with the requirements of option 1; or, in the alternative, option 2; or, in the alternative, option 3; or, in the alternative, option 4 as follows:

<u>Option (1) - Designs using appendices A, C, and D</u> Designs for timber shoring in trenches will be determined in accordance with the conditions and requirements set forth in appendices A and C to this subpart. Designs for aluminum hydraulic shoring will be in accordance with paragraph (c)(2) of this section, but if manufacturer's tabulated data cannot be utilized, designs will be in accordance with Appendix D.

<u>Option (2) - Designs Using Manufacturer's Tabulated Data</u>

a. Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data will be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.
b. Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer will only be allowed after the manufacturer issues specific written approval.
c. Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations will be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy will be made available to OSHA upon request.

<u>Option (3) - Designs using other tabulated data</u>

a. Designs of support systems, shield systems, or other protective systems will be selected from and be in accordance with tabulated data, such as tables and charts.
b. The tabulated data will be in written form and include all of the following:
    1. Identification of the parameters that affect the selection of a protective system drawn from such data;
    2. Identification of the limits of use of the data;
    3. Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.
c. At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, will be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data will be made available upon request.

<u>Option (4) - Design by a registered professional engineer</u>

a. Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2, or Option 3, above, will be approved by a registered professional engineer.
b. Designs will be in written form and will include the following:
    1. A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and
    2. The identity of the registered professional engineer approving the design.

c. At least one copy of the design will be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design will be made available to OSHA upon request.

4. Materials and equipment.

a. Materials and equipment used for protective systems will be free from damage or defects that might impair their proper function.
b. Manufactured materials and equipment used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.
c. When material or equipment that is used for protective systems is damaged, a competent person will examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment will be removed from service, and will be evaluated and approved by a registered professional engineer before being returned to service.

5. Installation and removal of support

a. General.
   1. Members of support systems will be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.
   2. Support systems will be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.
   3. Individual members of support systems will not be subjected to loads exceeding those which those members were designed to withstand.
   4. Before temporary removal of individual members begins, additional precautions will be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.
   5. Removal will begin at, and progress from, the bottom of the excavation. Members will be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.
   6. Backfilling will progress together with the removal of support systems from excavations.
b. Additional requirements for support systems for trench excavations.
   1. Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system will be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

2. Installation of a support system will be closely coordinated with the excavation of trenches.

N. Sloping and benching systems

Employees will not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

O. Shield systems

1. General
   a. Shield systems will not be subjected to loads exceeding those which the system was designed to withstand.
   b. Shield will be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.
   c. Employees will be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.
   d. Employees will not be allowed in shield when shields are being installed, removed, or moved vertically.
2. Additional requirement for shield systems used in trench excavations. Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield will be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

(1) *Option (1)—Designs using appendices A, C, and D.* Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in appendices A and C to this subpart. Designs for aluminum hydraulic shoring shall be in accordance with paragraph (c)(2) of this section, but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with appendix D.

(2) *Option (2)—Designs Using Manufacturer's Tabulated Data.* (i) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(ii) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(iii) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall be made available to the Secretary upon request.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of support systems, shield systems, or other protective systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and include all of the following:

(A) Identification of the parameters that affect the selection of a protective system drawn from such data;

(B) Identification of the limits of use of the data;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2 or Option 3, above, shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include the following:

(A) A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and

(B) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design shall be made available to the Secretary upon request.

(d) *Materials and equipment.* (1) Materials and equipment used for protective systems shall be free from damage or defects that might impair their proper function.

(2) Manufactured materials and equipment used for protective systems shall be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

(3) When material or equipment that is used for protective systems is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.

(e) *Installation and removal of support*—(1) *General.* (i) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(ii) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(iii) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(iv) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(v) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(vi) Backfilling shall progress together with the removal of support systems from excavations.

(2) *Additional requirements for support systems for trench excavations.* (i) Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(ii) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) *Sloping and benching systems.* Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) *Shield systems*—(1) *General.* (i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(2) *Additional requirement for shield systems used in trench excavations.* Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

Appendix A to Subpart P

Soil Classification

(a) *Scope and application*—(1) *Scope.* This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(2) *Application.* This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in §1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in §1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) *Definitions.* The definitions and examples given below are based on, in whole or in part, the following: American Society for Testing Materials (ASTM) Standards D653-85 and D2488; The Unified Soils Classification System, The U.S. Department of Agriculture (USDA) Textural Classification

Scheme; and The National Bureau of Standards Report BSS-121.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-sized sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt, (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

Soil classification system means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil means soil which is underwater or is free seeping.

Type A means cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

(i) The soil is fissured; or

(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or

(iii) The soil has been previously disturbed; or

(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or

(v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means:

(i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or

(ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil.

(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

(v) Dry rock that is not stable; or

(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C means:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or

(ii) Granular soils including gravel, sand, and loamy sand, or

(iii) Submerged soil or soil from which water is freely seeping; or

(iv) Submerged rock that is not stable, or

(v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) *Requirements*—(1) *Classification of soil and rock deposits.* Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(2) *Basis of classification.* The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the America Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(3) *Visual and manual analyses.* The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(4) *Layered systems.* In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(5) *Reclassification.* If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) *Acceptable visual and manual tests*—(1) *Visual tests.* Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(iii) Observe the side of the open excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(v) Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(2) *Manual tests.* Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as 1/8-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of 1/8-inch thread can be held on one end without tearing, the soil is cohesive.

quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as ⅛-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of ⅛-inch thread can be held on one end without tearing, the soil is cohesive.

(ii) *Dry strength.* If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(iii) *Thumb penetration.* The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488—"Standard Recommended Practice for Description of Soils (Visual—Manual Procedure).") Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(iv) *Other strength tests.* Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(v) *Drying test.* The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(A) If the sample develops cracks as it dries, significant fissures are indicated.

(B) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as a unfissured cohesive material and the unconfined compressive strength should be determined.

(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

Appendix B to Subpart P

Sloping and Benching

(a) *Scope and application.* This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in § 1926.652(b)(2).

(b) *Definitions.*

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) *Requirements*—(1) *Soil classification.* Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(2) *Maximum allowable slope.* The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.

(3) *Actual slope.* (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least ½ horizontal to one vertical (½H:1V) less steep than the maximum allowable slope.

(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with § 1926.651(i).

(4) *Configurations.* Configurations of sloping and benching systems shall be in accordance with Figure B-1.

TABLE B-1

MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V) [1] FOR EXCAVATIONS LESS THAN 20 FEET DEEP [3]
STABLE ROCK	VERTICAL (90°)
TYPE A [2]	3/4 : 1 (53°)
TYPE B	1:1 (45°)
TYPE C	1½: 1 (34°)

NOTES:

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
3. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

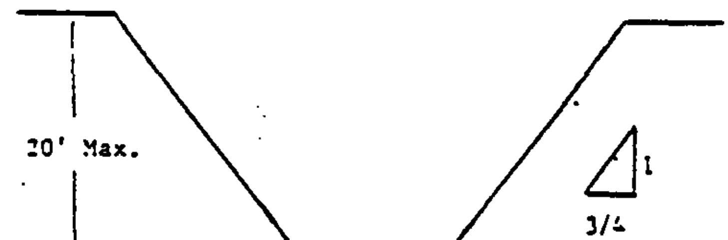
Figure B-1

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

B-1.1 Excavations made in Type A soil.

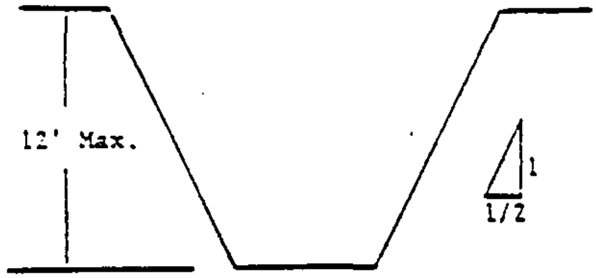
1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of ¾:1.



Simple Slope—General

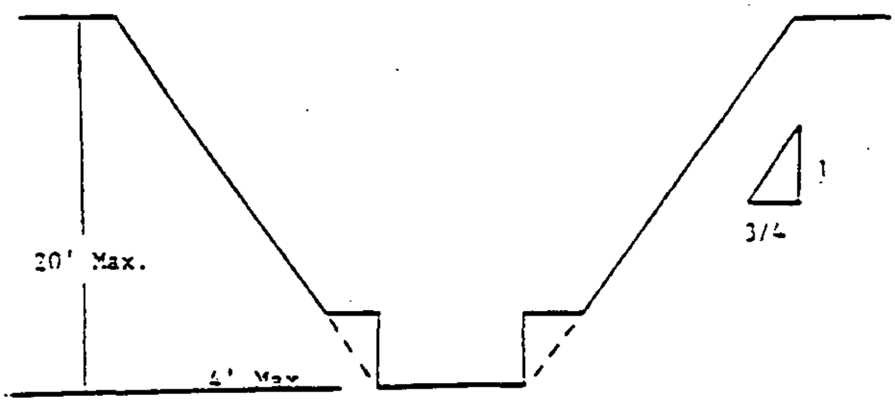
Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of ½:1.

[Sec. 1926.652, Table B-1]

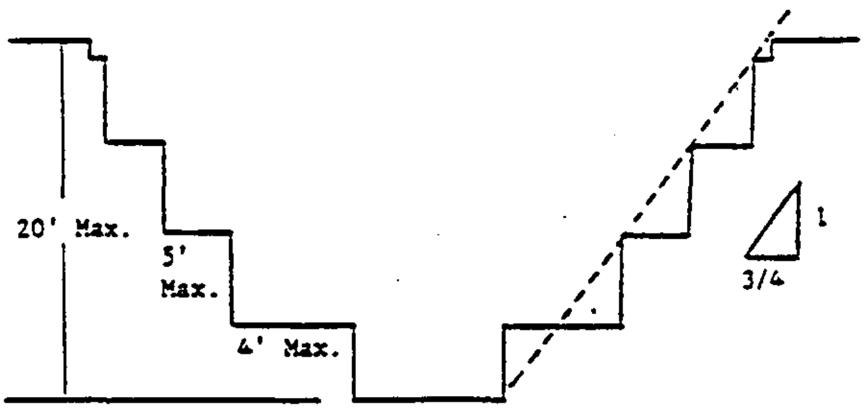


Simple Slope—Short Term

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of ¾ to 1 and maximum bench dimensions as follows:



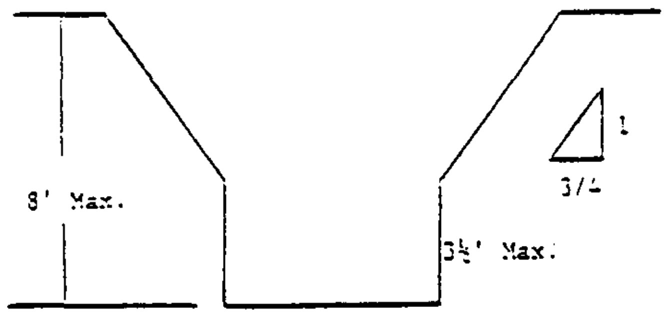
Simple Bench



Multiple Bench

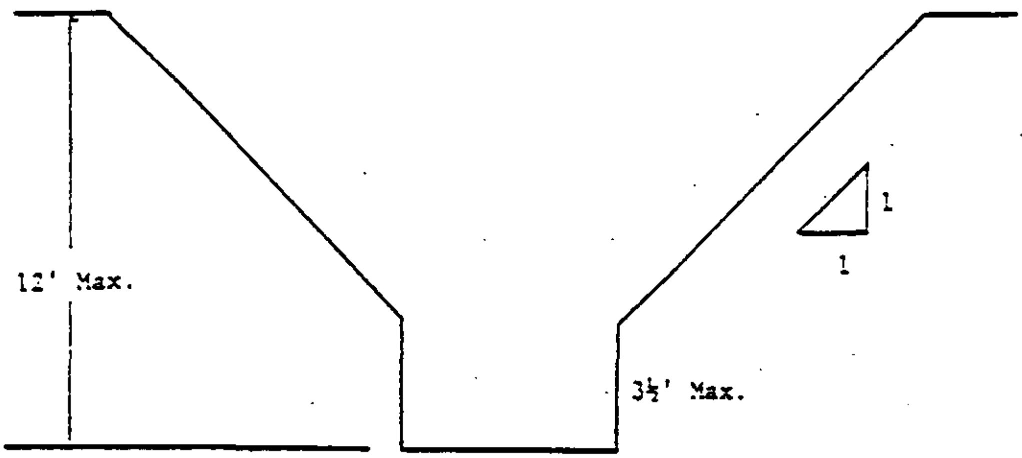
3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3½ feet.

[Sec. 1926.652, Table B-1]



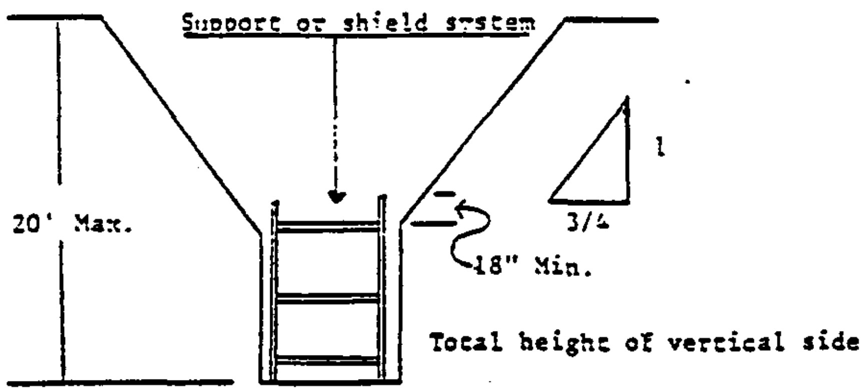
Unsupported Vertically Sided Lower Portion—Maximum 8 Feet in Depth

All excavations more than 8 feet but not more than 12 feet in depth which unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3½ feet.



Unsupported Vertically Sided Lower Portion—Maximum 12 Feet in Depth

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of ¾:1. The support or shield system must extend at least 18 inches above the top of the vertical side.



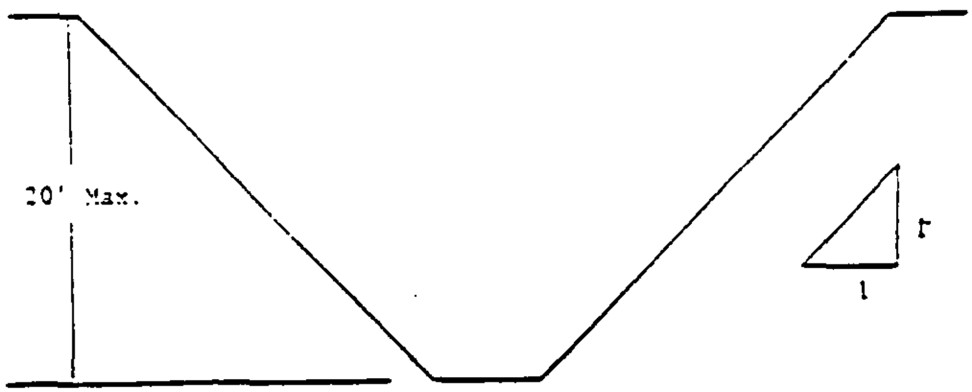
Suported or Shielded Vertically Sided Lower Portion

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under § 1926.652(b).

B-1.2 Excavations Made in Type B Soil

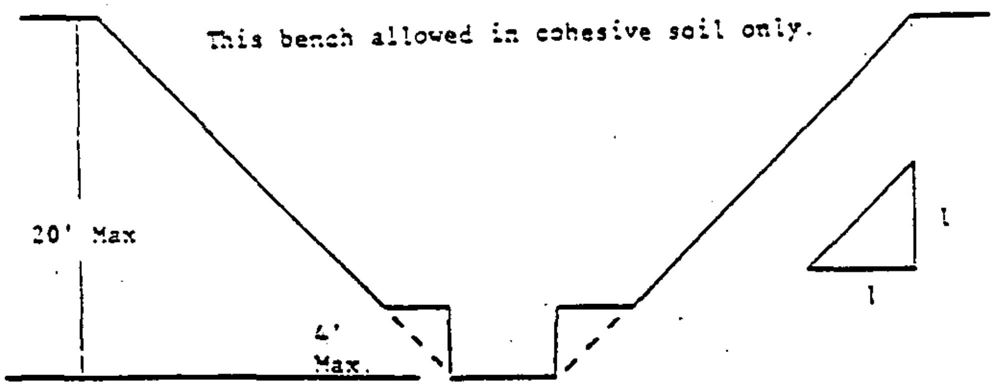
1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

[Sec. 1926.652, Table B-1.2]

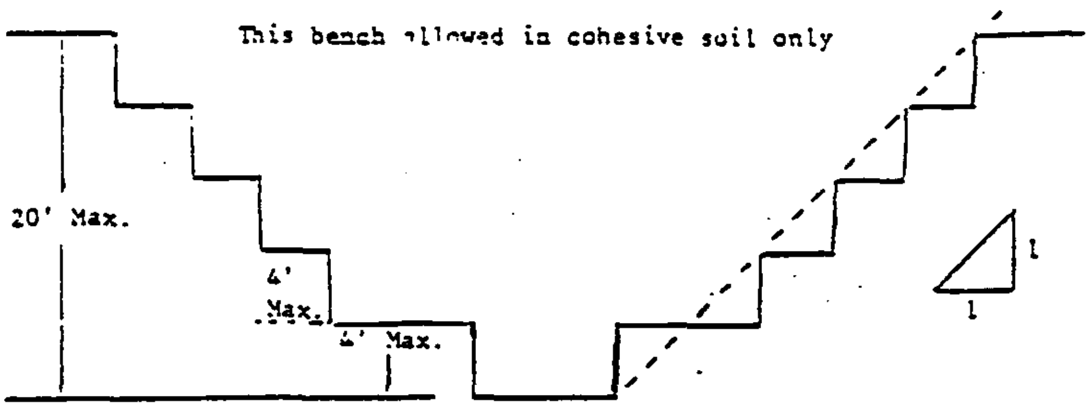


Simple Slope

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:



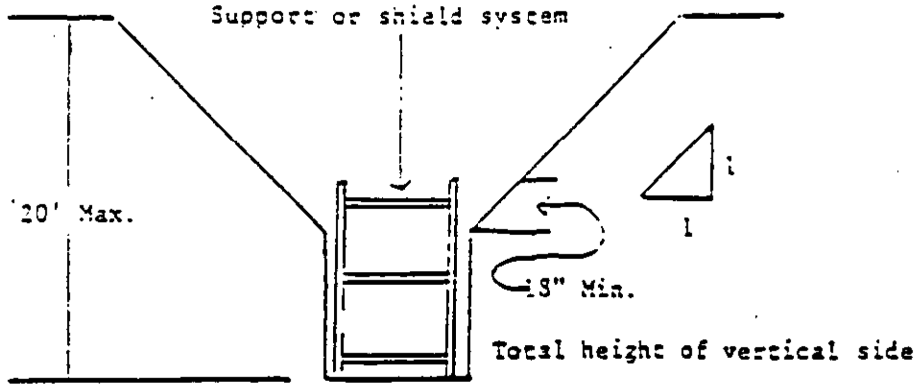
Single Bench



Multiple Bench

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

[Sec. 1926.652, Figure B-1.3]

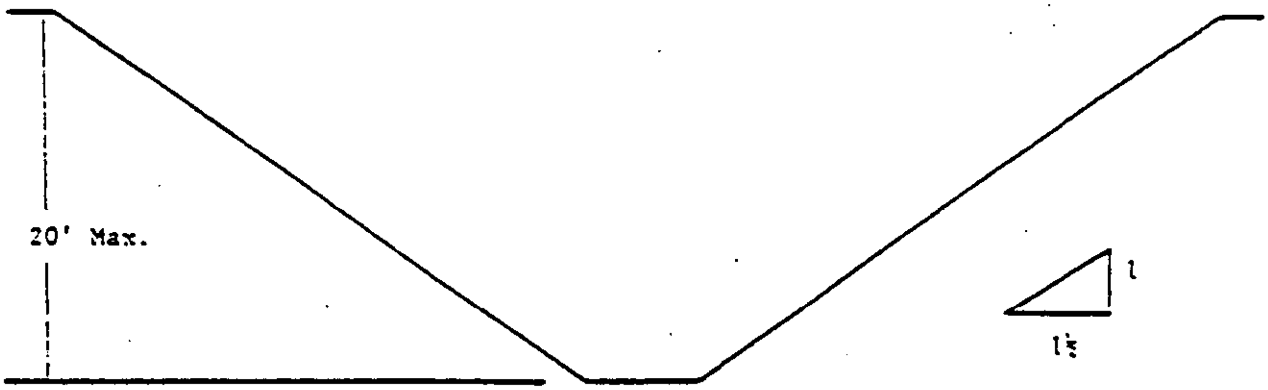


Vertically Sided Lower Portion

4. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

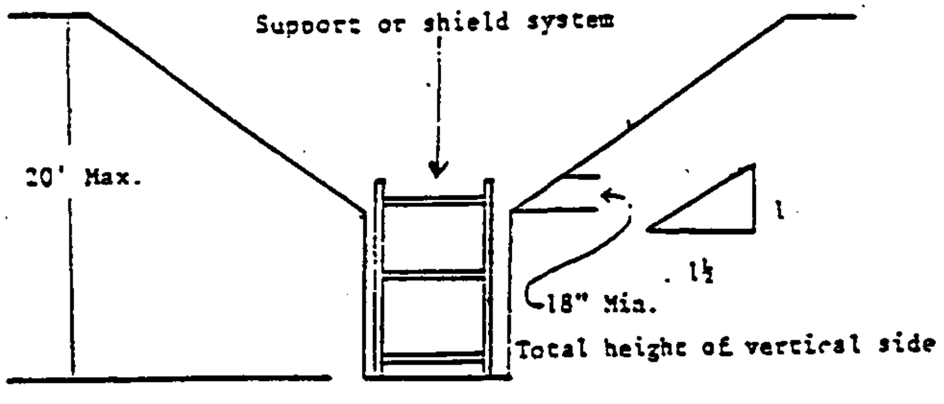
B-1.3 Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.



Simple Slope

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1½:1.



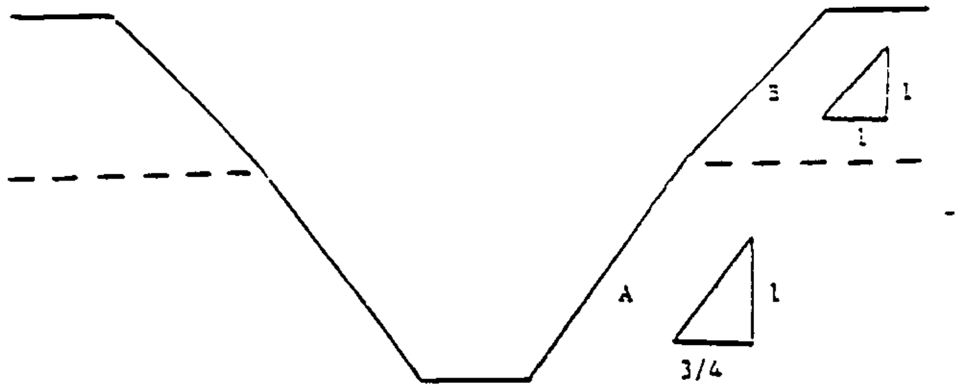
Vertical Sided Lower Portion

3. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

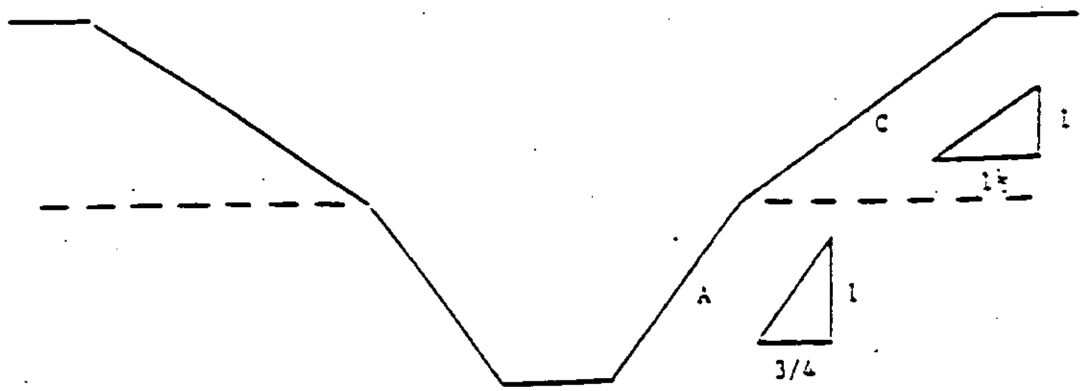
B-1.4 Excavations Made in Layered Soils

1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.

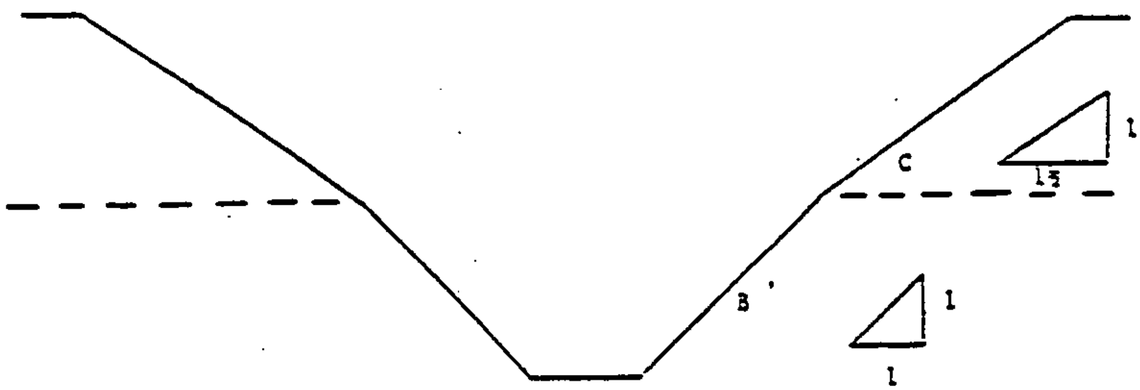
[Sec. 1926.652, Figure B-1.4]



B OVER A

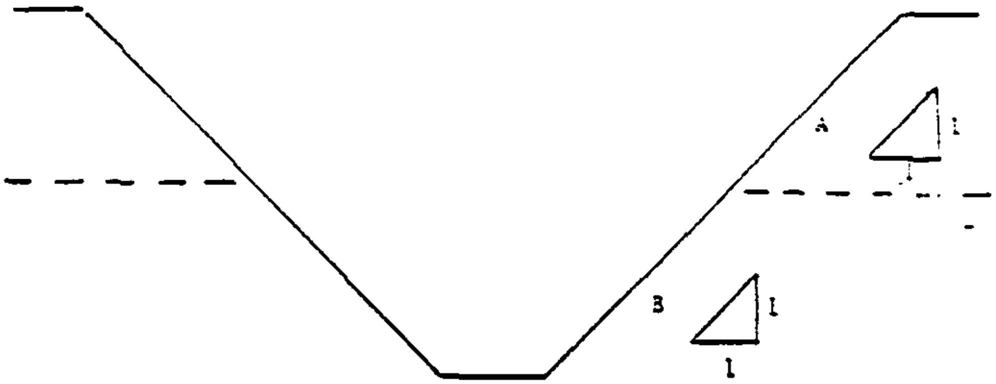


C OVER A

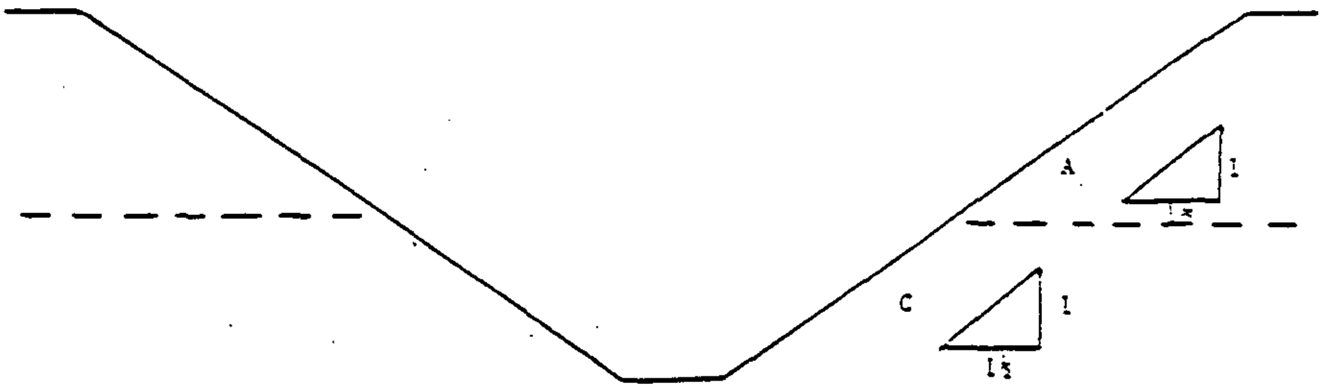


C OVER B

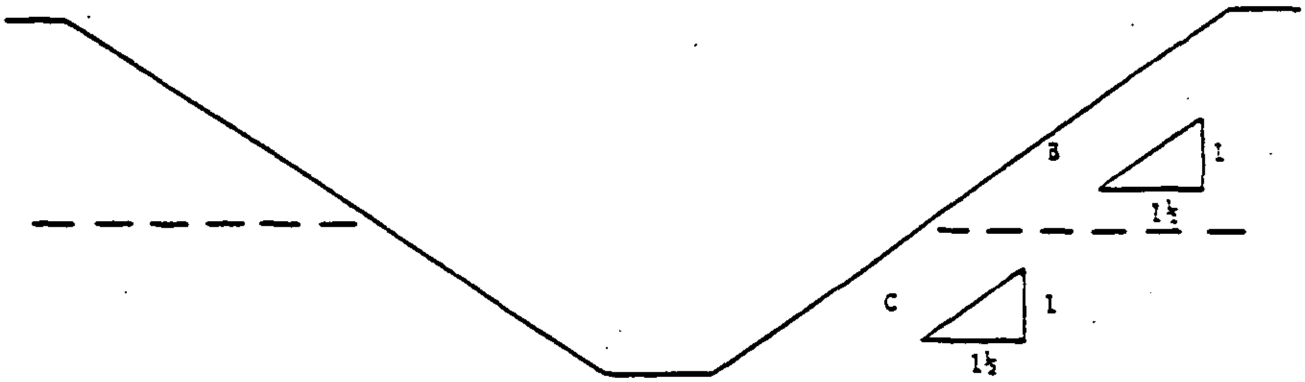
[Sec. 1926.652, Figures B-C]



A OVER B



A OVER C



B OVER C

2. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

Appendix C to Subpart P

Timber Shoring for Trenches

(a) *Scope.* This appendix contains information that can be used timber shoring is provided as a method of protection from cave-ins in trenches that do not exceed 20 feet (6.1 m) in depth. This appendix must be used when design of timber shoring protective systems is to be performed in accordance with § 1926.652(c)(1). Other timber shoring configurations: other systems of support such as hydraulic and pneumatic systems: and other protective systems such as sloping, benching, shielding, and freezing systems must be designed in accordance with the requirements set forth in § 1926.652(b) and § 1926.652(c).

(b) *Soil Classification.* In order to use the data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil

[Appendix C]

classification method set forth in appendix A of subpart P of this part.

(c) *Presentation of information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables C–1.1, C–1.2, and C–1.3, and Tables C–2.1, C–2.2 and C–2.3 following paragraph (g) of the appendix. Each table presents the minimum sizes of timber members to use in a shoring system, and each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. The data are arranged to allow the user the flexibility to select from among several acceptable configurations of members based on varying the horizontal spacing of the crossbraces. Stable rock is exempt from shoring requirements and therefore, no data are presented for this condition.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix, and on the tables themselves.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations regarding Tables C–1.1 through C–1.3 and Tables C–2.1 through C–2.3 are presented in paragraph (g) of this Appendix.

(d) *Basis and limitations of the data.*—(1) *Dimensions of timber members.* (i) The sizes of the timber members listed in Tables C–1.1 through C–1.3 are taken from the National Bureau of Standards (NBS) report, "Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations." In addition, where NBS did not recommend specific sizes of members, member sizes are based on an analysis of the sizes required for use by existing codes and on empirical practice.

(ii) The required dimensions of the members listed in Tables C–1.1 through C–1.3 refer to actual dimensions and not nominal dimensions of the timber. Employers wanting to use nominal size shoring are directed to Tables C–2.1 through C–2.3, or have this choice under § 1926.652(c)(3), and are referred to The Corps of Engineers, The Bureau of Reclamation or data from other acceptable sources.

(2) *Limitation of application.* (i) It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be designed as specified in § 1926.652(c).

(ii) When any of the following conditions are present, the members specified in the tables are not considered adequate. Either an alternate timber shoring system must be designed or another type of protective system designed in accordance with § 1926.652.

(A) When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two-foot soil surcharge. The term "adjacent" as used here means the area within a horizontal distance from the edge of the trench equal to the depth of the trench.

(B) When vertical loads imposed on cross braces exceed a 240-pound gravity load distributed on a one-foot section of the center of the crossbrace.

(C) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(D) When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables.* The members of the shoring system that are to be selected using this information are the cross braces, the uprights, and the wales, where wales are required. Minimum sizes of members are specified for use in different types of soil. There are six tables of information, two for each soil type. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is then made. The selection is based on the depth and width of the trench where the members are to be installed and, in most instances, the selection is also based on the horizontal spacing of the crossbraces. Instances where a choice of horizontal spacing of crossbracing is available, the horizontal spacing of the crossbraces must be chosen by the user before the size of any member can be determined. When the soil type, the width and depth of the trench, and the horizontal spacing of the crossbraces are known, the size and vertical spacing of the crossbraces, the size and vertical spacing of the wales, and the size and horizontal spacing of the uprights can be read from the appropriate table.

(f) *Examples to Illustrate the Use of Tables C–1.1 through C–1.3.*

(1) *Example 1.*

A trench dug in Type A soil is 13 feet deep and five feet wide.

From *Table C–1.1*, for acceptable arrangements of timber can be used.

Arrangement #1

Space 4×4 crossbraces at six feet horizontally and four feet vertically.

Wales are not required.

Space 3×8 uprights at six feet horizontally. This arrangement is commonly called "skip shoring."

Arrangement #2

Space 4×6 crossbraces at eight feet horizontally and four feet vertically.

Space 8×8 wales at four feet vertically.

Space 2×6 uprights at four feet horizontally.

Arrangement #3

Space 6×6 crossbraces at 10 feet horizontally and four feet vertically.

Space 8×10 wales at four feet vertically.

Space 2×6 uprights at five feet horizontally.

Arrangement #4

Space 6×6 crossbraces at 12 feet horizontally and four feet vertically.

Space 10×10 wales at four feet vertically.

Spaces 3×8 uprights at six feet horizontally.

(2) *Example 2.*

A trench dug in Type B soil in 13 feet deep and five feet wide. From Table C–1.2 three acceptable arrangements of members are listed.

Arrangement #1

[Appendix C]

Space 6×8 crossbraces at six feet horizontally and five feet vertically.

Space 8×8 wales at five feet vertically.

Space 2×6 uprights at two feet horizontally.

Arrangement #2

Space 8×8 crossbraces at eight feet horizontally and five feet vertically.

Space 10×10 wales at five feet vertically.

Space 2×6 uprights at two feet horizontally.

Arrangement #3

Space 8×8 crossbraces at 10 feet horizontally and five feet vertically.

Space 10×12 wales at five feet vertically.

Space 2×6 uprights at two feet vertically.

(3) *Example 3.*

A trench dug in Type C soil is 13 feet deep and five feet wide.

From Table C–1.3 two acceptable arrangements of members can be used.

Arrangement #1

Space 8×8 crossbraces at six feet horizontally and five feet vertically.

Space 10×12 wales at five feet vertically.

Position 2×6 uprights as closely together as possible.

If water must be retained use special tongue and groove uprights to form tight sheeting.

Arrangement #2

Space 8×10 crossbraces at eight feet horizontally and five feet vertically.

Space 12×12 wales at five feet vertically.

Position 2×6 uprights in a close sheeting configuration unless water pressure must be resisted. Tight sheeting must be used where water must be retained.

(4) *Example 4.*

A trench dug in Type C soil is 20 feet deep and 11 feet wide. The size and spacing of members for the section of trench that is over 15 feet in depth is determined using Table C-1.3. Only one arrangement of members is provided.

Space 8×10 crossbraces at six feet horizontally and five feet vertically.

Space 12×12 wales at five feet vertically.

Use 3×6 tight sheeting.

Use of Tables C-2.1 through C-2.3 would follow the same procedures.

(g) *Notes for all Tables.*

1. Member sizes at spacings other than indicated are to be determined as specified in § 1926.652(c), "Design of Protective Systems."

2. When conditions are saturated or submerged use Tight Sheeting. Tight Sheeting refers to the use of specially-edged timber planks (e.g., tongue and groove) at least three inches thick, steel sheet piling, or similar construction that when driven or placed in position provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. Close Sheeting refers to the placement of planks side-by-side allowing as little space as possible between them.

3. All spacing indicated is measured center to center.

4. Wales to be installed with greater dimension horizontal.

5. If the vertical distance from the center of the lowest crossbrace to the bottom of the trench exceeds two and one-half feet, uprights shall be firmly embedded or a mudsill shall be used. Where uprights are embedded, the vertical distance from the center of the lowest crossbrace to the bottom of the trench shall not exceed 36 inches. When mudsills are used, the vertical distance shall not exceed 42 inches. Mudsills are wales that are installed at the toe of the trench side.

6. Trench jacks may be used in lieu of or in combination with timber crossbraces.

7. Placement of crossbraces. When the vertical spacing of crossbraces is four feet, place the top crossbrace no more than two feet below the top of the trench. When the vertical spacing of crossbraces is five feet, place the top crossbrace no more than 2.5 feet below the top of the trench.

[Appendix C]

TABLE C-1.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A $P_a = 25 \times H + 72$ psf (2 ft Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				2X6	
TO	UP TO 8	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---					2X8
10	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			2X6		
	UP TO 12	4X6	4X6	6X6	6X6	6X6	4	8X8	4				2X6	
10	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				3X8	
TO	UP TO 8	4X6	4X6	6X6	6X6	6X6	4	8X8	4		2X6			
15	UP TO 10	6X6	6X6	6X6	6X8	6X8	4	8X10	4			2X6		
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	10X10	4				3X8	
15	UP TO 6	6X6	6X6	6X6	6X8	6X8	4	6X8	4	3X6				
TO	UP TO 8	6X6	6X6	6X6	6X8	6X8	4	8X8	4	3X6				
20	UP TO 10	8X8	8X8	8X8	8X8	8X10	4	8X10	4	3X6				
	UP TO 12	8X8	8X8	8X8	8X8	8X10	4	10X10	4	3X6				
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

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TABLE C-1.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B $P_a = 45 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3		
5 TO 10	UP TO 6	4X6	4X6	6X6	6X6	6X6	5	6X8	5			2X6		
	UP TO 8	6X6	6X6	6X6	6X8	6X8	5	8X10	5			2X6		
	UP TO 10	6X6	6X6	6X6	6X8	6X8	5	10X10	5			2X6		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5		2X6			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5		2X6			
	UP TO 10	8X8	8X8	8X8	8X8	8X10	5	10X12	5		2X6			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	3X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	3X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C P_a = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES									UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET) UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15	VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) (See Note 2) CLOSE				
5 TO 10	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	2X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6				
	See Note 1													
10 TO 15	UP TO 6	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6				
	UP TO 8	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed Oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A $P_a = 25 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X4	4X4	4X6	4	Not Req'd	Not Req'd				4X6	
	UP TO 8	4X4	4X4	4X4	4X6	4X6	4	Not Req'd	Not Req'd					4X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			4X6		
	UP TO 12	4X6	4X6	4X6	6X6	6X6	4	8X8	4				4X6	
10 TO 15	UP TO 6	4X4	4X4	4X4	6X6	6X6	4	Not Req'd	Not Req'd				4X10	
	UP TO 8	4X6	4X6	4X6	6X6	6X6	4	6X8	4		4X6			
	UP TO 10	6X6	6X6	6X6	6X6	6X6	4	8X8	4			4X8		
	UP TO 12	6X6	6X6	6X6	6X6	6X6	4	8X10	4		4X6		4X10	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X6	6X6	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X6	6X6	4	8X8	4	3X6	4X12			
	UP TO 10	6X6	6X6	6X6	6X6	6X8	4	8X10	4	3X6				
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	8X12	4	3X6	4X12			
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3	4	6
5 TO 10	UP TO 6	4X6	4X6	4X6	6X6	6X6	5	6X8	5			3X12 4X8		4X12
	UP TO 8	4X6	4X6	6X6	6X6	6X6	5	8X8	5		3X8		4X8	
	UP TO 10	4X6	4X6	6X6	6X6	6X8	5	8X10	5			4X8		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5	3X6	4X10			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5	3X6	4X10			
	UP TO 10	6X8	6X8	8X8	8X8	8X8	5	10X12	5	3X6	4X10			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	6X8	8X8	5	8X10	5	4X6				
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X12	5	4X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C $P_a = 80 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET) UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15	VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) CLOSE				
5 TO 10	UP TO 6	6X6	6X6	6X6	6X6	8X8	5	8X8	5	3X6				
	UP TO 8	6X6	6X6	6X6	8X8	8X8	5	10X10	5	3X6				
	UP TO 10	6X6	6X6	8X8	8X8	8X8	5	10X12	5	3X6				
	See Note 1													
10 TO 15	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	10X10	5	4X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8X8	8X8	8X8	8X10	8X10	5	10X12	5	4X6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

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Appendix D to Subpart P

Aluminum Hydraulic Shoring for Trenches

(a) *Scope.* This appendix contains information that can be used when aluminum hydraulic shoring is provided as a method of protection against cave-ins in trenches that do not exceed 20 feet (6.1m) in depth. This appendix must be used when design of the aluminum hydraulic protective system cannot be performed in accordance with § 1926.652(c)(2).

(b) *Soil Classification.* In order to use data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of part 1926.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables D-1.1, D-1.2, D-1.3 and D-1.4. Each table presents the maximum vertical and horizontal spacings that may be used with various aluminum member sizes and various hydraulic cylinder sizes. Each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. Tables D-1.1 and D-1.2 are for vertical shores in Types A and B soil. Tables D-1.3 and D1.4 are for horizontal waler systems in Types B and C soil.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations (footnotes) regarding Table D-1.1 through D-1.4 are presented in paragraph (g) of this appendix.

(6) Figures, illustrating typical installations of hydraulic shoring, are included just prior to the Tables. The illustrations page is entitled "Aluminum Hydraulic Shoring; Typical Installations."

(d) *Basis and limitations of the data.*

(1) Vertical shore rails and horizontal wales are those that meet the Section Modulus requirements in the D-1 Tables. Aluminum material is 6061-T6 or material of equivalent strength and properties.

(2) Hydraulic cylinders specifications. (i) 2-inch cylinders shall be a minimum 2-inch inside diameter with a minimum safe working capacity of no less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe working capacity of not less than 30,000 pounds axial compressive load at extensions as recommended by product manufacturer.

(3) Limitation of application.

(i) It is not intended that the aluminum hydraulic specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be otherwise designed as specified in § 1926.652(c).

(ii) When any of the following conditions are present, the members specified in the Tables are not considered adequate. In this case, an alternative aluminum hydraulic shoring system or other type of protective system must be designed in accordance with § 1926.652.

(A) When vertical loads imposed on cross braces exceed a 100 Pound gravity load distributed on a one foot section of the center of the hydraulic cylinder.

(B) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(C) When only the lower portion or a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables D-1.1, D-1.2, D-1.3 and D-1.4.* The members of the shoring system that are to be selected using this information are the hydraulic cylinders, and either the vertical shores or the horizontal wales. When a waler system is used the vertical timber sheeting to be used is also selected from these tables. The Tables D-1.1 and D-1.2 for vertical shores are used in Type A and B soils that do not require sheeting. Type B soils that may require sheeting, and Type C soils that always require sheeting are found in the horizontal wale Tables D-1.3 and D-1.4. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is made. The selection is based on the depth and width of the trench where the members are to be installed. In these tables the vertical spacing is held constant at four feet on center. The tables show the maximum horizontal spacing of cylinders allowed for each size of wale in the waler system tables, and in the vertical shore tables, the hydraulic cylinder horizontal spacing is the same as the vertical shore spacing.

(f) *Example to Illustrate the Use of the Tables:*

(1) Example 1:

A trench dug in Type A soil is 6 feet deep and 3 feet wide. From Table D-1.1: Find vertical shores and 2 inch diameter cylinders spaced 8 feet on center (o.c.) horizontally and 4 feet on center (o.c.) vertically. (See Figures 1 & 3 for typical installations.)

(2) Example 2:

A trench is dug in Type B soil that does not require sheeting, 13 feet deep and 5 feet wide. From Table D-1.2: Find vertical shores and 2 inch diameter cylinders spaced 6.5 feet o.c. horizontally and 4 feet o.c. vertically. (See Figures 1 & 3 for typical installations.)

(3) A trench is dug in Type B soil that does not require sheeting, but does experience some minor raveling of the trench face. The trench is 16 feet deep and 9 feet wide. From Table D-1.2: Find vertical shores and 2 inch diameter cylinder (with special oversleeves as designated by footnote #2) spaced 5.5 feet o.c. horizontally and 4 feet o.c. vertically. plywood (per footnote (g)(7) to the D-1 Table) should be used behind the shores. (See Figures 2 & 3 for typical installations.)

(4) Example 4: A trench is dug in previously disturbed Type B soil, with characteristics of a Type C soil, and will require sheeting. The trench is 18 feet deep and 12 feet wide. 8 foot horizontal spacing between cylinders is desired for working space. From Table D-1.3: Find horizontal wale with a section modulus of 14.0 spaced at 4 feet o.c. vertically and 3 inch diameter cylinder spaced at 9 feet maximum o.c. horizontally. 3 × 12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(5) Example 5: A trench is dug in Type C soil, 9 feet deep and 4 feet wide. Horizontal cylinder spacing in excess of 6 feet is desired for working space. From Table D-1.4: Find horizontal wale with a section modulus of 7.0 and 2 inch diameter cylinders spaced at 6.5 feet o.c. horizontally. Or, find horizontal wale with a 14.0 section modulus and 3 inch diameter cylinder spaced at 10 feet o.c. horizontally. Both wales are spaced 4 feet o.c. vertically. 3 × 12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(g) *Footnotes, and general notes, for Tables D-1.1, D-1.2, D-1.3, and D-1.4.*

(1) For applications other than those listed in the tables, refer to § 1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to § 1926.652(c)(2) and § 1926.652(c)(3).

(2) 2 inch diameter cylinders, at this width, shall have structural steel tube (3.5 × 3.5 × 0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

(3) Hydraulic cylinders capacities. (i) 2 inch cylinders shall be a minimum 2-inch inside diameter with a safe working capacity of not less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe work capacity of not less than 30,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(4) All spacing indicated is measured center to center.

(5) Vertical shoring rails shall have a minimum section modulus of 0.40 inch.

(6) When vertical shores are used, there must be a minimum of three shores spaced equally, horizontally, in a group.

(7) Plywood shall be 1.125 in. thick softwood or 0.75 inch. thick, 14 ply, arctic white birch (Finland form). Please note that plywood is not intended as a structural member, but only for prevention of local raveling (sloughing of the trench face) between shores.

(8) See appendix C for timber specifications.

(9) Wales are calculated for simple span conditions.

(10) See appendix D, item (d), for basis and limitations of the data.

[Appendix D]

ALUMINUM HYDRAULIC SHORING
TYPICAL INSTALLATIONS

FIGURE NO. 1
VERTICAL ALUMINUM HYDRAULIC SHORING (SPOT BRACING)

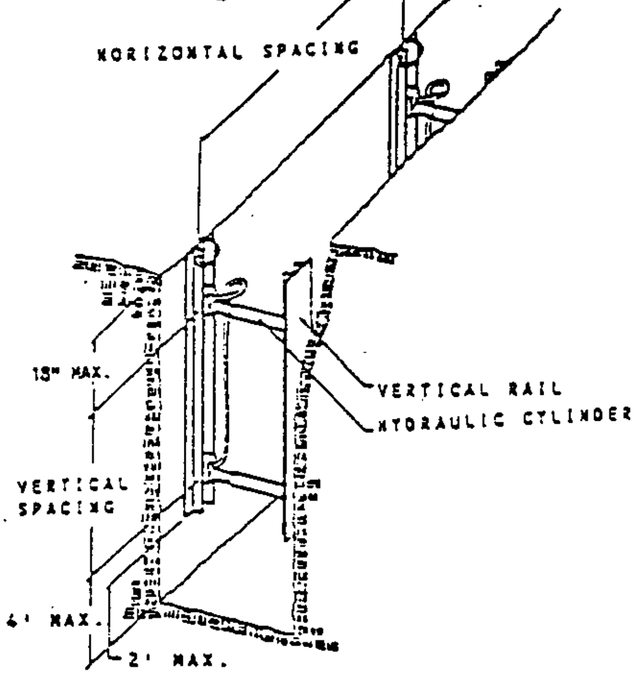


FIGURE NO. 2
VERTICAL ALUMINUM HYDRAULIC SHORING (WITH PLYWOOD)

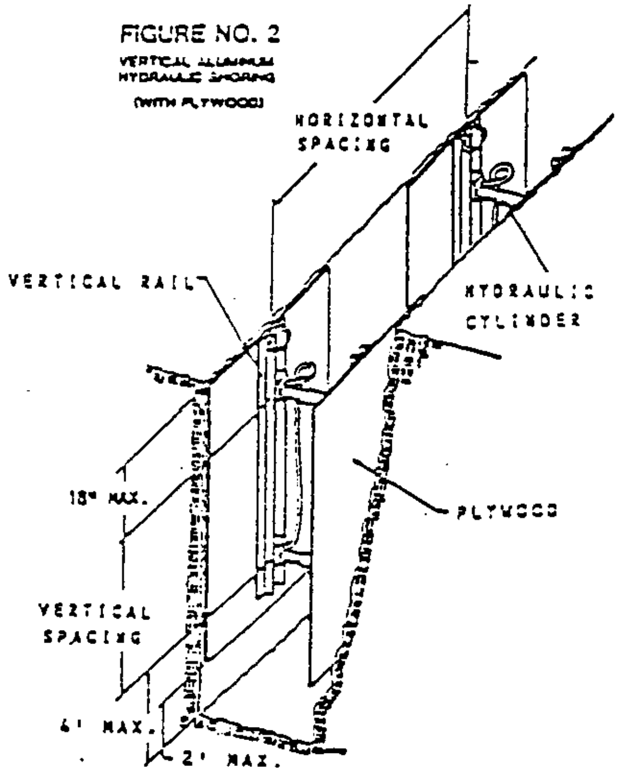


FIGURE NO. 3
VERTICAL ALUMINUM HYDRAULIC SHORING (STACKED)

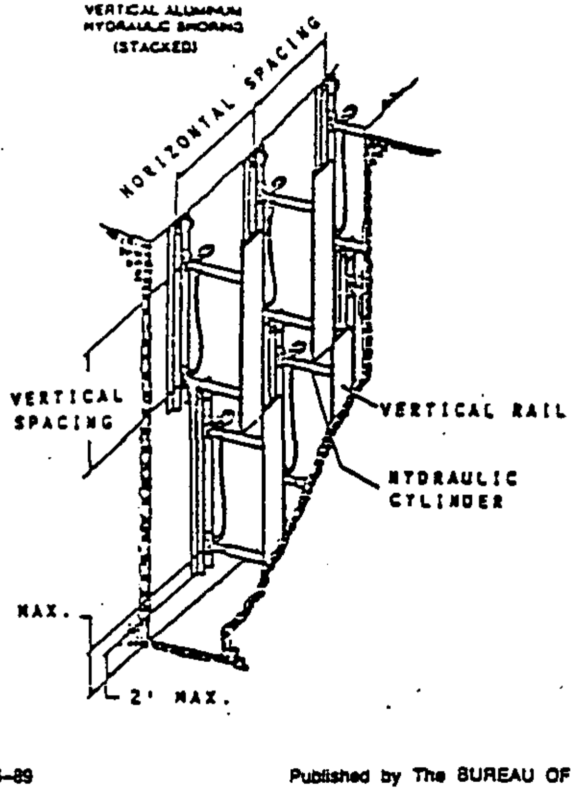
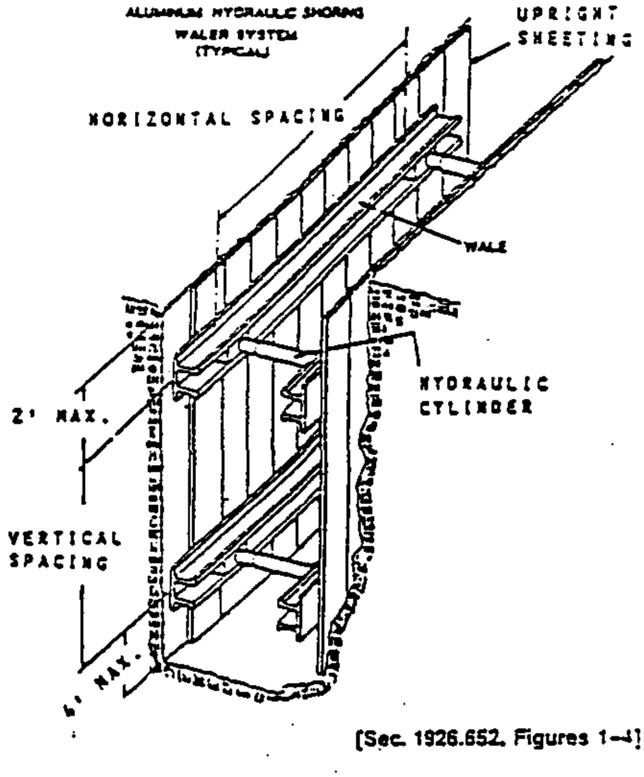


FIGURE NO. 4
ALUMINUM HYDRAULIC SHORING WALER SYSTEM (TYPICAL)



[Sec. 1926.652, Figures 1–4]

TABLE D - 1.1
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE A

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	8				
OVER 15 UP TO 20	7				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

TABLE D - 1.2
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	6.5				
OVER 15 UP TO 20	5.5				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

[Sec. 1926.652, Table D-1.2]

TABLE D - 1.3
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	WALES: VERTICAL SPACING (FEET)	WALES: * SECTION MODULUS (IN^3)	HYDRAULIC CYLINDERS, WIDTH OF TRENCH (FEET): UP TO 8, HORIZ. SPACING	UP TO 8, CYLINDER DIAMETER	OVER 8 UP TO 12, HORIZ. SPACING	OVER 8 UP TO 12, CYLINDER DIAMETER	OVER 12 UP TO15, HORIZ. SPACING	OVER 12 UP TO15, CYLINDER DIAMETER	TIMBER UPRIGHTS, MAX.HORIZ.SPACING (ON CENTER): SOLID SHEET	2 FT.	3 FT.
OVER 5 UP TO 10	4	3.5	8.0	2 IN	8.0	2 IN NOTE(2)	8.0	3 IN	—	—	3x12
		7.0	9.0	2 IN	9.0	2 IN NOTE(2)	9.0	3 IN			
		14.0	12.0	3 IN	12.0	3 IN	12.0	3 IN			
OVER 10 UP TO 15	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	—	3x12	—
		7.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 15 UP TO 20	4	3.5	5.5	2 IN	5.5	2 IN NOTE(2)	5.5	3 IN	3x12	—	—
		7.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
		14.0	9.0	3 IN	9.0	3 IN	9.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

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TABLE D - 1.4
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE C

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX.HORIZ SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	SECTION MODULUS* (IN³)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	3x12	—	—
		7.0	6.5	2 IN	6.5	2 IN NOTE(2)	6.5	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 10 UP TO 15	4	3.5	4.0	2 IN	4.0	2 IN NOTE(2)	4.0	3 IN	3x12	—	—
		7.0	5.5	3 IN	5.5	3 IN	5.5	3 IN			
		14.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
OVER 15 UP TO 20	4	3.5	3.5	2 IN	3.5	2 IN NOTE(2)	3.5	3 IN	3x12	—	—
		7.0	5.0	3 IN	5.0	3 IN	5.0	3 IN			
		14.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

[Sec. 1926.652, Table D-1.4]

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Appendix E to Subpart P—Alternatives to Timber Shoring

Figure 1. Aluminum Hydraulic Shoring

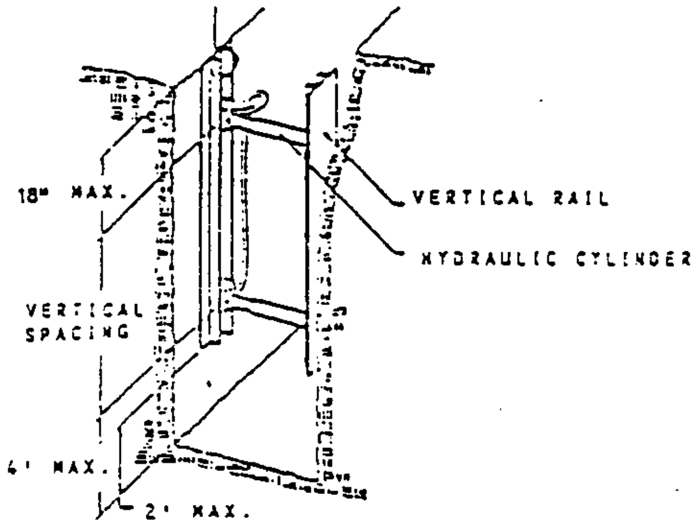
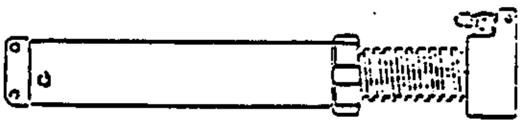
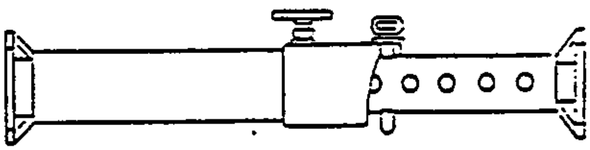


Figure 2. Pneumatic/hydraulic Shoring





[Appendix E]

Figure 3. Trench Jacks (Screw Jacks)

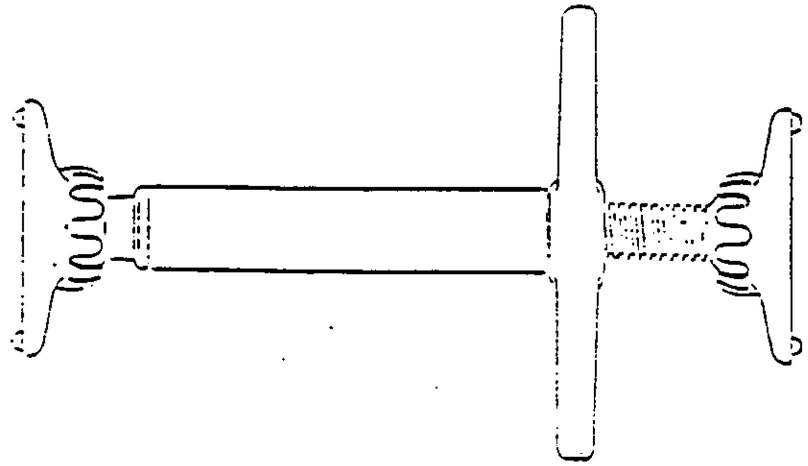
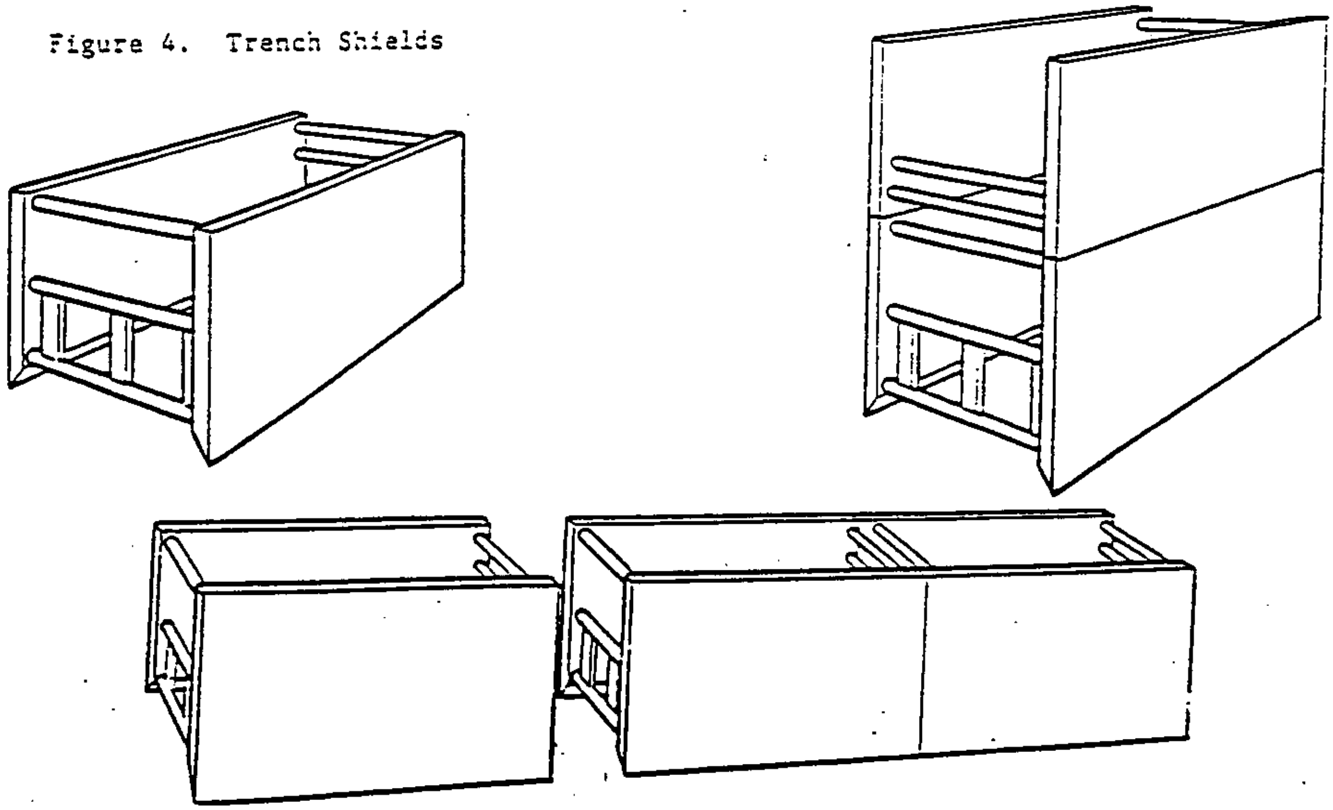


Figure 4. Trench Shields



[Appendix E]

Appendix F to Subpart P—Selection of Protective Systems

The following figures are a graphic summary of the requirements contained in subpart P for excavations 20 feet or less in depth. Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional engineer in accordance with § 1926.652 (b) and (c).

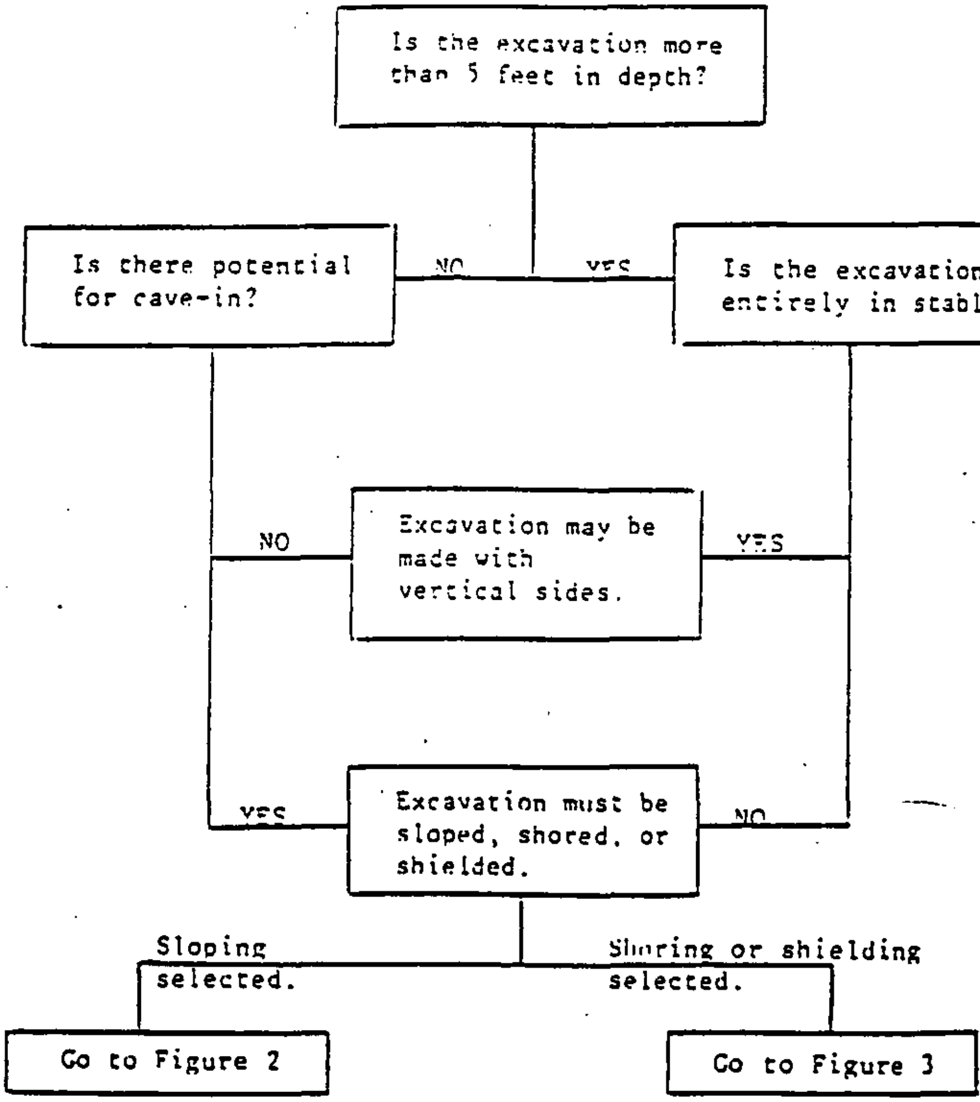


FIGURE 1 - PRELIMINARY DECISIONS

[Appendix F]

Sloping selected as the method of protection

Will soil classification be made in accordance with §1926.652 (b)?

YES

Excavation must comply with one of the following three options:

Option 1:
§1926.652 (b)(2) which requires Appendices A and B to be followed

Option 2:
§1926.652 (b)(3) which requires other tabulated data (see definition) to be followed.

Option 3:
§1926.652 (b)(4) which requires the excavation to be designed by a registered professional engineer.

NO

Excavations must comply with §1926.652 (b)(1) which requires a slope of 1½H:1V (34°).

FIGURE 2 - SLOPING OPTIONS

[Appendix F]

Shoring or shielding selected as the method of protection.

Soil classification is required when shoring or shielding is used. The excavation must comply with one of the following four options:

Option 1
§1926.652 (c)(1) which requires Appendices A and C to be followed (e.g. timber shoring).

Option 2
§1926.652 (c)(2) which requires manufacturers data to be followed (e.g. hydraulic shoring, trench jacks, air shores, shields).

Option 3
§1926.652 (c)(3) which requires tabulated data (see definition) to be followed (e.g. any system as per the tabulated data).

Option 4
§1926.652 (c)(4) which requires the excavation to be designed by a registered professional engineer (e.g. any designed system).

FIGURE 3 - SHORING AND SHIELDING OPTIONS

[Appendix F]

Appendix H

4.04 Hazard Communication

A. Introduction

OBG Technical Services, Inc. is committed to providing a safe and healthy work environment for all employees through compliance with the Federal Hazard Communication Standards. It is recognized that certain work activities and procedures require the use of chemicals which have potentially hazardous properties. When using such chemicals, it is important that workers are aware of the identity and potentially hazardous properties of the chemicals. Thus, this section represents the Written Program and has been established to summarize the components of the Hazard Communication Program instituted by OBG Tech.

This Written Hazard Communication Program is available to all employees, their designated representatives, and representatives of the Federal Occupational Safety and Health Administration. This Program has been developed in compliance with the federal regulations contained in 29 CFR 1910.1200 and 29 CFR 1926.59. Further information on the program may be obtained from the Safety Coordinator in the Syracuse office.

B. Materials Exempted

The following materials are exempt from ALL aspects of the Federal Hazard Communication regulations:

1. Tobacco or tobacco products;
2. Wood or wood products;
3. Articles (defined as manufactured items, intended for use in specific shape or design, which do not release, or otherwise result in exposure to a hazardous chemical);
4. Food, drugs, cosmetics, or alcoholic beverages in a retail establishment packaged for sale to consumers;
5. Any consumer product or hazardous substance (as governed by the Consumer Product Safety Commission) which is used in the workplace in the same manner as normal consumer use, which results in a frequency and duration of exposure which is not greater than exposures experienced by consumers;
6. Drugs in solid, final form for direct administration to the patient (i.e., tablets or pills); and
7. Hazardous wastes, as defined under the Solid Waste Disposal Act and the Resource Conservation and Recovery Act.

C. Labeling program

1. No hazardous chemicals or chemical products will be used or accepted for use by OBG Tech, unless labeled with at least the following information:

   i. Identity of the hazardous chemical(s);
   ii. Appropriate hazard warnings;
   iii. Name and address (and phone number, if available) of the chemical manufacturer, importer, distributer, supplier, or other responsible party.

All OBG Tech employees are responsible for compliance with these requirements.

2. The identity of the chemical that appears on the manufacturer's label will be the same name to identify the chemical on the List of Hazardous Chemicals, and the MSDS for that substance.
3. All labels will be legible, in English, and prominently displayed on the container.
4. In the situation of a stationary container, the label may be replaced by a sign, placard, process sheet, batch ticket, or other means to convey the identity of the hazardous chemical and the appropriate hazard warnings. If these other forms of warning are used, they will be readily accessible to employees in their work area throughout each work shift.
5. The Standard does not require a label to be placed on portable containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for the immediate use of the employee who performs the transfer. However, by labeling the portable container appropriately, accidental misuse of the chemical by other employees may be prevented.
6. No label is to be defaced or removed unless the container is immediately marked with the required information. Any container without an appropriate label should be reported immediately to the job-site Supervisor.
7. Exemptions from these labeling requirements are as follows:

   i. Pesticides subject to the Federal Insecticide, Fungicide and Rodenticide Act;
   ii. Food, food additives, color additives, drugs, cosmetics, or medical or veterinary devices, as governed by the Food and Drug Administration;
   iii. Alcoholic beverages, wine or malted beverages intended for non-industrial use;
   iv. Any consumer product or hazardous substance as defined by the Consumer Product Safety Commission;

D. Comprehensive List of Hazardous Chemicals

Every chemical or product mixture of chemicals in any of the OBG Tech jobsites which is included in any of the four following lists of hazardous chemicals is listed in the List of Hazardous Chemicals for each jobsite. This List will be kept and maintained by the job-site Supervisor in a central location at each jobsite, such as the field office trailer. The four defining lists of hazardous chemicals are as follows:

1. Those compounds with designated OSHA Permissible Exposure Limits, as listed in 29 CFR 1910, Subpart Z ("Toxic and Hazardous Substances");
2. Those compounds listed in "Threshold Limit Values for Chemical Substances in the Work Environment" as published in the latest edition by the American Conference of Governmental Industrial Hygienists;
3. The latest edition of the "Annual Report on Carcinogens", published by the National Toxicology Program;
4. The Monographs published by the International Agency for Research on Cancer.

If a product contains a mixture of chemicals, it is considered to be hazardous if it contains 1% or more of any of the chemicals contained in any of the four lists referenced above. In the case of carcinogens, a mixture is considered to be hazardous if it contains 0.1% or more of any of the carcinogens within the lists referenced above.

The identity of each chemical, as noted in the List of Hazardous Chemicals, will be the same as the identity that appears on the container label and on the MSDS. A copy of the List of Hazardous Chemicals will be located at each Field Office along with a corresponding MSDS file for each compound on the list. Updating of the Comprehensive List of Hazardous Chemicals will be done regularly, upon acquisition of new materials and/or elimination of "old" materials. Each job-site Supervisor or his designate within OBG Tech will be responsible for updating each jobsite's list and MSDS file.

E. Material Safety Data Sheets

Copies of Material Safety Data Sheets for all hazardous chemicals to which employees may be exposed will be kept at a central location at each jobsite, such as the field office trailer and are readily accessible to employees in the work area during each work shift. The job-site Supervisor or his designate is responsible for maintaining and updating the file of Material Safety Data Sheets.

Each Material Safety Data Sheet shall be in English and shall contain the following information:

1. The identity used on the label.
2. Physical and chemical characteristics of the hazardous chemical.
3. Physical and health hazards of the hazardous chemical.
4. The primary routes of entry.
5. The OSHA permissible exposure limit, ACGIH threshold limit value, and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the material safety data sheet, where available.
6. Whether the chemical is found to be a potential carcinogen.
7. Precautions for safe handling.
8. Control measures, such engineering controls, work practice, or appropriate personal protective equipment.
9. Emergency and first aid procedures.
10. The date of the preparation of the material safety data sheet or the last change to it; and
11. The name, address, and telephone number of the responsible party for preparation or distribution of the material safety data sheet.

F. Employee Information and Training

Employees working with or potentially exposed to hazardous chemicals appropriately informed and trained concerning the potential hazards of the materials to which they may be exposed at the time of their initial work assignment. Training will be appropriately supplemented whenever a new hazard is introduced into the work area.

Employee information includes:

1. The requirements of the Hazard Communication Standard;
2. Any job-related activities involving hazardous chemicals;

3. The locations and availability of the Written Hazard Communication Program, the List(s) of Hazardous Chemicals, and the Material Safety Data Sheet File.

Employee training includes:

1. Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area. Such procedures include monitoring, visual appearance and/or odor recognition, symptoms, etc.;
2. The physical and health hazards of the chemicals in the work area.
3. Measures employees can take to protect themselves from such hazards. This includes specific procedures instituted by OBG Tech to protect employees from exposure to hazardous chemicals such as appropriate work practices, emergency procedures, and personal protective equipment suitable for use.
4. The details of the Hazard Communication Program developed by OBG Tech, including an explanation of the labelling system and the Material Safety Data Sheets, and how employees can obtain and use the appropriate hazard information.

The Safety Coordinator is responsible for overseeing the employee information and training program. All training is documented and is filed in the Syracuse office.

G. Provisions for Non-routine Tasks and Sub-Contractors

Before any non-routine task is performed that could involve exposure to hazardous chemicals, the supervisor for the area involved will evaluate the task for appropriate work practice procedures, potential chemical hazards of the task, safety and protective measures are reviewed and understood by the employee.

Prior to beginning work on OBG Tech jobsite, all sub-contractors will be given a copy of the Written Hazard Communication Program. The particular hazards associated with the work area(s) will be identified, along with all appropriate MSDSs for the materials to be used and/or encountered. Sub-Contractors are responsible for training their own employees. The job-site Supervisor or Foreman is responsible for verifying that training has been performed by the sub-contractors.

H. Multi-Employer Workplaces

OBG Technical Services, Inc. employees may use or store hazardous chemicals at a workplace in such a way that the employees of another employer or employers may be exposed. If this occurs, then the following steps must be taken.

1. Prior to the beginning of work on a multi-employer site, the Supervisor will notify all of the other contractors and sub-contractors where the MSDSs for all the hazardous chemicals, brought on-site by OBG Tech, are available.
2. The Supervisor will inform the other employers of precautionary measures which need to be taken to protect employees from hazardous chemicals used by OBG Tech employees during normal operating conditions and in foreseeable emergencies. This communication will also include a brief description of the container labeling system used by OBG Tech.
3. OBG Technical Services, Inc. will request similar information from all the other contractors

working on this site.

4. OBG Tech employees will receive training in the hazards of new chemicals that they will use, and the chemicals to be used by other contractors at a tool box safety meeting to be held prior to the beginning of work.

Appendix I

3.05 Confined Spaces

A. Introduction

OSHA has a standard, 29 CFR 1910.146, for permit-required confined spaces. The standard includes provisions for testing and entering confined spaces. The employee who enters a confined space may be subject to multiple hazards. The purpose of this section is to outline procedures to reduce these hazards.

B. Definitions

"Permit-required confined space" means a confined space (see definition below) that has one or more of the following characteristics:

1. Contains or has a potential to contain a hazardous atmosphere (see definition below).
2. Contains a material that has the potential for engulfing an entrant.
3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or by a floor which slopes downward and tapers to a smaller cross-section, or
4. Contains any other recognized serious safety or health hazard.

"Confined Space" means a space that:

1. Is large enough and so configured that an employee can bodily enter and perform assigned work; and
2. Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry): and
3. Is not designed for continuous employees occupancy.

"Hazardous Atmosphere" means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness from one or more of the following causes:

1. Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);
2. Airborne combustible dust at a concentration that meets or exceeds its LFL (Note: this concentration may be approximated as a condition in which dust obscures vision at a distance of 5 feet (1.52 meters) or less);
3. Atmospheric oxygen concentration below 19.5% or above 23.5%;
4. Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in 29 CFR 1910 Subparts G or Z and which could result in employee exposure in excess of its dose or permissible exposure limit (Note: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment or ability to self-rescue, injury, or acute illness due to its health effects is not covered).
5. Any other atmospheric condition that is immediately dangerous to life or health.

Note: For air contaminants for which OSHA has not determined a dose or permissible exposure limit, other sources of information, such as Material Safety Data Sheets that comply with the Hazard Communication Program, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

"Non-permit confined space" means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

C. Confined Space Entry Program

1. Coordination with Host Employer (Owner)

The Supervisor/Foreman in charge of entry will:

a. Obtain any available information regarding permit space hazards and entry operations from the host employer (Owner);
b. Coordinate entry operations with the host employer (Owner), when both host employer personnel and OBG Tech personnel will be working near permit spaces;
c. Inform the host employer (Owner) of the permit space program that OBG Tech personnel will follow and of any hazards confronted or created in permit spaces, either through a debriefing or during the entry operation.
d. Follow the Host Employers (Owners) confined space entry program whenever possible.

2. Determine classification of Confined Space

Should OBG Tech employees need to enter a confined space that has not been classified, then the following procedures will be used:

a. Determine whether the space meets the definition of a confined space as defined in Part B of this Section.
b. If the space meets the definition of a confined space, then determine whether it meets the definition of a permit-required confined space. If the confined space does not meet the definition of a permit-required confined space, employees may enter the space after the appropriate safety pre-cautions have been taken.
c. If the confined space requires a permit, refer to Part 3 of this section for the procedures to be followed under these conditions.

3. Preparations for Permit-Required Confined Spaces

The Supervisor/Foreman in charge of entry is responsible for:

a. Implementing the measures necessary to prevent unauthorized entry.
b. Identifying and evaluating the hazards before employees enter the permit space.
c. Specifying acceptable entry conditions on the "Safety, Work, Flame, Tank Entry, & Gas Test Permit" (An example is attached. Four-copy pressure sensitive forms are available from the Syracuse office).
d. Isolating the permit space and following lock-out/tag-out procedures as necessary.
e. Purging, inerting, flushing or ventilating the permit space as necessary to eliminate or control atmospheric hazards.
f. Providing signs and pedestrian, vehicle, or other barriers as necessary to protect entrants from external hazards.
g. Verifying that conditions in the permit space are acceptable for entry throughout the duration of an authorized entry.
h. Confirming that the necessary equipment is available and that employees are trained to use it as outlined on the permit.
i. Performing testing as described in Section 6.
j. Verifying that at least one attendant is stationed outside the permit space into which entry

is authorized for the duration of the entry.

k. Verifying that the emergency rescue team has been notified (see Section 10).

l. Coordinating entry operations when employees of more than one employer are simultaneously as authorized attendants in a permit space, so that the employees of one employer do not endanger the employees of any other employers.

m. Prior to entry, signing the permit to authorize entry.

n. Posting the completed permit at the entry portal or by any other equally effective means, so that the entrants can confirm that pre-entry preparations have been completed.

o. When a ladder is required to enter the confined space, the ladder must be tied securely and must not be removed while anyone is in the confined space.

p. Adequate lighting of an approved safety type must be provided.

q. All necessary safety equipment to be used by the person entering the confined space as well as for the safety watch will be checked.

r. Emergency procedures will be reviewed.

s. Smoking is prohibited inside of and within twenty feet of the confined space.

t. Spark proof hand tools and explosion proof equipment will be used.

u. If welding is to be performed in the confined space that previously or now contain combustibles, all residues, including dry scale or sediment must be removed. If it is not possible to remove all combustible materials, they must be covered with a non-combustible blanket.

v. At least one 20 lb. ABC multi-purpose fire extinguisher must be available for instant use in a confined space containing flammable gases or vapors.

w. Each person involved shall be trained on the hazards, as outlined in Section 4, how to recognize the hazards, and how to protect themselves from the hazards. Additionally, the attendants will be training on the use of rescue equipment and other duties outlined Section 8.

4. Training

Each employee who is required to enter a permit-required confined space will be trained in the safe performance of duties.

a. Training will be provided to each affected employee:

(1) before an employee is assigned duties which require entry into permit-required confined spaces,
(2) whenever there is a change in permit space operations that presents a hazard about which an employee has not previously been trained, or
(3) whenever there is reason to believe either that there are deviations from the permit-required confined space entry procedures or that there are inadequacies in the employee's knowledge or use of these procedures.

b. The training will be documented by the employees name, the signatures or initials of the trainers, and the dates of training. This documentation will be filed in the employees safety file and is available for inspection.

5. Procedures during entry

a. The duration of the permit may not exceed the time required to complete the assigned task or job identified on the permit.

b. The Foreman/Supervisor in charge of entry will terminate and cancel the entry permit when:

(1) Entry operations covered by the entry permit have been completed; or
(2) A condition that is not allowed under the entry permit arises in or near the permit space.

6. Procedures for Atmospheric Testing

a. Before an employee enters that space, the internal atmosphere will be tested, with a calibrated direct-reading instrument to determine if acceptable entry conditions exist, for the following conditions in the order given:

(1) Oxygen content
(2) Flammable gases and vapors
(3) Potential toxic air contaminants

b. If isolation of the space is infeasible because the space is large or is part of a continuous system, such as a sewer, pre-entry testing will be performed to the extent feasible before entry is authorized and, if entry is authorized, entry conditions will be continuously monitored in the areas where authorized entrants are working.

c. Test or monitor the permit space as necessary to determine if acceptable entry conditions are being maintained during the course of the entry operations.

d. Evaluation and interpretation of data should be done or reviewed by the Safety Coordinator.

e. When monitoring for entries involving a descent into atmospheres that may be stratified, the atmospheric envelope should be tested a distance of 4 feet in the direction of travel and to each side. If a sampling probe is use, the entrant's rate of progress should be slowed to accommodate the sampling speed and detector response.

7. Authorized Entrants

The Foreman/Supervisor in charge of entry is responsible for confirming that all authorized entrants:

a. Know the hazards they face during entry, including information on the mode, signs or symptoms, and consequences of exposure;
b. Properly use equipment as required by this section;
c. Communicate with the attendant as necessary to enable the attendant to monitor entrants status and to enable the attendant to alert entrants of the need to evacuate the space;
d. Alert the attendant whenever:
(1) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation;
(2) The entrant detects a prohibited condition;
e. Exit from the permit space as quickly as possible whenever:
(1) An order to evacuate is given by the attendant or the entry supervisor;
(2) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation
(3) The entrant recognizes a prohibited condition, or
(4) An evacuation alarm is activated.

8. Attendants

The Foreman/Supervisor is charge of entry is responsible for confirming that attendants:

a. Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of exposure;
b. Is aware of possible behavioral effects of hazard exposure in authorized entrants;
c. Initial entry will be accomplished with an attendant stationed outside for the purpose of immediate assistance.
d. The designated attendant will never enter into the permit space for the purpose of an attempt to rescue the entrants.

e. Attendants will use any rescue equipment provided for their use and perform other rescue and emergency duties, without entering the permit space.
f. The attendant will be responsible for continuously maintaining an accurate count of all authorized entrants in the space.
g. Communication between attendants and entrants will be maintained continuously during entry.
h. Attendants will order authorized entrants to evacuate a space immediately when:

(1) The attendant observes a prohibited condition.
(2) The attendant detects behavioral effects hazard exposure.
(3) The attendant detects a situation outside the space which could endanger entrants.
(4) The attendant detects an uncontrolled situation within the permit space.
(5) The attendant is monitoring entry in more than one permit space and must focus attention on the rescue of entrants from one of those spaces.
(6) The attendant must leave the work station.
(7) If the attendant cannot effectively and safely perform all the duties required under this section.

i. Attendants will summon rescue and other emergency services as soon as the attendant determines that the authorized entrants may need assistance to escape from the confined space hazards.
j. Attendants will warn unauthorized persons away from the space, request that unauthorized persons exit immediately if they have entered the space, and inform authorized entrants if unauthorized persons have entered the space.
k. Attendants will perform no duties that might interfere with the attendant's primary duty to monitor and protect the authorized entrants.

9. Supervisor/Foreman

Employees of OBG Tech authorizing or in charge of entry will:

a. Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of exposure;
b. Determine that the entry permit is properly filled out.
b. Determine that the entrants and attendants are properly trained.
c. Determine that necessary procedures, practices and equipment for safe entry are in place, including verifying rescue services are available and that the means of summoning them are operable.
d Remove unauthorized individuals who enter or attempt to enter the permit space during entry operations.
e. Periodically monitor to determine that confined space operations remain consistent with the terms of the entry permit and that acceptable entry conditions are present.
f. Cancel authorization and terminate entry whenever entry conditions are not present.
g. Take the necessary measures for concluding an entry operation, such as closing off a permit space and cancelling the permit, once the authorized work has been completed.
h. The supervisor/foreman in charge of authorizing the confined space entry may also be an entrant or an attendant.

10. Rescue and Emergency Services

a. Arrangements must be made prior to entry under which a rescue team will respond to a request for rescue activities. The outside rescue team will be informed of the hazards they may confront when called to the rescue.

b. To facilitate non-entry rescue, retrieval systems or methods will be used whenever an authorized entrant enters a permit-required confined space, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. Retrieval systems will meet the following requirements:

(1) Each authorized entrant will use a chest or full body harness, with a retrieval line attached at the center of the entrants back near shoulder level, or above the entrant's head. Wristlets may be used in lieu of the chest or full body harness if it can be demonstrated that the use of a chest or full body harness is infeasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative.

(2) The other end of the retrieval line will be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. A mechanical device will be available to retrieve personnel from vertical type permit-required confined spaces more than 5 feet deep.

c. If an injured entrant is exposed to a substance for which a Material Safety Data Sheet (MSDS) or other similar written information is required to be kept at the worksite, that MSDS or written information will be made available to the medical facility treating the exposed entrant.

D. <u>Records</u>

Permits will be filed with other pertinent project health and safety information, as well as with the Safety Coordinator.

F. <u>Evaluation of Program</u>

The Permit-Required Confined Space Entry Program will be reviewed once per year, using the cancelled permits and revise the program as necessary to confirm that employees participating in entry operations are protected from permit space hazards.

G. <u>Exception to Permit Requirements</u>

If the only hazard posed by the confined space is an actual or potential hazardous atmosphere and it can be demonstrated that continuous forced air ventilation alone is sufficient to maintain that confined space for safe entry, then a permit is not required under the regulations. However, it is OBG Tech's policy to require a permit for entries that meet the definition of a "permit-required confined space" (see Section B). If a project requires regular entry into a confined space that does not require a permit under the regulations, the Safety Coordinator must be contacted and the permit waiver will be considered on a project by project basis. Special procedures to be followed under these conditions will be developed by the Safety Coordinator.

OEG TECHNICAL SERVICES INC.
SAFETY, WORK, FLAME, TANK ENTRY & GAS TEST PERMIT

PROJECT:	PROJ.NUMBER	
LOCATION OF WORK: PLANT	BUILDING	FLOOR
DESCRIPTION OF WORK TO BE PERFORMED:		
SPECIAL SAFETY PRECAUTIONS TO BE OBSERVED:		

HAZARD COMMUNICATION Work crew supervisor and all work crew personel have been notified of chemicals ans physical hazards in the work area. MSDS location, safety equipment required and emergency instructions. Work personnel have been instructed to report any unsafe or unusual conditions.

Safety Equipment required: check off if required					
Goggles		Ventilation Equip.		Safety Belt	
Face Shield		Water Hose		Plastic Apron	
Nitrile or Vinyl Gloves		Vinyl Suit		Uncoated Tyvek Suit	
Rubber Boots		Acid Suit		Coated Tyvek Suit	
Half-face Respirator		Air-line Respirator		Ladder/Scaffold	
Full-face Respirator		Carrridge Type		Non-sparking Tools	
GFI		Fire Extinguisher		Vaporproof Ext. Light	
Lockout		Grounding Equipment		Other	
Communication Equip		Barriers & Signs		Other	

CHECK EACH QUESTION: YES, NO OR NOT APPLICABLE	YES	NO	NA
* Have valves been properly set, locked and tagged?			
* Has electric been locked open? Test local starter button.			
* Has piping been disconnected or blanked off?			
* Has vessel/piping been drained, cleaned or purged?			
* Is Gas or Air test necessary? Cont? Every hrs.			
* Can sparks ignite material in vicinity, sewers, lower floors?			
* Is adjacent equipment safe?			
* Is a stand-by fire watch required? If so, present?			
* Tests have been conducted for Flammable Vapors?			
* Tests have been conduted for Oxygen?			
* Tests for Toxic Gases have been conducted and approved?			
* Has a pre-entry briefing been conducted?			
* Have Safety Belt and Harness been provided for work?			
* Has OSHA approved shoring been provided for work?			

Confined Space Entry
Potential Hazards:
Entry Supervisor:
Attendant(s):
Entrants:
Rescue Procedures (Equipment to use and Numbers to Call):
Monitoring Procedures:
Communication Procedures:

LOCKOUT # Locks	# Tags

Air Tests	PEL	Required?	PreEntry	Initial	1 hour	2 hours	4 hours	6 hours	8 hours
Oxygen	19.5 - 23%								
LEL	10 %								
CO	35 ppm								
H2S	10 ppm								
Volatiles	5ppmSTEL								
Others									

Authorizations
Owner:
Agent:
Subcontractor:

PERMIT VALIDATION (Valid for one shift only)	
FROM: DATE	TIME
TO: DATE	TIME

Work Completed?	Yes	No	NA	Comments:	
Lockout/Tagout Protection has been removed and equipment can be placed into service					Yes
Protection Removed By:				Time:	Date:

APPENDIX C

SPDES PERMIT

ACCURATE DIE CASTING SITE, ONONDAGA COUNTY

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning December 1, 1993

and lasting until December 1, 1998

the discharges from the permitted facility shall be limited and monitored by the permittee as specified below:

Outfall Number & Effluent Parameter	Discharge Limitations Daily Avg.	Discharge Limitations Daily Max.	Units	Minimum Monitoring Requirements Measurement Frequency	Minimum Monitoring Requirements Sample Type
Remedial Discharge to Bishop Brook (0-66-11-P26-37-6-2-4), Class C (TS)					
Flow	Monitor	150,000	GPD	Continuous	Meter
pH	(6.5 - 8.5)		SU	2/week	Grab
Solids, Total Suspended	Monitor	20	mg/l	Weekly	3-hr. comp.
Solids, Total Dissolved	Monitor	500	mg/l	Weekly	3-hr. comp.
$CBOD_5$	Monitor	Monitor	mg/l	Monthly	3-hr. comp.
TKN	Monitor	Monitor	mg/l	Monthly	3-hr. comp.
TOD*	Monitor	15	mg/l	Monthly	Calculated
Dissolved Oxygen	Monitor	7 min.	mg/l	Monthly	Grab
Aluminum, Dissolved	Monitor	200	µg/l	2/month	3-hr. comp.
Antimony, Total	Monitor	100	µg/l	2/month	3-hr. comp.
Chromium, Total	Monitor	500	µg/l	2/month	3-hr. comp.
Cobalt, Total	Monitor	10	µg/l	2/month	3-hr. comp.
Copper, Total	Monitor	100	µg/l	2/month	3-hr. comp.
Iron, Total	Monitor	300	µg/l	2/month	3-hr. comp.
Lead, Total	Monitor	20	µg/l	2/month	3-hr. comp.
Mercury, Total	Monitor	0.8	µg/l	2/month	3-hr. comp.
Nickel, Total	Monitor	200	µg/l	2/month	3-hr. comp.
Silver, Total	Monitor	100	µg/l	2/month	3-hr. comp.
Vanadium, Total	Monitor	30	µg/l	2/month	3-hr. comp.
Zinc, Total	Monitor	300	µg/l	2/month	3-hr. comp.
Cis-1,2-Dichloroethylene	Monitor	10	µg/l	2/month	Grab
Trans-1,2-Dichloroethylene	Monitor	10	µg/l	2/month	Grab
Methylene Chloride	Monitor	50	µg/l	2/month	Grab
1,1,2,2-Tetrachloroethane	Monitor	30	µg/l	2/month	Grab
Tetrachloroethylene	Monitor	20	µg/l	2/month	Grab
Toluene	Monitor	20	µg/l	2/month	Grab
Trichloroethylene	Monitor	10	µg/l	2/month	Grab
Acetone	Monitor	1000	µg/l	2/month	Grab
2-Hexanone	Monitor	1000	µg/l	2/month	Grab
4-Methyl-2-Pentanone	Monitor	1000	µg/l	2/month	Grab

<u>Special Conditions</u>:

Authorization is valid only for the period noted above but may be renewed if appropriate. A request for renewal must b received 6 months prior to the expiration date to allow for a review of monitoring data and reassessment of monitoring requirements.

Only site generated wastewater is authorized for treatment and discharge.

Discharge is not authorized until such time as an engineering report, plans and specifications are submitted detailing th *proposed method of treatment and approval is granted by the Department.*

*TOD = 1.5 x $CBOD_5$ + 4.5 x TKN.

SPDES PERMIT FACT SHEET

Prepared by: Shayne Mitchell Date: 12/02/93

Company: Accurate Die Casting Permit No.: 734052

Location: Onondaga County, Fayetteville Industrial Code No.: 9511

Industrial Segment: NA Part No.:

Type of Processing & Production Rate:

Site Remediation.

Basis for Technology Effluent Limitations:

Best Professional Judgement (BPJ).

PARAMETER	BASIS FOR PERMIT CONDITION
Outfall No.: 001 :Remedial	Discharge: Nominal Flow: 0.15 MGD
Flow	BPJ
pH	WQ
TSS	BPJ
TDS	WQ
CBOD	Monitor
TKN	Monitor
TOD	WQ
DO	WQ
Aluminum	WQ
ntimony	BPJ
hromium	BPJ
obalt	WQ
opper	BPJ
ron	WQ
ead	WQ
ercury	WQ/Detection Limit
ickel	BPJ
ilver	BPJ
anadium	WQ
hloride Zinc	WQ
is-1.2-DCE	BPJ
rans-1.2-DCE	BPJ
ethylene Chloride	BPJ
.1.2.2-PCA	BPJ

PARAMETER	BASIS FOR PERMIT CONDITION
Outfall No.: 001 ;Remedial (contd)	Discharge: Nominal Flow: 0.15 MGD
PCE	WQ
Toluene	BPJ
TCE	BPJ
Acetone	BPJ
2-Hexanone	BPJ
4-Methyl-2-Pentanone	BPJ

APPENDIX D

SOIL BORING PROCEDURES

SOIL BORING PROCEDURES

Soil borings shall be completed using hollow stem augers and/or other applicable drilling methods (i.e. air rotary, spun casing) to the approximate depth specified in the work plan.

Samples of the encountered subsurface materials will be collected continuously to provide physical descriptions of the material at each location. The sampling method employed will be the ASTM Method D- 1586-84 using either a standard 2-foot long, 2-inch outside diameter split-barrel sampler with a 140 lb. hammer or a 3-inch outside diameter sampler with a 300 lb. hammer. Upon retrieval of the sampling barrel, the collected sample shall be described, labelled, and placed in a glass jar.

A hydrogeologist will be on-site during the drilling and sampling operations to fully describe each soil sample including but not limited to: 1) soil type, 2) color, 3) percent recovery, 4) moisture content, 5) odor and other observations, such as organic content and cohesiveness. The Wentworth Soil Classification System will be used to describe the soil samples. The hydrogeologist will be responsible for retaining a representative portion of each sample in a glass jar labeled at a minimum with: 1) site name; 2) boring number; 3) sample interval; 4) date; and, 5) time of sample collection. Split-spoon soil samples will be field screened for volatile organic compounds (VOCs).

The VOC screening procedure will be performed by placing a portion of each soil sample into a plastic self-sealing baggie or a glass jar sealed with aluminum foil. The sample will be retained until it equilibrates with ambient temperature. The sample will then be gently agitated to volatilize potential VOCs and the headspace will be monitored with a PID.

The drilling contractor will be responsible for obtaining accurate and representative samples, informing the supervising hydrogeologist of changes in drilling pressure, and keeping a separate general log of soils encountered. Included in this log will be a record of blow counts (i.e. the number of blows from a 140 or 300 pound soil sampling drive weight required to drive the split barrel sampler 6 inches).

Soil sampling equipment, including split spoon samplers, will be decontaminated prior to the initial boring and following advancement of each successive boring in accordance with the decontamination protocol provided below:

<u>Equipment Decontamination</u>

A decontamination pad will be constructed adjacent to the PCB/PAH/VOC soils area for cleaning the drill rig and apparatus. The pad will be lined with polyethylene sheeting and sloped and curbed. Wash and rinse water will be pumped from the decontamination pad and collected in 55-gallon drums. Once the collected liquids are characterized, the drums will be transported to an appropriate off-site treatment or disposal facility.

Decontamination procedures will be followed for drilling and sampling activities. The split barrel sampling equipment will be decontaminated after each use. Drilling equipment mobilized to the site will receive an initial decontamination. Decontamination will consist of steam cleaning of the entire rig and associated equipment to the satisfaction of the hydrogeologist. The rear portion of the drill rig will be decontaminated as necessary by steam cleaning between soil boring installations. In addition, equipment used for sample collection will be decontaminated using a high pressure steam cleaner to remove soil and volatilize organics. Drilling equipment will be decontaminated prior to removing the equipment from the site.

The field sampling equipment cleaning and decontamination procedures will be as follows:

1. Non-phosphate detergent wash.

2. Tap water rinse.

3. Distilled water rinse

Information concerning decontamination methodology, date, time, and personnel will be recorded in the field log book.

APPENDIX E

GROUND WATER MONITORING PLAN OUTLINE

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Ground Water Monitoring Plan

APPENDIX F

PROGRESS REPORT FORMS

FORMER ACCURATE DIE CASTING SITE
FAYETTEVILLE, NEW YORK

Monthly Progress Report for: ______________________

(a) Activities Performed

This section will provide a brief description of the activities completed and documents submitted to or received from the NYSDEC during the month for which this report was prepared. For activities not complete, an estimated percentage of completion will be provided.

(b) Sampling and Test Results

This section will present the data obtained during the month as a result of sampling and test efforts. However, an interpretation of the data, and conclusions made based on the data, may not be presented in this Report. Interpretations and conclusions will be presented within the documents proposed within the RD/RA Plan.

(c) Projected Activities

This section will present a brief description of the activities proposed to be undertaken during the next month.

(d) Project Schedule

This section will identify if there have been any conditions encountered that may delay completion of the project. Included will be a brief description of the condition, measures taken to remedy it, and anticipated impact to the completion of the remedial efforts.

(e) Work Plan Modifications

This section will identify NYSDEC approved modifications made during the month, and identify proposed modifications that may be necessary in the future.

(f) Activities in support of Community Relations Plan

This section will identify activities performed and proposed in support of the Community Relations Plan.

APPENDIX G

OPERATION AND MAINTENANCE PLAN OUTLINE

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Operation and Maintenance Manual

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Operation and Maintenance Manual
(Continued)

Figures

Appendices

Separately Bound Documents

Exhibits

O'BRIEN & GERE
ENGINEERS, INC.

EXHIBIT A

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

Remedial Design/Remedial Actions

Prepared for:
Former Accurate Die Casting Site
Fayetteville, NY

February 1995
Revised March 7, 1995

O'BRIEN & GERE
TECHNICAL SERVICES

O'Brien & Gere Technical Services, Inc.
5000 Brittonfield Pkwy.
E. Syracuse, NY 13057
(315) 437-6400

O'BRIEN & GERE
TECHNICAL SERVICES

This Health and Safety Plan has been prepared to meet the requirements of 29 CFR 1926.65, Hazardous Waste Operatons and Emergency Response.

Signed,

OBG TECHNICAL SERVICES, INC.

Jeffrey R. Parsons, CIH
Corporate Safety Coordinator

Revision Summary

Date	DEC Comments to HSP	Revision Incorporated
3/7/95	Particulate monitoring should be included for the work zone.	Section 5.3 page 12
3/7/95	In Table 2, hazard control such as the respiratory protection was not provided for the inhalation of contaminated materials.	Respiratory protection is listed as a hazard control for protection from inhaling contaminated materials. Personal protective equipment (PPE) levels are listed in the hazard control column along with a description in Section 4.3, Site-specific personal protection. Further upgrade in PPE level to include respiratory protection is also outlined in the Air Monitoring Section, Table 3 & 4 of this HSP.
3/7/95	In Table 3, action level 200 ppm for upgrading to Level B seems to be high.	Action levels have been changed to accommodate levels of TCE are encountered. Action levels are now 100 ppm and 300 ppm. See page 11.
3/7/95	Section 7 should include the DEC's toll free number 1-800-342-9296 and the regional office telephone number (315)426-7551 with Charlie Branagh	Section 7.3 on page 15.
3/7/95	As proposed for the previous IRM activities, documentation air monitoring should be carried out at the site during the implementation of the excavation work.	Section 1.1.7 and section 5's introduction paragraph. Also see attachments 5-7.

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EXHIBITS

ATTACHMENTS

APPENDICES

SECTION 1 - INTRODUCTION

The following Health and Safety Plan (HSP) has been developed in accordance with the requirements set forth in 29 CFR Part 1926.65, *Hazardous Waste Operations and Emergency Response*, and in conjunction with the O'Brien & Gere Technical Services (OBG Tech) Hazardous Waste Operations Standard Operating Procedures for OBG Technical Services' on-site activities. OBG Tech's Hazardous Waste Operations Standard Operating Procedures are in Section 4.05 of OBG Technical Services' Corporate Health and Safety Manual (see Appendix E). Section 4.05 as well as other pertinent Sections are appended to this HSP (Appendices A through I).

The purpose of this HSP is to assign site-specific responsibilities, site-specific training requirements, establish site-specific personnel protective requirements, and to provide guidance for site-specific contingencies that may arise for OBG Technical Services' and subcontracted employees. In addition to this site-specific HSP, a copy of the OBG Technical Services Corporate Health and Safety Manual will be kept on site for reference purposes. All OBG Tech personnel and subcontractor personnel must be familiar with this site specific HSP and the OBG Tech Corporate Health and Safety Manual prior to participation in site activities.

The front portion of this HSP is designed to include site-specific information, so that it can be separated from the Corporate protocols in the Appendices and distributed and posted as necessary.

This HSP may be provided to interested parties for informational purposes, however, the HSP is specifically intended for the conduct of activities within the scope of work for OBG Technical Services.

1.1 Corporate Protocols

The following are the sections required by 29 CFR 1926.65 that can be found in the Corporate Health & Safety Manual and are appended to this HSP.

1.1.1 Employee Training Assignments

The employee training assignments are found in Section 2.02 of the Corporate Health and Safety Manual and are included in Appendix A. The description for the hazardous waste pre-entry briefing can be found in the hazardous waste protocols in Section 4.05 of the Corporate Health and Safety Manual. The hazardous waste protocols are included in Appendix E. There are no additions to these protocols.

1.1.2 Personal Protective Equipment (PPE)

The EPA definitions of personal protective equipment (PPE) and donning and decontamination procedures are found in Section 5.01 of the Corporate Health and Safety Manual, which is included in Appendix B. The site-specific personal protective equipment can be found in Section 4.

1.1.3 Medical Surveillance

The Corporate Medical Surveillance program can be found in Section 2.04 and is included in Appendix C. There are no site-specific additions to these protocols.

1.1.4 Air Monitoring

The corporate air monitoring program and calibration and maintenance procedures for air monitoring equipment is found in Section 4.03 of the Corporate Health and Safety Manual and is attached in Appendix D. The site-specific air monitoring program is found in Section 5.

1.1.5 Site Control

The Corporate Site Control Program is found in the Hazardous Waste Protocols, attached in Appendix E. The site-specific site control program can be found in Section 6.

1.1.6 Confined Space Entry Procedures

The Corporate Confined Space Entry Procedures are found in Section 3.05 of the Corporate Health and Safety Manual and are attached in Appendix I. Site-specific confined space entry information is included in Section 6.1.

1.1.7 Health and Safety Forms

The following OBG Tech health and safety forms will be available for use on-site:

- Accident Investigation Form
- Health and Safety Plan Compliance Form
- Toolbox Meeting Record
- Entry/Exit Log
- Air Monitoring Log
- Air Monitoring Instrument Calibration Record
- Air Sampling Form
- Quantitative Fit Test Form

1.2 Site-Specific Protocols

The following are the sections required by 29 CFR 1910.120 that can be found in this HSP. Section 2 is the project background and Scope of Work. Personnel involved in the project can be found in Section 3. Section 4 includes the hazard evaluation and hazard control. Air monitoring procedures are included in Section 5. Section 6 outlines the site-specific site control measures. Section 7 includes the emergency response and spill control procedures.

SECTION 2 - BACKGROUND AND SCOPE OF WORK

2.1 General

This document is the Health and Safety Plan prepared in support of the Remedial Design/Remedial Action (RD/RA) activities to be conducted at the former Accurate Die Casting Site located at 547 East Genesee Street in the Village of Fayetteville, New York (Figure 1). Based on the results of the Remedial Investigation and Feasibility Study completed in August 1994, the New York State Department of Environmental Conservation (NYSDEC) has published a Record of Decision (ROD) directing that remedial design/remedial action be performed.

This section presents background information pertaining to the site, a description of the selected remedy for the site, and the RD/RA activities to be conducted on-site.

2.2 Background

The facility was constructed in 1950 as a die casting industry. Die Casting activities were conducted at the site until mid-1988 when the then owners, the former Accurate Die Casting Corporation and George and Theresa Slyman, abandoned the facility and filed for bankruptcy. In December 1988, ITT Commercial Finance Corporation (ITT) assumed control of the property as mortgagee-in-possession as a result of the foreclosure process.

Upon acquiring the property, ITT conducted a Phase I (June 1989) and Phase II (September 1990) environmental assessment. During the Phase II environmental assessment:

- Approximately 70 drums of waste found at the site after foreclosure and located inside the building were characterized and disposed;
- Sludge from an abandoned trichloroethylene (TCE) degreasing system was removed and the system was decontaminated; and
- A TCE free product pool, which was discovered adjacent to and outside the northeast corner of the building proximal to monitoring well MW-3 (Figure 2), was pumped and disposed until no TCE free product was detected in samples.

Upon reviewing the Phase II assessment of the Former Accurate Die Casting site, the NYSDEC required that a Remedial Investigation be conducted. The investigation was completed in accordance with the Remedial Investigation (RI)/Feasibility Study (FS) Work Plan (Stearns & Wheler, May 1992). In the RI Report (Stearns & Wheler, December 1993), it was concluded among other things that:

- Ground water quality had been impacted by TCE. An overburden TCE plume extends from outside the northeast corner of the facility north towards Bishop Brook;
- The highest TCE concentrations in soils were observed at about 20 to 25 feet below grade outside the northeast corner of the facility, at the interface between the sand/gravel and clayey till layers;
- Surface and subsurface soils contain residues of polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAH), and volatile organic compounds (VOCs) in the location referred to as the PCB/PAH/VOC Soils Area shown on Figure 2; and
- The material inside the abandoned septic tank contains levels of zinc that could present a risk to the environment.

In May 1994, an Interim Remedial Measure Work Plan was prepared to separately address the soils exhibiting TCE outside the northeast corner of the facility and the TCE impacted overburden aquifer. The IRM Work Plan was subsequently approved by the NYSDEC in a letter dated May 23, 1994. In accordance with the approved Work Plan, the soil remediation activities were initiated on May 24, 1994 and completed on June 22, 1994, as documented in the Summary Report dated October 1994, and activities to address the overburden aquifer were initiated in September 1994.

As part of the soil remediation activities conducted outside the northeast corner of the facility, approximately 3,000 cubic yards (CY) of soil were excavated. Of that amount, approximately 1,250 CY of soil exhibited TCE levels above the established Remedial Action Objective (RAO) of 0.7 mg/kg, but below 15 mg/kg. The soil exhibiting TCE above 0.7 mg/kg was processed on site through a mechanical volatilization system. Once processed, the average residual TCE concentration was 0.13 mg/kg. The treated soils, as well as the excavated soils that did not contain TCE above the RAO, were subsequently used to backfill the excavation.

In association with the soil remediation activities conducted outside the northeast corner of the facility, a ground water collection sump was constructed on top of the clay layer at the base of the excavation, prior to backfilling. The sump is located approximately 20 feet from the north wall of the east building addition, and approximately 20 feet east of the main building, as shown in Figure 2. The purpose of the ground water collection sump is to monitor the quality and facilitate removal of overburden ground water in the previously excavated area.

In accordance with approved IRM Work Plan (O'Brien & Gere, May 1994), an overburden aquifer test recovery well, RW-1, was also installed on site (Figure 2) for the purpose of conducting a 24-hour pump test and hydrogeologic evaluation. The results of the 24-hour pump test and hydrogeologic evaluation are presented in the Basis of Design Report (O'Brien & Gere, December 1994) which also presents a description of the proposed overburden ground water recovery and treatment system.

Upon approval of the Basis of Design Report dated December 1994 by the NYSDEC, the overburden ground water treatment system will be constructed in accordance with IRM Work Plan.

2.3 NYSDEC Selected Remedial Alternative

Based upon the results of the RI/FS at the former Accurate Die Casting site and the criteria identified for the evaluation of alternatives, the NYSDEC has further directed that the contaminated soil and sludge be excavated and disposed off-site and the TCE impacted bedrock ground water be extracted and treated on-site. The components of the selected remedy identified in the ROD are as follows:

- The PCB/PAH/VOC soils from the former oil spill area, located on the northwest portion of the site, will be excavated and disposed of in a permitted landfill. The excavated area will be backfilled with clean soil;
- The sludge from the septic tank, located on the north-east portion of the site, will be excavated and disposed of in a permitted landfill;
- The TCE impacted bedrock ground water will be extracted and treated on-site. The treated ground water will be discharged to Bishop Brook;
- Soil samples will be obtained from the area northeast of the facility, where soils containing TCE were excavated as part of an Interim Remedial Measure, to verify that a potentially significant source of TCE is no longer present in the vadose zone soil; and
- A long-term ground water monitoring program will be implemented to monitor the effectiveness of the ground water (overburden and bedrock) and soil remediation program.

2.4 Scope of Work

The RD/RA activities to be performed to implement the NYSDEC selected remedial alternative are described in the RD/RA Work Plan dated February 1995. The specific field activities for which this HSP has been prepared include:

- The completion of soil borings, in the area outside the northeast corner of the facility, to obtain soil samples where TCE contaminated soils were previously excavated;
- The completion of soil borings, in the location of previous oil spill, to obtain soil

samples. The soils in this area contain residues of polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), and volatile organic compounds (VOCs);

- The excavation of soils in the PCB/PAH/VOC area, and the removal of the septic tank and its contents. The septic tank contains a sludge exhibiting levels of zinc potentially harmful to the environment.
- The completion of a bedrock aquifer ground water recovery well outside the northeast corner of the facility. This area exhibited the highest levels of TCE in the ground water on site.
- The installation of the ground water recovery and treatment systems. Construction activities will include excavation of a pipe trench between the existing recovery well RW-1 and the facility, installation of tanks and other apparatus inside the facility, and the excavation of a pipe trench between the proposed bedrock ground water recovery well RW-2 and the facility; and
- The collection of periodic ground water level measurements and samples.

SECTION 3 - PROJECT PERSONNEL

Section 4.05 of OBG Technical Services' Corporate Health and Safety Manual (see Appendix E) contains the specific responsibilities for the below personnel.

Project Officer:	Terry L. Brown, PE
Sr. Project Supervisor:	Anthony J. Geiss
Corporate Safety Coordinator:	Jeffrey R. Parsons, CIH
Health and Safety Specialist:	Kelly L. Fisher
Field Supervisor/Site Safety and Health Coordinator:	To Be Determined

SECTION 4 - HAZARD EVALUATION AND HAZARD CONTROL

4.1 Potential Health and Safety Hazards

Previous soil analysis in the PCB/PAH/VOC soils area has shown the following:

1. PCBs present at concentrations up to 2.6 milligrams of PCBs per kilogram of soil (mg/kg)
2. PAHs present at concentrations up to 113 mg/kg.
3. Dichloroethylene (VOCs) at concentrations up to 190 parts per million (ppm)

Septic tank sludge analysis detected the presence of several metals, but only zinc was elevated when compared to other soil samples taken from the site. No VOCs were detected.

The highest TCE concentrations were observed in the previously excavated soil area at about 20 to 25 feet below grade. In addition, ground water TCE concentrations were noted in bedrock MW-10 and bedrock MW-11 located in the previously excavated soil area.

Health and safety information for PCBs, PAHs, and VOCs (trichloroethylene and dichloroethylene) are included in Table 1. Because metals concentrations are low, they are not considered a hazard for this project.

The exposure pathways of concern are inhalation of materials volatilized from the soil and groundwater; inhalation of dusts containing the contaminants; accidental ingestion of soil and groundwater containing contaminants; and dermal exposure to soil and groundwater containing contaminants. Based upon anticipated site activities and prudent safety practices during site work, ingestion of site contaminants is unlikely. Due to the use of personal protective equipment, direct contact with site contaminants poses a low health hazard. Direct-reading air monitoring equipment will be used to monitor the airborne volatile organic compounds and dusts, thus minimizing the inhalation of VOCs and dust from the soil and sludge.

4.2 Operations and Tasks to be performed

OBG Technical Services employees are required to use personal protective equipment appropriate to their work task and potential exposures, as detailed in Section 5 of the OBG Technical Services' Corporate Health and Safety Manual. Specific sections related to this site include "EPA Levels of Protection for Hazardous Waste Sites" and "Respiratory Protection."

In addition, the soil amendment material(s) used during the soils aeration activities have the potential to cause health effects. All hazard information regarding the soil amendment material(s) should be reviewed by site personnel prior to initiating site treatment activities. The SSHC is responsible for administering the Hazard Communication program (Appendix H), including informing all employees about the amendment material(s) and the location of the material safety data sheet (MSDS) for the amendment material(s), as well as all other MSDS's for materials brought on-site.

The levels of protection assigned to each activity below are based on available information and represent an estimate of exposure potential and appropriate protective equipment. The SSHC may revise these levels in accordance with Section 4.05 of OBG Technical Services' Corporate Health & Safety Manual.

When dry and/or dusty conditions are observed by the SSHC or dust levels are above the action level specified in Section 5.3, a water spray will be applied to the contaminated soils. In addition, excavated materials will be covered.

TABLE 1 - SUMMARY OF POTENTIAL HEALTH EFFECTS

Chemical	Location	PEL[1]	IDLH	Characteristics	Routes of Exposure	Symptoms of Exposure
Trichloroethylene	Soil Groundwater	100 ppm TWA 200 ppm Ceiling (1989 - 50 ppm TWA 200 ppm STEL)	1000 ppm	Colorless liquid with a chloroform-like odor. Lowest reported odor threshold is 0.2 ppm.	Inhalation Ingestion Contact	Headache, vertigo; visual disturbances, tremors, somnolence, nausea, vomiting; irritated eyes; dermatitis; cardiac arrhythmia, paresthesia; potential carcinogen.
Dichloroethylene	Soil	200 ppm TWA	4000 ppm	Colorless liquid with a slightly acrid, chloroform-like odor. Lowest reported odor threshold is 0.1 ppm	Inhalation Ingestion Contact	Irritation of the eyes and respiratory tract. Central nervous system depression (i.e. alcohol-like effects)
Polychlorinated Biphenyls (PCBs)	Soil	1 mg/m^3	10 mg/m^3	Colorless to light colored, viscous liquid with a mild hydrocarbon odor.	Inhalation Absorption Ingestion Contact	Eye irritation, Chloracne, liver damage, carcinogen
Polynuclear Aromatic Hydrocarbons (PAHs)[2]	Soil	0.2 mg/m^3	700 mg/m^3	Black or dark brown amorphous residue.	Inhalation Contact	Skin dermatitis, bronchitis, kidney damage, carcinogen

3-6-00

1 An appeals court decision forced OSHA to revert the PELs published in 1989 to the PELs published in 1971. The PELs listed here reflect the 1971 PELs with 1989 PELs listed in parentheses.

2 Exposure limits for PAHs are referenced by OSHA as coal tar pitch volatiles, benzene soluble fraction. This includes the following compounds: anthracene, benzo-a-pyrene, phenanthrene, acridine, chrysene, and pyrene.

mol vol 7 1 liter = 22.4 liter/mole

$.2 \frac{mg}{m^3} \times \frac{m^3}{}$

$\frac{mg}{m^3} \times \frac{24.45}{mol\ wt} \times \cancel{760}$

$\frac{.2}{100} \frac{\times .24.45}{200}$ $\frac{.05}{100} = \frac{5}{10000} = 5$

TABLE 2 - HAZARD EVALUATION AND CONTROL

Operation/Task	Hazards	Hazard Control
MOBILIZATION		
General Site Workers performing non-intrusive activities including mobilization, equipment set-up	1. Safety/Physical Hazards -Noise -Use of Heavy Equipment -Overhead Utilities -Heat or cold stress -Exposure to toxic plants, insects, and reptiles	1. Level D PPE 2. Hearing protection when necessary 3. Eye protection when necessary 4. Review hazard recognition and prevention at toolbox safety meeting 5. Stay 20 feet from overhead utility lines
EXCAVATION AND HANDLING OF CONTAMINATED SOILS		
Operator	1. Contact with contaminated materials 2. Inhalation of contaminated materials 3. Safety/Physical Hazards -Noise -Use of heavy equipment -Overhead utilities -Underground utilities -Exposure to excavations -Heat or cold stress -Confined space entry for excavations greater than 4 feet deep.	1. Modified Level D PPE (includes skin protection - coveralls, gloves, boots, eye protection) 2. Hearing Protection is required while operating equipment. 3. Use trained operators 4. Review hazard recognition and prevention at toolbox safety meeting 5. Follow excavation safety rules and inspection forms found in Appendix G 6. Call utilities before breaking ground 7. Review hand signals with laborer 8. Follow confined space entry procedure. 9. Air monitor as detailed in Section 5
Laborer	1. Contact with contaminated materials 2. Inhalation of contaminated materials 3. Safety/Physical Hazards -Slip/trip/fall hazards -Exposure to heavy equipment -Noise -Exposure to toxic plants, insects, and reptiles -Exposure to excavations -Heat or cold stress -Confined space entry for excavations greater than 4 feet.	1. Modified Level D PPE 2. Hearing Protection 3. Review hand signals with operators 4. Review hazard recognition and prevention at toolbox safety meeting 5. Follow excavation safety procedures (see Appendix G) when entering an excavation 6. Follow confined space entry procedure 7. Air monitor as detailed in Section 5
REMOVAL OF SOIL AND SLUDGES FROM SEPTIC TANK		
Laborer	1. Contact with contaminated materials 2. Inhalation of contaminated materials 3. Safety/Physical Hazards -Noise -Slip/trip/fall hazards -Exposure to heavy equipment -Exposure to toxic plants, flying insects, and reptiles -Exposure to excavations -Heat or cold stress -Confined space entry	1. Modified Level D PPE 2. Hearing protection 3. Review hand signals with operators 4. Review hazard recognition and prevention at toolbox safety meeting 5. Follow excavation safety procedures (see Appendix G) 6. Follow confined space entry procedures found in Appendix I 7. Air monitor as detailed in Section 5

Operation/Task	Hazards	Hazard Control
SOIL BORING & SAMPLING CONTAMINATED SOIL		
Sampler	1. Contact with contaminated materials 2. Inhalation of contaminated materials 3. Safety/Physical Hazards -Exposure to heavy equipment -Noise -Pinch points -Heat or cold stress	1. Modified Level D PPE 2. Hearing protection 3. Review hazard recognition and prevention at toolbox safety meeting 4. Collect sample using excavator bucket 5. Air monitor as detailed in Section 5
GROUNDWATER RECOVERY AND TREATMENT SYSTEMS		
Laborer	1. Contact with contaminated materials 2. Inhalation of contaminated materials 3. Safety/Physical Hazards -Slip/trip/fall hazards -Exposure to heavy equipment -Noise -Exposure to toxic plants, insects, and reptiles -Exposure to excavations -Handling pipe -Heat or cold stress -Confined space entry	1. Modified Level D PPE 2. Hearing protection 3. Review hand signals with operators 4. Review hazard recognition and prevention at toolbox safety meeting 5. Follow excavation safety procedures (see Appendix G) when entering an excavation 6. Follow confined space entry procedures (see Appendix I) 7. Air monitor as detailed in Section 5
DECONTAMINATION ACTIVITIES		
Decontamination of Equipment	1. Contact with contaminated tools and equipment 2. Safety/Physical Hazards -Noise -Exposure to Heavy Equipment -Heat or cold stress -Burns from steam decon equip.	1. Level C PPE 2. Hearing protection 3. Review SOPs/operating instructions for decontamination equipment

4.3 Site-specific Personal Protection

The site-specific personal protective equipment is to be used in accordance with the protocols in Section 5.01 of the Corporate Health and Safety Manual. These protocols include the definitions of the EPA levels of protection for Level B, Level C and Level D to be used on-site, as well as donning and decontamination procedures. The site-specific personal protective equipment is as follows:

Coveralls: Poly-coated Tyvek® when exposed to dirt/dusts
Saranex®-coated Tyvek® when exposed to site waters/liquids

Outer Gloves: Viton Gloves
(Note: Work gloves dedicated to the exclusion zone may be used over the viton gloves)

Respirator: Level C: Full-face air purifying respirator with organic vapor cartridges and high efficiency particulate (HEPA) filters

Level B: Positive pressure, full-facepiece Self-Contained Breathing Apparatus (SCBA) or Positive pressure, supplied-air respirator with escape SCBA

Hard hats, steel-toed boots, and safety glasses are mandatory on-site.

SECTION 5 - AIR MONITORING AND ACTION LEVELS

Air monitoring is to be performed in accordance with Appendix D (Section 4.03 of the Corporate Health and Safety Manual - Airborne Materials Exposure) and Appendix E (Section 4.05 of the Corporate Health and Safety Manual - Hazardous Waste Operations). Air monitoring results will be documented using appropriate forms (see Attachments 5, 6, & 7). Presented below is the site-specific information.

5.1 Wind Indicator

Wind direction will be monitored each day of on-site activities by using a portable wind indicator.

5.2 Air Monitoring Equipment to be used

Photoionization Detector (PID) with 10.2 eV lamp

Combustible gas/oxygen meter

Direct-Reading Dust Monitor

5.3 Work Zone Air Monitoring Procedures and Action Levels

The following describes the methods and parameters to be used on-site for PPE upgrades and work cessation. The action levels are based upon total organic vapors detected by a photoionization detector (PID) calibrated to isobutylene. PID readings will be adjusted in accordance with manufacturer's guidelines to read in ppm of dichloroethylene.

TABLE 3 - WORK ZONE ACTION LEVELS

Type	Frequency	Action Level	Action
Volatile Organic Compounds (VOCs) (Using PID)	1. Initially when a new task begins and hourly thereafter 2. When obvious contamination is encountered 3. Prior to and continuously during entry into excavations over 4 feet	25 ppm above background in breathing zone for 5 minutes	Increase to Level C PPE
		100 ppm above background in breathing zone for 5 minutes	1. Notify SSHC 2. Increase to Level B PPE 3. Consider engineering controls.
		300 ppm above background in breathing zone for 5 minute	1. Stop work - consult SSHC; 2. use engineering controls (e.g. ventilation) to decrease concentrations
Combustible Gases (Lower Explosive Limit - LEL)	Prior to and continuously during entry into an excavation over 4 feet	10 %	Stop work - increase ventilation to bring below 10 % LEL

Type	Frequency	Action Level	Action
Oxygen	Prior to and continuously during entry into an excavation over 4 feet	19.5 %	Stop work - increase ventilation to bring above 19.5 % oxygen
Particulate	Continuously downwind during excavation of contaminated materials integrated over 15 minute periods	150 ug/m^3	Monitor the upwin background level immediately. If the working site dust measurement is greater then 100 ug/m^3, then dust suppression techniques will be implemented (e.g. using water sprays, covering excavated materials and areas)

5.4 Community Air Monitoring Plan

Real-time monitoring for volatile compounds and particulate levels at the perimeter of the work area will be performed.

TABLE 4 - COMMUNITY ACTION LEVELS

Type	Frequency	Action Level	Action
VOCs (using PID)	Initially when a new task begins, every fifteen minutes for the first hour and every two hours thereafter	5 ppm above background sustained for one minute in breathing zone at downwind perimeter of work area	1. Stop work until emission controls (covering excavated areas) are in place and the concentrations detected by the PID are reduced to below 5 ppm at the downwind perimeter of the work area. 2. Air monitor as directed below. 3. When work continues monitoring at the downwind perimeter of the work area will be performed at least every one-half hour.
	Monitoring will be performed within 20 feet of the perimeter of the nearest residential or commercial structure when 5 ppm above background sustained for one minute in breathing zone at downwind perimeter of work area	1 ppm above background sustained for one minute	1. Stop work and continue to monitor. 2. Contact Corporate Safety Coordinator for appropriate action. 3. Work may continue when concentrations detected by the PID are reduced to below 1 ppm. 4. Monitor with pumps and charcoal tubes following NIOSH 1022 (see below)
VOCs (pumps and charcoal tubes following NIOSH 1022)	1. Daily for the first week of excavation actives in contaminated area - one upwind and two downwind 2. When 5 ppm above background sustained for one minute in breathing zone at downwind perimeter of work area is detected using PID	1/2 of PEL after subtracting upwind from downwind	The SSHC and Project Supervisor will re-evaluate vapor suppression techniques
Particulates	Continuously downwind during excavation of contaminated materials integrated over 15 minute periods	100 ug/m³	1. Measure the upwind background level. 2. Implement dust suppression techniques (e.g. using water sprays, covering excavated materials and areas) 3. Notify the SSHC
		150 ug/m³	1. STOP WORK 2. Measure upwind background level immediately 3. Implement additional dust suppression techniques

SECTION 6 - SITE CONTROL

The elements of site control include site work zones (exclusion zone, contamination reduction zone, and support zone), the "buddy" system, site communication, and site security. Protocols for site control can be found in Section 4.04 of the Corporate Health and Safety Manual (see Appendix E).

Only approved, trained personnel will be allowed to enter the exclusion zone and contamination reduction zone. Personnel must understand this HSP and the potential on-site hazards before being allowed on site.

6.1 Potential Confined Space Areas

The excavations (greater than 4 feet) do pose a potential confined space entry area. When entry occurs then the confined space procedures in the Corporate Health & Safety Manual will be followed (section 3.05 - see Appendix I). Specifically, the following precautions will apply:

1. Confined Space Entry permit will be filled out by the SSHC.
2. Air monitoring will be performed continuously for oxygen deficiency and LEL.
3. Personal protective equipment as outlined previously will be used.
4. Barriers and signs will be used to protect opening.
5. Provisions will be made for confined space rescue.

Specific procedures, such as coordination with Owner, training, entrant responsibilities. attendant responsibilities, supervisor/foreman responsibilities, and atmospheric testing can be found in Section 3.05 of the Corporate Health & Safety Manual (see Appendix I).

In addition, the safety requirements for excavations will be followed, as outlined in Section 10.06 of the Corporate Health and Safety Manual (See Appendix G).

6.2 Work Area

A map of the work areas depicting the exclusion and contamination reduction zones will be prepared and submitted with the Construction plans and performance specifications.

SECTION 7 - EMERGENCY RESPONSE AND CONTINGENCY PLAN

Sections 3.01, Medical Services and First Aid, 3.03, Emergency Action, and 4.05, Hazardous Waste Operations, of the Corporate Health and Safety Manual provide guidance on emergency response. This section provides the site-specific emergency response information.

<u>7.1 Directions to Hospital</u> - To be posted in all site trailers (See Figure 3).

Genesee Street West to I-481 North.
I-481 to I-690 West
I-690 West to Townsend Street
Left onto Townsend Street
Turn left onto Genesee Street
Turn right onto Irving Ave
The hospital on right.

<u>7.2 Location of Nearest Available Telephone</u>

The telephone will be located in the site field office.

<u>7.3 Emergency Telephone numbers</u> - To be posted in site office

Police	911
Crouse Irving Memorial Hospital	470-7111
Fire Department	911
DEC	(800)342-9296
DEC Regional - Charlie Branagh	426-7551
OBG Technical Services, Inc.	437-6400

<u>7.4 Safe Refuge</u>

The field office will serve as point of safe refuge. An air horn will be kept in the field office. If the air horn is sounded, all on-site personnel must return to the office.

<u>7.5 Spill Control</u>

A major spill is not anticipated at the site. Should a spill of any type occur, the personnel present at the spill should report it immediately to the SSHC and/or the OBG Tech emergency contacts, who will make arrangements for the proper clean-up of the spill and contact the appropriate local emergency groups and regulatory agencies. On-site personnel should immediately secure the area to prevent unauthorized entry into the spill area. On-site personnel must evaluate the extent of the hazard(s) and if available, utilize engineering controls and proper safety equipment to contain the spill until response personnel are on site. The emergency response personnel will be contacted immediately by SSHC in the event that the spill can not be immediately contained by on-site materials.

Attachment 1

O'BRIEN & GERE
TECHNICAL SERVICES

Health and Safety Plan Compliance

Project Name: ______________________
Project Number: ______________________

This is to certify that I have read, fully understand, and agree to comply fully with the attached Health and Safety Plan furnished to me by O'BRIEN & GERE TECHNICAL SERVICES, INC.

NAME	SIGNATURE	COMPANY	DATE

Revision: 12/29/94 (File Name: HSPCOMP.FRM)

Attachment 2

ACCIDENT INVESTIGATION FORM

FORWARD TO SAFETY COORDINATOR WITHIN 24 HOURS!

O'BRIEN & GERE TECHNICAL SERVICES

Instructions: This form must be filled out be the employees' Manager, Supervisor, or Foreman. Mark N.A. (not applicable) for those items which do not apply to case. Write "none", "unknown", or "don't know" for applicable items for which there is no answer. NEVER LEAVE A BLANK. Write a description of the incident on the back, including any information on conditions that may have contributed to the incident.

EMPLOYEE DATA

Name	Subcontractor? Yes - Name of Company:	SS#:	
Job Title:	Time in Job:	Age:	Sex: M F

ACCIDENT DETAILS

Date:	Day:	Time:	Treatment at:
Location of accident:	Job being performed:		Witnesses:
How did the accident happen?			
What is the extent of the injury?			

ACCIDENT TYPE

	Contact w/Temp. Extreme		Strain/Overexertion		Caught Between		Caught On		Struck By		Contact w/Haz Subst.
	Contact w/Elect. Current		Different Level Fall		Same Level Fall		Caught In		Struck Against		Other:

REASONS FOR WHAT WAS DONE OR WAS FAILED TO BE DONE

	Unaware of job hazard		Tried to gain/save time		Acted to avoid discomfort		Influence of illness
	Unaware of safe methods		Defective hearing/vision		Influence of intoxicants		Influence of emotions
	Influence of fatigue		Tried to avoid extra effort		Low level of job skill		Inattentive to hazards

UNSAFE CONDITIONS

	Hazardous Defects of equipment		Inadequate aisle, space, etc.		Unguarded		Improperly placed (includes housekeeping)
	Inadequately placed against undesired motion		Inadequate ventilation		Inadequately guarded		Un- or in- adequately labeled
	Hazardous methods and/or procedures		Improper illumination		Ungrounded		Improperly piled
	Lack of or inadequate warning systems		Fire or explosion hazard		Uninsulated		Inadequate clearance for moving parts

UNSAFE ACTS

	Cleaning, oiling, adjusting of moving equip.		Improper use of hands or body parts		Making safety device inoperative		Improper use of equipment
	Working in an electrically charged environ.		Inattention to footings or surroundings		Taking an unsafe position or posture		Using unsafe equipment
	Failure to wear safe personal attire		Operating or working at unsafe speed		Fail to secure or warn		Failure to wear PPE
	Horseplay, distracting, teasing, etc.						

ACTIONS TO PREVENT ACCIDENT REOCCURANCE

	Reinstruction of person(s) involved		Action to improve inspection		Installation of guard or safety device		Equipment repair or replacement
	Conversation record with person(s) involved		Action to improve clean-up		Correction of unnecessary congestion		Inform all foreman/supervisors
	Discipline of person(s) involved		Check with manufacturer		Permanent reassignment of person		Order use of safer materials
	Reinstruction of others doing job		Action to improve design		Order regular pre-job instructions		Action to improve construction
	Improvement of personal protective protective equipment						

CASE TYPE - TO BE FILLED IN BY SAFETY COORDINATOR

	First Aid		Injury - lost time		Occupational illness		Injury - No Lost Time		Restricted work		Fatality

Name	Date	Name	Date
Investigated By:		Project Manager:	
Supervisor/Foreman:		Safety Coordinator:	

Revision: 12/27/94 (File Name: ACCIDENT.FRM)

Attachment 3

SAFETY/TOOLBOX MEETING

O'BRIEN & GERE
TECHNICAL SERVICES

DATE:____________ PROJECT NUMBER:____________

PROJECT LOCATION:____________

CONDUCTED BY:____________

EMPLOYEE NAME	COMPANY	Social Security #

Safety Meeting Topic(s):____________

Comments:____________

Revision: 01/03/95 (File Name: TOOLBOX.FRM)

Attachment 4

O'BRIEN & GERE TECHNICAL SERVICES

ENTRY/EXIT LOG

Site:

Date:

Name	Company	Time In	Time Out	Reason

Revision: 01/03/95 (File Name: ENTRYLOG.FRM)

Attachment 5

DIRECT READING INSTRUMENT CALIBRATION RECORD

O'BRIEN & GERE TECHNICAL SERVICES

Instrument:
Serial No.:
Calibration concentration

Date	Initial Reading	Adjusted Reading	Performed By

Air Monitoring Log-
Organic Vapors, Oxygen, LEL

Attachment 6

O'BRIEN & GERE
TECHNICAL SERVICES

Date:	Project Name:	Project Location:
Job Number:	SSHC:	
Background:	Wind Direction:	Temperature:
Activities:		

Time	Location	HNU (ppm)	LEL	O_2

Revision: 12/30/94 (File Name: AIRVAPOR.FRM)

AIR MONITORING DATA SHEET

OBRIEN & GERE TECHNICAL SERVICES

Attachment 7

CLIENT: ____________ LOCATION: ____________ PROJECT NUMBER: ____________ SURVEY DATE: ____________

Pump Type: | Manufacturer: | Model:

Serial Number	Pre-Cal	Post-Cal	COMMENTS - Include Reason for Sampling, Operations, and Processes

Collection Media: | Analysis Required:

Sample No.	Sample Media, & Pump ID No.	Person (name & SSN) OR Sample Location	Start Time	End Time	Duration	Flow Rate	Shift Duration	Analysis Required

SAMPLER(S): ____________

Revision 01/03/95 (File Name: AIRSMPL.FRM)

Attachment 8

QUALITATIVE FIT TEST

O'BRIEN & GERE
TECHNICAL SERVICES

Name: ______________________________

SS#: ______________________________

Company: ______________________________

Respirator Brand: ______________________________

Model: ______________________ Size: ____________

Procedure: _____ Irritant Smoke _____ Banana Oil

NOTE: Failure in any one of the following exercises indicates unacceptable respirator fit.

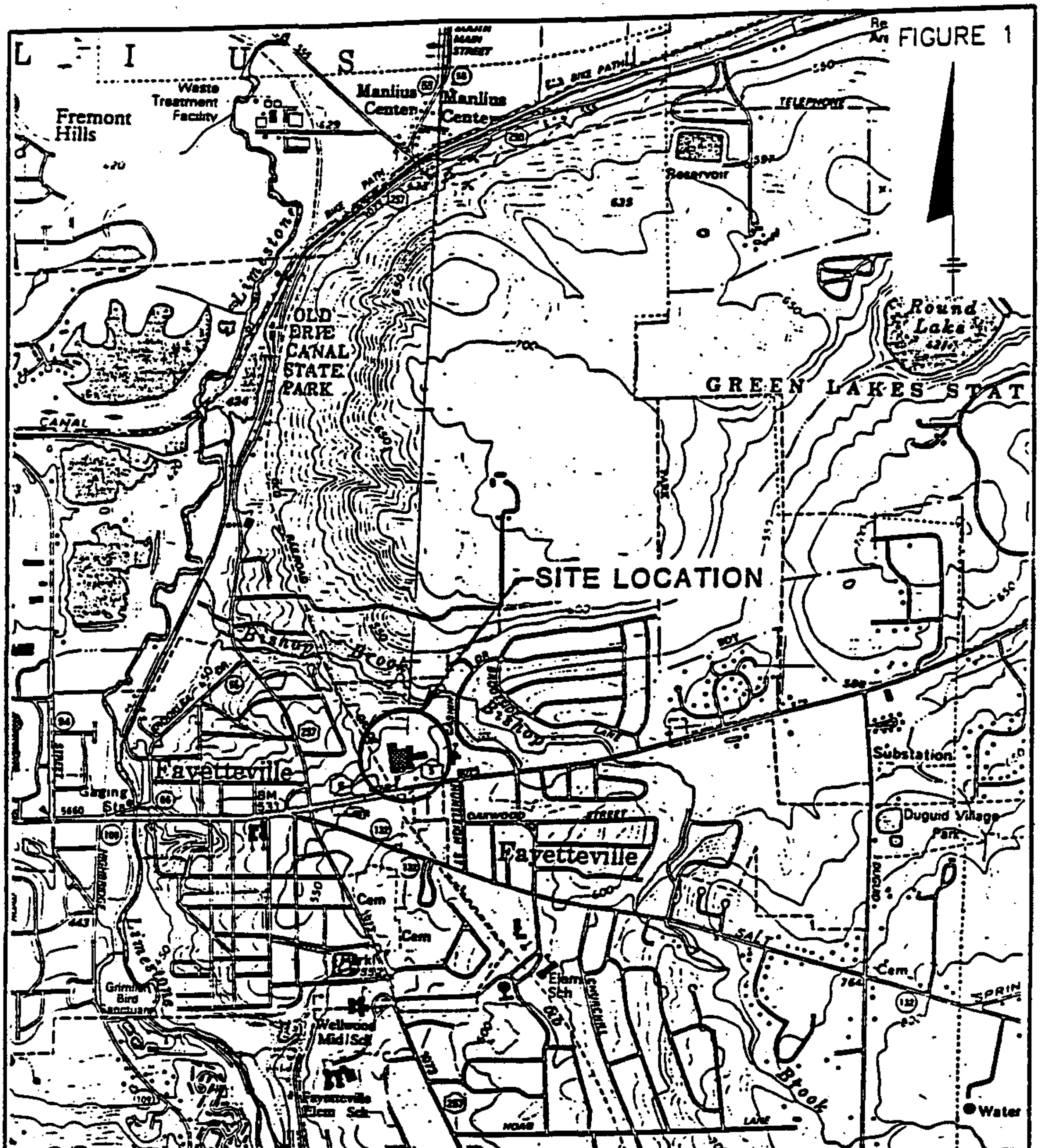
1. _______ Positive and negative fit test
2. ______ Breath normally
3. ______ Turn head side to side
4. ______ Nod head
5. ______ Jog in place
6. _____ Breath normally and read the following:

   When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

Test performed by: ______________________ Date: _______

Revision: 01/03/95 (File Name: FITTEST.FRM)

MHB H:\DIVISION\71\ACCURATE\SITE SF=1 04/15/94



ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK

SITE MAP

SCALE: 1" = 2,000 FT.

USGS TOPOGRAPHIC 7.5 MIN. QUAD
SYRACUSE EAST, N.Y. QUADRANGLE

FILE NO. 2488.396-

O'BRIEN & GERE ENGINEERS INC.

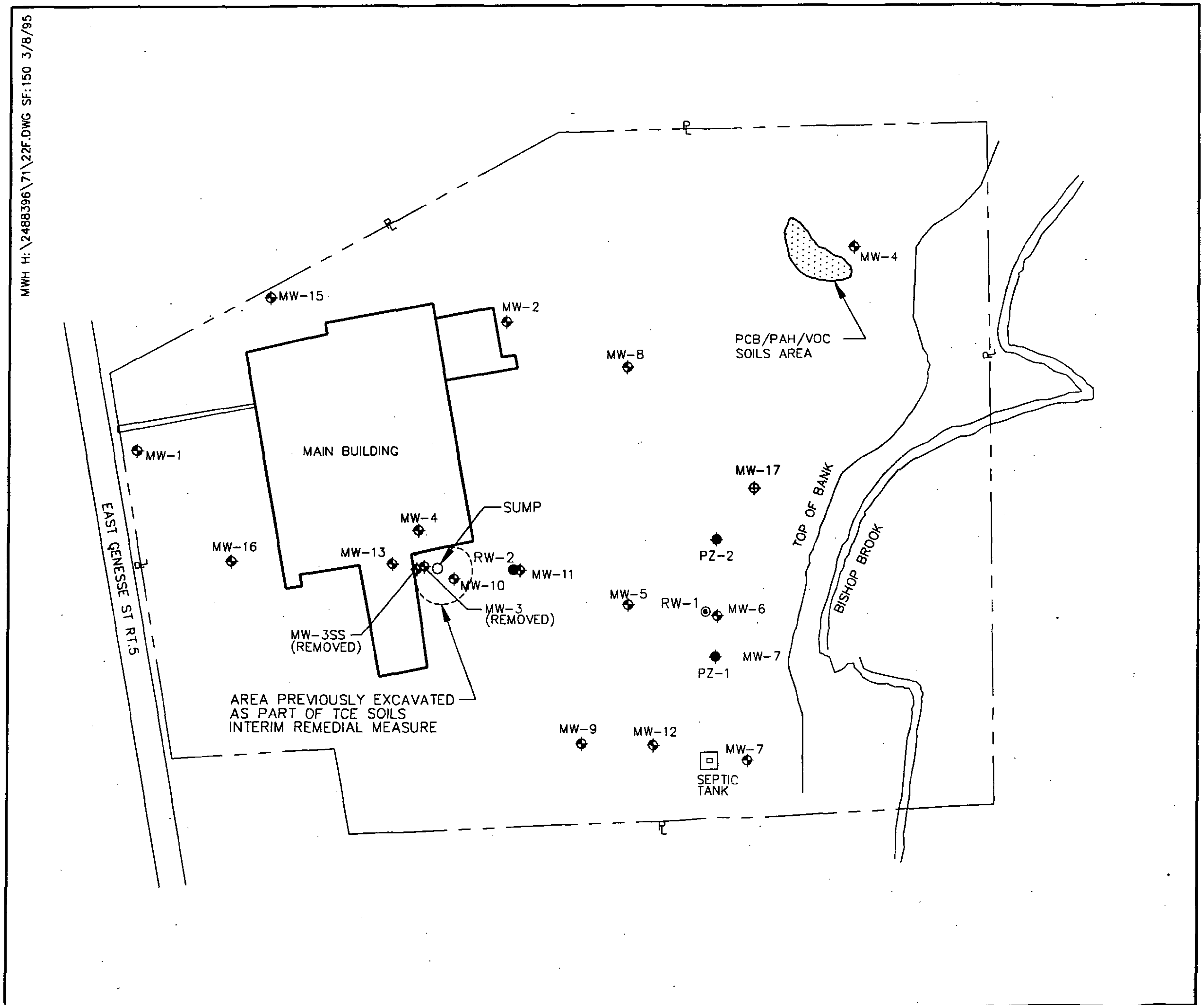


FIGURE 2

LEGEND

PL	PROPERTY LINE
MW-4	MONITORING WELL
PZ-1	PIEZOMETER LOCATION
RW-1	OVERBURDEN AQUIFER RECOVERY WELL
RW-2	PROPOSED BEDROCK GROUND WATER RECOVERY WELL

ACCURATE DIE CASTING
FAYETTEVILLE, NEW YORK
REMEDIAL DESIGN/REMEDIAL
ACTION WORK PLAN

SITE PLAN

150 0 150

APPROX. SCALE IN FEET

FILE NO. 2488.396-22F

O'BRIEN & GERE ENGINEERS INC.

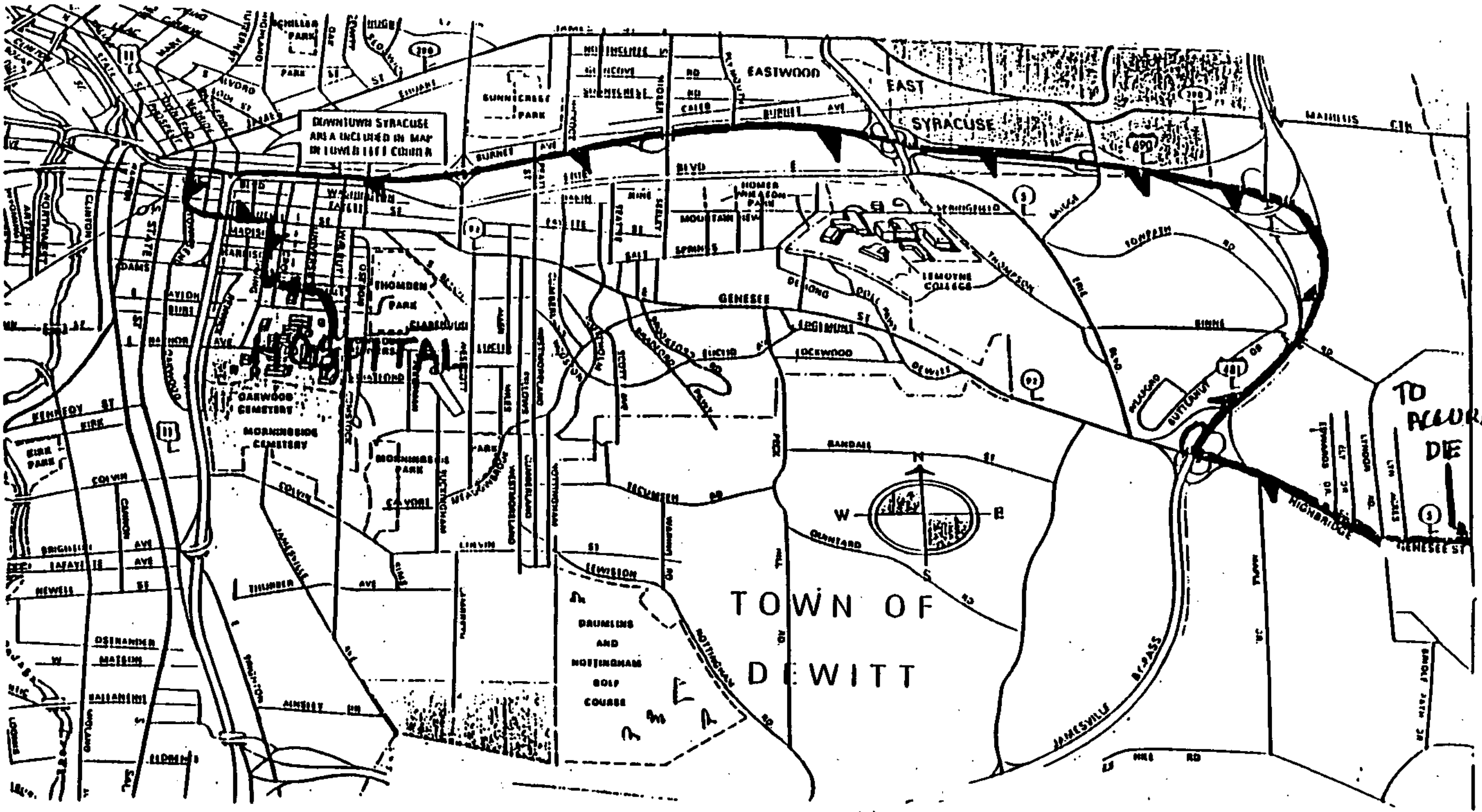


FIGURE 3

HOSPITAL ROUTE MAP

Appendix A

2.02 Health and Safety Training

A. Introduction

All employees must recognize and understand the potential hazards to health and safety associated with the tasks that they perform. The objectives of safety training programs are:

1. To make employees aware of the potential hazards they may encounter;
2. To provide employees with the knowledge and skill necessary to perform the work with minimal risk to employee health and safety;
3. To make employees aware of the purpose and limitations of equipment; and
4. To provide employees with information to avoid or procedures to follow in the event of an emergency.

B. New Employee

All new employees to OBG Technical Services, Inc. will receive training that will provide an introduction to the Safety Program, employees rights and responsibilities on safety, electrical safety, minimizing back strain on the job, Hazard Communication, and substance abuse-free workplace policy.

C. Job specific

Field Supervisors/Foreman will be responsible for training new employees on site-specific information, such as safe work practices and procedures to follow in the event of an emergency.

D. Haz Com

All OBG Tech employees will receive training on the OSHA Hazardous Communication Standard ("Right-to-Know"). Each employee receives a copy of the written program with their job offer letter. However, formal training is conducted to verify that all employees have been made aware of the plan, its requirements, and be informed of their right to receive information about hazardous materials.

Each supervisor is responsible for training employees on new materials introduced on specific jobs.

E. Other Safety Training

1. "Toolbox" Safety Meetings

   There are a number of OSHA regulations which require training. Many of these are specific to jobs and should be documented by "tool box" meetings. These include: medical services and emergency action, fire protection, accident prevention, and power-operated and woodworking hand tools, stairways and ladders, guardrails and handrails, welding and cutting, scaffolds, concrete and masonry construction, and demolition.

   Supervisors/Foreman review the applicable topics in weekly "tool box" safety meetings on every project. Names of employees attending the meeting and topics covered are forwarded to the Safety Coordinator for recordkeeping purposes.

2. Quarterly Staff and Safety Meetings

Staff and safety meetings are held quarterly for all employees. These meetings cover staff and personnel issues, as well as selected topics related to safety.

3. Haz Waste Training

Employees who are assigned to perform duties on hazardous waste sites will receive the OSHA initial 40-hour health and safety training prior to on-site activities at a hazardous waste site. Applicable employees will receive yearly 8-hour refresher courses. In addition, Foreman, Supervisors, and Project Managers will receive the OSHA 8-hour health and safety supervisors training.

4. Other Safety Training

Periodically, employees will be sent to safety training courses relevant to their duties, such as confined space entry.

F. Records

The Safety Coordinator will maintain safety training records on each individual.

Appendix B

Section 5.01 EPA Levels of Personal Protective Equipment

A. Introduction

Due to the nature of the business of OBG Tech. employees may be required to work on hazardous waste sites. Use of personal protective equipment (PPE) is required by OSHA. EPA has defined four Levels of Protection: Levels A, B, C, and D. These levels are defined below and may be used as a starting point for PPE on sites, but must be tailored to the specific situation.

B. Levels of Personal Protection

Level A

Level A protection provides the highest available level of respiratory, skin and eye protection. The material in the suit, gloves, and boots must be compatible with the substances involved.

1. Positive pressure, full-facepiece SCBA or positive pressure supplied-air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH).

2. Fully-encapsulating, chemical-resistant suit.

3. Outer chemical-resistant gloves.

4. Inner chemical-resistant gloves.

5. Chemical-resistant safety boots.

6. Two-way communications.

   Options:

   1. Cooling unit.

   2. Coveralls.

   3. Long-underwear.

   4. Other PPE as required in Section 5.02 through 5.09 of this Health and Safety Manual.

Level B

Level B protection provides the highest level of respiratory protection but less skin protection than Level A. Use only when airborne chemicals are not hazardous to the skin or not capable of being absorbed through the intact skin.

   1. Positive-pressure, full-facepiece SCBA or positive-pressure supplied-air respirator

with escape SCBA (NIOSH approved).

2. Chemical-resistant suit.

3. Inner and outer chemical-resistant gloves.

4. Chemical-resistant safety boots.

5. Two-way communications.

Options:

1. Cooling unit.

2. Coveralls.

3. Long-underwear.

4. Other PPE as required in Section 5.02 through 5.09 of this Health and Safety Manual.

Level C

Level C protection provides less skin protection as Level A and a lower level of respiratory protection than Levels A and B.

1. Full-facepiece, air-purifying, canister-equipped respirator (NIOSH approved).

2. Chemical-resistant suit.

3. Inner and outer chemical-resistant gloves.

4. Chemical-resistant safety boots or chemical-resistant boot covers.

5. Two-way communications.

Options:

1. Cooling unit.

2. Coveralls.

3. Long underwear.

4. Other PPE as required in Sections 5.02 through 5.09 of this Health and Safety Manual.

Level D

Level D protection provides minimal skin protection and no respiratory protection.

1. Coveralls or long pants and long-sleeved shirt.

2. Safety boots.

Options:

1. Other PPE as required in Sections 5.02 through 5.09 of this Health and Safety Manual.

C. PPE donning procedures

1. Inspect the PPE before donning with the procedures outlined in Sections 5.02 through 5.09.
2. Make adjustments to hard hat to fit user's head, if necessary.
3. Standing or sitting, step into legs of the suit; evaluate proper placement of feet within the suit; then gather suit and pull sleeves over arms and secure suit front.
4. Put on chemical-resistant safety boots over the feet of the suit. Tape the leg cuff over the tops of the boots.
5. Put on air tanks and harness assembly of the SCBA (if applicable). Don the facepiece or respirator and adjust it to be secure, but comfortable. Do *not* connect the breathing hose of the SCBA. Open valve on the air tank (if applicable).
6. Perform negative and positive respirator facepiece seal test procedures.
7. Put on inner gloves.
8. Put on other PPE (e.g hard hat, hearing protectors).
9. Raise hood over head carefully so that the face seal of the respirator is not disrupted.
10. Connect the breathing hose while opening the main valve (if applicable).
11. Have assistant observe the wearer for a period of time to evaluate whether the wearer is comfortable, stable, and that the PPE is functioning properly.

D. PPE Decontamination Procedures

Station 1: Equipment Drop

Deposit equipment used on-site (tools, sampling devices, clipboards, etc) onto plastic drop cloths. During hot weather a cool down station may be set up within this area.

Station 2: Outer Garment, Boots, and Gloves Wash and Rinse

Scrub outer boots, outer gloves and chemical-resistant splash suit with decontamination solution or detergent water. Rinse off using large amounts of water.

Station 3: Outer Boot and Glove Removal

Remove outer boots and gloves. Deposit in appropriate area.

Station 4: Tank, Canister, or Mask Change

If worker leaves exclusion zone to change air tank, canister, filters, or mask, this is the last step in the decontamination procedure. Worker's air tank, canister, filters, or mask is exchanged, new outer gloves and boots are donned, joints taped, and worker returns to duty.

Station 5: Boot, Gloves, and Outer Garment Removal

Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.

Station 6: SCBA or Face-piece Removal

SCBA backpack and/or facepiece is removed. Avoid touching face with finger. SCBA deposited on plastic sheets.

Station 7: Field Wash

Hands and face are thoroughly washed. Shower if appropriate.

E. Upgrading/Downgrading of PPE Levels

The PPE used and the overall level of protection should be reevaluated periodically as the amount of information on the site increases, and as workers as required to perform different tasks.

Reasons to upgrade the level of PPE may include:

- Known or suspected presence of skin contact hazards.
- Occurance or likely occurance of gas or vapor emission.
- Change in work task that will increase contact or potential contact with hazardous materials.

Appendix C

2.04 Medical Surveillance

A. Introduction

OBG Technical Services provides medical and environmental surveillance of the health of those individuals exposed to materials or work conditions which are associated with adverse health conditions or who participate in the Health & Exercise Program.

B. Medical Examinations

1. Warehouse Employees

The examination for warehouse employees, for the purposes of medical examinations, includes any employee who works on regular basis at the warehouse, and is not covered under another examination (e.g. hazardous waste examination). This is the examination for DOT driver certification. This examination is required every two years. This examination fulfills the requirement for employee participation in the Firm's Health & Exercise Program.

The examination includes the Medical Questionnaire, a Medical Examination, Sudiology Test, DOT Driver Certification, and testing for complete biled count and chemistry profile.

2. Field Employees

The examination for field employees, for the purposes of medical examinations, is any employee who visits or works at a job site on a regular basis. Field employees, for the purpose of medical examination, includes some Supervisors, Foreman, and Laborers. This examinations is required by OSHA in 29 CFR 1910.120, the Hazardous Waste Operations regulations. This examination fulfills the requirement for employee participation in the Firm's Health & Exercise Program.

The examination includes the OSHA required Medical Questionnaire, Respirator Suitability Form, a Medical Examination, Audiology Test, Pulmonary Function Test, DOT Driver Certification, and testing for complete blood count and chemistry profile, and phenols (quantitative).

3. Supervisor/Managerment Employees

A Supervisor/Management employee is any employee who periodically visits a job site (less than 30 days a year). Supervisors/Management employees, for the purpose of medical examinations, includes Officers, Project Managers, and all levels of Supervisor not covered elsewhere (i.e. hazardous waste examination). This examination is required at a frequency based on the individuals age. This examination fulfills the requirement for employee participation in the Firm's Health & Exercise Program.

The examination includes the Medical Questionaire, a Medical Examination, Audiology Test, and testing for complete blood count, and chemistry profile.

4. Office Personnel

Office personnel, for the purposes of medical examinations, include administrative and office personnel. This examination fulfills the requirement for employee participation in the Firm's Health & Exercise Program.

The examination includes a Medical Examination, and testing for complete blood count and chemistry profile.

5. Drug Screen

The drug screen is mandatory for all newly hire, "regular status" employees. Temporary status employees may also require a drug screen, based upon a variety of factors. Please refer to OBG Technical Services' "Substance Abuse-Free Workplace" policy for more information.

C. Frequency

1. Baseline examinations

Individuals who are assigned temporarily or permanently to field work will receive a baseline examination prior to job assignment.

2. Periodic Examinations

Individuals who are assigned temporarily or permanently to field work will receive periodic examinations yearly.

3. Termination Examinations

Field employees permanently leaving the company will receive an exit examination.

4. Possible Exposure Examinations

As soon as possible upon notification by an employee that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that employee has been injured or exposed above the permissible exposure limits in an emergency situation, that employee will be required to receive medical attention.

D. Examination Results

OBG Tech must receive a letter from the attending physician stating the parameters of the examination and whether or not the individual is able to work with or without restriction. This letter will be filed by the Office Administrator and a copy is distributed to the employee.

Appendix D

Section 4.03 Airborne Materials Exposure

A. Introduction

OSHA, in 29 CFR 1910.1000, specifies that an employee's exposure to substances listed in Table Z-1-A, Z-2, or Z-3 shall be limited in accordance with the requirements of the section. OSHA, in 29 CFR 1926.55, specifies that an employee's exposure to those specified in the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) for Airborne Contaminants for 1970 shall be avoided. Where the requirements of the two standards overlap, the most stringent of the two will be enforced.

B. Administrative and Engineering Controls

To achieve compliance with airborne materials exposure, administrative or engineering controls must first be implemented to achieve compliance.

C. Respirator Use

When effective engineering or administrative controls are not feasible to control airborne exposures, or while they are being instituted, appropriate respirators will be used. Training, selection, issuance, and standard operating procedures are outlined in Section 5.06 of this Health and Safety Manual.

D. Action Specific Hazards

As specified in 29 CFR 1910 Subpart Z, action specific hazards, i.e. lead, asbestos, and formaldehyde, have certain requirements. Such material will be monitored as directed under specific regulatory requirements.

E. Monitoring

1. Monitoring for IDLH and other dangerous conditions

During confined space entry and other situations where the quality of the air is unknown, air monitoring will be conducted for combustible or oxygen deficient atmospheres, as well as for volatile organics. Calibration and maintenance procedures for direct-reading equipment are included as Appendix A.

2. General On-site Monitoring

Site conditions may change during site activities. Air monitoring will be conducted when:

a. Work begins on a different portion of the site.
b. A different type of operation is initiated.
c. Employees are working in obvious contamination.

3. Personal Monitoring

Personal monitoring will be performed on high-risk workers who are closest to the source of contaminant generation. This approach is based upon the rationale that the probability of significant exposure varies directly with distance from the source. If workers who are closest to the source are not significantly exposed, then all other workers are, presumably, also not significantly exposed and probably do not need to be monitored.

However, any employee may request personal monitoring be performed if a potential risk exists.

Personal air monitoring methodology will be determined by the Safety Coordinator using the appropriate National Institute for Occupational Safety and Health (NIOSH) or other appropriate methods.

F. Notification

Employees will be notified of the results of the monitoring performed in accordance with the procedures specified in Section 2.05.

Appendix A

Calibration and Maintenance Procedures

A. Loan of Equipment

1. Sign-out Procedures

The health and safety monitoring equipment can be obtained from the Warehouse Supervisor or the Safety Coordinator. The information that will be required prior to a piece of equipment leaving the warhouse equipment room will be:

- Serial Number of equipment
- Name of Person responsible for equipment
- Job Number and Location
- Expected Return Date

2. Equipment Return

Never use carrying cases as shipping cases.

Should a piece of equipment be damaged or in need of maintenance, it should be tagged with appropriate instructions.

Upon return, the piece of equipment will be checked to see if it is in the same condition as it left in. If it is broken, an assessment will be made to determine whether it was broken by mishandling or by normal wear and tear. It will also be determined whether the repair can be performed in-house or must be sent to the manufacturer. If the equipment was determined to be broken due to mishandling and the equipment must be sent to the manufacturer, the Project Manager in charge will be contacted to determine if the project can absorb the cost of the repair.

B. Photoionization Detectors (PIDs)

1. Calibration Procedures

This is to be performed, at a minimum, on a daily basis or whenever the detector is used.

a. Turn on photoionization detector (PID) and allow to warm up.

b. Zero instrument in "clean" air. (Note: "Clean" air refers to upwind of a waste site).

c. Connect Span Gas cylinder to PID with a piece of clean tubing.

d. Open the valve on the cylinder until a steady reading is obtained.

e. Adjust the SPAN control, if necessary, until reading is the same as the Span Gas concentration.

f. Close the valve on the Span Gas cylinder. Disconnect the cylinder from the PID.

g. Sample again in "clean" air. Adjust the zero, if necessary.

2. Maintenance Procedures

Keeping the PID in top operating shape means charging the battery, cleaning the lamp window, and replacing filters. The exterior of the PID can be wiped clean with a damp cloth and mild detergent, if necessary.

B. Combustible Gas and Oxygen Meters (CGI/O_2 Meters)

1. Calibration Procedures

a. Combustible Gas Meter

i. Turn on the instrument and allow to warm up.
ii. Zero % LEL meter in "clean" air.
iii. Connect calibration gas with clean piece of tubing to meter.
iv. Open the valve on the cylinder until a steady reading is obtained.
v. Adjust the combustible gas calibration control, if necessary, until reading is the same as the calibration gas concentration.
vi. Close the valve on the calibration gas cylinder. Disconnect the cylinder from the meter.
vii. Sample again in "clean" air. Adjust the zero, if necessary.

b. Oxygen Meter

i. Turn on the instrument in "clean" air and allow to warm up.
ii. If the % oxygen stabilizes at a value other than 20.8%, adjust the oxygen calibration control until the reading is 20.8%.

2. Maintenance Procedures

Keeping the meter in top operating shape means charging the battery and replacing worn parts. The exterior of the meter can be wiped clean with a damp cloth and mild detergent, if necessary.

C. Flame Ionization Detector (FID)

1. Calibration Procedures

This is to be performed on a daily basis or, at a minimum, whenever the instrument is used.

a. Place instrument in normal operation with CALIBRATE Switch set to X10). Allow 20 minutes for warm up and stabilization.

b. Introduce a methane sample of known concetration (between 90 and 100 ppm) and adjust the GAS SELECT dial so the meter reading corresponds to the known sample.

Periodically (once a month), the FID should be calibrated over the full range using the trimpots. Please refer to the Operations and Maintenance Manual for further instructions.

2. Maintenance Procedures

a. The battery pack can be recharged overnight; however care should be taken to completely discharge tha batery prior to recharging.

b. A supply of analytical grade hydrogen is needed to recharge the 75 cc hydrogen tank in the OVA.

3. Shipping

Compressed hydrogen cannot be shipped by air. A supply of compressed hydrogen must be available locally.

D. Air Sampling Pumps

1. Calibration Procedures

Calibrate personal air sampling pumps before and after each day of use using a primary calibrator. If it is not feasible to use a primary calibrator, a precision rotameter may be used.

a. Allow the pump to run 5 minutes prior to calibration.

b. Check the battery charge.

c. Connect the collection device in the same manner in which the sample will be collected. Please note that the sampling media used for calibration is not to be used for sample collection.

d. Wet the inside of the glass tube with soap solution.

e. Turn on the pump and adjust the pump rotameter to the appropriate flow rate setting.

f. Draw two or three bubbles up the glass tube.

g. If the flowrate is not within the range of accuracy, adjust the flowrate and draw more bubbles up the glass tube.

h. Record the average of three runs on the sample data sheet.

i. Repeat the procedures for all pumps to be used. The same sampling media may be used for all calibrations.

2. Maintenance

a. Battery

The NiCad battery pack should be completely discharged from time to time to minimize the potential for "memory effect" which occurs frequently with rechargeable batteries. "Memory effect" would prevent a pump from running a full eight-hour period in some cases. The "Full Cycle" mode on the batery charger will fully discharge the battery pack, then recharge it and switch to a trickle automatically. A status lamp on the battery charger shows the status of the attached battery pack.

b. Pump Inlet Filter

A filter/trap inside the clear plastic intake port housing prevents particulates and liquids from being drawn into the pump mechanism. Replace the filter as needed.

E. Dust Monitor

1. Zero

a. Inlet should be in clear position.
b. Selector switch should be in 0-2 position, and the letter "m" should appear to the right of the display reading, indicating that the instrument is set to read concentration measurements.
c. Place time constant switch in 2-second position.
d. Allow 1-minute warm-up period.
e. If required, slowly adjust the ZERO control (while lifting its protective spring loaded cap) until an average reading of 0.000 m is obtained.

2. Calibration

a. Keep inlet in clear position.
b. Unlock hinged flow chamber and place it in the horizontal position.
c. Push reference scaterer knob (REF SCAT) inwards until a positive stop is reached. It is important to ensure the plunger has been fully inserted to the limit of its travel. Insertion of the reference scatter will automatically shut off the pump.
d. The letter "K" should be flashing at the upper right side of the digital display indicating that the reference scatterer has been inserted in the sensing beam.

e. Place the time constant in the 2-second position.
f. Move range selector switch to its 0-20 position and allow about 30 seconds for the reading to fully stabilize. The display should read approximately the calibration number indicated on the RAM-1 calibration serial number label within the flow chamber.
g. If the indicated readings differ substantially (i.e. by more than 5%) from the factory-labelled value, unlock the CAL control and adjust until the desired reading obtained. Relock CAL control.
h. Pull reference scatterer knob completely out of sensing region until the "K" indicator on the display ceases to flash.
i. Close flow chamber cover by tightening two thumb-screws at its upper corner.

F. <u>Drager Pump</u>

1. Pump Leak Test

a. Insert unopened tube into socket.
b. Squeeze pump completely and release.
c. Pump is adequately leak-proof if the end of stroke indicator has not appeared after 15 minutes.
d. Remove tube from socket.
e. Press button to reset counter to zero; button is recessed to prevent accidental resetting.

2. To clean or replace the exhaust valve

a. Lift lower pump plate up with a coin or screwdriver.
b. Pull valve disc from its seating.
c. Wipe valve seating with a damp cloth.
d. Moisten the stem on a new valve disc and push ti firmly into the center hole of the valve seat.
e. Check correct seating by pulling on valve disc lightly.
f. Put back lower pump plate and press it into place.
g. Perform leak test discribed above.

3. Replacing the socket and the membrane

a. Press spring hook down with a suitable tool (e.g. screwdriver).
b. Take out cover plate.
c. Press spring flanges together and remove socket.
d. Insert new socket.
e. Using a new End-of-Stroke Indicator Membrane, place parts into the housing.
f. Insert spring hook of cover plate and push on firmly.
g. Perform leak test described above.

Appendix E

Section 4.05 Hazardous Waste Operations

A. Introduction

Due to the nature of the business conducted by OBG Tech, employees may be working on hazardous waste sites. OSHA has requirements for such things as air monitoring, health and safety plans, site control, and emergency response. This section is to define OBG Tech's Standard Operating Procedures (SOPs) for hazardous waste sites and to outline the elements for inclusion in the Site-specific Health and Safety Plan.

B. Other Pertinent Sections of OBG Tech's Health and Safety Manual

Section	Topic
1.01	Safety Policy
2.01	Health and Safety Records
2.02	Health and Safety Training
2.03	Injury/Illness and Accident Report Process
2.04	Medical Surveillance
2.05	Exposure Monitoring
2.09	General Safety Rules
3.01	Medical Services and First Aid
3.02	Sanitation
3.03	Emergency Action
3.04	Confined Space Entry
4.01	Occupational Noise Exposure
4.02	Radiation Exposure
4.03	Airborne Materials Exposure
5	Personal Protective and Life Saving Equipment
6	Fire Protection and Prevention
8	Materials, Handling, Storage, Use, and Disposal

C. Hazardous Waste Standard Operating Procedures

1. Contractors and Sub-contractors

All contractors and sub-contractors retained by OBG Tech for work in hazardous waste will be informed of emergency response procedures and any potential fire, explosion, health, safety, or other hazards of the hazardous waste operation that have been identified by OBG Tech.

2. Program Availability

The written safety and health program will be made available to: any contractor or sub-contractor; OBG Tech employees; OSHA personnel; and to personnel of other Federal, State, or local agencies.

3. Project Personnel

Certain individuals have specifically designated responsibilities on hazardous waste sites.

Project Manager - The Project Manager is responsible for the over-all management of the project. The Project Manager manages administrative requirements.

Project Supervisor - The Project Supervisor is responsible for coordinating between office and field personnel. The Project Supervisor is responsible for the day-to-day activities of the project. The Project Supervisor will oversee field and related activities.

Site Safety and Health Coordinator - The Site Safety and Health Coordinator (SSHC) will establish operating standards and coordinate overall project safety and health activities for the site. The SSHC will review project plans and revisions to plans to determine that safety and health procedures are maintained throughout the project. The specific responsibilities of the SSHC are outlined in Part 16, below.

4. Pre-entry Briefing

Pre-entry briefings will be held prior to initiating any site activity and at other times as necessary to inform employees of the site-specific health and safety plan. In situations covered by OBG Tech's Haz Com Program or the 40-hour Hazardous Waste Operations Health and Safety Training, training required by that program need not be duplicated.

5. Effectiveness of site-specific health and safety plan

Inspections will be made by the Site Health and Safety Coordinator or the Project Supervisor to determine the effectiveness of the site safety and health plan.

6. Personal Protective Equipment

Personal protective equipment (PPE) will be provided in accordance with Section 5 of this Health and Safety Manual. PPE will be selected and used which will provide protection against known or suspected hazardous substances and health hazards.

7. Initial Site Entry Monitoring

When information on the site shows that the potential for ionizing radiation, for IDLH conditions, or when site information is not sufficient to reasonably eliminate the following conditions:

a. Monitoring with direct-reading instruments for hazardous levels of ionizing radiation (See Section 4.02).
b. Monitoring the air with direct-reading instruments for IDLH conditions (See Section 4.03).
c. Visually observing for signs of actual of potential IDLH or other dangerous conditions.

8. On-going Air Monitoring Program

An on-going monitoring program will be established for every site where there is a potential for employee exposure to hazardous concentrations of hazardous substances. This on-going monitoring is to evaluate proper selection engineering controls, work practices, and PPE, so that employees are not exposed above OSHA PELs and published exposure levels. Specifically the on-going monitoring will be conducted:

- when work begins on a different part of the site;
- when contaminants other than those previously identified are being handled;
- when a different type of operation is initiated;
- when employees are handling leaking drums or containers or working in areas with obvious liquid contamination (e.g. spill or lagoon)

Personal monitoring will be performed on those employees likely to have the highest exposures to airborne materials in accordance with Section 4.03 of this Health and Safety Manual.

9. Site Control

The elements of the site control program will include a site map; site work zones; site communications, including alerting means for emergencies; and identification of nearest medical assistance. OSHA also requires the use of the "buddy" system, which is defined below and standard operating procedures, which are encompassed into this Health and Safety Manual. These need not be repeated in the site-specific health and safety plan when this Health and Safety Manual is on-site.

a. Site Work Zones

- *Exclusion Zone*: The exclusion zone or the Hot Zone is the area where contamination does or could occur. The exclusion zone boundary should be clearly marked by lines, placards, hazard tape and/or signs or enclosed by physical barriers, such as chains, fences, or ropes. Access control points should be established at the periphery of the exclusion zone to regulate the flow of personal and equipment into an out of the zone and to help verify that proper procedures for entering and exiting are followed.

The required level of PPE in the exclusion zone can vary according to job assignment. This will allow a flexible, effective, and less costly operation, while still maintaining a high degree of safety.

- *Contamination Reduction Zone*: The contamination reduction zone or the decontamination zone is the transition area between the contaminated area and the clean area. At least two lines of decontamination stations should be set up within the contamination reduction zone: one for personnel and one for heavy equipment. Personnel entering the contamination reduction zone should be required to wear PPE prescribed for working in the contamination reduction zone. To reenter the support zone, workers must remove any PPE. Personnel stationed in the contamination reduction zone includes the Site Health and Safety Coordinator, the Project Supervisor, personnel assisting in decontamination procedures, and emergency response personnel.

The contamination reduction zone should be designed to facilitate: decontamination, emergency response, equipment resupply, sample packaging, and temporary work rest area.

- *Support Zone*: The support zone is the location of the administrative and other support functions needed to keep the operations in the exclusion and contamination reduction zone running smoothly. Any function that need not or cannot be performed in a hazardous atmosphere is performed here. Personnel may wear normal work clothes within this zone. Any potentially contaminated clothing, equipment and samples must remain in the contamination reduction zone until decontaminated. All emergency telephone numbers, change for the telephone (if necessary), evacuation route maps, and vehicle keys should be kept in the support zone.

b. "Buddy" System

Most activities in a contaminated or otherwise hazardous areas should be conducted with a buddy who is able to:

- Provide his or her partner with assistance.
- Observe his or her partner for signs of chemical or heat exposure.
- Periodically check the integrity of his or her partner's protective clothing.
- Notify the Project Supervisor or the Site Health and Safety Coordinator if emergency help is needed.

c. Site Communication

Internal communication among personnel on site and external communication between on site and off-site personnel should be established.

Verbal communication at a site can be impeded by on-site background noise and the use of personal protective equipment. In the absence of site-specific communication signals, the following will be used for emergencies:

Hand clutching throat: Out of air/can't breathe

Thumbs up: OK/I'm alright/I understand

Thumbs down: No, negative

Grip partner's wrist or both hands around partner's waist: Leave area immediately

Hands on top of head: Need assistance

10. Site Security

Site security is necessary to prevent the exposure of unauthorized, unprotected people to the site, to avoid the increased hazards of vandals, to prevent theft, and to avoid interference with safe working procedures.

A physical barrier will be constructed to help prevent exposure of unauthorized and unprotected people to site hazards.

The Site-specific health and safety plan will include any other provisions for maintaining security at the Site.

11. Engineering Controls, work practices, and personal protective equipment for employee protection

Engineering controls and work practices must be first instituted to reduce and maintain employee exposure to or below the OSHA PELs, except to the extent that such controls and work practices are not feasible.

Engineering controls which may be feasible include the use of remotely operated material handling equipment. Work practices which may be feasible include wetting down dusty operations and locating employees upwind of possible hazards.

Whenever engineering controls and work practices are not feasible, PPE will be used in accordance with Section 5 of this Health and Safety Manual to reduce employee exposure to or below the OSHA PELs.

Engineering controls, work practices, and personal protective equipment will be used to reduce and maintain employee exposure to or below published exposure levels not regulated by OSHA. PPE will be used in accordance with Section 5 of this Health and Safety Manual to reduce employee exposure to or below the published exposure levels.

Guidance for PPE selection can be obtained from 29 CFR 1910.120 Appendix B or the NIOSH/OSHA/USCG/EPA document "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities." The guidance document is usually handed out in the OSHA 40-hour course. However, should an employee desire a copy of 29 CFR 1910.120 Appendix B or the guidance document, the safety coordinator can provide one.

12. Levels of Protection

OBG Tech often employs the use of PPE based upon the EPA Levels of Protection. They are listed in Section 5 as a starting point, however site-specific PPE may be required. Site-specific PPE will be addressed in the site-specific health and safety plan. The type of equipment used and the overall level of protection should be re-evaluated periodically as the amount of information about the site increases and as workers as required to perform different tasks.

13. PPE Decontamination Procedures

General PPE decontamination procedures are outlined in Section 5.01. Site-specific decontamination procedures, if any, will be included in the Site-specific Health and Safety Plan.

14. Emergency Response Procedures

The nature of hazardous waste work makes emergencies a continuous potential, no matter how infrequently they occur. The communications network, as outlined in Section 4.05, part 9.c, must be conveyed to all workers so that emergency information may quickly distributed. Equipment will be necessary for emergency situations. At a minimum each site will be equipped with a fire extinguisher, eye wash bottle, and first aid kit. Other equipment, which should be considered on a project by project basis, are emergency showers, safety harnesses, and spill-containment equipment.

Follow-up procedures, as follows, must be implemented before activities resume on-site:

- Appropriate governmental agencies must be notified as required.
- Restock, replace, and/or clean all equipment and supplies.
- The Site Health and Safety Coordinator, the Project Supervisor, and the employee affected should fill out an accident report, as outlined in Section 2.03.

15. Hazards of hazardous waste sites

Chemical

Most sites contain a variety of chemicals that may be in a gaseous, liquid, or solid form. These substances can be hazardous through inhalation, skin absorption, ingestion, or through injection (a puncture wound).

Acute chemical exposures usually occur during or shortly after exposure to a high concentration of a chemical. *Chronic* usually refers to exposures to low concentrations of a chemical over a long period of time. Both of these are dependant on the chemical and may be temporary or reversible or may be permanent. Some chemicals may exhibit warning signs, while other chemicals are odorless, colorless, and tasteless.

Inhalation is the primary route of exposure at a hazardous waste site. Therefore the selection and use of the proper respiratory protection is extremely important where there is a potential for inhalation of hazardous materials. Direct skin and eyes contact is also a potential route of exposure, therefore proper selection and use of PPE is extremely important. Ingestion and injection are the least significant routes of exposure at a hazardous waste site. However, personal habits such as eating, drinking, or smoking, and safety hazards such as puncture wounds can be potential routes, therefore following SOPs and use of PPE can reduce the hazards from both of these routes of exposure.

Further information is presented in OBG Tech's Haz Com and OSHA 40-hour hazardous waste operations health and safety training.

Explosion and Fire

Due to the nature of activities at hazardous waste sites, there is a potential for explosions and fires. To minimize the hazards from fire and explosion: monitor for explosive and flammable atmospheres following the procedures in Section 4.03; keep all potential ignition sources away from an explosive or flammable environment; use non-sparking, explosion-proof equipment; and follow safe work practices.

Oxygen Deficiency

Oxygen deficiency may result from the displacement of oxygen by another gas, or the consumption of oxygen by another chemical reaction. Confined spaces and low-lying areas are particularly vulnerable and should always be monitored prior to entry following the procedures in Section 3.04.

Ionizing Radiation

Monitoring for ionization radiation is required to be performed when there is not sufficient information to eliminate the possibility of it being present on-site (e.g. uncontrolled hazardous waste sites, where little or no information is available on past history). The procedure in Section 4.02 will be followed for monitoring.

Biological Hazards

Wastes from hospitals and research facilities may contain biological materials that may cause infections to site personnel. Other biological hazards that may be present at hazardous waste sites include poisonous plants, insects, and animals. PPE can reduce the potential for exposure. The Safety Coordinator can assist in determining the correct PPE for the hazard present.

Safety Hazards

Hazardous waste sites contain numerous potential safety hazards such as: holes, ditches, drums, boards, nails, broken glass, slippery surfaces, steep grades, and uneven terrains. The work itself may be a potential safety hazard. Site personnel should constantly look out for potential safety hazards and should immediately inform the Project Supervisor or the Site Health and Safety Coordinator of any new hazards.

Electrical Hazards

As in all construction work, overhead power lines, electrical wires and cables, site electrical equipment, and lightning also pose a potential hazard to site workers. Section 10.02 provides guidance on safe electrical practices.

Heat Stress

Heat stress is potentially a major hazard for workers wearing protective clothing. Due to the impervious nature of the PPE to keep chemicals away from the skin, body heat and moisture are trapped within the PPE. Careful training and frequent monitoring of personal who wear protective clothing, scheduling of work and rest periods, and the frequent replacement of fluids can protect against this hazard.

Heat stress can be minimized by taking the following steps:

- Adjusting work schedules
- Provided air conditioned or shaded rest areas
- A total of 1 to 1.6 gallons of fluid intake recommended, but more may be necessary to maintain body weight
- Acclimatize workers to site work conditions
- Provide cooling devices to aid natural body heat exchange during prolonged work or

severe heat exposure

- Review recognition and treatment of heat stress with workers

For workers wearing semi-permeable or impermeable PPE and when the temperature in the work area is above 70°F, measure:

- Heart Rate: count the radial pulse during a 30-second period as early as possible in the rest period.

  If heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the work cycle by one-third and keep the rest period the same.

  If the heart rate exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.

- Oral Temperature: use a clinical thermometer or similar device to measure the oral temperature at the end of the work period (before intake of fluids).

  If the oral temperature exceeds 99.6°F, shorten the next work cycle by one-third without changing the rest period.

  If the oral temperature still exceeds 99.6°F at the beginning of the next rest cycle, shorten the following work cycle by one-third.

- Body Water Loss, if possible: measure weight on a scale accurate to +/- 0.25 lb at the beginning and end of each work day to see if enough fluids are being taken in to prevent dehydration. Weights should taken while the employee is wearing similar clothing each day. The body water loss should not exceed 1.5 percent total body weight loss in a work day.

The frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work. The suggested frequency of physiological monitoring for fit and acclimatized workers.

Adjusted Temp.	Normal Work Ensemble	Impermeable Ensemble
90°F and above	45 minutes	15 minutes
87.5°F to 90°F	60 minute	30 minutes
82.5°F to 87.5°F	90 minutes	60 minutes
77.5°F to 82.5°F	120 minutes	90 minutes
72.5°F to 77.5°F	150 minutes	120 minutes

Cold Exposure

Cold stress and impaired ability to work are dangers at low temperatures and when the wind-chill factor is low. To guard against cold stress: wear appropriate clothing; have warm clothing and warm shelter readily available; and carefully monitor workers' physical conditions.

Noise

Work around large equipment often creates excess noise. The procedures set forth in Section 4.01 for occupational noise exposure and Section 5.04 for hearing protection should be followed.

16. Responsibilities of Site Health and Safety Coordinator

The Site Health and Safety Coordinator advises the Project Manager and the Project Supervisor on the matters of health and safety on the site. Specifically the responsibilities of the Site Health and Safety Coordinator include:

a. Aiding the selection of protective clothing and equipment.
b. Periodically inspecting protective clothing and equipment.
c. Maintaining proper storage of protective clothing and equipment.
d. Monitors the workers for signs of heat stress, cold stress, and fatigue.
e. Monitors on-site hazards and conditions.
f. Conducts periodic surveillance to evaluate effectiveness of Site-specific Health and Safety Plan.
g. Has knowledge of emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
h. Posts the directions to the hospital and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
i. Notifies, when necessary, local public emergency officials.
j. Coordinates emergency medical care.

17. Safe Work Practices

a. No eating, smoking, eating, drinking, or application of cosmetics in the Contamination Reduction Zone or the Exclusion Zone.
b. No matches or lighters in the Contamination Reduction Zone or the Exclusion Zone.
c. Enter and exit following procedures in the Site-specific Health and Safety Plan.
d. Wear the PPE specified in the site-specific Health and Safety Plan in the Exclusion Zone.
e. Use the "buddy" system.
f. Report any unusual conditions to the Project Supervisor or the Site Health and Safety Coordinator immediately.

D. <u>Requirements for Site-Specific Health and Safety Plans</u>

As a company policy, site-specific health and safety plans are required on projects. The following site-specific information must be included in the health and safety plan, as well as this manual attached as an appendix. The Safety Coordinator will prepare and/or review each site-specific health and safety plan.

1. Organizational structure of site program

The following information, at a minimum, will be included in the site-specific health and safety plan:

- Project Manager's name and telephone number
- Project Supervisor's name and telephone number
- Site Safety and Health Coordinator's name and telephone number
- Other personnel needed for emergency response

This organizational structure will be reviewed and updated as necessary to reflect the current status of the hazardous waste site operations.

2. Workplan Summary

A summary of the workplan, including location and approximate size of the site, will be included in the site-specific health and safety plan addressing the anticipated activities.

3. Safety and Health Hazard Analysis

A safety and health hazard analysis will be prepared for the site-specific health and safety plan, including pathways for hazardous substance dispersion. The safety and health hazard analysis will include hazardous substances and health hazards involved or expected at the site, and their chemical and physical properties.

Information to consider to include in the site-specific health and safety plan:

- Exposures exceeding the permissible exposure limits and published exposure levels
- IDLH situations
- Potential skin absorption and irritation sources
- Potential eye irritation sources
- Explosion sensitivity and flammability ranges
- Oxygen deficiency

4. Site-specific Training Assignments

Initial 40-hour worker, Supervisor, and Refresher training are addressed in Section 2.02, Health and Safety Training. Hazard Communication training is also addressed in this section. Training specific to the site will be addressed in the site-specific health and safety plan.

5. Personal Protective Equipment

Personal protective equipment to be used by employees for each of the site tasks and operations being conducted will be addressed in the site-specific health and safety plan. The following information will be included in the site-specific plan: PPE selection based upon site hazards; work mission duration; site-specific information on PPE decontamination and disposal;

6. Frequency and types of air monitoring

Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used will be addressed in the site-specific health and safety plan. Methods of maintenance and calibration of monitoring equipment can be found in Section 4.03.

7. Site Control Program

The site-specific site control program will include a site map and the identification of the nearest medical assistance.

8. Site Security

Site-specific information for maintaining security will be included in the site-specific health and safety plan.

9. Emergency Response Plan

Site-specific information such as safe distances and places of refuge, evacuation routes and procedures, and procedures for reporting incidents to local, state, and federal agencies not covered in OBG Tech's SOPs will be covered in the site-specific health and safety plan. The nearest telephone for emergency communication will be identified in the site-specific emergency response plan.

10. Spill Containment Program

A spill containment program unique to the site will be developed for the site-specific health and safety plan, if applicable.

11. Site-specific information other than in SOPs

a. Medical surveillance requirements unique to the site, other than what is covered in OBG Tech's SOP in Section 2.04.
b. Employee training assignments unique to the site other than what is covered in OBG Tech's SOP in Section 2.02.
c. Decontamination procedures which are unique to the site other than what is covered in OBG Tech's SOP in Section 4.04 (E).
d. Safe work practices unique to the site, other than what is covered in OBG Tech's SOP in this section.

4.06 Process Safety

A. Introduction

Releases of toxic, reactive, or flammable liquids and gases in processes involving highly hazardous chemicals have been reported for many years. In an effort to control these releases, OSHA has published a regulation, 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals. In that regulation is a section on contract employer (such as OBG Tech) responsibilities. This section has been developed in compliance with the regulation.

B. Requirements

1. Each employee is provided health and safety training, as outlined in Section 2.02 of this Health and Safety Manual. Specific training required at a jobsite regarding the known potential fire, explosion, or toxic release hazards related to his/her job and the process, and the applicable provisions of the emergency action plan will be the responsibility of the Project Manager.

2. Each employee will sign a document stating that they have received and understood the training that is outlined above.

3. Each employee is expected to follow the safety rules of the facility.

4. In addition to the training required above, employees will be informed of unique hazards presented by the project or any of the hazards found by the work.

Appendix F

5.06 Respiratory Protection

A. Introduction

OSHA in 29 CFR 1910.134 specifies that "when effective engineering controls are not feasible, or while they are being instituted, appropriate respirators will be used." OSHA references exposure to air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors.

Due to the nature of the business conducted by the company, respiratory protection may be necessary for specific activities performed by our employees. This section will serve as the respiratory protection program and is adopted by the company in an effort to assist ensuring a safer working environment for our employees during work activities requiring respiratory protection as dictated in the site-specific Health and Safety Plan. In order to comply with regulatory requirements, this program is developed pursuant to 29 CFR 1910.134 and 29 CFR 1926.103. This program and use of respirators are instituted according to the site-specific Health and Safety Plan and only after exhausting all feasible engineering controls.

B. Employer and Employee Responsibility

1. Employer Responsibilities

The Safety Coordinator will see that approved respirators, cartridges, and spare parts will be provided by the company. The Safety Coordinator will also be responsible for the establishment and maintenance of this respiratory protection program and the upkeep of records for fit testing, medical surveillance, and training.

2. Employee Responsibilities

It is the responsibility of the employee to use the respiratory protection in accordance with instructions and training received. The employee will maintain the respirator to insure that cartridges and parts are replaced when necessary. The employee will report any problems with his respirator to his supervisor or the Safety Coordinator.

C. Training of Employees

All employees required to wear respirators on the job will be trained prior to the use of respirators. That training will cover the topics required by 29 CFR 1910.120 (Hazardous waste operations and emergency response) and 29 CFR 1910.134 (Respiratory Protection), and include the following:

- basics of respiration
- basics of respiratory hazards
- capabilities and limitations of respirators
- inspection of respirators
- how a respirator should be worn
- cleaning and disinfecting respirators
- storage of respirators
- respirator-specific training
- fit-checking procedures

All employees will be given the opportunity to wear their respirator in an uncontaminated atmosphere and a test atmosphere for a period of time to become familiar with the use of respirators.

All training is documented and is filed in the Syracuse office.

D. Physician's Approval

All employees required to wear a respirator will have a physician's written approval to wear a respirator prior to being required to wear one. The respirator user's medical status will be reviewed annually.

The local physician will determine which health and physical conditions are pertinent. A description of the respiratory hazards, specifics of employee's job functions while wearing a respiratory and copies of all applicable regulations will be provided to the physicians to further aid the decision process.

The physical will be provided at no cost to the employee. A copy of the written report will be made to the employee upon request.

All medical examinations are recorded and are filed in the Syracuse office.

E. Selection of Respirators

Respirators will be selected on the basis of the following:

- chemical and physical hazards
- characteristics of the hazardous operation of process
- face piece to face fit
- comfort
- utilization of NIOSH recommendations
- utilization of manufacturer's recommendations
- the guidance of American National Standard Practices for Protection Z88.2-1969.

All respirators selected will be NIOSH/MSHA approved for the hazards encountered.

The Safety Coordinator will be adequately instructed to insure that the correct respirator is selected and that the appropriate personal modifications are made such as corrective lens for full-face masks.

F. Issuance of Respirators

The Warehouse Supervisor will be responsible for the issuance of a properly selected respirator to each employee. Each employee will be given his own respirator and will be responsible for bringing it to the jobsite. Employees should mark his respirator so that it will not be confused with others.

G. Fit-Testing of Respirators

To insure a proper fit of negative pressure respirators, respirator fit-testing will be performed. Where fit-testing is not required by specific hazard regulation, as it is with lead or asbestos, the qualitative irritant vapor or smoke protocol of the asbestos standard will be adopted (29 CFR 1910.1001, Appendix C). Fit-testing will be performed to select respirators and be performed at the discretion of the Safety Coordinator thereafter unless required by law to be performed more often or unless there is sufficient need to do so (i.e., denture replacement, scarring of face, weight change).

Fit-test failure will result in selection of a different size respirator. Continued test failure will result in selection of a different manufacturer's respirator.

All fit-testing information such as the employee, the date, and the type of respirator is recorded and filed in the Syracuse office.

H. Inspection of Respirators

Respirators will be inspected for damage before and after each use. Each employee, after training, will responsible for inspection. The following areas will be inspected:

- tightness of connections
- face piece
- headbands
- inhalation valve
- exhalation valve
- cartridge or filter fittings
- pliability of rubber or elastomer parts
- signs of deterioration

Any malformation, distortion, missing parts, cracks, etc. will be sufficient to issue replacement parts or if necessary, a new respirator.

I. Standard Operating Procedures

Before entering any potentially contaminated environment, each employee will:

1. Carefully inspect the respirator following the procedures specified in Section 8.

2. Duct tape should be removed from cartridges (if applicable).

3. The respirator should be donned and checked for a proper fit using the following tests:

   a. Positive Pressure Test - close off the exhalation valve with your hand. Breathe into the mask. The face-to-facepiece seal is satisfactory if some pressure can be built up inside the mask and sustained.

b. Negative Pressure Test - close off the inlet openings of the cartridge with the palm of your hand. Inhale gently so that a vacuum occurs inside the mask. Hold your breath for 10 seconds. If the vacuum is sustained, and no inward leakage is detected, the respirator fits properly.

4. Inside the contaminated environment, respirators will not be removed except in a medical emergency such as a suspected heart attack.

5. Respirators will be worn with straps inside the disposable garment allowing a worker to maintain respiratory protection while removing contaminated garments.

J. Cleaning and Disinfecting of Respirators

Respirators will be cleaned after each use. Manufacturers may have specific recommendations for cleaning and these should be followed. In absence of manufacturers recommendations, the following procedures should be used:

1. Remove the cartridges and headbands
2. Disassemble all respirator parts
3. Wash all respirator parts (except cartridges and headbands) in a cleaner - disinfectant solution or use soap and hot water
4. Rinse completely in clean, warm water
5. Air dry in a clean area
6. Re-assemble the respirator

No alcohol will be used to clean the respirator. If a disinfecting solution is not used, a disinfecting spray will be used at least weekly, but preferably after each use.
Respirator wipes will be provided to employees in order to clean respirators during work shifts between uses. The employee will be allowed to leave work area and remove respirator to wash face in order to prevent rashes and discomfort. The respirators will be wiped out at each of these times.

K. Storage of Respirators

Respirators will be stored in clean plastic bags and protected against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Respirator cartridges will have the inhalation holes covered with duct tape (or acceptable substitute tape) immediately after leaving a contaminated area. The tape will be left on until the respirator is donned for the nest entry into a contaminated area. This tape will prevent any contaminants from being dislodged from the cartridge.

Respirators should be packed or stored so that the facepiece and exhalation valve will rest in a normal position and function will not be impaired by the elastomer setting in an abnormal position.

L. Periodic Surveillance

Work areas will be monitored as required by specific hazard regulations or on a periodic timetable as set by the site-specific Health and Safety Officer and the site-specific Health and Safety Plan. This surveillance is required to ensure that the proper level of protection is provided to employees. Whenever new hazards are encountered or a substantial change in magnitude of the existing hazard occurs, then additional monitoring will take place.

M. Evaluation of Respiratory Protection Program

In order to maintain an effective program, the respiratory protection program will be re-evaluated on at least an annual basis. This evaluation will address:

- employee acceptance of program and respirators
- methods of surveillance of hazards and results
- regulatory compliance
- changing job functions
- changes in hazards

Employees are encouraged to express any concerns about respirator protection, such input is critical for evaluating the program.

Each employee will be made aware of this written program and any annual changes.

Frequent random inspections will be conducted by the Safety Coordinator to assure that respirators are properly selected, used, cleaned, and maintained.

N. Hazard Specific Respiratory Protection

As specified in 29 CFR Parts 1910, action specific hazards, i.e. lead, asbestos, and formaldehyde, require specific respiratory protection. Any such material will be monitored as directed under specific regulatory requirements, and respiratory protection will issued pursuant to specific regulatory requirement.

Appendix G

Project:		Project Number:
Date:	Time:	Competent Person:
Where was the sample taken from:		
Excavation Length:	Excavation Depth:	Excavation Width:

VISUAL TEST

Particle type: Fine grained (cohesive) ________			Granular (sand/silt or gravel) ________		
Water conditions: Wet ________ Surface water present ________			Dry ________ Seeping Water ________ Submerged ________		
Previously disturbed soils:			Layered soils dipping into excavation:		
Underground utilities: If yes, what type?			Excavation exposed to vibrations: If yes, from what?		
Layered soils? *Note: The less stable layer controls soil type.*			Crack like openings or spallings observed:		

MANUAL TEST

Plasticity:	Cohesive ________	Non-cohesive ________
Dry strength:	Granular (crumbles easily) ________	Cohesive (broken with difficulty) ________
Wet shake:	Water comes to surface (granular material) ________	Surface remains dry (clay material) ________

NOTE: The following unconfined compressive strength tests should be performed on undisturbed soils.

Thumb Test used to estimate unconfined compressive strength of cohesive soil:

Test performed: Yes ________ No________
________ Type A - soil indented by thumb with very great effort
________ Type B - soil indented by thumb with some effort
________ Type C - soil easily penetrated several inches by thumb with little or no effort. If soil is submerged, seeping water, subjected to surface water, runoff, exposed to wetting.

Penetrometer or Shearvane used to estimate unconfined compressive strength of cohesive soils:

Test performed: Yes ________ No ________ Device used:
________ Type A - *soil with unconfined compressive strength of 1.5 tsf or greater*
________ Type B - soil with unconfined compressive strength greater than 0.5 tsf and less than 1.5 tsf
________ Type C - soil with unconfined compressive strength of 0.5 tsf or less If soil is submerged, seeping water, subjected to surface water, runoff, exposed to wetting

NOTE: Type A - no soil is type A if soil is fissured, subject to vibration, previously disturbed, layered dipping into excavation on a slope of 4H:1V.

SOIL CLASSIFICATION

Stable Rock ________ Type A ________ Type B ________ Type C ________

SELECTION OF PROTECTIVE SYSTEM (Appendix F)

________ Sloping (Appendix B) Specify angle ________	________ Aluminum hydraulic shoring (Appendix D)
________ Timber shoring (Appendix C)	________ Trench shield Maximum depth in this soil:

DAILY EXCAVATION CHECKLIST

Project:		Project Number:	
Date:	Time:	Competent Person:	
Soil Type:			
Soil Classification:		Excavation Depth:	Excavation Width:
Type of Protective System Used:			

Excavation Entrants:	Time In	Time Out	Parameter	Pre-Entry	Initial	hours	hours	hours	hours
			LEL (<10%)						
			O_2 (19.5%-22%)						
			Volatiles (<5 ppm)						
			Other						

Yes	No	N/A	Description
			GENERAL INSPECTION OF JOBSITE
			Employees protected from cave-ins and loose rock or soil that could fall or roll into the excavation
			Spoils, materials, and equipment set back at least 2 feet from the edge of the excavation
			Walkways and bridges over excavations are equipped with standard guardrails and toeboards
			Adequate signs have been posted and barricades provided
			WET CONDITIONS
			Precautions taken to protect employees from the accumulation of water
			Surface water or runoff diverted or controlled to prevent accumulation in the excavation
			Inspection made after every rainstorm or other hazard increasing occurrence
			MEANS OF ACCESS AND EGRESS
			Ladder or ramp egress no greater than 25 feet
			Ladders used secured and extended 3 feet above the edge of the trench
			Ramps constructed of materials of uniform thickness, cleated together on the bottom, equipped with no-slip surface
			Employees protected from cave-ins when entering or exiting the excavation

Yes	No	N/A	Description
			UTILITIES
			Utility companies contacted and/or utilities located and marked
			Overhead transmission lines are noted and precautions taken to ensure that equipment does not come in contact with them
			Utilities crossing the excavation supported from above, and protected from falling material exist
			Underground installations protected, supported, or removed when excavation is open
			HAZARDOUS ATMOSPHERE
			Air in the excavation tested for oxygen deficiency, combustibles, or other contaminants
			Ventilation or supplied air used in atmospheres containing less than 19.5 % oxygen and/or other hazardous substance
			Ventilation provided to keep LEL below 10%
			Emergency equipment available where hazardous atmospheres could or do exist
			Safety harness and lifeline used and individually attended when entering bell bottom or other deep confined excavations
			OTHER COMMENTS:

10.06 Excavations

A. Introduction

This section applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

B. General Requirements

1. All surface encumbrances that are located so as to create a hazard to employees will be removed or supported, as necessary, to safeguard employees.
2. Underground installations.
   a. The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, will be determined prior to opening an excavation.
   b. Utility companies or owners will be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the work may proceed, provided caution is taken, and provided detection equipment or other acceptable means to locate utility installations are used.
   c. When excavation operations approach the estimated location of underground installations, the exact location of the installations will be determined by safe and acceptable means.
   d. While the excavation is open, underground installations will be protected, supported or removed as necessary to safeguard employees.

C. Access and egress

1. Structural ramps.
   a. Structural ramps that are used solely by employees as a means of access or egress from excavations will be designed by a competent person. Structural ramps used for access or egress of equipment will be designed by a competent person qualified in structural design, and will be constructed in accordance with the design.
   b. Ramps and runways constructed of two or more structural members will have the structural members connected together to prevent displacement.
   c. Structural members used for ramps and runways will be of uniform thickness.
   d. Cleats or other appropriate means used to connect runway structural members will be attached to the bottom of the runway or will be attached in a manner to prevent tripping.
   e. Structural ramps used in lieu of steps will be provided with cleats or other surface treatments on the top surface to prevent slipping.

2. Means of egress from trench excavations. A stairway, ladder, ramp or other safe means of egress will be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

D. Exposure to vehicular traffic

Employees exposed to public vehicular traffic will be provided with, and will wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

E. Exposure to falling loads

No employee will be permitted underneath loads handled by lifting or digging equipment. Employees will be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped to provide adequate protection for the operator during loading and unloading operations.

F. Warning system for mobile equipment

When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system will be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

G. Hazardous atmospheres

1. Testing and controls

In addition to the procedures set forth in Sections 3 and 4 of this Health and Safety Manual to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements will apply:

a. Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation will be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.
b. Adequate precautions will be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation.
c. Adequate precaution will be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.
d. When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, the testing will be conducted as often as necessary to ensure that the atmosphere remains safe.

2. Emergency rescue equipment

a. Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, will be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment will be attended when in use.

b. Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, will wear a harness with a life-line securely attached to it. The lifeline will be separate from any line used to handle materials, and will be individually attended at all times while the employee wearing the lifeline is in the excavation.

H. Protection from hazards associated with water accumulation

1. Employees will not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.
2. If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations will be monitored by a competent person to ensure proper operation.
3. If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means will be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person.

I. Stability of adjacent structures

1. Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operation, support systems such as shoring, bracing, or underpinning will be provided to ensure the stability of such structures for the protection of employees.
2. Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees will not be permitted except when:
   a. A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or
   b. The excavation is in stable rock; or
   c. A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.
   d. Sidewalks, pavements, and appurtenant structure will not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

J. Protection of employees from loose rock or soil

1. Adequate protection will be provided to protect employees from loose rock or soil that could pose a hazard by failing or rolling from an excavation face. Such protection will consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.
2. Employees will be protected from excavated or other materials of equipment that could pose a hazard by falling or rolling into excavations. Protection will be provided by

placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

K. Inspections

1. Daily inspections of excavations, the adjacent areas, and protective systems will be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection will be conducted by conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections will also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.
2. Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees will be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

L. Fall protection

1. Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails will be provided.
2. Adequate barrier physical protection will be provided at all remotely located excavations. All wells, pits, shafts, etc., will be barricaded or covered. Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc., will be backfilled.

M. Requirements for protective systems

1. Protection of employees in excavations.
   a. Each employee in an excavation will be protected from cave-ins by an adequate protective system designed in accordance with paragraph 2 or 3 of this section except when:
      1. Excavations are made entirely in stable rock; or
      2. Excavations are less than 5 feet (1.52 m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.
   b. Protective systems will have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

2. Design of sloping and benching systems. The slopes and configurations of sloping and benching systems will be in accordance with the requirements of option 1; or, in the alternative, option 2; or, in the alternative, option 3, or, in the alternative, option 4, as follows:

Option (1) - Allowable configurations and slopes

1. Excavations will be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless one of the other options listed below is used.
2. Slopes specified in paragraph 1 of this section, will be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this subpart.

Option (2) - Determination of slopes and configurations using 29 CFR 1926 Subpart P Appendices A and B

Maximum allowable slopes, and allowable configurations for sloping and benching systems, will be determined in accordance with the conditions and requirements set forth in appendices A and B to this subpart.

Option (3) - Designs using other tabulated data

1. Designs of sloping or benching systems will be selected from and be in accordance with tabulated data, such as tables and charts.
2. The tabulated data will be in written form and will include all of the following:
   A. Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;
   B. Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;
   C. Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.
3. At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, will be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data will be made available to the Secretary upon request.

Option (4) - Design by a registered professional engineer

1. Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under paragraph 2 of this section will be approved by a registered professional engineer.
2. Designs will be in written form and will include at least the following:
   A. The magnitude of the slopes that were determined to be safe for the particular project;
   B. The configurations that were determined to be safe for the particular project; and
   C. The identity of the registered professional engineer approving the design.
3. At least one copy of the design will be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy will be made available to OSHA upon request.

3. Design of support systems, shield systems, and other protective systems. Designs of support systems shield systems, and other protective systems will be in accordance with the requirements of option 1; or, in the alternative, option 2; or, in the alternative, option 3; or, in the alternative, option 4 as follows:

Option (1) - Designs using appendices A, C, and D Designs for timber shoring in trenches will be determined in accordance with the conditions and requirements set forth in appendices A and C to this subpart. Designs for aluminum hydraulic shoring will be in accordance with paragraph (c)(2) of this section, but if manufacturer's tabulated data cannot be utilized, designs will be in accordance with Appendix D.

Option (2) - Designs Using Manufacturer's Tabulated Data

a. Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data will be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

b. Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer will only be allowed after the manufacturer issues specific written approval.

c. Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations will be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy will be made available to OSHA upon request.

Option (3) - Designs using other tabulated data

a. Designs of support systems, shield systems, or other protective systems will be selected from and be in accordance with tabulated data, such as tables and charts.

b. The tabulated data will be in written form and include all of the following:
   1. Identification of the parameters that affect the selection of a protective system drawn from such data;
   2. Identification of the limits of use of the data;
   3. Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

c. At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, will be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data will be made available upon request.

Option (4) - Design by a registered professional engineer

a. Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2, or Option 3, above, will be approved by a registered professional engineer.

b. Designs will be in written form and will include the following:
   1. A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and
   2. The identity of the registered professional engineer approving the design.

c. At least one copy of the design will be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design will be made available to OSHA upon request.

4. Materials and equipment.

a. Materials and equipment used for protective systems will be free from damage or defects that might impair their proper function.
b. Manufactured materials and equipment used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.
c. When material or equipment that is used for protective systems is damaged, a competent person will examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment will be removed from service, and will be evaluated and approved by a registered professional engineer before being returned to service.

5. Installation and removal of support

a. General.
   1. Members of support systems will be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.
   2. Support systems will be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.
   3. Individual members of support systems will not be subjected to loads exceeding those which those members were designed to withstand.
   4. Before temporary removal of individual members begins, additional precautions will be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.
   5. Removal will begin at, and progress from, the bottom of the excavation. Members will be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.
   6. Backfilling will progress together with the removal of support systems from excavations.
b. Additional requirements for support systems for trench excavations.
   1. Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system will be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

2. Installation of a support system will be closely coordinated with the excavation of trenches.

N. Sloping and benching systems

Employees will not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

O. Shield systems

1. General
   a. Shield systems will not be subjected to loads exceeding those which the system was designed to withstand.
   b. Shield will be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.
   c. Employees will be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.
   d. Employees will not be allowed in shield when shields are being installed, removed, or moved vertically.
2. Additional requirement for shield systems used in trench excavations. Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield will be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

(1) *Option (1)—Designs using appendices A, C, and D.* Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in appendices A and C to this subpart. Designs for aluminum hydraulic shoring shall be in accordance with paragraph (c)(2) of this section, but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with appendix D.

(2) *Option (2)—Designs Using Manufacturer's Tabulated Data.* (i) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(ii) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(iii) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall be made available to the Secretary upon request.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of support systems, shield systems, or other protective systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and include all of the following:

(A) Identification of the parameters that affect the selection of a protective system drawn from such data;

(B) Identification of the limits of use of the data;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2 or Option 3, above, shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include the following:

(A) A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and

(B) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design shall be made available to the Secretary upon request.

(d) *Materials and equipment.* (1) Materials and equipment used for protective systems shall be free from damage or defects that might impair their proper function.

(2) Manufactured materials and equipment used for protective systems shall be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

(3) When material or equipment that is used for protective systems is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.

(e) *Installation and removal of support—(1) General.* (i) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(ii) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(iii) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(iv) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(v) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(vi) Backfilling shall progress together with the removal of support systems from excavations.

(2) *Additional requirements for support systems for trench excavations.* (i) Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(ii) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) *Sloping and benching systems.* Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) *Shield systems—(1) General.* (i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(2) *Additional requirement for shield systems used in trench excavations.* Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

Appendix A to Subpart P

Soil Classification

(a) *Scope and application—(1) Scope.* This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(2) *Application.* This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in §1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in §1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) *Definitions.* The definitions and examples given below are based on, in whole or in part, the following: American Society for Testing Materials (ASTM) Standards D653-85 and D2488; The Unified Soils Classification System, The U.S. Department of Agriculture (USDA) Textural Classification

Scheme; and The National Bureau of Standards Report BSS-121.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-sized sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt, (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

Soil classification system means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil means soil which is underwater or is free seeping.

Type A means cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

(i) The soil is fissured; or

(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or

(iii) The soil has been previously disturbed; or

(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or

(v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means:

(i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or

(ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil.

(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

(v) Dry rock that is not stable; or

(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C means:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or

(ii) Granular soils including gravel, sand, and loamy sand, or

(iii) Submerged soil or soil from which water is freely seeping; or

(iv) Submerged rock that is not stable, or

(v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) *Requirements*—(1) *Classification of soil and rock deposits.* Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(2) *Basis of classification.* The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the America Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(3) *Visual and manual analyses.* The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(4) *Layered systems.* In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(5) *Reclassification.* If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) *Acceptable visual and manual tests*—(1) *Visual tests.* Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(iii) Observe the side of the open excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(v) Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(2) *Manual tests.* Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as 1/8-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of 1/8-inch thread can be held on one end without tearing, the soil is cohesive.

quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as ⅛-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of ⅛-inch thread can be held on one end without tearing, the soil is cohesive.

(ii) *Dry strength.* If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(iii) *Thumb penetration.* The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488—"Standard Recommended Practice for Description of Soils (Visual—Manual Procedure).") Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(iv) *Other strength tests.* Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(v) *Drying test.* The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(A) If the sample develops cracks as it dries, significant fissures are indicated.

(B) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as a unfissured cohesive material and the unconfined compressive strength should be determined.

(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

Appendix B to Subpart P

Sloping and Benching

(a) *Scope and application.* This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in § 1926.652(b)(2).

(b) *Definitions.*

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) *Requirements*—(1) *Soil classification.* Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(2) *Maximum allowable slope.* The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.

(3) *Actual slope.* (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least ½ horizontal to one vertical (½H:1V) less steep than the maximum allowable slope.

(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with § 1926.651(i).

(4) *Configurations.* Configurations of sloping and benching systems shall be in accordance with Figure B-1.

TABLE B-1

MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V) [1] FOR EXCAVATIONS LESS THAN 20 FEET DEEP [3]
STABLE ROCK	VERTICAL (90°)
TYPE A [2]	3/4 : 1 (53°)
TYPE B	1:1 (45°)
TYPE C	1½ : 1 (34°)

NOTES:

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
3. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

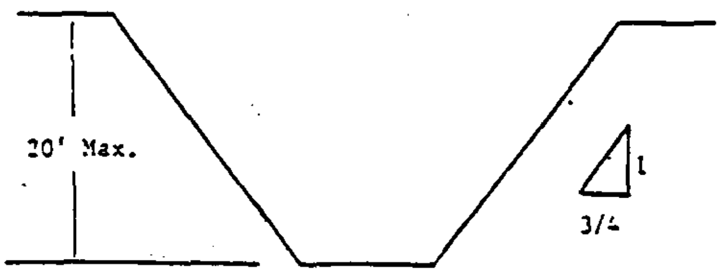
Figure B-1

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

B-1.1 Excavations made in Type A soil.

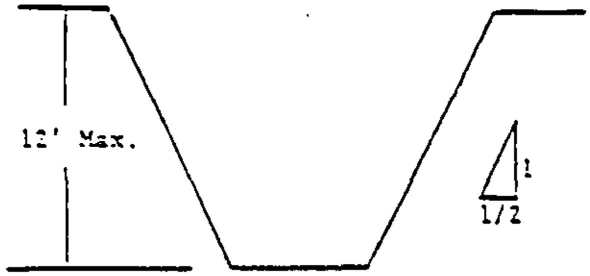
1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of ¾:1.



Simple Slope—General

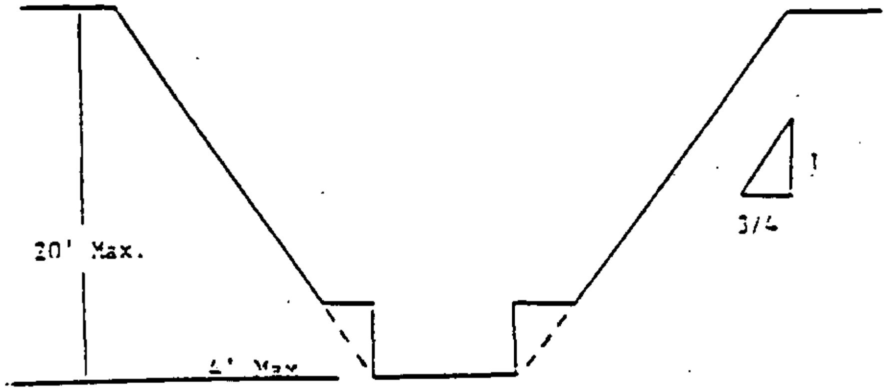
Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of ½:1.

[Sec. 1926.652, Table B-1]

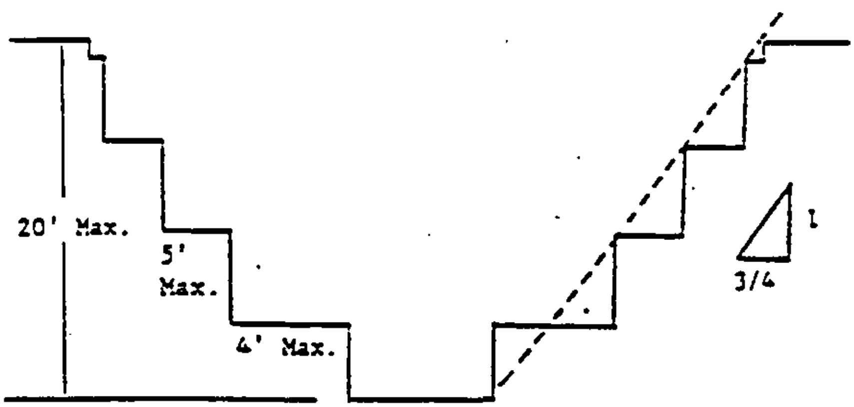


Simple Slope—Short Term

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of ¾ to 1 and maximum bench dimensions as follows:



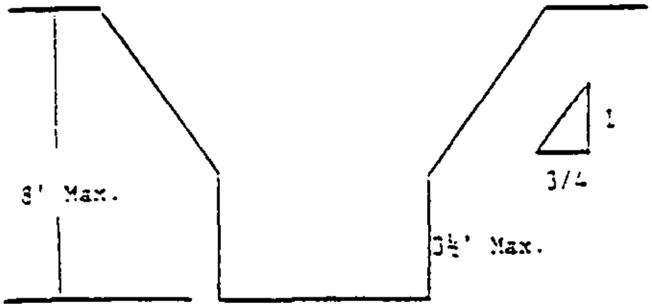
Simple Bench



Multiple Bench

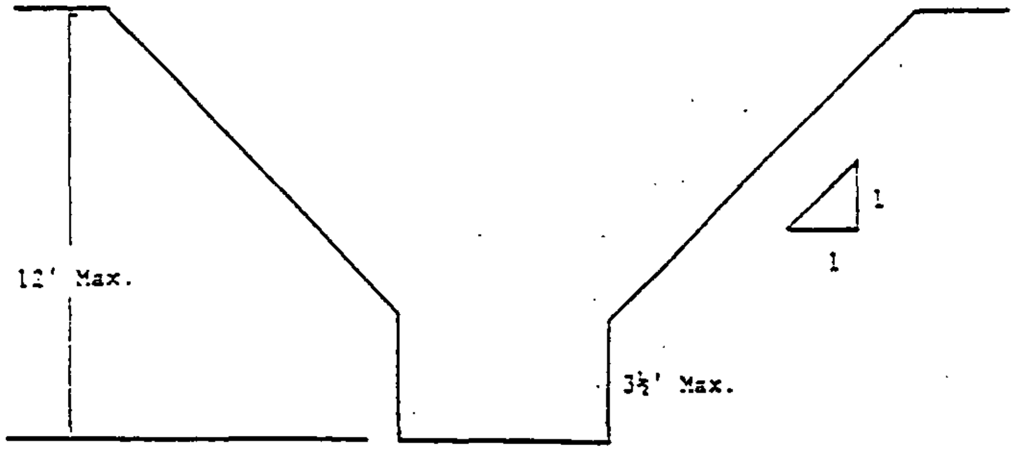
3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3½ feet.

[Sec. 1926.652, Table B-1]



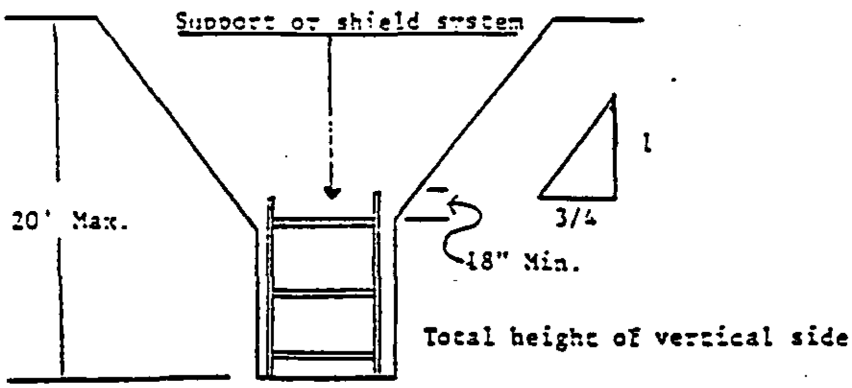
Unsupported Vertically Sided Lower Portion—Maximum 8 Feet in Depth

All excavations more than 8 feet but not more than 12 feet in depth which unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3½ feet.



Unsupported Vertically Sided Lower Portion—Maximum 12 Feet in Depth

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of ¾:1. The support or shield system must extend at least 18 inches above the top of the vertical side.



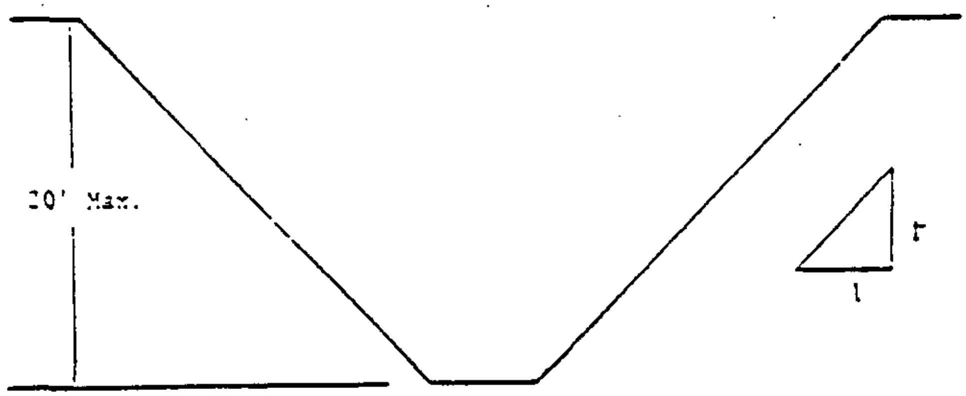
Suported or Shielded Vertically Sided Lower Portion

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under § 1926.652(b).

B-1.2 Excavations Made in Type B Soil

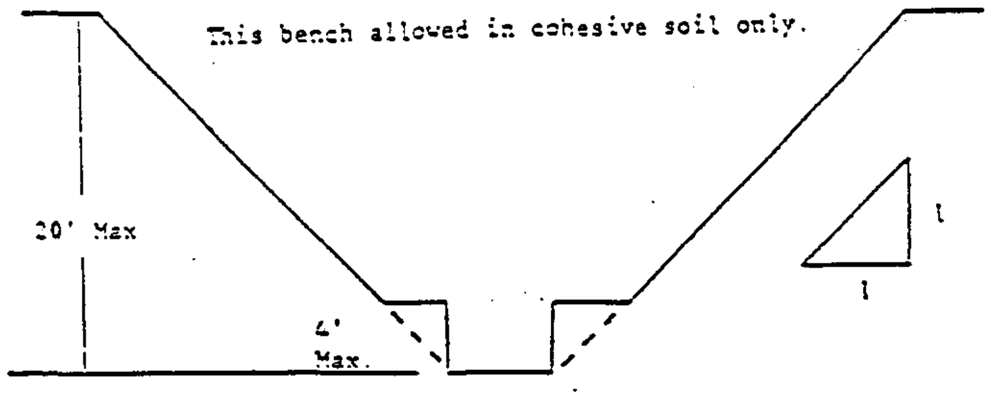
1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

[Sec. 1926.652, Table B-1.2]

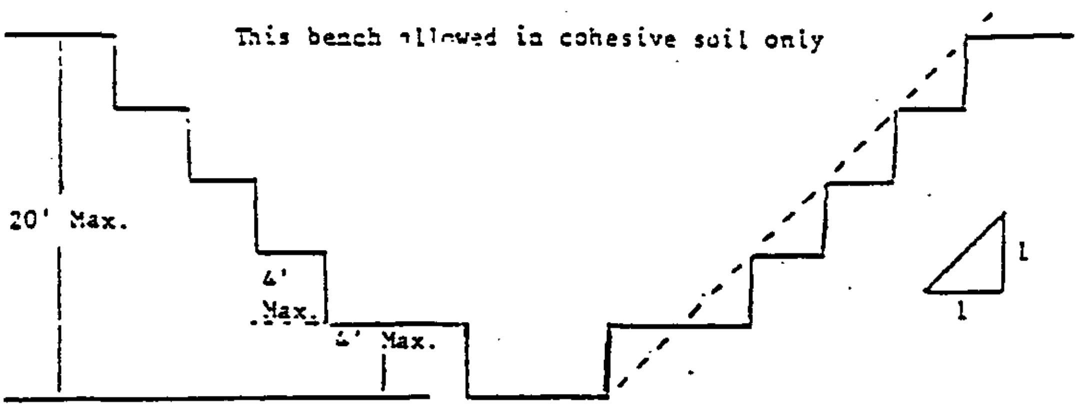


Simple Slope

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:



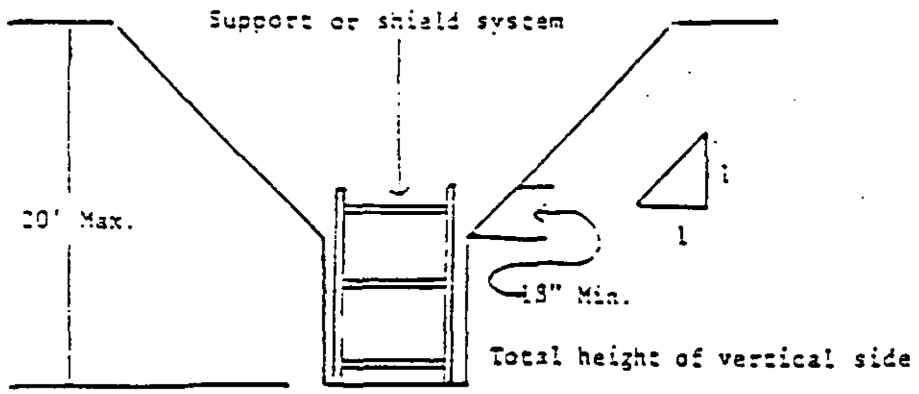
Single Bench



Multiple Bench

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

[Sec. 1926.652, Figure B-1.3]

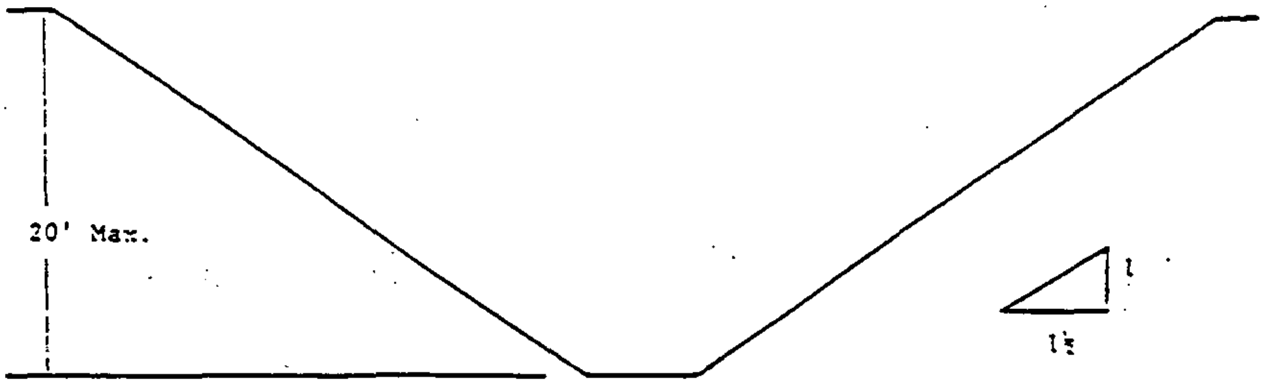


Vertically Sided Lower Portion

4. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

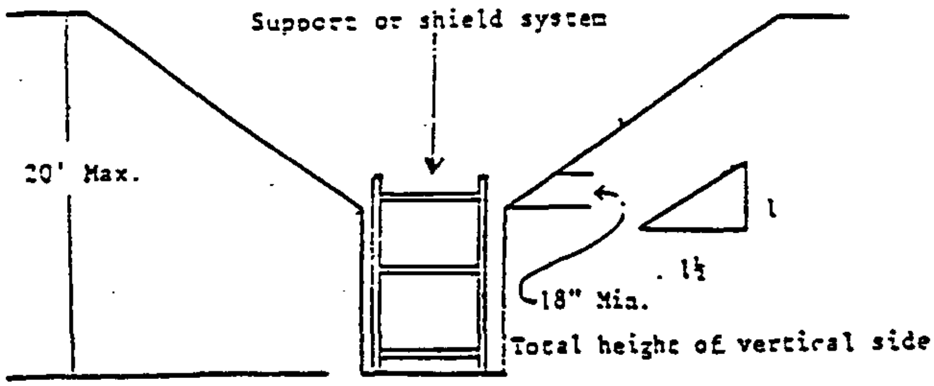
B–1.3 Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.



Simple Slope

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1½:1.



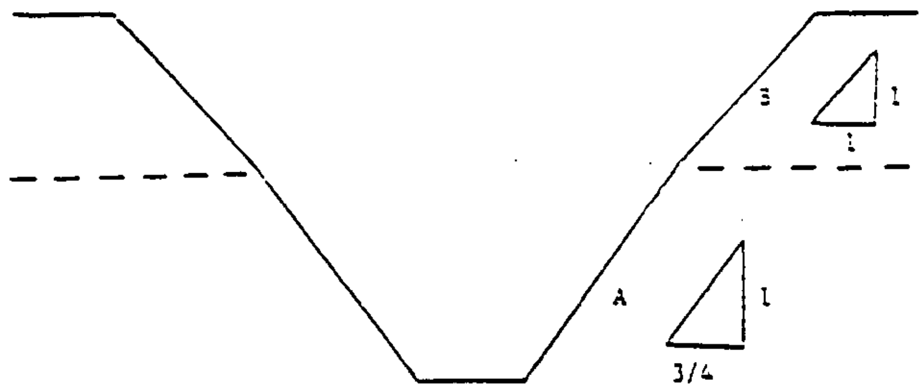
Vertical Sided Lower Portion

3. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

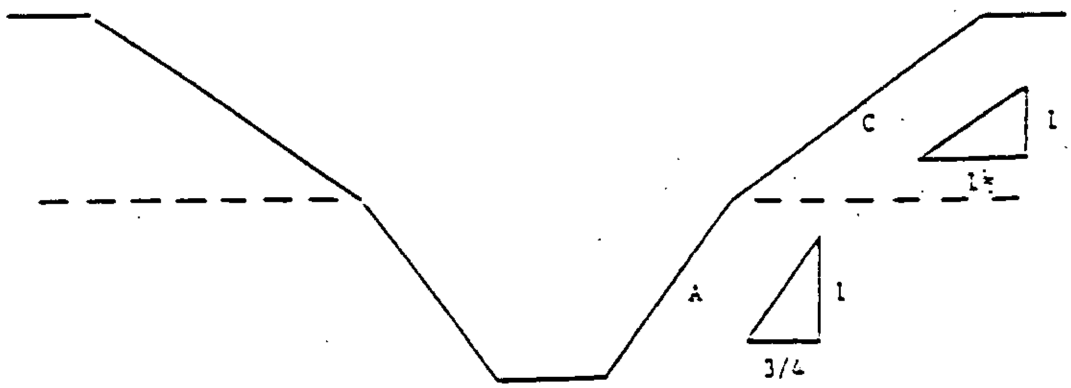
B–1.4 Excavations Made in Layered Soils

1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.

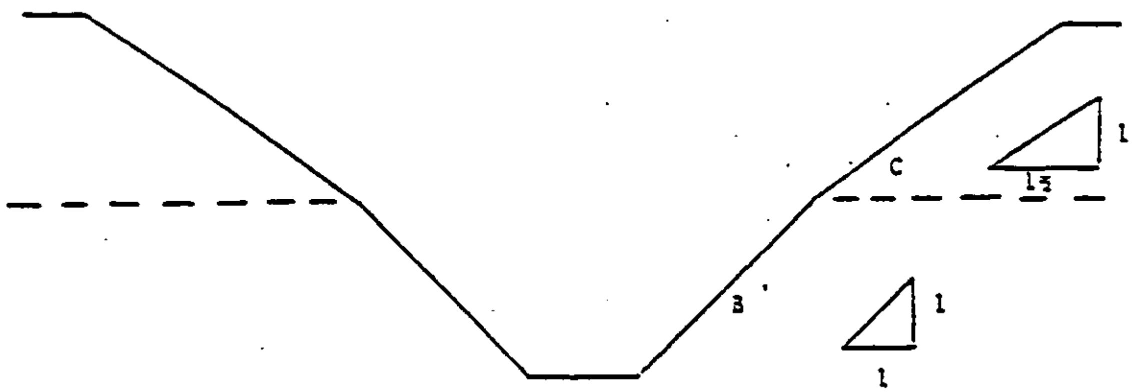
[Sec. 1926.652, Figure B-1.4]



B OVER A

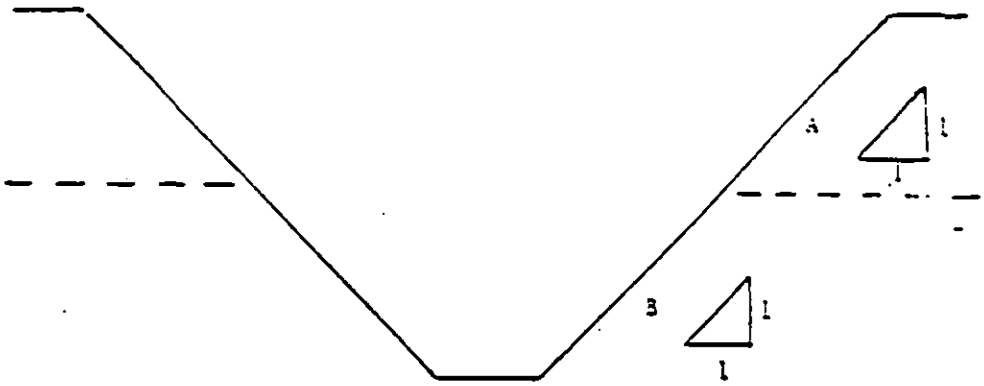


C OVER A

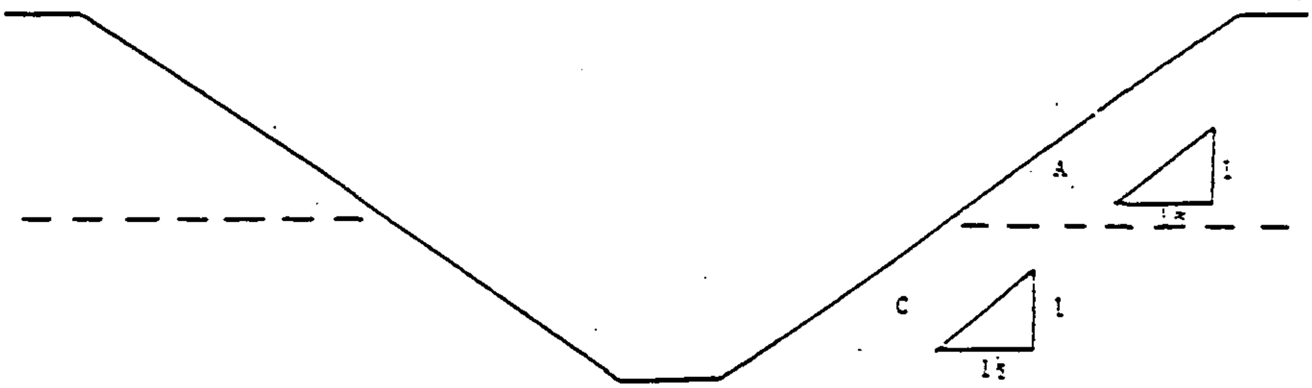


C OVER B

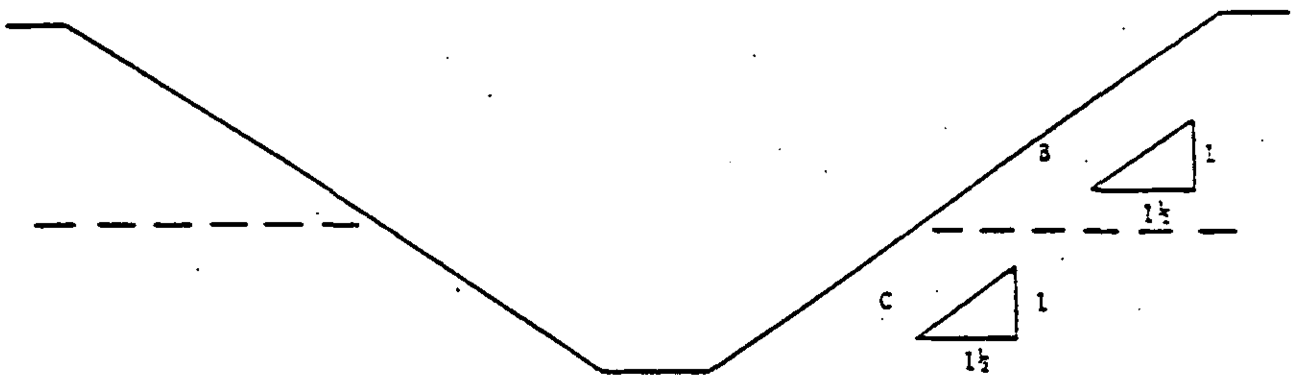
[Sec. 1926.652, Figures B-C]



A OVER B



A OVER C



B OVER C

2. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

Appendix C to Subpart P

Timber Shoring for Trenches

(a) *Scope.* This appendix contains information that can be used timber shoring is provided as a method of protection from cave-ins in trenches that do not exceed 20 feet (6.1 m) in depth. *This appendix must be* used when design of timber shoring protective systems is to be performed in accordance with § 1926.652(c)(1). Other timber shoring configurations; other systems of support such as hydraulic and pneumatic systems; and other protective systems such as sloping, benching, shielding, and freezing systems must be designed in accordance with the requirements set forth in § 1926.652(b) and § 1926.652(c).

(b) *Soil Classification.* In order to use the data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil

[Appendix C]

classification method set forth in appendix A of subpart P of this part.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables C–1.1, C–1.2, and C–1.3, and Tables C–2.1, C–2.2 and C–2.3 following paragraph (g) of the appendix. Each table presents the minimum sizes of timber members to use in a shoring system, and each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. The data are arranged to allow the user the flexibility to select from among several acceptable configurations of members based on varying the horizontal spacing of the crossbraces. Stable rock is exempt from shoring requirements and therefore, no data are presented for this condition.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix, and on the tables themselves.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations regarding Tables C–1.1 through C–1.3 and Tables C–2.1 through C–2.3 are presented in paragraph (g) of this Appendix.

(d) *Basis and limitations of the data.*—(1) *Dimensions of timber members.* (i) The sizes of the timber members listed in Tables C–1.1 through C–1.3 are taken from the National Bureau of Standards (NBS) report, "Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations." In addition, where NBS did not recommend specific sizes of members, member sizes are based on an analysis of the sizes required for use by existing codes and on empirical practice.

(ii) The required dimensions of the members listed in Tables C–1.1 through C–1.3 refer to actual dimensions and not nominal dimensions of the timber. Employers wanting to use nominal size shoring are directed to Tables C–2.1 through C–2.3, or have this choice under § 1926.652(c)(3), and are referred to The Corps of Engineers, The Bureau of Reclamation or data from other acceptable sources.

(2) *Limitation of application.* (i) It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be designed as specified in § 1926.652(c).

(ii) When any of the following conditions are present, the members specified in the tables are not considered adequate. Either an alternate timber shoring system must be designed or another type of protective system designed in accordance with § 1926.652.

(A) When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two-foot soil surcharge. The term "adjacent" as used here means the area within a horizontal distance from the edge of the trench equal to the depth of the trench.

(B) When vertical loads imposed on cross braces exceed a 240-pound gravity load distributed on a one-foot section of the center of the crossbrace.

(C) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(D) When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables.* The members of the shoring system that are to be selected using this information are the cross braces, the uprights, and the wales, where wales are required. Minimum sizes of members are specified for use in different types of soil. There are six tables of information, two for each soil type. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is then made. The selection is based on the depth and width of the trench where the members are to be installed and, in most instances, the selection is also based on the horizontal spacing of the crossbraces. Instances where a choice of horizontal spacing of crossbracing is available, the horizontal spacing of the crossbraces must be chosen by the user before the size of any member can be determined. When the soil type, the width and depth of the trench, and the horizontal spacing of the crossbraces are known, the size and vertical spacing of the crossbraces, the size and vertical spacing of the wales, and the size and horizontal spacing of the uprights can be read from the appropriate table.

(f) *Examples to Illustrate the Use of Tables C–1.1 through C–1.3.*

(1) *Example 1.*

A trench dug in Type A soil is 13 feet deep and five feet wide.

From Table C–1.1, for acceptable arrangements of timber can be used.

Arrangement #1

Space 4×4 crossbraces at six feet horizontally and four feet vertically.

Wales are not required.

Space 3×8 uprights at six feet horizontally. This arrangement is commonly called "skip shoring."

Arrangement #2

Space 4×6 crossbraces at eight feet horizontally and four feet vertically.

Space 8×8 wales at four feet vertically.

Space 2×6 uprights at four feet horizontally.

Arrangement #3

Space 6×6 crossbraces at 10 feet horizontally and four feet vertically.

Space 8×10 wales at four feet vertically.

Space 2×6 uprights at five feet horizontally.

Arrangement #4

Space 6×6 crossbraces at 12 feet horizontally and four feet vertically.

Space 10×10 wales at four feet vertically.

Spaces 3×8 uprights at six feet horizontally.

(2) *Example 2.*

A trench dug in Type B soil in 13 feet deep and five feet wide. From Table C–1.2 three acceptable arrangements of members are listed.

Arrangement #1

[Appendix C]

Space 6×6 crossbraces at six feet horizontally and five feet vertically.
Space 8×8 wales at five feet vertically.
Space 2×6 uprights at two feet horizontally.

Arrangement #2

Space 6×8 crossbraces at eight feet horizontally and five feet vertically.
Space 10×10 wales at five feet vertically.
Space 2×6 uprights at two feet horizontally.

Arrangement #3

Space 8×8 crossbraces at 10 feet horizontally and five feet vertically.
Space 10×12 wales at five feet vertically.
Space 2×6 uprights at two feet vertically.

(3) *Example 3.*

A trench dug in Type C soil is 13 feet deep and five feet wide.

From Table C-1.3 two acceptable arrangements of members can be used.

Arrangement #1

Space 8×8 crossbraces at six feet horizontally and five feet vertically.
Space 10×12 wales at five feet vertically.
Position 2×6 uprights as closely together as possible.

If water must be retained use special tongue and groove uprights to form tight sheeting.

Arrangement #2

Space 8×10 crossbraces at eight feet horizontally and five feet vertically.
Space 12×12 wales at five feet vertically.
Position 2×6 uprights in a close sheeting configuration unless water pressure must be resisted. Tight sheeting must be used where water must be retained.

(4) *Example 4.*

A trench dug in Type C soil is 20 feet deep and 11 feet wide. The size and spacing of members for the section of trench that is over 15 feet in depth is determined using Table C-1.3. Only one arrangement of members is provided.

Space 8×10 crossbraces at six feet horizontally and five feet vertically.
Space 12×12 wales at five feet vertically.
Use 3×6 tight sheeting.

Use of Tables C-2.1 through C-2.3 would follow the same procedures.

(g) *Notes for all Tables.*

1. Member sizes at spacings other than indicated are to be determined as specified in § 1926.652(c), "Design of Protective Systems."

2. When conditions are saturated or submerged use Tight Sheeting. Tight Sheeting refers to the use of specially-edged timber planks (e.g., tongue and groove) at least three inches thick, steel sheet piling, or similar construction that when driven or placed in position provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. Close Sheeting refers to the placement of planks side-by-side allowing as little space as possible between them.

3. All spacing indicated is measured center to center.

4. Wales to be installed with greater dimension horizontal.

5. If the vertical distance from the center of the lowest crossbrace to the bottom of the trench exceeds two and one-half feet, uprights shall be firmly embedded or a mudsill shall be used. Where uprights are embedded, the vertical distance from the center of the lowest crossbrace to the bottom of the trench shall not exceed 36 inches. When mudsills are used, the vertical distance shall not exceed 42 inches. Mudsills are wales that are installed at the toe of the trench side.

6. Trench jacks may be used in lieu of or in combination with timber crossbraces.

7. Placement of crossbraces. When the vertical spacing of crossbraces is four feet, place the top crossbrace no more than two feet below the top of the trench. When the vertical spacing of crossbraces is five feet, place the top crossbrace no more than 2.5 feet below the top of the trench.

[Appendix C]

TABLE C-1.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A $P_a = 25 \times H + 72$ psf (2 ft Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				2X6	
TO	UP TO 8	4X4	4X4	4X5	6X6	6X6	4	Not Req'd	---					2X8
10	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			2X6		
	UP TO 12	4X6	4X6	6X6	6X6	6X6	4	8X8	4				2X6	
10	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				3X8	
TO	UP TO 8	4X6	4X6	6X6	6X6	6X6	4	8X8	4		2X6			
15	UP TO 10	6X6	6X5	6X6	6X8	6X8	4	8X10	4			2X6		
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	10X10	4				3X8	
15	UP TO 6	6X6	6X6	6X6	6X8	6X8	4	6X8	4	3X6				
TO	UP TO 8	6X6	6X6	6X6	6X8	6X8	4	8X8	4	3X6				
20	UP TO 10	8X8	8X8	8X8	8X8	8X10	4	8X10	4	3X6				
	UP TO 12	8X8	8X8	8X8	8X8	8X10	4	10X10	4	3X6				
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

[Sec. 1926.652, Table C-1.1]

TABLE C-1.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B $P_a = 45 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3		
5 TO 10	UP TO 6	4X6	4X6	6X6	6X6	6X6	5	6X8	5			2X6		
	UP TO 8	6X6	6X6	6X6	6X8	6X8	5	8X10	5			2X6		
	UP TO 10	6X6	6X6	6X6	6X8	6X8	5	10X10	5			2X6		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5		2X6			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5		2X6			
	UP TO 10	8X8	8X8	8X8	8X8	8X10	5	10X12	5		2X6			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	3X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	3X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C $P_a = 80 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**														
	CROSS BRACES							STRINGERS		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET) UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15	VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) (See Note 2) CLOSE					
5 TO 10	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	2X6					
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6					
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6					
	See Note 1														
10 TO 15	UP TO 6	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6					
	UP TO 8	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6					
	See Note 1														
	See Note 1														
15 TO 20	UP TO 6	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6					
	See Note 1														
	See Note 1														
	See Note 1														
OVER 20	SEE NOTE 1														

* Mixed Oak or equivalent with a bending strength not less than 850 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A $P_a = 25 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **														
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X4	4X4	4X6	4	Not Req'd	Not Req'd				4X6	
	UP TO 8	4X4	4X4	4X4	4X6	4X6	4	Not Req'd	Not Req'd					4X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			4X6		
	UP TO 12	4X6	4X6	4X6	6X6	6X6	4	8X8	4				4X6	
10 TO 15	UP TO 6	4X4	4X4	4X4	6X6	6X6	4	Not Req'd	Not Req'd				4X10	
	UP TO 8	4X6	4X6	4X6	6X6	6X6	4	6X8	4		4X6			
	UP TO 10	6X6	6X6	6X6	6X6	6X6	4	8X8	4			4X8		
	UP TO 12	6X6	6X6	6X6	6X6	6X6	4	8X10	4		4X6		4X10	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X6	6X6	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X6	6X6	4	8X8	4	3X6	4X12			
	UP TO 10	6X6	6X6	6X6	6X6	6X8	4	8X10	4	3X6				
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	8X12	4	3X6	4X12			
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS ** — CROSS BRACES: HORIZ. SPACING (FEET)	CROSS BRACES: WIDTH OF TRENCH (FEET) UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15	CROSS BRACES: VERT. SPACING (FEET)	WALES: SIZE (IN)	WALES: VERT. SPACING (FEET)	UPRIGHTS: MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) CLOSE	2	3	4	6
5 TO 10	UP TO 6	4X6	4X6	4X6	6X6	6X6	5	6X8	5			3X12 4X8		4X12
	UP TO 8	4X6	4X6	6X6	6X6	6X6	5	8X8	5		3X8		4X8	
	UP TO 10	4X6	4X6	6X6	6X6	6X8	5	8X10	5			4X8		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5	3X6	4X10			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5	3X6	4X10			
	UP TO 10	6X8	6X8	8X8	8X8	8X8	5	10X12	5	3X6	4X10			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	6X8	8X8	5	8X10	5	4X6				
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X12	5	4X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C $P_a = 80 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE				
5 TO 10	UP TO 6	6X6	6X6	6X6	6X6	8X8	5	8X8	5	3X6				
	UP TO 8	6X6	6X6	6X6	8X8	8X8	5	10X10	5	3X6				
	UP TO 10	6X6	6X6	8X8	8X8	8X8	5	10X12	5	3X6				
	See Note 1													
10 TO 15	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	10X10	5	4X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8X8	8X8	8X8	8X10	8X10	5	10X12	5	4X6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

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Appendix D to Subpart P

Aluminum Hydraulic Shoring for Trenches

(a) *Scope.* This appendix contains information that can be used when aluminum hydraulic shoring is provided as a method of protection against cave-ins in trenches that do not exceed 20 feet (6.1m) in depth. This appendix must be used when design of the aluminum hydraulic protective system cannot be performed in accordance with § 1926.652(c)(2).

(b) *Soil Classification.* In order to use data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of part 1926.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables D-1.1, D-1.2, D-1.3 and D-1.4. Each table presents the maximum vertical and horizontal spacings that may be used with various aluminum member sizes and various hydraulic cylinder sizes. Each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. Tables D-1.1 and D-1.2 are for vertical shores in Types A and B soil. Tables D-1.3 and D1.4 are for horizontal waler systems in Types B and C soil.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations (footnotes) regarding Table D-1.1 through D-1.4 are presented in paragraph (g) of this appendix.

(6) Figures, illustrating typical installations of hydraulic shoring, are included just prior to the Tables. The illustrations page is entitled "Aluminum Hydraulic Shoring; Typical Installations."

(d) *Basis and limitations of the data.*

(1) Vertical shore rails and horizontal wales are those that meet the Section Modulus requirements in the D-1 Tables. Aluminum material is 6061-T6 or material of equivalent strength and properties.

(2) Hydraulic cylinders specifications. (i) 2-inch cylinders shall be a minimum 2-inch inside diameter with a minimum safe working capacity of no less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe working capacity of not less than 30,000 pounds axial compressive load at extensions as recommended by product manufacturer.

(3) Limitation of application.

(i) It is not intended that the aluminum hydraulic specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be otherwise designed as specified in § 1926.652(c).

(ii) When any of the following conditions are present, the members specified in the Tables are not considered adequate. In this case, an alternative aluminum hydraulic shoring system or other type of protective system must be designed in accordance with § 1926.652.

(A) When vertical loads imposed on cross braces exceed a 100 Pound gravity load distributed on a one foot section of the center of the hydraulic cylinder.

(B) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(C) When only the lower portion or a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables D-1.1, D-1.2, D-1.3 and D-1.4.* The members of the shoring system that are to be selected using this information are the hydraulic cylinders, and either the vertical shores or the horizontal wales. When a waler system is used the vertical timber sheeting to be used is also selected from these tables. The Tables D-1.1 and D-1.2 for vertical shores are used in Type A and B soils that do not require sheeting. Type B soils that may require sheeting, and Type C soils that always require sheeting are found in the horizontal wale Tables D-1.3 and D-1.4. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is made. The selection is based on the depth and width of the trench where the members are to be installed. In these tables the vertical spacing is held constant at four feet on center. The tables show the maximum horizontal spacing of cylinders allowed for each size of wale in the waler system tables, and in the vertical shore tables, the hydraulic cylinder horizontal spacing is the same as the vertical shore spacing.

(f) *Example to Illustrate the Use of the Tables:*

(1) Example 1:

A trench dug in Type A soil is 8 feet deep and 3 feet wide. From Table D-1.1: Find vertical shores and 2 inch diameter cylinders spaced 8 feet on center (o.c.) horizontally and 4 feet on center (o.c.) vertically. (See Figures 1 & 3 for typical installations.)

(2) Example 2:

A trench is dug in Type B soil that does not require sheeting, 13 feet deep and 5 feet wide. From Table D-1.2: Find vertical shores and 2 inch diameter cylinders spaced 6.5 feet o.c. horizontally and 4 feet o.c. vertically. (See Figures 1 & 3 for typical installations.)

(3) A trench is dug in Type B soil that does not require sheeting, but does experience some minor raveling of the trench face. The trench is 13 feet deep and 9 feet wide. From Table D-1.2: Find vertical shores and 2 inch diameter cylinder (with special oversleeves as designated by footnote #2) spaced 5.5 feet o.c. horizontally and 4 feet o.c. vertically. plywood (per footnote (g)(7) to the D-1 Table) should be used behind the shores. (See Figures 2 & 3 for typical installations.)

(4) Example 4: A trench is dug in previously disturbed Type B soil, with characteristics of a Type C soil, and will require sheeting. The trench is 19 feet deep and 12 feet wide. 8 foot horizontal spacing between cylinders is desired for working space. From Table D-1.3: Find horizontal wale with a section modulus of 14.0 spaced at 4 feet o.c. vertically and 3 inch diameter cylinder spaced at 9 feet maximum o.c. horizontally. 3×12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(5) Example 5: A trench is dug in Type C soil, 9 feet deep and 4 feet wide. Horizontal cylinder spacing in excess of 6 feet is desired for working space. From Table D-1.4: Find horizontal wale with a section modulus of 7.0 and 2 inch diameter cylinders spaced at 6.5 feet o.c. horizontally. Or, find horizontal wale with a 14.0 section modulus and 3 inch diameter cylinder spaced at 10 feet o.c. horizontally. Both wales are spaced 4 feet o.c. vertically. 3×12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(g) *Footnotes, and general notes, for Tables D-1.1, D-1.2, D-1.3, and D-1.4.*

(1) For applications other than those listed in the tables, refer to § 1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to § 1926.652(c)(2) and § 1926.652(c)(3).

(2) 2 inch diameter cylinders, at this width, shall have structural steel tube (3.5 × 3.5 × 0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

(3) Hydraulic cylinders capacities. (i) 2 inch cylinders shall be a minimum 2-inch inside diameter with a safe working capacity of not less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe work capacity of not less than 30,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(4) All spacing indicated is measured center to center.

(5) Vertical shoring rails shall have a minimum section modulus of 0.40 inch.

(6) When vertical shores are used, there must be a minimum of three shores spaced equally, horizontally, in a group.

(7) Plywood shall be 1.125 in. thick softwood or 0.75 inch. thick, 14 ply, arctic white birch (Finland form). Please note that plywood is not intended as a structural member, but only for prevention of local raveling (sloughing of the trench face) between shores.

(8) See appendix C for timber specifications.

(9) Wales are calculated for simple span conditions.

(10) See appendix D, item (d), for basis and limitations of the data.

ALUMINUM HYDRAULIC SHORING

TYPICAL INSTALLATIONS

FIGURE NO. 1
VERTICAL ALUMINUM HYDRAULIC SHORING (SPOT BRACING)

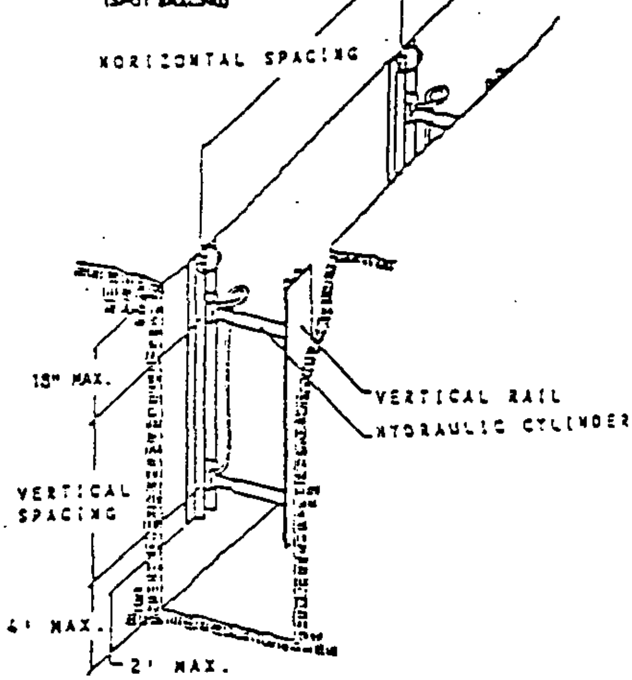


FIGURE NO. 2
VERTICAL ALUMINUM HYDRAULIC SHORING (WITH PLYWOOD)

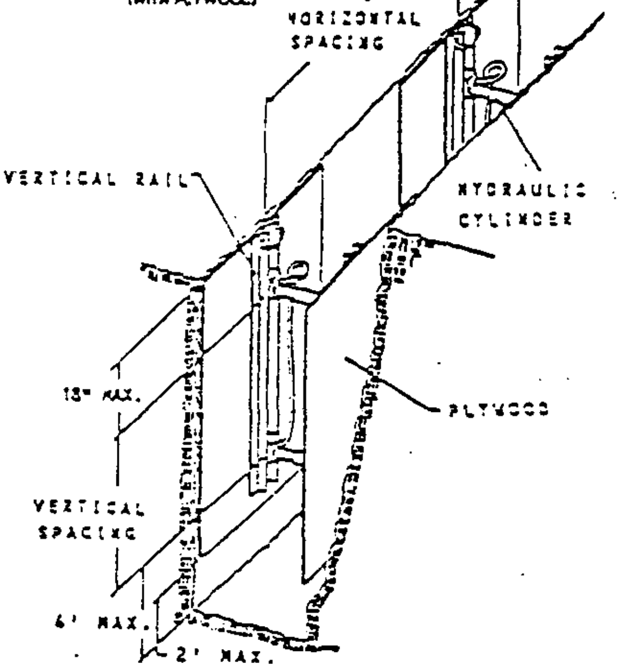


FIGURE NO. 3
VERTICAL ALUMINUM HYDRAULIC SHORING (STACKED)

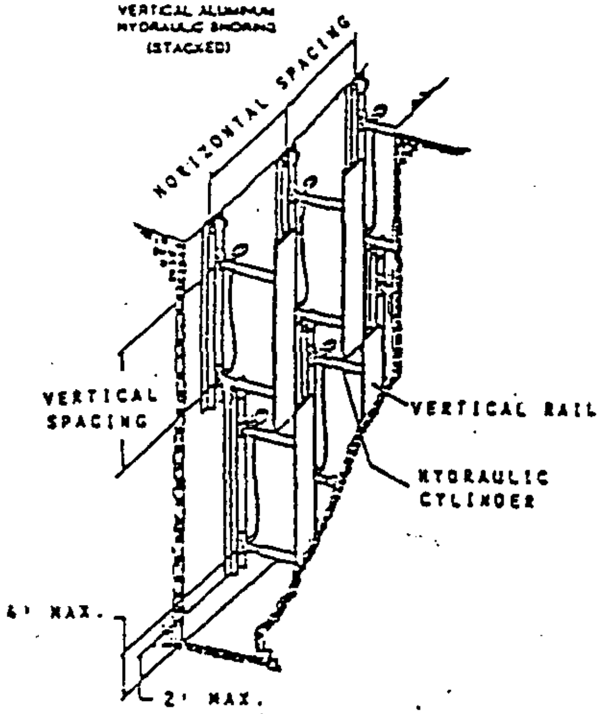
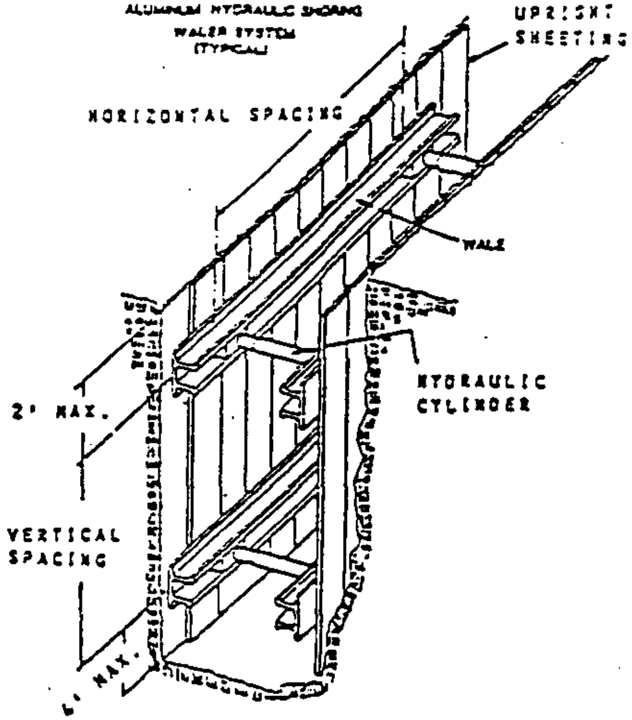


FIGURE NO. 4
ALUMINUM HYDRAULIC SHORING WALER SYSTEM (TYPICAL)



[Sec. 1926.652, Figures 1–4]

TABLE D - 1.1
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE A

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8				
OVER 10 UP TO 15	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 15 UP TO 20	7				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

TABLE D - 1.2
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	6.5				
OVER 15 UP TO 20	5.5				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

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TABLE D - 1.3
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS MAX.HORIZ.SPACING (ON CENTER)		
			WIDTH OF TRENCH (FEET)								
	VERTICAL SPACING (FEET)	SECTION MODULUS * (IN³)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO15		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	8.0	2 IN	8.0	2 IN NOTE(2)	8.0	3 IN	——	——	3x12
		7.0	9.0	2 IN	9.0	2 IN NOTE(2)	9.0	3 IN			
		14.0	12.0	3 IN	12.0	3 IN	12.0	3 IN			
OVER 10 UP TO 15	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	——	3x12	——
		7.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 15 UP TO 20	4	3.5	5.5	2 IN	5.5	2 IN NOTE(2)	5.5	3 IN	3x12	——	——
		7.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
		14.0	9.0	3 IN	9.0	3 IN	9.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

TABLE D - 1.4
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE C

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX.HORIZ SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	SECTION MODULUS * (IN³)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	3x12	—	—
		7.0	6.5	2 IN	6.5	2 IN NOTE(2)	6.5	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 10 UP TO 15	4	3.5	4.0	2 IN	4.0	2 IN NOTE(2)	4.0	3 IN	3x12	—	—
		7.0	5.5	3 IN	5.5	3 IN	5.5	3 IN			
		14.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
OVER 15 UP TO 20	4	3.5	3.5	2 IN	3.5	2 IN NOTE(2)	3.5	3 IN	3x12	—	—
		7.0	5.0	3 IN	5.0	3 IN	5.0	3 IN			
		14.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

Appendix E to Subpart P—Alternatives to Timber Shoring

Figure 1. Aluminum Hydraulic Shoring

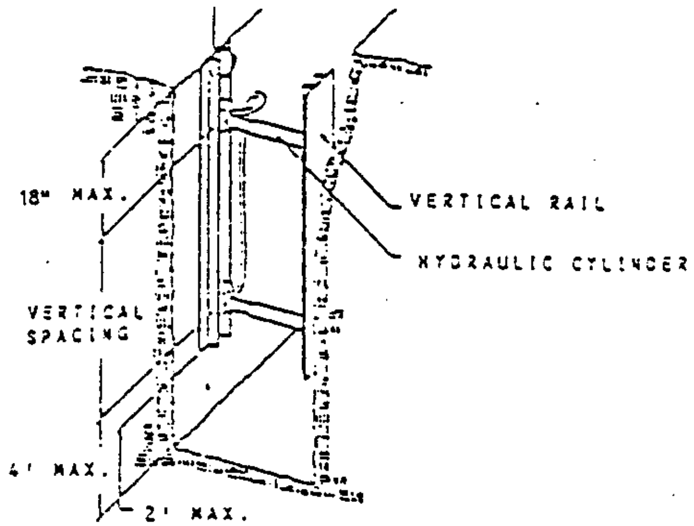
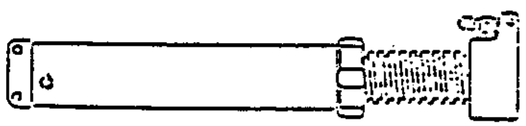


Figure 2. Pneumatic/hydraulic Shoring



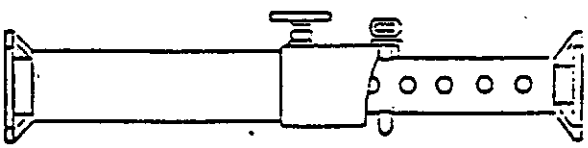


Figure 3. Trench Jacks (Screw Jacks)

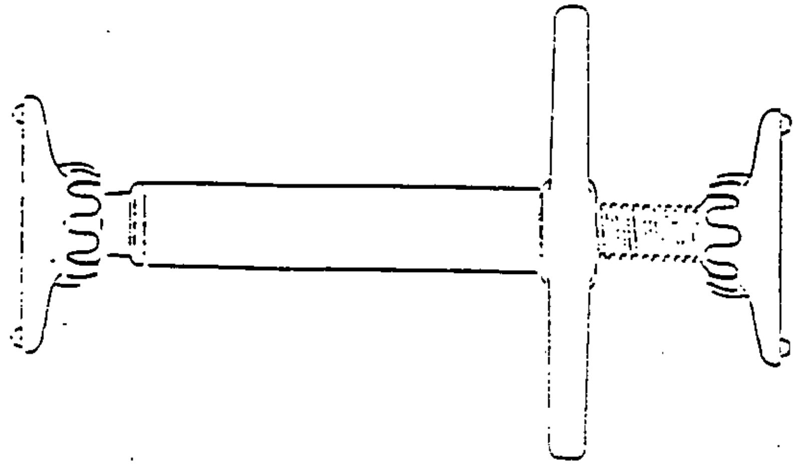
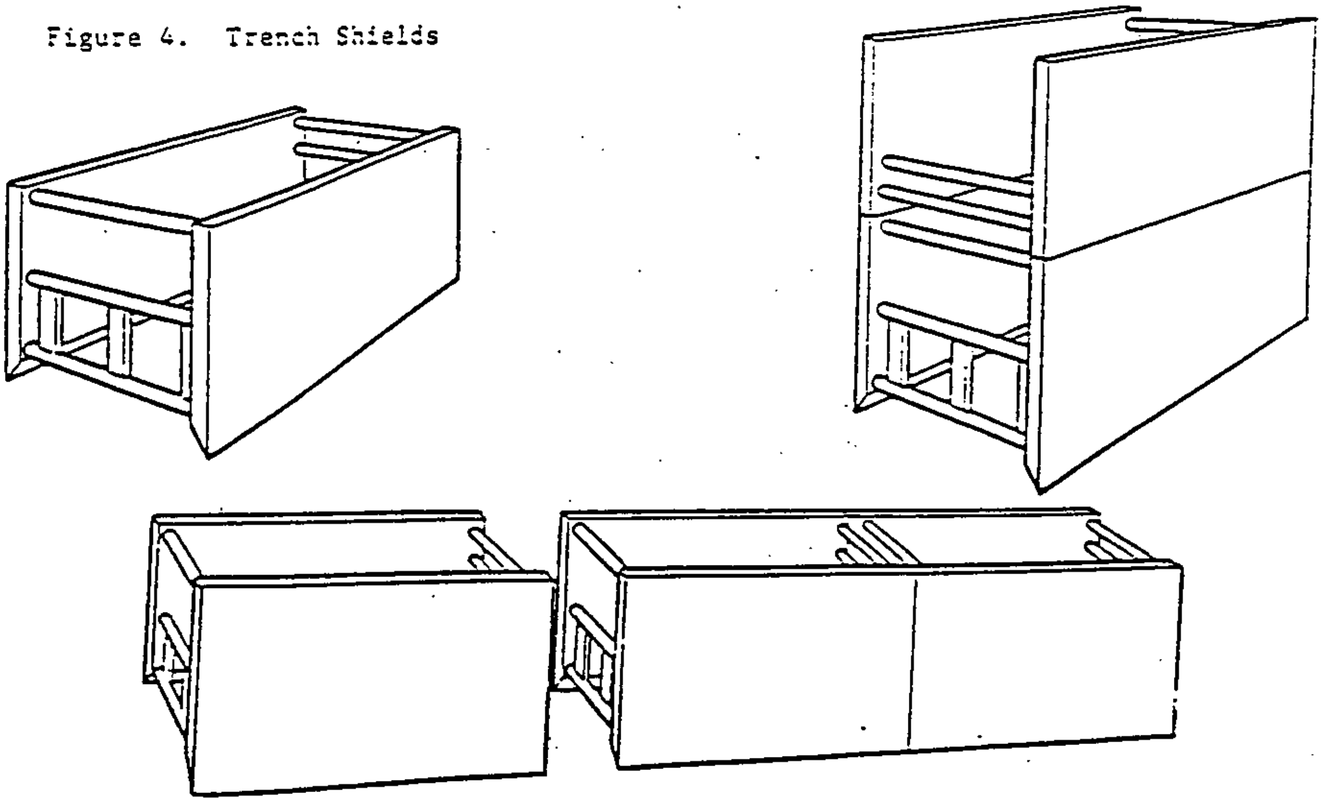


Figure 4. Trench Shields



[Appendix E]

Appendix F to Subpart P—Selection of Protective Systems

The following figures are a graphic summary of the requirements contained in subpart P for excavations 20 feet or less in depth. Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional engineer in accordance with § 1926.652 (b) and (c).

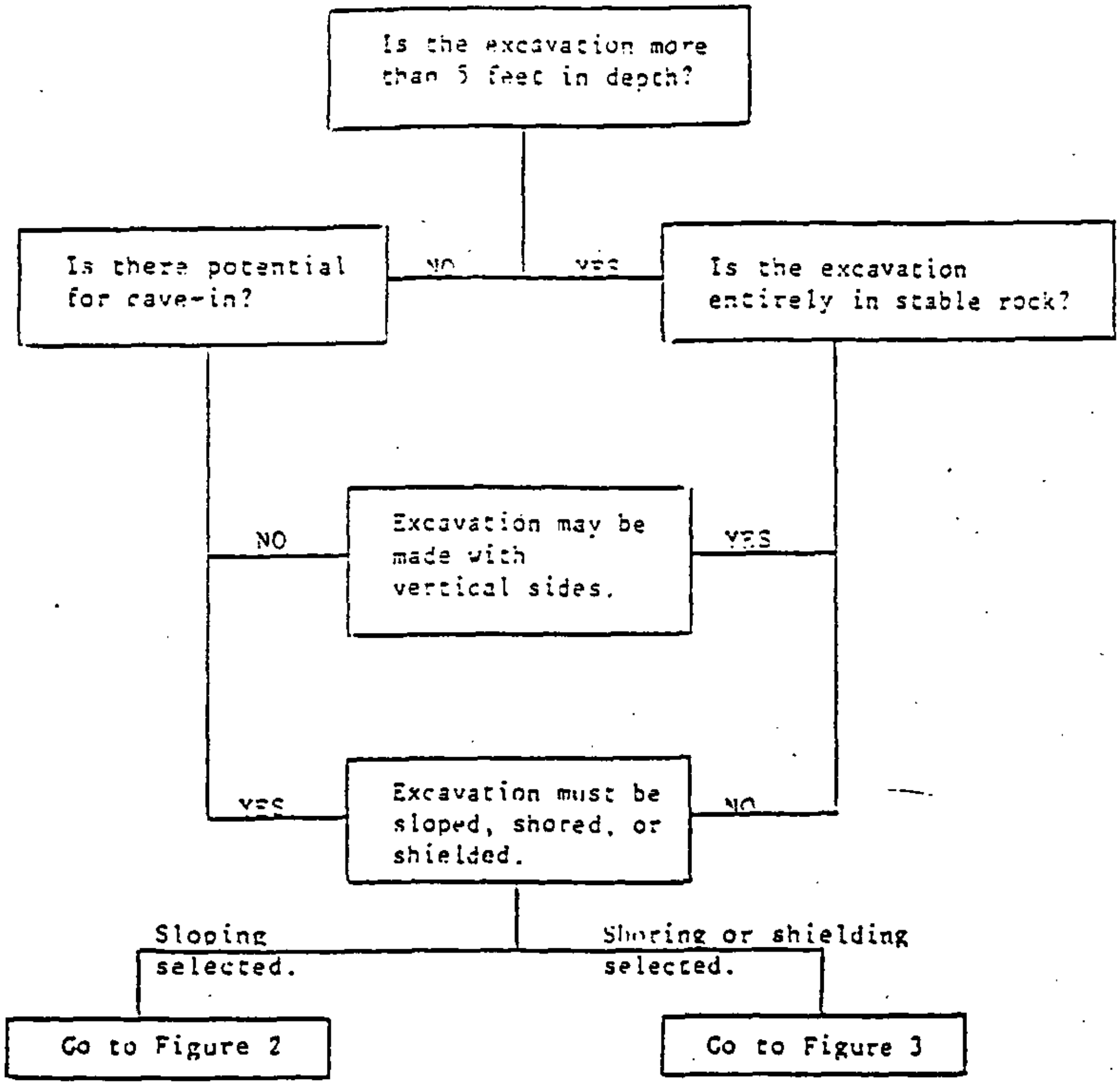


FIGURE 1 - PRELIMINARY DECISIONS

[Appendix F]

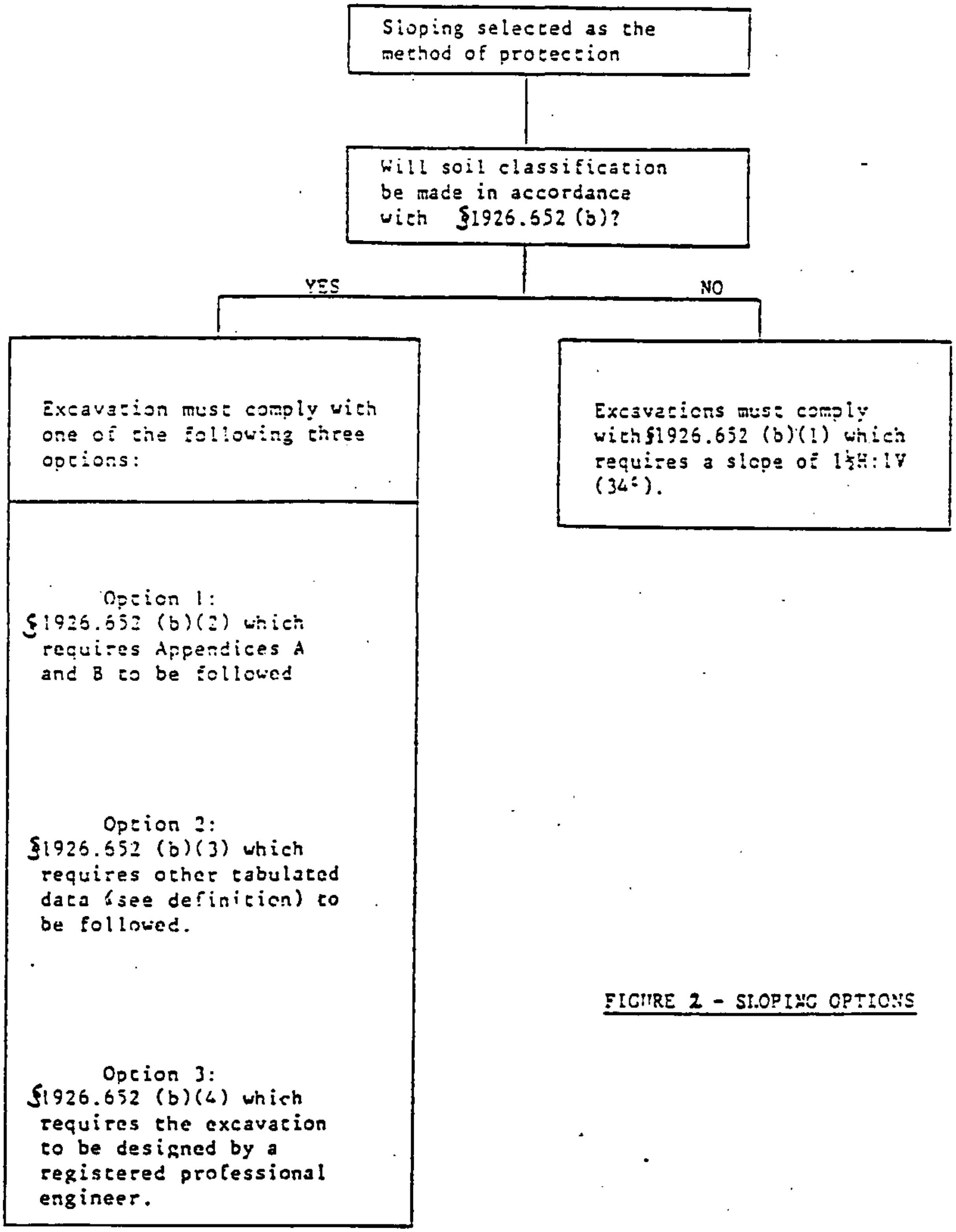


FIGURE 2 - SLOPING OPTIONS

[Appendix F]

Shoring or shielding selected as the method of protection.

Soil classification is required when shoring or shielding is used. The excavation must comply with one of the following four options:

Option 1
§1926.652 (c)(1) which requires Appendices A and C to be followed (e.g. timber shoring).

Option 2
§1926.652 (c)(2) which requires manufacturers data to be followed (e.g. hydraulic shoring, trench jacks, air shores, shields).

Option 3
§1926.652 (c)(3) which requires tabulated data (see definition) to be followed (e.g. any system as per the tabulated data).

Option 4
§1926.652 (c)(4) which requires the excavation to be designed by a registered professional engineer (e.g. any designed system).

FIGURE 3 - SHORING AND SHIELDING OPTIONS

[Appendix F]

Appendix H

4.04 Hazard Communication

A. Introduction

OBG Technical Services, Inc. is committed to providing a safe and healthy work environment for all employees through compliance with the Federal Hazard Communication Standards. It is recognized that certain work activities and procedures require the use of chemicals which have potentially hazardous properties. When using such chemicals, it is important that workers are aware of the identity and potentially hazardous properties of the chemicals. Thus, this section represents the Written Program and has been established to summarize the components of the Hazard Communication Program instituted by OBG Tech.

This Written Hazard Communication Program is available to all employees, their designated representatives, and representatives of the Federal Occupational Safety and Health Administration. This Program has been developed in compliance with the federal regulations contained in 29 CFR 1910.1200 and 29 CFR 1926.59. Further information on the program may be obtained from the Safety Coordinator in the Syracuse office.

B. Materials Exempted

The following materials are exempt from ALL aspects of the Federal Hazard Communication regulations:

1. Tobacco or tobacco products;
2. Wood or wood products;
3. Articles (defined as manufactured items, intended for use in specific shape or design, which do not release, or otherwise result in exposure to a hazardous chemical);
4. Food, drugs, cosmetics, or alcoholic beverages in a retail establishment packaged for sale to consumers;
5. Any consumer product or hazardous substance (as governed by the Consumer Product Safety Commission) which is used in the workplace in the same manner as normal consumer use, which results in a frequency and duration of exposure which is not greater than exposures experienced by consumers;
6. Drugs in solid, final form for direct administration to the patient (i.e., tablets or pills); and
7. Hazardous wastes, as defined under the Solid Waste Disposal Act and the Resource Conservation and Recovery Act.

C. Labeling program

1. No hazardous chemicals or chemical products will be used or accepted for use by OBG Tech, unless labeled with at least the following information:

   i. Identity of the hazardous chemical(s);
   ii. Appropriate hazard warnings;
   iii. Name and address (and phone number, if available) of the chemical manufacturer, importer, distributer, supplier, or other responsible party.

All OBG Tech employees are responsible for compliance with these requirements.

2. The identity of the chemical that appears on the manufacturer's label will be the same name to identify the chemical on the List of Hazardous Chemicals, and the MSDS for that substance.
3. All labels will be legible, in English, and prominently displayed on the container.
4. In the situation of a stationary container, the label may be replaced by a sign, placard, process sheet, batch ticket, or other means to convey the identity of the hazardous chemical and the appropriate hazard warnings. If these other forms of warning are used, they will be readily accessible to employees in their work area throughout each work shift.
5. The Standard does not require a label to be placed on portable containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for the immediate use of the employee who performs the transfer. However, by labeling the portable container appropriately, accidental misuse of the chemical by other employees may be prevented.
6. No label is to be defaced or removed unless the container is immediately marked with the required information. Any container without an appropriate label should be reported immediately to the job-site Supervisor.
7. Exemptions from these labeling requirements are as follows:

   i. Pesticides subject to the Federal Insecticide, Fungicide and Rodenticide Act;
   ii. Food, food additives, color additives, drugs, cosmetics, or medical or veterinary devices, as governed by the Food and Drug Administration;
   iii. Alcoholic beverages, wine or malted beverages intended for non-industrial use;
   iv. Any consumer product or hazardous substance as defined by the Consumer Product Safety Commission;

D. Comprehensive List of Hazardous Chemicals

Every chemical or product mixture of chemicals in any of the OBG Tech jobsites which is included in any of the four following lists of hazardous chemicals is listed in the List of Hazardous Chemicals for each jobsite. This List will be kept and maintained by the job-site Supervisor in a central location at each jobsite, such as the field office trailer. The four defining lists of hazardous chemicals are as follows:

1. Those compounds with designated OSHA Permissible Exposure Limits, as listed in 29 CFR 1910, Subpart Z ("Toxic and Hazardous Substances");
2. Those compounds listed in "Threshold Limit Values for Chemical Substances in the Work Environment" as published in the latest edition by the American Conference of Governmental Industrial Hygienists;
3. The latest edition of the "Annual Report on Carcinogens", published by the National Toxicology Program;
4. The Monographs published by the International Agency for Research on Cancer.

If a product contains a mixture of chemicals, it is considered to be hazardous if it contains 1% or more of any of the chemicals contained in any of the four lists referenced above. In the case of carcinogens, a mixture is considered to be hazardous if it contains 0.1% or more of any of the carcinogens within the lists referenced above.

The identity of each chemical, as noted in the List of Hazardous Chemicals, will be the same as the identity that appears on the container label and on the MSDS. A copy of the List of Hazardous Chemicals will be located at each Field Office along with a corresponding MSDS file for each compound on the list. Updating of the Comprehensive List of Hazardous Chemicals will be done regularly, upon acquisition of new materials and/or elimination of "old" materials. Each job-site Supervisor or his designate within OBG Tech will be responsible for updating each jobsite's list and MSDS file.

E. Material Safety Data Sheets

Copies of Material Safety Data Sheets for all hazardous chemicals to which employees may be exposed will be kept at a central location at each jobsite, such as the field office trailer and are readily accessible to employees in the work area during each work shift. The job-site Supervisor or his designate is responsible for maintaining and updating the file of Material Safety Data Sheets.

Each Material Safety Data Sheet shall be in English and shall contain the following information:

1. The identity used on the label.
2. Physical and chemical characteristics of the hazardous chemical.
3. Physical and health hazards of the hazardous chemical.
4. The primary routes of entry.
5. The OSHA permissible exposure limit, ACGIH threshold limit value, and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the material safety data sheet, where available.
6. Whether the chemical is found to be a potential carcinogen.
7. Precautions for safe handling.
8. Control measures, such engineering controls, work practice, or appropriate personal protective equipment.
9. Emergency and first aid procedures.
10. The date of the preparation of the material safety data sheet or the last change to it; and
11. The name, address, and telephone number of the responsible party for preparation or distribution of the material safety data sheet.

F. Employee Information and Training

Employees working with or potentially exposed to hazardous chemicals appropriately informed and trained concerning the potential hazards of the materials to which they may be exposed at the time of their initial work assignment. Training will be appropriately supplemented whenever a new hazard is introduced into the work area.

Employee information includes:

1. The requirements of the Hazard Communication Standard;
2. Any job-related activities involving hazardous chemicals;

3. The locations and availability of the Written Hazard Communication Program, the List(s) of Hazardous Chemicals, and the Material Safety Data Sheet File.

Employee training includes:

1. Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area. Such procedures include monitoring, visual appearance and/or odor recognition, symptoms, etc.;
2. The physical and health hazards of the chemicals in the work area.
3. Measures employees can take to protect themselves from such hazards. This includes specific procedures instituted by OBG Tech to protect employees from exposure to hazardous chemicals such as appropriate work practices, emergency procedures, and personal protective equipment suitable for use.
4. The details of the Hazard Communication Program developed by OBG Tech, including an explanation of the labelling system and the Material Safety Data Sheets, and how employees can obtain and use the appropriate hazard information.

The Safety Coordinator is responsible for overseeing the employee information and training program. All training is documented and is filed in the Syracuse office.

G. Provisions for Non-routine Tasks and Sub-Contractors

Before any non-routine task is performed that could involve exposure to hazardous chemicals, the supervisor for the area involved will evaluate the task for appropriate work practice procedures, potential chemical hazards of the task, safety and protective measures are reviewed and understood by the employee.

Prior to beginning work on OBG Tech jobsite, all sub-contractors will be given a copy of the Written Hazard Communication Program. The particular hazards associated with the work area(s) will be identified, along with all appropriate MSDSs for the materials to be used and/or encountered. Sub-Contractors are responsible for training their own employees. The job-site Supervisor or Foreman is responsible for verifying that training has been performed by the sub-contractors.

H. Multi-Employer Workplaces

OBG Technical Services, Inc. employees may use or store hazardous chemicals at a workplace in such a way that the employees of another employer or employers may be exposed. If this occurs, then the following steps must be taken.

1. Prior to the beginning of work on a multi-employer site, the Supervisor will notify all of the other contractors and sub-contractors where the MSDSs for all the hazardous chemicals, brought on-site by OBG Tech, are available.
2. The Supervisor will inform the other employers of precautionary measures which need to be taken to protect employees from hazardous chemicals used by OBG Tech employees during normal operating conditions and in foreseeable emergencies. This communication will also include a brief description of the container labeling system used by OBG Tech.
3. OBG Technical Services, Inc. will request similar information from all the other contractors

working on this site.

4. OBG Tech employees will receive training in the hazards of new chemicals that they will use, and the chemicals to be used by other contractors at a tool box safety meeting to be held prior to the beginning of work.

Appendix I

3.05 Confined Spaces

A. Introduction

OSHA has a standard, 29 CFR 1910.146, for permit-required confined spaces. The standard includes provisions for testing and entering confined spaces. The employee who enters a confined space may be subject to multiple hazards. The purpose of this section is to outline procedures to reduce these hazards.

B. Definitions

"Permit-required confined space" means a confined space (see definition below) that has one or more of the following characteristics:

1. Contains or has a potential to contain a hazardous atmosphere (see definition below).
2. Contains a material that has the potential for engulfing an entrant.
3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or by a floor which slopes downward and tapers to a smaller cross-section, or
4. Contains any other recognized serious safety or health hazard.

"Confined Space" means a space that:

1. Is large enough and so configured that an employee can bodily enter and perform assigned work; and
2. Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry): and
3. Is not designed for continuous employees occupancy.

"Hazardous Atmosphere" means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness from one or more of the following causes:

1. Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);
2. Airborne combustible dust at a concentration that meets or exceeds its LFL (Note: this concentration may be approximated as a condition in which dust obscures vision at a distance of 5 feet (1.52 meters) or less);
3. Atmospheric oxygen concentration below 19.5% or above 23.5%;
4. Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in 29 CFR 1910 Subparts G or Z and which could result in employee exposure in excess of its dose or permissible exposure limit (Note: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment or ability to self-rescue, injury, or acute illness due to its health effects is not covered).
5. Any other atmospheric condition that is immediately dangerous to life or health.

Note: For air contaminants for which OSHA has not determined a dose or permissible exposure limit, other sources of information, such as Material Safety Data Sheets that comply with the Hazard Communication Program, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

"Non-permit confined space" means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

C. Confined Space Entry Program

1. Coordination with Host Employer (Owner)

The Supervisor/Foreman in charge of entry will:

a. Obtain any available information regarding permit space hazards and entry operations from the host employer (Owner);
b. Coordinate entry operations with the host employer (Owner), when both host employer personnel and OBG Tech personnel will be working near permit spaces;
c. Inform the host employer (Owner) of the permit space program that OBG Tech personnel will follow and of any hazards confronted or created in permit spaces, either through a debriefing or during the entry operation.
d. Follow the Host Employers (Owners) confined space entry program whenever possible.

2. Determine classification of Confined Space

Should OBG Tech employees need to enter a confined space that has not been classified, then the following procedures will be used:

a. Determine whether the space meets the definition of a confined space as defined in Part B of this Section.
b. If the space meets the definition of a confined space, then determine whether it meets the definition of a permit-required confined space. If the confined space does not meet the definition of a permit-required confined space, employees may enter the space after the appropriate safety pre-cautions have been taken.
c. If the confined space requires a permit, refer to Part 3 of this section for the procedures to be followed under these conditions.

3. Preparations for Permit-Required Confined Spaces

The Supervisor/Foreman in charge of entry is responsible for:

a. Implementing the measures necessary to prevent unauthorized entry.
b. Identifying and evaluating the hazards before employees enter the permit space.
c. Specifying acceptable entry conditions on the "Safety, Work, Flame, Tank Entry, & Gas Test Permit" (An example is attached. Four-copy pressure sensitive forms are available from the Syracuse office).
d. Isolating the permit space and following lock-out/tag-out procedures as necessary.
e. Purging, inerting, flushing or ventilating the permit space as necessary to eliminate or control atmospheric hazards.
f. Providing signs and pedestrian, vehicle, or other barriers as necessary to protect entrants from external hazards.
g. Verifying that conditions in the permit space are acceptable for entry throughout the duration of an authorized entry.
h. Confirming that the necessary equipment is available and that employees are trained to use it as outlined on the permit.
i. Performing testing as described in Section 6.
j. Verifying that at least one attendant is stationed outside the permit space into which entry

is authorized for the duration of the entry.

k. Verifying that the emergency rescue team has been notified (see Section 10).

l. Coordinating entry operations when employees of more than one employer are simultaneously as authorized attendants in a permit space, so that the employees of one employer do not endanger the employees of any other employers.

m. Prior to entry, signing the permit to authorize entry.

n. Posting the completed permit at the entry portal or by any other equally effective means, so that the entrants can confirm that pre-entry preparations have been completed.

o. When a ladder is required to enter the confined space, the ladder must be tied securely and must not be removed while anyone is in the confined space.

p. Adequate lighting of an approved safety type must be provided.

q. All necessary safety equipment to be used by the person entering the confined space as well as for the safety watch will be checked.

r. Emergency procedures will be reviewed.

s. Smoking is prohibited inside of and within twenty feet of the confined space.

t. Spark proof hand tools and explosion proof equipment will be used.

u. If welding is to be performed in the confined space that previously or now contain combustibles, all residues, including dry scale or sediment must be removed. If it is not possible to remove all combustible materials, they must be covered with a non-combustible blanket.

v. At least one 20 lb. ABC multi-purpose fire extinguisher must be available for instant use in a confined space containing flammable gases or vapors.

w. Each person involved shall be trained on the hazards, as outlined in Section 4, how to recognize the hazards, and how to protect themselves from the hazards. Additionally, the attendants will be training on the use of rescue equipment and other duties outlined Section 8.

4. Training

Each employee who is required to enter a permit-required confined space will be trained in the safe performance of duties.

a. Training will be provided to each affected employee:

(1) before an employee is assigned duties which require entry into permit-required confined spaces,
(2) whenever there is a change in permit space operations that presents a hazard about which an employee has not previously been trained, or
(3) whenever there is reason to believe either that there are deviations from the permit-required confined space entry procedures or that there are inadequacies in the employee's knowledge or use of these procedures.

b. The training will be documented by the employees name, the signatures or initials of the trainers, and the dates of training. This documentation will be filed in the employees safety file and is available for inspection.

5. Procedures during entry

a. The duration of the permit may not exceed the time required to complete the assigned task or job identified on the permit.

b. The Foreman/Supervisor in charge of entry will terminate and cancel the entry permit when:

(1) Entry operations covered by the entry permit have been completed; or
(2) A condition that is not allowed under the entry permit arises in or near the permit space.

6. Procedures for Atmospheric Testing

a. Before an employee enters that space, the internal atmosphere will be tested, with a calibrated direct-reading instrument to determine if acceptable entry conditions exist, for the following conditions in the order given:

(1) Oxygen content
(2) Flammable gases and vapors
(3) Potential toxic air contaminants

b. If isolation of the space is infeasible because the space is large or is part of a continuous system, such as a sewer, pre-entry testing will be performed to the extent feasible before entry is authorized and, if entry is authorized, entry conditions will be continuously monitored in the areas where authorized entrants are working.

c. Test or monitor the permit space as necessary to determine if acceptable entry conditions are being maintained during the course of the entry operations.

d. Evaluation and interpretation of data should be done or reviewed by the Safety Coordinator.

e. When monitoring for entries involving a descent into atmospheres that may be stratified, the atmospheric envelope should be tested a distance of 4 feet in the direction of travel and to each side. If a sampling probe is use, the entrant's rate of progress should be slowed to accommodate the sampling speed and detector response.

7. Authorized Entrants

The Foreman/Supervisor in charge of entry is responsible for confirming that all authorized entrants:

a. Know the hazards they face during entry, including information on the mode, signs or symptoms, and consequences of exposure;
b. Properly use equipment as required by this section;
c. Communicate with the attendant as necessary to enable the attendant to monitor entrants status and to enable the attendant to alert entrants of the need to evacuate the space;
d. Alert the attendant whenever:
(1) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation;
(2) The entrant detects a prohibited condition;
e. Exit from the permit space as quickly as possible whenever:
(1) An order to evacuate is given by the attendant or the entry supervisor;
(2) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation
(3) The entrant recognizes a prohibited condition, or
(4) An evacuation alarm is activated.

8. Attendants

The Foreman/Supervisor is charge of entry is responsible for confirming that attendants:

a. Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of exposure;
b. Is aware of possible behavioral effects of hazard exposure in authorized entrants;
c. Initial entry will be accomplished with an attendant stationed outside for the purpose of immediate assistance.
d. The designated attendant will never enter into the permit space for the purpose of an attempt to rescue the entrants.

e. Attendants will use any rescue equipment provided for their use and perform other rescue and emergency duties, without entering the permit space.

f. The attendant will be responsible for continuously maintaining an accurate count of all authorized entrants in the space.

g. Communication between attendants and entrants will be maintained continuously during entry.

h. Attendants will order authorized entrants to evacuate a space immediately when:

(1) The attendant observes a prohibited condition.
(2) The attendant detects behavioral effects hazard exposure.
(3) The attendant detects a situation outside the space which could endanger entrants.
(4) The attendant detects an uncontrolled situation within the permit space.
(5) The attendant is monitoring entry in more than one permit space and must focus attention on the rescue of entrants from one of those spaces.
(6) The attendant must leave the work station.
(7) If the attendant cannot effectively and safely perform all the duties required under this section.

i. Attendants will summon rescue and other emergency services as soon as the attendant determines that the authorized entrants may need assistance to escape from the confined space hazards.

j. Attendants will warn unauthorized persons away from the space, request that unauthorized persons exit immediately if they have entered the space, and inform authorized entrants if unauthorized persons have entered the space.

k. Attendants will perform no duties that might interfere with the attendant's primary duty to monitor and protect the authorized entrants.

9. Supervisor/Foreman

Employees of OBG Tech authorizing or in charge of entry will:

a. Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of exposure;

b. Determine that the entry permit is properly filled out.

b. Determine that the entrants and attendants are properly trained.

c. Determine that necessary procedures, practices and equipment for safe entry are in place, including verifying rescue services are available and that the means of summoning them are operable.

d Remove unauthorized individuals who enter or attempt to enter the permit space during entry operations.

e. Periodically monitor to determine that confined space operations remain consistent with the terms of the entry permit and that acceptable entry conditions are present.

f. Cancel authorization and terminate entry whenever entry conditions are not present.

g. Take the necessary measures for concluding an entry operation, such as closing off a permit space and cancelling the permit, once the authorized work has been completed.

h. The supervisor/foreman in charge of authorizing the confined space entry may also be an entrant or an attendant.

10. Rescue and Emergency Services

a. Arrangements must be made prior to entry under which a rescue team will respond to a request for rescue activities. The outside rescue team will be informed of the hazards they may confront when called to the rescue.

b. To facilitate non-entry rescue, retrieval systems or methods will be used whenever an authorized entrant enters a permit-required confined space, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. Retrieval systems will meet the following requirements:

(1) Each authorized entrant will use a chest or full body harness, with a retrieval line attached at the center of the entrants back near shoulder level, or above the entrant's head. Wristlets may be used in lieu of the chest or full body harness if it can be demonstrated that the use of a chest or full body harness is infeasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative.

(2) The other end of the retrieval line will be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. A mechanical device will be available to retrieve personnel from vertical type permit-required confined spaces more than 5 feet deep.

c. If an injured entrant is exposed to a substance for which a Material Safety Data Sheet (MSDS) or other similar written information is required to be kept at the worksite, that MSDS or written information will be made available to the medical facility treating the exposed entrant.

D. Records

Permits will be filed with other pertinent project health and safety information, as well as with the Safety Coordinator.

F. Evaluation of Program

The Permit-Required Confined Space Entry Program will be reviewed once per year, using the cancelled permits and revise the program as necessary to confirm that employees participating in entry operations are protected from permit space hazards.

G. Exception to Permit Requirements

If the only hazard posed by the confined space is an actual or potential hazardous atmosphere and it can be demonstrated that continuous forced air ventilation alone is sufficient to maintain that confined space for safe entry, then a permit is not required under the regulations. However, it is OBG Tech's policy to require a permit for entries that meet the definition of a "permit-required confined space" (see Section B). If a project requires regular entry into a confined space that does not require a permit under the regulations, the Safety Coordinator must be contacted and the permit waiver will be considered on a project by project basis. Special procedures to be followed under these conditions will be developed by the Safety Coordinator.

OBG TECHNICAL SERVICES INC.
SAFETY, WORK, FLAME, TANK ENTRY & GAS TEST PERMIT

PROJECT: | PROJ. NUMBER

LOCATION OF WORK: PLANT | BUILDING | FLOOR

DESCRIPTION OF WORK TO BE PERFORMED:

SPECIAL SAFETY PRECAUTIONS TO BE OBSERVED:

HAZARD COMMUNICATION Work crew supervisor and all work crew personel have been notified of chemicals ans physical hazards in the work area, MSDS location, safety equipment required and emergency instructions. Work personnel have been instructed to report any unsafe or unusual conditions.

Safety Equipment required: check off if required					
Goggles		Ventilation Equip.		Safety Belt	
Face Shield		Water Hose		Plastic Apron	
Nitrile or Vinyl Gloves		Vinyl Suit		Uncoated Tyvek Suit	
Rubber Boots		Acid Suit		Coated Tyvek Suit	
Half-face Respirator		Air-line Respirator		Ladder/Scaffold	
Full-face Respirator		Cartridge Type		Non-sparking Tools	
GFI		Fire Extinguisher		Vaporproof Ext. Light	
Lockout		Grounding Equipment		Other	
Communication Equip.		Barriers & Signs		Other	

CHECK EACH QUESTION: YES, NO OR NOT APPLICABLE	YES	NO	NA
* Have valves been properly set, locked and tagged?			
* Has electric been locked open? Test local starter button.			
* Has piping been disconnected or blanked off?			
* Has vessel/piping been drained, cleaned or purged?			
* Is Gas or Air test necessary? Cont? Every hrs.			
* Can sparks ignite material in vicinity, sewers, lower floors?			
* Is adjacent equipment safe?			
* Is a stand-by fire watch required? If so, present?			
* Tests have been conducted for Flammable Vapors?			
* Tests have been conduted for Oxygen?			
* Tests for Toxic Gases have been conducted and approved?			
* Has a pre-entry briefing been conducted?			
* Have Safety Belt and Harness been provided for work?			
* Has OSHA approved shoring been provided for work?			

Confined Space Entry

Potential Hazards:

Entry Supervisor:

Attendant(s):

Entrants:

Rescue Procedures (Equipment to use and Numbers to Call):

Monitoring Procedures:

Communication Procedures:

LOCKOUT # Locks	# Tags

Air Tests	PEL	Required?	PreEntry	Initial	1 hour	2 hours	4 hours	6 hours	8 hours
Oxygen	19.5 - 23%								
LEL	10 %								
CO	35 ppm								
H2S	10 ppm								
Volatiles	5ppmSTEL								
Others									

Authorizations
Owner:
Agent:
Subcontractor:

PERMIT VALIDATION (Valid for one shift only)	
FROM: DATE	TIME
TO: DATE	TIME

Work Completed?	Yes	No	NA	Comments:
Lockout/Tagout Protection has been removed and equipment can be placed into service				Yes
Protection Removed By:		Time:		Date:

END

OF

DOCUMENT