WORK PLAN
PHASE II INVESTIGATION

GRIFFIN TECHNOLOGY, INC.
VICTOR, NEW YORK

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SECTION 1 - INTRODUCTION

This Phase II Investigation Work Plan has been prepared by Blasland & Bouck Engineers, P.C., for the Griffin Technology, Inc., (GTI) manufacturing facility located in Victor, New York. Although, we have submitted this document in the form of a Phase II Investigation Work Plan, as requested by the NYSDEC, it is our intent to implement this program as a comprehensive remedial investigation designed to provide the necessary data to evaluate the environmental impacts associated with the former solvent disposal practices of this facility and to select an appropriate remedial response, if necessary.

This Work Plan has been prepared as a comprehensive document upon which the evaluation of the site and the evaluation of any required remedial activities will be based. The initial sections of this Work Plan present information on the background and setting of the site; an evaluation of the existing data associated with the existing environmental concerns; an identification of additional data needed to complete the evaluation of the site; and the Work Plan's approach with regard to addressing these needs. The subsequent sections of the Work Plan provide a presentation of the tasks to be performed as part of the Phase II Investigation; the Sampling and Analysis Plan (SAP) to be utilized during the site characterization tasks, including the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPP); the Health and Safety Plan (HSP) to be followed during all on-site activities; the tentative schedule for implementation of the Phase II Investigation; and a discussion of project organization and staffing.

SECTION 2 - SITE BACKGROUND AND PHYSICAL SETTING

2.1 Site Background

GTI purchased the existing facility from a swimming pool manufacturing company in 1975. The activities of the former owner/operator of this site are largely unknown. GTI has owned and operated this plant as a manufacturing facility for plastic identification cards.

The manufacturing processes utilized on this site generate small quantities of two types of wastes, including film developer consisting of ethylenediamine, formaldehyde, and silver and waste photo-coating composed of 90% trichloroethylene (TCE) and 10% tetrabutyl orthotitanate. According to GTI records, the ethylenediamine, silver, and formaldehyde have always been discharged directly to the Farmington sewer system throughout the history of GTI's operations at this facility. From 1986 to early 1989, the spent photo-coating was collected in 55-gallon drums and removed from the site for proper disposal by an authorized chemical collection company. GTI no longer uses the above-mentioned solvent at the facility. However, between 1977 and 1986, approximately 491 gallons of spent photo-coating were reportedly discharged to the ground surface in a small area west of Building I.

There are no other known practices by Griffin Technology which would have contributed to soil or ground-water contamination. Griffin Technology has not operated any other process on site that utilizes materials other than those previously described. There is no information currently available concerning the materials or the disposal practices utilized by the prior owner of the site (swimming pool manufacturer). Based on this information, the only known disposal area is along the western property line directly adjacent to the side door of the building, and the only materials disposed of on-site were the spent solvents associated with the photo-coat material.

In 1975, when Griffin took over the facility from the swimming pool manufacturer, they initiated the photo-coating process for plastic identification cards. The process for coating the cards was located toward the back of the original building. The photo-coating process generated a small amount of waste which was routinely disposed of by going out the side door on the western side of the building and disposing of it along the property line. The building was subsequently expanded in the 1980s, but the door remained on the western side of the building and the disposal practice continued through 1986. The disposal area is located across a one-lane driveway and is currently undistinguishable from other areas along the hedge row. The area is currently vegetated with grasses, shrubs, and trees. The disposal practice consisted of periodically emptying a small tray of spent solvents to the ground surface. Given the small quantity of material spilled during each disposal incident, no pooling or obvious buildup would have occurred and the material that did not evaporate would have soaked into the soils. Therefore, overland migration of these materials across the ground surface is not believed to be a significant migration pathway. This was the only on-site disposal activity practiced by Griffin Technology.

2.2 Physical Setting

2.2.1 General

The GTI facility is located on a 4-acre parcel of land located in the Town of Farmington, Ontario County, New York. The property is bordered on the east and west by vacant lots, on the south by

Manchester Road (New York State Route 96), and on the north by what appears to be undeveloped land. The southern half of the property is occupied by GTI's 25,000 square foot manufacturing facility, paved parking areas, and a gravel driveway, which runs along the west side of the building. The only other structure on the property is a shed located on the northern half of the property. The shed located on the northern end of the property is used by Griffin as a storage facility to store records and spare camera parts. Pallets, which are stored back in this area, are from the incoming shipment of the roles of plastic laminate used in the manufacturing of the ID cards. No other raw materials used in the process are stored in this area. After the disposal of spent solvents on the ground was terminated in 1986, the liquids were then stored in 55 gallon drums and from 1986 until 1989, two 55 gallon drums of spent solvents were stored in the warehouse area. These drums have since been removed from the site and were properly disposed of.

There appears to be little topographic change across the site. However, a north-south oriented topographic low with approximately two feet of relief was observed about 200 feet southwest of the former disposal area on the neighboring vacant lot.

2.2.2 Geology/Hydrogeology

The regional geology of the site vicinity is generally characterized by successive units of sedimentary deposits which trend approximately east-west and dip toward the south-southwest. Based on observations of the material observed at the ground surface and the presence of numerous bedrock outcrops in the site vicinity, the overburden in the vicinity of the site appears to be a thin veneer of fine-grained soils consisting predominantly of silt and clay. In addition, temporary soil gas probes installed at the site in November 1988 and August-September 1989 encountered bedrock at very shallow depths at numerous locations.

The bedrock units immediately underlying the site are composed of interbedded units of dolostone and shale known locally as the Akron Dolostone and Bertie Formation (Rickard et al., 1970). The Akron Dolostone is typically a light grey laminated, banded and/or mottled dolostone to dolomitic limestone. The underlying Bertie Formation is typically composed of interbedded units of light grey argillaceous dolostone, dolomitic and gypsiferous shales, and gypsum. Beneath the Bertie Formation are the Camillus and Syracuse Formations. The Camillus Formation is typically a soft green dolomitic shale to thin gypsiferous shale, while the Syracuse Formation may be locally composed of light grey argillaceous dolostones, green dolomitic shales, and/or gypsum.

The occurrence of ground water in the vicinity of the site is anticipated to be limited to fractured water-bearing zones of the bedrock, as the unconsolidated materials overlying the bedrock consist of fine-grained sand and silt which appear to be generally unsaturated, based on the observations made during the installation of the soil gas survey probes performed at the site and in the site vicinity. The direction of ground-water flow through the bedrock in the vicinity of the site is probably generally toward the west. This is suggested by the general trend of lower surface elevations toward the west and southwest, as well as by the fact that the local surface drainage is through a series of unnamed streams towards Mud Creek and Ganargun Creek located west of the site. Furthermore, we understand that the results of a study performed on the adjacent parcel of land also would confirm these assumptions regarding the occurrence of ground water in the site vicinity.

SECTION 3 - PRELIMINARY EVALUATION OF POTENTIAL ENVIRONMENTAL CONCERNS

The previous waste disposal practices implemented at the GTI facility included the discharge of spent solvent to the ground surface in a small area west of the manufacturing building. This method of disposing of the spent solvent was practiced from 1977 until 1986. Beginning in 1986 through early 1989, all spent solvent was collected and disposed of off-site. GTI no longer uses solvents in the pre-coat process. The solvent previously utilized at this site was composed largely of TCE (approximately 90 percent). To calculate the approximate volume of solvent discharged to the ground surface between 1977 and 1986, the total quantity of solvent purchased (approximately 733 gallons) was multiplied by a percent waste factor of 67 percent. Therefore, it has been estimated that approximately 491 gallons of solvent were discharged over the nine year period that this disposal method was practiced.

The potential routes of migration for the discharged solvent would include the following:

- volatilization directly from the ground surface into the air;
- migration horizontally and vertically through the overburden soil;
- migration horizontally across the bedrock surface;
- migration vertically into the bedrock; and
- migration horizontally and vertically downgradient within the bedrock, either dissolved in the ground water or as a separate non-aqueous phase.

Some of the physical properties of Trichloroethylene are listed below:

Density	1,465 @ 20° C
Vapor Pressure	74mm of Hg @ 25° C
Solubility in Water	1,100 mg/L
Adsorption Coefficient	Log Koc = 2.0

Although inadequate information exists upon which to evaluate whether, and to what degree, migration of the volatile organic materials has occurred within the various potential migration pathways identified above, certain assumptions can be made based on the existing information. Spills or releases of TCE to soil will tend to evaporate rapidly due to its high vapor pressure. However, it may also leach into ground water since it does not adsorb strongly to soils. The material is fairly stable in soil and ground water, however, some breakdown does occur. The remaining material that is not volatilized from the disposal area may be expected to migrate down through the soils, possibly to the water table. Although it has low solubility, the small quantities disposed of on a periodic basis are not anticipated to generate a separate non-aqueous phase and any concentrations in ground water are expected to be well below the approximately 1,100 ppm solubility limit for the TCE. Assuming that the ground surface topography generally reflects the topography of the bedrock surface, the likely route of horizontal migration across the bedrock surface would probably be in the direction of a surficial topographic low located west-southwest of the former disposal area.

The zone of consolidated bedrock immediately below the bedrock/overburden interface is commonly observed to be more extensively fractured than the same rock unit below this zone. Should this also be the case in the site vicinity, ground-water movement in the bedrock would be expected to be more easily transmitted horizontally than vertically. As we anticipate this condition to exist in the site vicinity, volatile organic compounds which have migrated into the bedrock aquifer may be expected to migrate primarily horizontally with the bedrock ground-water flow. Based on the original topography and surficial drainage patterns, it is anticipated that ground-water flow in the bedrock would generally be toward the west. However, our observations during the soil gas surveys and our understanding of the previous investigation results of the adjacent property both indicated that the fractured zone immediately along the bedrock/overburden interface is unsaturated in the vicinity of the disposal site. However, saturated overburden may be encountered locally in areas of depressed bedrock surface.

A soil vapor survey was performed in the area in November 1988 and a second survey was performed in late August, early September 1989. The data developed through these surveys was provided to the DEC with our letter of October 16, 1990. A review of this information shows that the highest TCE concentrations were detected adjacent to the disposal area in the 1988 survey, with levels exceeding 107 ppm. Concentrations tended to decrease away from the disposal area, with some detections found at the probe location on the east boundary and near the storage shed. The 1988 soil vapor survey also indicated the presence of another compound, 1,1,1-Trichloroethane, which was detected near the disposal area in concentrations above 12,000 ppm. There is no explanation for the source of this material. The soil vapor survey performed in 1989 primarily on the adjacent parcel to the west, indicated low levels of TCE concentrations in the center of the adjacent property with increasing concentrations further to the west. The highest concentrations detected in this survey were at the property line between the adjacent property and the auto repair business located further to the west.

SECTION 4 - WORK PLAN RATIONALE

This section presents an identification of the additional data required to evaluate the nature and extent of the potential environmental impacts which may have resulted from GTI's former on-site solvent disposal activities. The data needs identified have been developed based on our current understanding of the past disposal activities and the existing site conditions. This section also presents the approach developed for implementation of the Phase II Investigation which has been developed to meet these data needs.

4.1 Identification of Additional Data Needed

To evaluate the nature and extent of any residual volatile organic compounds in soil associated with the former solvent disposal activities, data on the soil quality in the vicinity of the former disposal area is required. Given the tendency for lateral dispersion of compounds as they migrate vertically onto the soil horizon, the area investigated should include the former disposal area as well as a zone around the former disposal area. Given the potential for the vertical migration of volatile compounds to the top of bedrock, soil quality data is needed from the ground surface to the top of rock in the soil horizon.

To evaluate the potential for volatile compounds to have migrated horizontally across the bedrock surface, data regarding soil quality, perched ground-water quality (if present), and the elevation of the bedrock surface at selected locations is needed for the area topographically downgradient of the former disposal area.

The potential for adverse environmental impacts of the bedrock aquifer underlying the site must also be evaluated. Therefore, data regarding the existing hydrogeologic conditions of the bedrock including the direction of ground-water flow, the transmissivity of the bedrock units, and bedrock ground-water quality, must also be obtained. To distinguish between impacts associated with the former disposal activities and other potential sources which may exist upgradient of the site, background ground-water quality data is also needed.

4.2 Work Plan Approach

The overall approach of this Work Plan to addressing the potential concerns identified at the GTI facility incorporates a clearly-defined step-by-step program to proceed from the initial evaluation of the site conditions, potential concerns and data needs to evaluate these concerns, through the site characterization phase, and to the point at which the potential remedial alternatives may be initially screened and evaluated.

The site characterization activities proposed in the subsequent sections of this Work Plan were developed to provide a cost-effective method of addressing each of the identified data needs based on the initial evaluation of the site. Overburden investigation activities will include a soil boring, soil sampling, and overburden well installation program; hydraulic conductivity testing; and ground-water sampling. The bedrock investigation activities will include coring, well installation, hydraulic testing, and sampling of bedrock wells directly adjacent to the former disposal area, as well as upgradient and downgradient of this area. These actions are designed to provide the information pertaining to the hydrogeologic characteristics and ground-water quality of the bedrock necessary to evaluate potential remedial alternatives should they be required.

The Work Plan also incorporates detailed methods of protecting and evaluating the quality of the data obtained through the implementation of the investigation program. Adherence to these QA protocols will provide a reasonable degree of confidence regarding the validity of the data on which the evaluation of remedial alternatives will be based.

SECTION 5 - PHASE II INVESTIGATION TASKS

This section describes the proposed tasks to be implemented as part of this Phase II Investigation of the Griffin Technology site. The tasks to be performed as part of the investigation are described in detail in this section and following sections of this Work Plan.

Task 1 - Preliminary Evaluation of Potential Environmental Concerns

To the extent that existing data will allow, this task has already been performed. The results of the preliminary evaluation are presented in Section 2 of this Work Plan.

Task 2 - Project Planning

The activities associated with this task involve the evaluation of the data generated during Task 1; the development of a detailed Work Plan including the SAP (Section 6 of this Work Plan), FSP, QAPP, and HSP (Appendix G). This task also involves the scoping of the specific tasks to be performed throughout the Phase II Investigation. This task has already begun and will be completed upon receiving NYSDEC approval of the Phase II Work Plan.

Task 3 - Site Investigation

This task will involve the implementation of the site investigation activities as detailed in the FSP presented in Section 6.1 of this Work Plan. These site investigation activities will include soil borings, soil sampling, monitoring well installation, and hydrogeologic characterization testing.

Task 4 - Site Investigation Analysis

This task will involve the evaluation of the results of the site investigation for the purpose of determining if an adequate understanding of the site has been achieved to allow for the development and preliminary evaluation of remedial alternatives.

All analytical results will be compared to any applicable or relevant and appropriate requirements (ARARs), such as standards of environmental control or protection. Depending on the extent of chemical constituents observed at the site as compared with the NYSDEC clean-up standards or guidance, a risk assessment may prove useful in identifying clean-up levels based on actual risk to human health and the environment. However, a risk assessment may not be necessary if the concentrations observed are limited and could be readily remediated, or if these levels are below any identified ARARs.

Task 5 - Phase II Investigation Report

The results of the Phase II Investigation will be summarized into a comprehensive report as part of this task. This report will incorporate the following:

- A detailed discussion of the investigation activities performed;

- Tabulated summaries of analytical data, including results from the data validation activities;

- Map-based presentations of the horizontal and vertical distribution of constituents in the soil and ground water at the site;

- A characterization of the hydrogeologic conditions in the site vicinity based on the data generated through this investigation;

- Recommendations regarding any supplemental investigation activities necessary to sufficiently characterize the site to support the selection and implementation of any appropriate remedial measures.

The appendices to this report will also present boring logs and well construction details; Quality Assurance Field Audit Reports; Corrective Action Documentation, if any; complete Laboratory Analytical Data Packages in accordance with Exhibit B of the NYSDEC Analytical Services Protocol (ASP); and the HRS Scoring for the site.

SECTION 6 - SAMPLING AND ANALYSIS PLAN

The SAP has been developed to provide the detailed methods by which the site characterization activities will be performed. The SAP consists of both the FSP and the QAPP. The FSP provides a detailed discussion of the sampling activities, analytical methods, and data evaluation procedures which will be implemented to provide the data necessary to meet the sampling objectives of this investigation. The QAPP, which provides a detailed discussion of quality assurance (QA) protocols and procedures to be followed during implementation of this investigation.

6.1 Field Sampling Plan (FSP)

6.1.1 Sampling Objectives

The specific objectives of the sampling activities to be implemented are to:

- Provide data necessary to evaluate the nature and extent of the volatile organic soil contamination associated with the former on-site solvent disposal practices at the GTI site.

- Evaluate the horizontal extent of migration of volatile organic compounds in the overburden materials.

- Evaluate the nature and extent of any volatile organic compounds which may be present in bedrock downgradient of the former GTI solvent disposal area.

- Provide the hydrogeologic data necessary to characterize the subsurface conditions sufficiently to allow for the selection and development of a remediation program.

The NYSDEC has expressed an interest in expanding the scope of this investigation to include the evaluation of other areas of the Griffin Technology site such as the shed at the north end of the property and the ditch adjacent to Route 96. Alternatively, we propose to maintain the scope of this investigation as a focused evaluation of the known area of concern at the site (i.e., the former solvent disposal area). However, should concerns regarding these other areas of the site persist following the conclusion of the initial investigation, supplemental investigation activities may be performed to address any remainnig concerns. Furthermore, the information regarding ground-water flow direction, depth to ground water and hydraulic characteristics of the aquifer in the site vicinity developed through the implementation of this investigation could then be utilized in the development of any necessary additional investigation. Therefore, we believe the focused scope of investigation proposed herein is appropriate and justified.

6.1.2 Sample Location and Frequency

To meet the objectives stated above, the sampling program to be implemented will include the drilling of soil borings, collection and analysis of soil samples, drilling and installation of six monitoring wells, and the performance of hydraulic testing in selected wells.

To evaluate the nature and extent of the soil contamination associated with the former solvent disposal area, a total of nine soil borings (B-1 through B-9) will be drilled in a grid pattern, approximately 20 feet apart, in the vicinity of the former disposal area. The approximate locations of these proposed soil borings are indicated on Figure 2. Each soil boring will be continuously sampled from the ground surface to the top of water table or bedrock, whichever is encountered first. One soil sample from each soil boring will be selected for laboratory analysis. These samples will be selected on the basis of field observations and measurements (i.e., discoloration, odor, photoionization detector readings, etc.). To further characterize the vertical distribution of volatile constituents in the subsurface within the former disposal area, each of the soil samples from the boring drilled in the center of this area, will be submitted for laboratory analyses. This data may be used to augment the data on relative volatile organic content of the soil developed through the photoionization detector (PID) screening of all soil samples collected during the soil boring program.

Blasland & Bouck proposed the installation of six monitoring wells in order to evaluate the presence and extent of volatile organic compounds in ground water, and the direction of ground-water flow across the site. It is assumed that the occurrence of ground water is generally limited to fractured water-bearing zones in the bedrock, with the exception of potentially perched water above the bedrock surface in topographically low areas of the bedrock surface. Reconnaissance of the area indicates that the bedrock slopes north to south in the area adjacent to the disposal area. This assumption, together with the presence of a stream southwest of the site, suggests that ground-water flow may be toward the southwest along the top of rock interface.

Based on our limited understanding of the existing hydrogeologic conditions and the assumptions presented above, the six monitoring wells are proposed to be installed at the locations shown in Figure 2. Five bedrock monitoring wells (RW-1 through RW-5) are proposed for the investigation: one located along the upgradient (eastern) property boundary, one in the immediate vicinity of the disposal area, and three located downgradient of the disposal area. One overburden well is proposed southwest of the disposal area to investigate the possible influence of the slope of the bedrock surface may have on contaminant migration in the overburden. The one overburden well (OW-1) will be installed adjacent to the proposed bedrock well located southwest of the disposal area only if a significant saturated thickness is encountered above the bedrock. A ground-water sample will be collected from each of these six monitoring wells for laboratory analysis. In addition, to further characterize the condition of the overburden soil in the site vicinity, one soil sample will be selected, based on field screening with a PID, from each monitoring well borehole to be submitted for laboratory analysis. The soil sample submitted from the upgradient monitoring well borehole will be utilized to characterize background soil condition.

6.1.3 Sample Designations

Each of the environmental samples collected during the implementation of the FSP will be given a unique sample identification, which will include an identifier for the site, the sampling location, and the depth for soil samples. For example, a soil sample collected from a depth of 1.5 to 2.0 feet in Soil Boring SB-3 at the GTI site would be given the designation SB-3 (1.5-2.0). Similarly, a ground-water sample collected from bedrock Monitoring Well MW-5 would be given the designation GWSMW-5.

6.1.4 Sampling Equipment and Procedures

The soil borings to be performed will be completed using a hollow-stem auger drilling rig. Soil samples will be obtained using a two-inch diameter split-spoon sampler, as detailed in Appendix A. A representative portion of each soil sample will be placed into a glass jar and allow to warm to room temperature. Another representative portion will be placed into a glass jar and stored on ice for possible laboratory analysis. A HNU photoionizing detector with a 11.7 eV lamp will be used to screen the headspace from each soil sample container for volatile organic compounds once warmed to room temperature. Those samples from which volatile organic compounds are detected at 10 ppm, or greater, would be submitted for analysis. If more than one soil sample per boring has volatile organic compounds in excess of 10 ppm, the sample with the highest volatile organic compound concentration, which lies above the water table, will be submitted.

The drilling rig and all downhole equipment associated with drilling and sampling of the soil borings will be steam cleaned prior to drilling each boring. In addition, the split-spoon soil sampler will be decontaminated prior to each sample collection by the following five-step procedure:

- Detergent and tap water wash;
- Tap water rinse;
- Methanol (pesticide grade) rinse;
- Distilled water rinse; and
- Air dry.

All other equipment which comes in contact with the soil samples, such as the stainless steel hand trowels used to transfer soil from the sampler to the laboratory containers, will also be decontaminated prior to each use by the same method.

The rinsate generated through the equipment decontamination activities will be collected in an appropriate container for proper disposal by GTI at the conclusion of the field investigation program.

Wells will be installed by first boring to bedrock refusal using 6¼-inch minimum I.D. hollow-stem augers as detailed in Appendix A. Soil samples will be obtained, where possible, from the overburden deposits using a two-inch diameter split-spoon sampler. A HNU photoionization detector with a 11.7 eV photoionization lamp will be used to screen a portion of each soil sample for volatile organic compounds, after the sample has been permitted to equilibrate to room temperature. The results of these field screening measurements will be used as a basis for selecting soil samples for laboratory analysis.

Bedrock wells will be completed by creating a socket in the bedrock a minimum of five feet deep, and grouting a permanent steel casing into the bedrock in order to seal the well off from the overburden deposits. A NX-sized core barrel will then be advanced into the bedrock to allow for installation of the monitoring well according to the drilling/sampling protocol for rock coring (Appendix A). The bedrock wells will then be completed as open hole wells in accordance with Appendix B and as shown on Figure 3. However, in the event that the fractured zone at the bedrock/overburden interface is found to be saturated at any of the locations at which monitoring wells are proposed, the monitoring well will be constructed such that the top of the saturated zone is straddled by the monitoring well's screened interval.

The overburden well will be installed and screened immediately above the overburden/bedrock interface. The overburden well will have ten feet of two-inch I.D. Schedule 40 PVC screen (0.010-inch slot size) which will straddle the water table, and will be completed as detailed in Appendix C and as shown on Figure 4. The purpose of this well is to determine the ground-water quality in the saturated zone above the bedrock. The adjacent bedrock well will be installed in the upper portion of the bedrock. Comparison of the water quality from each of these wells may enable a determination to be made as to whether the main route of potential transport of organic compounds is via the overburden, the bedrock, or a combination of both routes. A comparison of ground-water levels in these two wells will also be used to establish the hydraulic gradient between bedrock and overburden.

All wells will be protected by a steel surface casing with a locking cap. Each well will also be developed until it yields as much sediment-free water as possible. The NYSDEC has guidelines requiring that all wells be designed, constructed, and developed to yield a water sample that has a turbidity measurement of less than 50 NTU. It will be our goal to achieve this level by using good design and sufficient well development. However, the high concentrations of silt and clay in the overburden often make this an unobtainable goal.

The hydraulic conductivity of the overburden and bedrock aquifer will be evaluated by using a rising head slug test and analyzing the data with the Bouwer and Rice method. Testing and data reduction protocols for this method are included in Appendix D. The slug test entails initially placing a solid slug in the well and monitoring the water levels in the well as it returns to static level. Since the overburden well will be screened above the water table, the Bouwer and Rice analysis will be completed using information from a "rising head" test, where the water levels rise after removing a solid slug from the well. During the hydraulic conductivity test, water level measurements in each monitoring well will be taken using an electric water level probe as rapidly as possible during the first five minutes of the test. Thereafter, readings will be taken approximately every minute, then decreasing in frequency with time until the static level has been reached or 30 minutes, whichever occurs first.

The elevation of the measuring point (top of PVC riser) will be obtained for each well relative to a common datum or benchmark, if available. The location of each well relative to a permanent structure on-site will also be obtained. After the wells have been allowed to equilibrate, water level elevations will be obtained in accordance with Appendix E. Each of the monitoring wells will also be checked with an interface probe for the presence of any immiscible layers. The ground-water flow direction will then determined based on the ground-water elevations measured in the monitoring wells. Following the round of water level measurements, the ground-water monitoring wells will be sampled according to the protocols described in Appendix F.

6.1.5 Sample Handling and Analysis

Each of the soil samples collected during drilling program will be screened for possible laboratory analyses. Therefore, each soil sample will be collected, handled, and stored as if it were to be analyzed, even though only selected soil samples will be submitted for laboratory analysis. Upon each retrieval, the split-spoon sampler will be opened and a representative sample of the lowest six-inch section of the interval sampled will be placed directly into a laboratory-provided sample container using a stainless steel spatula or trowel. Care will be taken not to include soil which has been in contact with the walls of the sampler, if possible. Immediately after collection, each soil sample will be labeled with the following information and placed in a cooler to be held at a temperature of approximately 4°C until delivery to the laboratory:

- sample designation;
- site name;
- sampling point;
- job number;
- date;
- time; and
- name of person collecting sample.

Each sample will be tracked by means of a Chain-of-Custody form (Figure 5), which will be initiated at the time of sample collection and will be maintained with the sample until delivery to the laboratory.

Laboratory analytical services associated with this program will be provided by Galson Laboratories of East Syracuse, New York. All of the soil samples collected for laboratory analysis will be analyzed for Target Compound List (TCL) Volatile Organic Compounds (VOCs) by Method 89-1 (NYSDEC 1989 ASP). In addition, two of the soil samples collected from the borings in the former disposal area will also be analyzed for TCL Base/Neutral/Acid Organic Compounds (BNAs) by Method 89-2 (NYSDEC 1989 ASP) and TAL Metals by 200 series CLP-M Methods (NYSDEC 1989 ASP). The results of these additional analyses may then be used to demonstrate whether volatile organic compounds are the only parameters of concern associated with the former disposal area. To establish background concentrations in the soil at the site, the soil sample collected for laboratory analysis from the upgradient monitoring well borehole will be analyzed for TCL VOCs, BNAs, and inorganics. However, we believe that site-specific cleanup criteria for the soil, protective of both human health and the environment may be developed by utilizing an approach similar to that adopted by the NYSDEC Division of Water and Division of Solid Waste for dealing with petroleum hydrocarbon contaminated soil. This approach is based on the establishment of concentration limits in soil above which constituents of concern could leach into the ground water at concentrations exceeding ground-water or drinking water standards.

Ground-water samples will be poured directly from the stainless steel, bottom-fill, bailer into the laboratory-provided glass, screw-top sample container(s) with teflon septa, which are to have been labeled with the same information as the soil samples. Immediately following placement of the sample into the appropriate containers, any necessary sample preservation methods will be performed and the samples will be placed in a cooler to be maintained at a temperature of approximately 4°C until delivery to the laboratory. Each ground-water sample will also be tracked from the time of collection through delivery at the laboratory by means of completing and maintaining a chain-of-custody form with the sample.

All of the ground-water samples collected for analysis will be analyzed for TCL VOCs. In addition, the ground-water sample collected from the well to be installed immediately downgradient of the former disposal area will also be analyzed for TCL BNAs and TAL Metals. The well located adjacent to the former disposal area will probably represent the worst case conditions for ground water at the site. Therefore, this sample may be used to identify the presence of any additional parameter beyond the volatile organic constituents already known to be present at the site. Should additional parameters of concern be identified, they could be included as target compounds for future investigation.

The overall analytical program which we propose to implement is summarized in Table 1. Each of the proposed sampling locations are indicated on Figure 2.

6.2 Quality Assurance Project Plan (QAPP)

The following QAPP describes the policy, organization, functional activities, and quality assurance and quality control (QA/QC) protocols necessary to meet the objectives of this project. A detailed project description including the overall project objectives, site background and setting, and an initial evaluation of the site conditions, is presented in at the site as is practical, given our current understanding of the background regarding the site. Although further investigative actions may be required to complete the evaluation of the site, the proposed program of soil and ground-water investigations at the site provides for a reasonably complete investigation for the potential concerns which may be anticipated at this time.

The sampling methods to be utilized during this investigation have been designed to provide for the collection of samples which are representative of the soil and ground-water conditions existing in the investigated areas. These methods are described in detail in the FSP presented in Section 6.1 of this Work Plan.

6.2.2 Sample Blanks and Duplicates

6.2.2.1 General

As part of our data validation program, several QA/QC samples will be prepared and collected. Three types of QA/QC samples will be prepared or collected: 1) trip blanks; 2) field (field rinsate) blanks; and 3) duplicate samples. The QA/QC samples are discussed in more detail below.

6.2.2.2 Trip Blanks

The primary purpose of a type of blank is to detect additional sources of contamination that may potentially influence compound concentration values reported in actual samples both quantitatively and qualitatively. Trip blanks serve as a mechanism of control on sample bottle preparation and blank water quality, as well as

Sections 1, 2, and 3 of this Work Plan. A discussion of the project management and staffing, including the assignment of responsibilities associated with implementation of this project, is presented in Section 9 of this Work Plan. Sampling procedures, sample custody, and analytical procedures are addressed in the FSP (Section 6.1).

6.2.1 Quality Assurance Objectives for Measurement

The overall objective of this QAPP is to provide a mechanism for control and evaluation of the quality of data to be acquired throughout the course of the Phase II Investigation for GTI's Victor, New York facility.

The environmental quality data to be generated will be utilized to characterize site conditions and to evaluate the nature and extent of volatile organic compounds, if any, associated with the former on-site solvent disposal activities. If necessary, this information will also be used to evaluate the need for remedial measures, as well as to assist in identifying appropriate remedial actions. The analytical methods utilized to quantify contaminant levels will conform with the requirements of NYSDEC September 1989 A.S.P. The specific laboratory QA guidelines are detailed in the laboratory's Standard Operating Procedures (SOP) Manual. The QA data and audit results generated in conformance with this plan will be used to evaluate the precision and accuracy of measured values generated through the implementation of this program.

The completeness of the program proposed is also a crucial QA objective. Therefore, the SAP has been carefully designed to provide the basis for as complete an evaluation of the environment concerns sample handling. The trip blank travels to the site with the empty sample bottles and back from the site with the collected samples in an effort to simulate sample handling controls. Contaminated trip blanks may indicate inadequate bottle cleaning or that the water used to prepare the blank was of questionable quality. The following have been identified as potential sources of contamination:

- laboratory reagent water;
- sample containers;
- cross-contamination in shipment;
- ambient air or contact with analytical instrumentation during preparation and analysis of the laboratory; and
- laboratory reagents used in analytical procedures.

A trip blank consists of a set of sample bottles filled at the laboratory with laboratory demonstrated analyte-free water. This water must originate from one common source and physical location within the laboratory, and must be the same water as the method blank water used by the laboratory performing the analysis. Trip blanks should be handled, transported, and analyzed in the same manner as the samples acquired that day, except that the sample containers themselves are not opened in the field. Rather, they must travel with the sample collector. Individual sample matrices and associated blanks must be packaged in separate sample shuttles prior to shipment back to the lab. Trip blanks must return to the lab with the same set of bottles they accompanied to the field.

Trip blanks will be prepared and analyzed at a rate of one per day per matrix. The trip blanks will be analyzed only for volatile organic parameters specified for the environmental samples collected that day.

6.2.2.3 Field Blanks (Field Rinsate Blanks)

The primary purpose of this type of blank is to provide an additional check on possible sources of contamination beyond that which is intended for trip blanks. A field blank serves the same purpose as a trip blank, and is also used to indicate potential contamination from ambient air (field blank) and from sampling instruments used to collect and transfer samples from point of collection into sample containers (field rinsate blank).

A field blank is conducted using two identical sets of laboratory-cleaned sample containers. One set of containers is empty and will serve as the sample containers to be analyzed. The second set of containers are filled at the laboratory with laboratory demonstrated analyte-free water. This water must originate from a common source and physical location within the laboratory, and must be the same water as the method blank water used by the laboratory performing the analysis. Field blanks should be handled, transported, and analyzed in the same manner as the samples acquired that day. At the field location, in the most contaminated area, this analyte-free water is passed through clean sampling equipment and placed in the empty sample container for analysis. (Note: it may be necessary for the lab to provide extra, full volatile organics vials to ensure sufficient volume of blank water to eliminate headspace). The reason for performing field blanks in the most contaminated area is to attempt to simulate a worst case scenario regarding ambient air contributions to sample contamination. Field blanks must return to the lab with the same set of sample bottles they accompanied to the field. Field blanks must be packaged with their associated matrix.

The purpose of a field blank is to place a mechanism of control on sample handling, storage, and shipment. The field blank travels and is stored with the samples, and is thereby representative of effects on sample quality. By being opened in the field and transferred over a cleaned sampling device (where applicable), the field blank is also indicative of ambient conditions and/or equipment conditions that may potentially affect the quality of the associated samples.

Field blanks will be collected and analyzed at a rate of one per day per matrix. The field blanks will be analyzed for the same chemical parameters specified for the environmental samples collected that day.

6.2.2.4 Duplicate Samples

Collection of duplicate samples provides for the evaluation of the laboratory's performance by comparing analytical results of two samples from the same location. Duplicate samples are to be included for each matrix at a minimum rate of five percent. If less than 20 samples are taken during a particular sampling event, then one duplicate should be performed.

a. Aqueous Matrix - Duplicates of water samples will be obtained by alternately filling sample containers from the same sampling device for each parameter. Samples for volatile organics analysis from monitoring wells will be filled from the same bailer full of water whenever possible, and will be the first set of containers filled. When the other sampling devices are used, the vials for volatile organics should be alternately filled.

b. Non-Aqueous Matrix - Obtaining duplicate samples in a soil or sediment matrix would normally require homogenization of the sample aliquot prior to filling sample containers. However, volatile organic samples must always be taken from discrete locations or intervals prior to compositing or mixing the sample. This practice is necessary to prevent loss of volatile constituents and to preserve, to the extent practicable, the physical integrity of the volatile fraction. Therefore, as only volatile organics are to be analyzed for, homogenization of the soil sample will be performed.

6.2.3 Calibration Procedures and Preventive Maintenance

Prior to the initiation of the field investigation, a preventive maintenance and calibration program will be implemented to assure proper operation of field instruments. Members of the field team will

Performance audits will be performed once the measurement systems are operational and initially generating measurement data. The QA Officer will plan, schedule, and approve system and performance audits based on company procedures customized to the project requirements. The field audits will be performed at the beginning of the various task, such as well installation, well sampling, soil sampling, etc. Additional unannounced audits may be performed as deemed necessary by the QA Officer. These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). At times, the QA Officer may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have participated in, or have responsibility for, the direct work associated with the performance audit.

Audit reports will be written by the auditor(s) after gathering and evaluating all resultant data. Items, activities, and documents determined by auditors to be in non-compliance shall be identified at exit interviews conducted with the involved management. Non-compliances will be logged, documented, and controlled through audit findings, which are attached to and a part of the Integral Audit Report. These audit finding forms are directed to project management to satisfactorily resolve the non-compliance in a specified and timely manner. All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QA Officer prior to being issued. QA verification of acceptable resolutions may be determined by a re-audit or documented surveillance of the item or activity. Upon be familiar with the maintenance, calibration, and operation of field equipment, and will perform the prescribed field operating procedures outlined in the operation manuals accompanying each instrument.

The pH and conductivity meters, as well as the air monitoring devices, will be calibrated during each day's use according to manufacturer instructions and recommended frequency. Calibration records for each instrument utilized will be maintained in the project QA files.

6.2.4 Data Validation

All laboratory analytical data generated through the implementation of this investigation will be submitted for independent data validation in accordance with the following guidance documents:

- "Functional Guidelines for Evaluation of Inorganic Data" (EPA - Region 2).

- "Functional Guidelines for Evaluation of Organic Analyses" Technical Directive Document No. HQ-8410-01 (USEPA).

6.2.5 Performance and System Audits

QA audits are performed under the direction and approval of the Quality Assurance Officer (QA Officer). Performance audits will be conducted to determine the accuracy and implementation of the measurement system(s) and parameter(s). The QA Officer, or assigned alternate, will exercise planned and scheduled performance audits with the understanding that unplanned audits may also be implemented.

verification acceptance, the QA Officer will close out the audit report and findings.

It is the Project Director's overall responsibility to ensure that all corrective actions to resolve audit findings are acted upon promptly and satisfactorily.

6.2.6 Corrective Action Procedures

The following procedures have been established to assure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

When a significant condition adverse to quality is noted at the site, laboratory, or subcontractor locations, the cause of the condition will be determined and corrective action taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the site investigation team leader, project manager, task leaders, QA Officer, and involved subcontractor management, as a minimum. Implementation of correction action is verified by documented follow-up by the QA Officer. All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions may be initiated, as a minimum:

when:

- predetermined acceptance standards are not attained;

- procedures are determined to have deviated from those prescribed by this Work Plan;
- equipment or instrumentation is found faulty;
- sample custody procedures are violated;
- QA requirements have been violated;
- designated approvals have been circumvented;

or

- as a result of performance audits;
- as a result of a management assessment;
- as a result of laboratory/interfield comparison studies.

<u>Procedure Description</u> - Project management and staff, such as field investigation teams, QA auditors, document and sample control personnel, and laboratory groups, monitor ongoing work performance in the normal course of daily responsibilities.

Work is audited at the site, laboratories, and subcontractor locations by the QA Officer or designated auditors. Items, activities, or documents ascertained to be in non-compliance with QA requirements will be documented and corrective actions mandated through audit finding sheets attached with the audit report. Audit findings are logged, maintained, and controlled by the QA Officer.

The Corrective Action Request (CAR) identifies the adverse condition, reference document(s), and recommended corrective action(s) to be administered. The issued CAR is directed to the responsible management in charge of the item or activity for action. The individual to whom the CAR is addressed returns the requested response promptly to the QA Officer, affixing his signature and the date to the corrective action block, after stating the cause of the conditions and the corrective action to be taken. The QA Officer maintains the log for status control of CARs and responses, confirms the adequacy of the intended corrective action, and verifies its implementation. The QA Officer will issue and distribute CARs to specified personnel, including the originator, responsible project management involved with the condition, the Project Manager, and the involved subcontractor, as a minimum. CARs are transmitted to the project file for the records.

6.2.7 Quality Assurance Reports

Effective management of a field sampling and analytical effort requires timely assessment and review of field activities. This will require effective interaction and feedback between the field team members, the task leader, and the Project Manager.

The task leader will keep the Project Manager up-to-date regarding potential quality control problems so that a quick and effective solution can be implemented. Topics they may address include:

- summary of activities and general program status;
- summary of calibration data;
- summary of unscheduled maintenance activities;
- summary of corrective action activities;
- status of any unresolved problems;
- assessment and summary of data completeness; and
- summary of any significant QA/QC problems and recommended and/or implemented solutions not included above.

The auditor(s) will prepare audit reports following the performance and systems audits which will address data accuracy and the qualitative assessment of overall system performance. This report will be submitted to the Project Director, Project Manager, task leaders, and field team leaders. The project final report will include a separate QA section which summarizes the audit results, as well as the QA data collected throughout the duration of the program.

Problems requiring swift resolution will be brought to the immediate attention of the Project Manager and Project Director.

SECTION 7 - SCHEDULE

The overall schedule to implement the Phase II investigation detailed within this Work Plan is anticipated to require a total of 18 weeks from receipt of authorization to proceed through submission of the draft report. This schedule includes: two weeks for mobilization of the field program, four weeks for completion of the field investigation activities, eight weeks for laboratory analysis and data validation, and four weeks for evaluation of the results and report preparation. This tentative schedule is illustrated on Figure 6.

SECTION 8 - PROJECT ORGANIZATION

This section describes the method by which Blasland & Bouck Engineers, P.C., will organize the project team. In addition, the specific responsibilities of the key project personnel are identified.

The project management team established for this project will consist of Tyler E. Gass, C.P.G., Project Director; George M. Thomas, QA Officer; and William T. McCune, Remedial Investigation Coordinator. Mr. Gass will have overall responsibility for the project. Mr. McCune will maintain specific responsibility for managing and coordinating the day-to-day aspects of the Phase II investigation. Mr. McCune will be assisted in the implementation of the investigation by Ms. Lisa A. Ryan, Project Geologist. Further assistance and support will be provided by members of the staff as needed for the successful completion of this project.

The overall project organization is illustrated on Figure 7.

TYLER E. GASS, C.P.G., PHg
VICE PRESIDENT

PROFESSIONAL HISTORY

Mr. Gass has over 16 years of experience in the areas of ground-water monitoring, remedial investigations, and corrective action programs at hazardous waste sites. He was formerly the President of Bennett, Gass & Williams and Director of Research for the National Water Well Association.

EDUCATION

MS/Geosciences, 1977, University of Arizona
BA/Geology, 1970, State University of New York at Buffalo

PROFESSIONAL REGISTRATIONS

Certified Professional Geologist
Professional Hydrogeologist

PROFESSIONAL AFFILIATIONS

National Water Well Association (Director of the Association of Ground-Water Scientists and Engineers)
American Water Works Association
American Association of Petroleum Geologists
American Society of Testing and Materials
American Institute of Professional Geologists
American Institute of Hydrology

EXPERIENCE

Supervised a comprehensive environmental program at a 30,000 bbl/day refinery in Wyoming. Following the assessment of hydrocarbon migration, he designed a product recovery system and coordinated all hydrogeologic and engineering activities.

Principal investigator for the evaluation of previous hydrogeologic work performed to define the vertical and horizontal extent of 2, 3, 7, 8 - TCDD (dioxin) migration in the ground water and vadose zone beneath a manufacturing facility.

Responsible for the coordination of the activities of several consulting firms performing investigations at a hazardous waste facility and for the preparation of the facility's RCRA Ground-Water Quality Assessment Monitoring Program. Also served as the company's Consultant of Record for all meetings with the State and Federal regulatory agencies.

Directed a program to delineate other local potential sources of TCE-contamination causing ground-water degradation at a Pennsylvania aluminum manufacturing facility. Initiated this project on the belief that existing data was inconclusive and that additional work was necessary to determine other possible sources before the client committed to a costly remediation program.

Ground-water resource evaluations and water well design, construction supervision and testing throughout the United States. Recognized expert and principal author of a textbook on water well maintenance and rehabilitation.

Extensive experience evaluating various types of hydrocarbon spills and leaks, and designing and installing product recovery systems.

Contaminant containment and aquifer restoration involving landfill leachate, petroleum products, brine and hazardous wastes from facilities throughout the United States. Designed ground-water monitoring systems and aquifer restoration programs for designated Superfund facilities.

As the Director of Research for the National Water Well Association, was involved in the establishment of emerging programs, expansion of research facilities and pursuit of new areas of investigation, proposal preparation, acquistion of funding, project management and direction of the entire Research Facility staff.

As a hydrogeologist, performed investigations which included water resources evaluations, ground-water recharge studies, wastewater treatment designs, monitoring of leachate migration from sanitary landfills, natural resource inventories and environmental impact studies. Duties ranged from project design and field analysis to interpretation of data and writing of reports.

Expert witness for industries on litigation involving ground-water law, ground-water contamination, aquifer restoration and mineral resource development.

Hydrogeologic investigations for siting of sanitary and hazardous waste landfills in California, Ohio, New York, Arizona, Florida and Virginia.

Participation and public speaking at seminars, symposia and community/public events. Lectured at California Institute of Technology, Columbia University, Ohio State University, University of Wisconsin and Louisiana State University. In addition, hired as adjunct professor of Hydrogeology at Wright State University, Ohio, teaching a summer program on Ground-Water Monitoring and Aquifer Restoration.

Provided assistance to federal, state and local ground-water officials developing ground-water regulations; technical assistance to contractors and consultants; expert testimony for litigation involving ground water.

As technical editor, prepared and reviewed technical articles for Ground Water Monitoring Review, Ground Water Heat Pump Journal and Water Well Journal.

As special consultant to the U.S. Agency for International Development Water and Sanitation for Health Program, provided rural water supply development and ground-water resource evaluation, technical assistance, development of training materials and instruction in Liberia, Nigeria, Jordan and the Philippines.

As a geologist for the City of Tucson (Arizona) Department of Water and Sewers, performed work consisting of analyzing well cutting and interpreting borehole geophysical logs to determine the production capabilities of water wells. Data derived from wells were used in planning future ground-water development.

Special advisor to the U.S. Environmental Protection Agency for preparation of a Technical Enforcement Guidance Document to address ground-water monitoring for RCRA facilities.

PUBLICATIONS

Published articles on diversity of hydrogeologic subjects, involving water well technology, ground-water geology, ground-water pollution, waste disposal and water-to-air heat pump technology.

Ground Water Monitoring for Corrective Action Activities, Proceedings of the National Solid Waste Management Association Technical Conference, Chicago, Illinois, 1986.

Manual of Water Well Maintenance and Rehabilitation Technology, Gass, T. E., C.P.G.S., et al. Water Well Journal Publishing Co. 1980.

Domestic Water Treatment, Lehr, Gass, C.P.G.S., Pettyjohn and DeMarre. McGraw-Hill, New York. 1980.

Preliminary Study of the Potential of Utilizing Underground Water as an Energy Source for Heat Pumps for Use in Heating and Cooling Domestic and Industrial Buildings, Gass, T. E., C.P.G.S. 1976.

Impact of Abandoned Wells on Ground-Water Quality, Gass, T. E., C.P.G.S., U.S. Environmental Protection Agency. 1976.

A more extensive list of approximately 100 publications can be supplied upon request.

PRESENTATIONS

Mr. Gass is frequently requested to participate in conferences and seminars, as well as many short courses throughout the United States. His reputation as an expert on water well technology, ground-water science and aquifer restoration is world-wide. Several universities, professional associations, and state and federal agencies retain Mr. Gass as a short-course instructor. During his 15 year professional career, Mr. Gass has made several hundred technical presentations. A partial list is available upon request.

PROFESSIONAL HISTORY

Mr. McCune has over six years experience in the environmental and waste management fields as a geologist/hydrologist, supervisor and project manager involving: the New Jersey Environmental Clean-up and Responsibility Act (ECRA); the federal Clean Water Act (CWA); the National Pollutant Discharge Elimination System (NPDES) program, the federal Resource Conservation and Recovery Act (RCRA); the New Jersey Underground Storage Tank (UST) program; and the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA-Superfund).

EDUCATION

BS/Geoscience, 1983, Hobart College

PROFESSIONAL AFFILIATIONS

Sigma Xi-Tha Scientific Research Facility

EXPERIENCE

Development of UST Management Plan, for adhesive manufacturing plant, New Jersey.

Development and implementation of numerous site investigations and geohydrologic investigations for industrial, manufacturing, and commercial facilities throughout New Jersey required under New Jersey ECRA regulations

Assisted in the development of a RCRA closure plan for a land farm facility in Westville, New Jersey; developed and managed the implementation of the NJPDES monitoring program associated with this RCRA facility closure.

Developed a comprehensive soil clean-up program for a manufacturing facility in Roseland, New Jersey involving the excavation and on-site solvent extraction treatment of soil contaminated with TCE, waste oils and PCBs.

Developed comprehensive soil remediation plan for a facility in northern New Jersey involving on-site slurry-phased biological treatment of soil contaminated with cutting oils, hydraulic oils, and xylenes. Also assisted in the development of the treatability study associated with finalizing remediation plan specifications.

Development and implementation of a three-phased site investigation and remediation project required under New Jersey Superfund program. Responsibilities included presenting each phase of the investigation results to the numerous PRPs involved and developing plans for subsequent investigation and remediation phases acceptable to all PRPs as well as acceptable to the NJDEP.

Principle Field Investigator for soil and ground-water contamination investigations performed for the U.S. Air Force as part of their Installation Restoration Program. Project assignments included Air Force bases in Anchorage and Fairbanks, Alaska, as well as Chicago, Illinois.

Principle Field Investigator for a ground-water investigation of a large electronics manufacturing facility in Kingston, New York. Assisted in the development and costing of the ground-water recovery systems utilized to remediate this site.

Project Manager for several ECRA site investigation and remediation projects in Northern and Central New Jersey. Project assignments included a lock manufacturing facility in Garfield, New Jersey; a pigment manufacturing facility in Garwood, New Jersey; and an aeronautical manufacturing facility in Wood Ridge, New Jersey.

LISA A. RYAN
SENIOR PROJECT GEOLOGIST

PROFESSIONAL HISTORY

Ms. Ryan has extensive experience in the areas of ground-water monitoring, well installation and sampling, topographic surveys and geophysical techniques.

EDUCATION

BS/Geology, 1984, Southampton College of Long Island University

PROFESSIONAL AFFILIATION

National Water Well Association

EXPERIENCE

Special Expertise: Petroleum recovery system design; geophysical techniques (electrical resistivity, seismic and electromagnetic surveying); ground-water monitoring system design and installation; data organization and management.

Technical: Served as principal investigator and author of 12 NYSDEC Phase I Reports. Generated hazard ranking scores and formulated recommendations for future remedial work.

Served as a principal investigator active in all phases of a remedial investigation/feasibility study at a Superfund site. Activities included literature review and research, generation of geologic structure maps, field supervision of drilling operations, analysis of contaminant migration trends, and final report production.

Evaluated distribution of PCBs in river bottom sediments at a Superfund site to develop conclusions regarding probable source.

Developed fuel oil recovery plans at six spill locations utilizing data collected during step drawdown pump testing.

Devised a pumping schedule and plan to maximize the effect of a group of existing product recovery wells which had exhibited a dramatic decrease in efficiency.

Sampled lagoon berm soils to establish extent of "hazardous" material to be removed during closure.

Sampled ground-water for Appendix IX parameters at an industrial site to fulfill assessment monitoring requirements.

Conducted initial site reconnaissance at a suspected hazardous waste site, developed protection criteria for site workers and conducted follow-up soil sampling program.

Evaluated potential liability associated with the purchase of land for a radar installation.

Reduction and editing of aerial magnetic data.

Interpretation of geomagnetic and seismic survey results on a regional scale to establish subsurface structural trends.

PROFESSIONAL HISTORY

Mr. Thomas has over six years of experience in the management and implementation of hazardous and industrial waste disposal site investigations, petroleum contamination studies, geologic mapping, geophysical survey techniques, and ground-water, surface water, and soil sampling.

EDUCATION

MS/Geology, 1984, University of Massachusetts/Amherst
BS/Geology, 1979, Lehigh University

PROFESSIONAL AFFILIATIONS

Geological Society of America
National Water Well Association

EXPERIENCE

Technical: Managed and implemented numerous environmental evaluations of existing or former industrial facilities in New York. Responsibilities included preparation of work plans, QAPPs, health and safety plans, report preparation, monitoring well installation in rock and soils, and conduct and oversight of numerous geophysical survey techniques.

Coordination and implementation of site investigations at numerous active or former gasoline stations. Investigations included soil gas sampling, indoor air monitoring, monitoring well installation, and ground-water and surface water sampling.

Development of a remedial alternative design capable of recovering four to five mgd of ground water contaminated with inorganic constituents.

Coordination of remedial design programs for hydrocarbon contamination sites, including development of a ground-water recovery system design.

Implementation of an on-site sampling and analysis program in conjunction with a lead-contaminated soils removal program.

Coordination and implementation of numerous hazardous materials site evaluation studies in New York, Massachusetts, Missouri, and Michigan.

Evaluation of impacts associated with waste beds covering more than a square mile in central New York. Tasks included historical documentation, aerial photo interpretation, mapping, monitoring well installation, ground-water and surface-water sampling, and aquifer analysis.

Collection and evaluation of data pertaining to the potential on-site and off-site impacts of landfills in Reading and Lexington, MA. Included installation and monitoring of ground-water and combustible gas wells.

Evaluation of data from remedial action programs at oil and solvent contamination sites in northeastern Massachusetts. Work efforts included monitoring well installation, and soil and ground-water sampling.

Data acquisition and evaluation of remedial action alternatives at a metal finishing facility responsible for a release of hazardous materials, principally cyanide.

Evaluation of potential environmental impacts from leather tanneries in New England. Included monitoring well installation, ground-water sampling, and historical research.

PUBLICATIONS

Correlation and Interpretation of Paleomagnetic Directions Derived from Late Wisconsinan Till and Varves of the Connecticut Valley. Thomas, G., M. Transactions, American Geophysical Union, 1983.

PRESENTATIONS

Sedimentation in a Proglacial Lake: Glacial Lake Hitchcock. Ashley, G. M., Thomas, G. M., Retelle, M. J., and Hartshorn, J. H. Presented at 74th Annual New England Intercollegiate Geologic Conference, 1982.

SECTION 9 - REFERENCES

Interpretative Soils Report, Ontario County; February 1978. Ontario County Environmental Management Council.

Lawrence, V. Rickard and Donald W. Fisher; March 1970. "Geologic Map of New York State, Fingerlakes Sheet."

NYSDEC ORB-5; Leslie S. Crain; 1974. "Ground Water Resources of the Western Oswego River Basin, New York."

USEPA/540-G-891/004; October 1988. "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final".

Tables

TABLE 1

SUMMARY OF PROPOSED ANALYTICAL PROGRAM

SAMPLE ID	SAMPLE LOCATION	SAMPLE DEPTH (Feet)	ANALYTICAL PARAMETERS	NYSDEC ANALYTICAL METHODS
Soil Samples				
SSB-1	Soil Boring SB-1	TBD	TCL VOC	89-1
SSB-2	Soil Boring SB-2	TBD	TCL VOC	89-1
SSB-3	Soil Boring SB-3	TBD	TCL VOC	89-1
SSB-4	Soil Boring SB-4	TBD	TCL VOC	89-1
SSB-5A	Soil Boring SB-5	0-2	TCL, VOCs, BNAs, Metals	89-1, 89-2, 200 Series CLP-M
SSB-5B	Soil Boring SB-5	2-4	TCL, VOCs	89-1
SSB-5C	Soil Boring SB-5	4-6	TCL, VOCs	89-1
SSB-5D	Soil Boring SB-5	6-8	TCL, VOCs	89-1
SSB-5E	Soil Boring SB-5	8-10	TCL, VOCs	89-1
SSB-6	Soil Boring SB-6	TBD	TCL, VOCs	89-1
SSB-7	Soil Boring SB-7	TBD	TCL, VOCs	89-1
SSB-8	Soil Boring SB-8/MW-2	TBD	TCL, VOCs, BNAs, Metals	89-1, 89-2, 200 Series CLP-M
SSB-9	Soil Boring SB-9	TBD	TCL, VOCs	89-1
SMW-1	MW-1	TBD	TCL, VOCs, BNAs, Metals	89-1
SMW-3	MW-3	TBD	TCL, VOCs	89-1
SMW-4	MW-4	TBD	TCL, VOCs	89-1
SMW-5S	MW-5S	TBD	TCL, VOCs	89-1
SMW-5D	MW-5D	TBD	TCL, VOCs	89-1
GROUND-WATER SAMPLES				
GWSMW-1	MW-1	N/A	TCL, VOCs	89-1
GWSMW-2	MW-2	N/A	TCL, VOCs, BNAs, Metals	89-1, 89-2, 200 Series CLP-M
GWSMW-3	MW-3	N/A	TCL, VOCs	89-1
GWSMW-4	MW-4	N/A	TCL, VOCs	89-1
GWSMW-5S	MW-5S	N/A	TCL, VOCs	89-1
GWSMW-5D	MW-5D	N/A	TCL, VOCs	89-1

Notes
TBD = To be determined
TCL = Target Compound List
VOCs = Volatile Organic Compounds
BNAs = Base/Neutral/Acid Organic Compounds
N/A = Not applicable

TABLE 2

SAMPLE HANDLING AND ANALYSIS SUMMARY

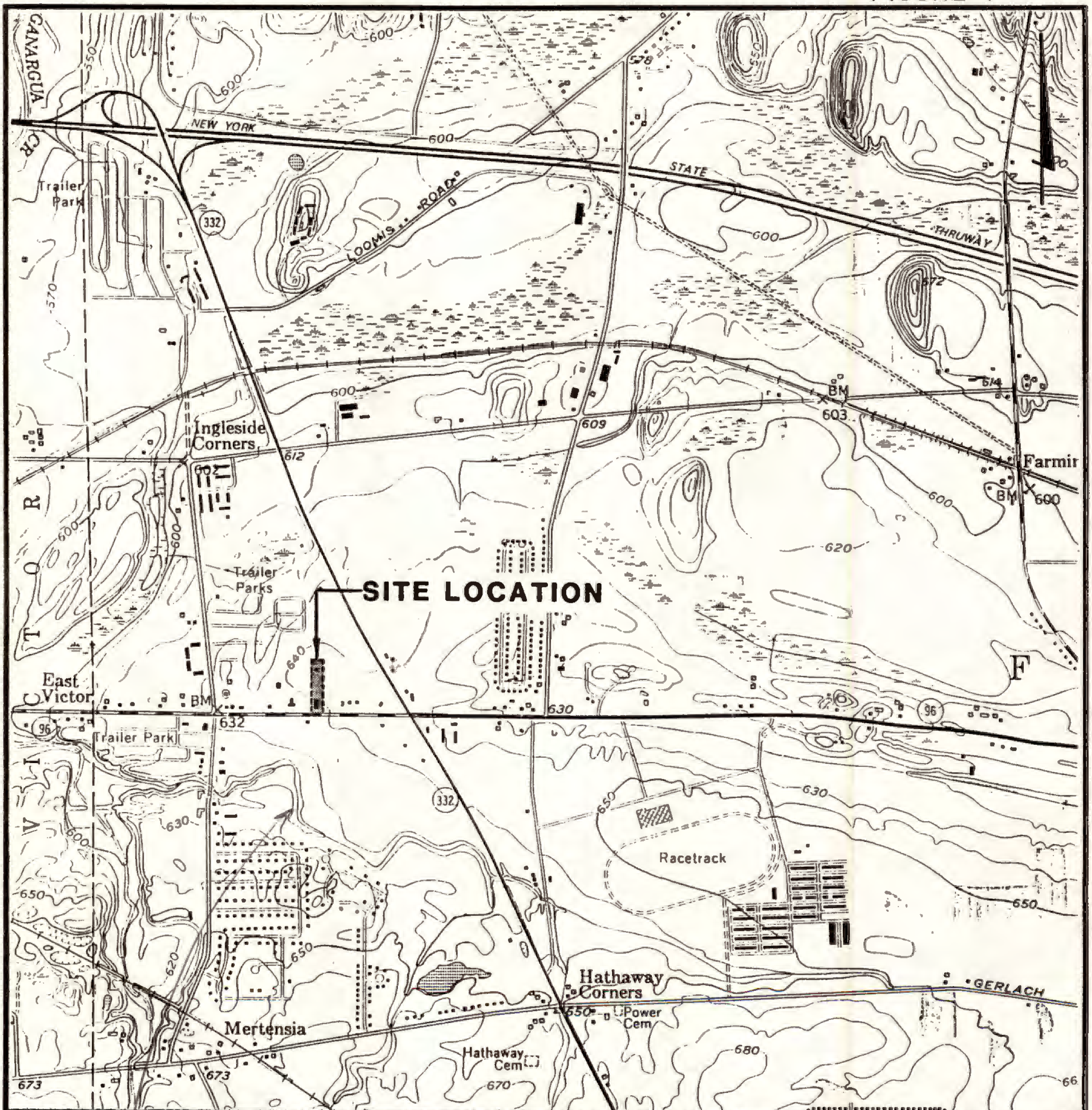
Parameter	Container	Preservative	Holding Time
TCL Volatiles:			
Aqueous	2 - 40 ml glass/Teflon septa	Store at 4°C	7 days
Solids	2 - 40 ml glass/Teflon septa	Store at 4°C	14 days
TCL Semi-Volatiles:			
Aqueous	1 - 1 liter glass/Teflon liner	Store at 4°C	7 days to extraction/ 40 days to analysis
Solids	1 - wide-mouth glass pint/ Teflon liner	Store at 4°C	7 days to extraction/ 40 days to analysis
TCL Metals:			
Aqueous	Glass pint/plastic lid	HNO_3 to pH=2, Store at 4°C	28 days
Solids	2 oz. glass/plastic lid	Store at 4°C	28 days

Note:

The analytical method used to perform sample analysis will be in accordance with NYSDEC September 1989 Analytical Services Protocol.

Figures

FIGURE 1



GRIFFIN TECHNOLOGY INC.
VICTOR, NEW YORK

Beaver Creek
Class C

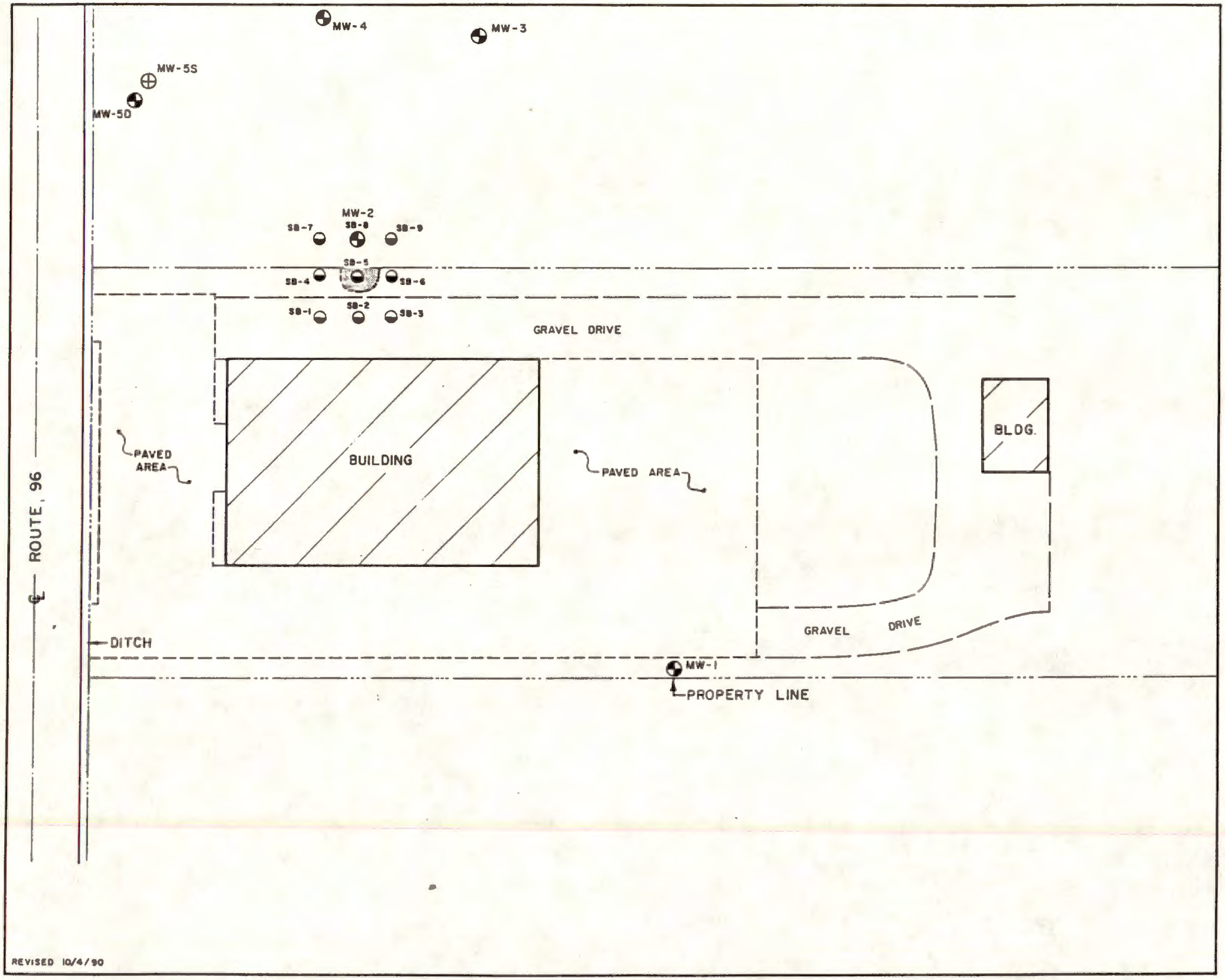
SITE LOCATION MAP

RECEIVED
JAN 30 1991
HAZ WASTE REM.
D.E.C. REG. #8

SCALE
2000' 0 2000'

BLASLAND & BOUCK ENGINEERS, P.C.
ENGINEERS & GEOSCIENTISTS

FIGURE 2



LEGEND

APPROXIMATE LOCATION OF FORMER DISPOSAL AREA

PROPOSED SOIL BORING LOCATION

PROPOSED OVERBURDEN MONITORING WELL LOCATION

PROPOSED BEDROCK MONITORING WELL LOCATION

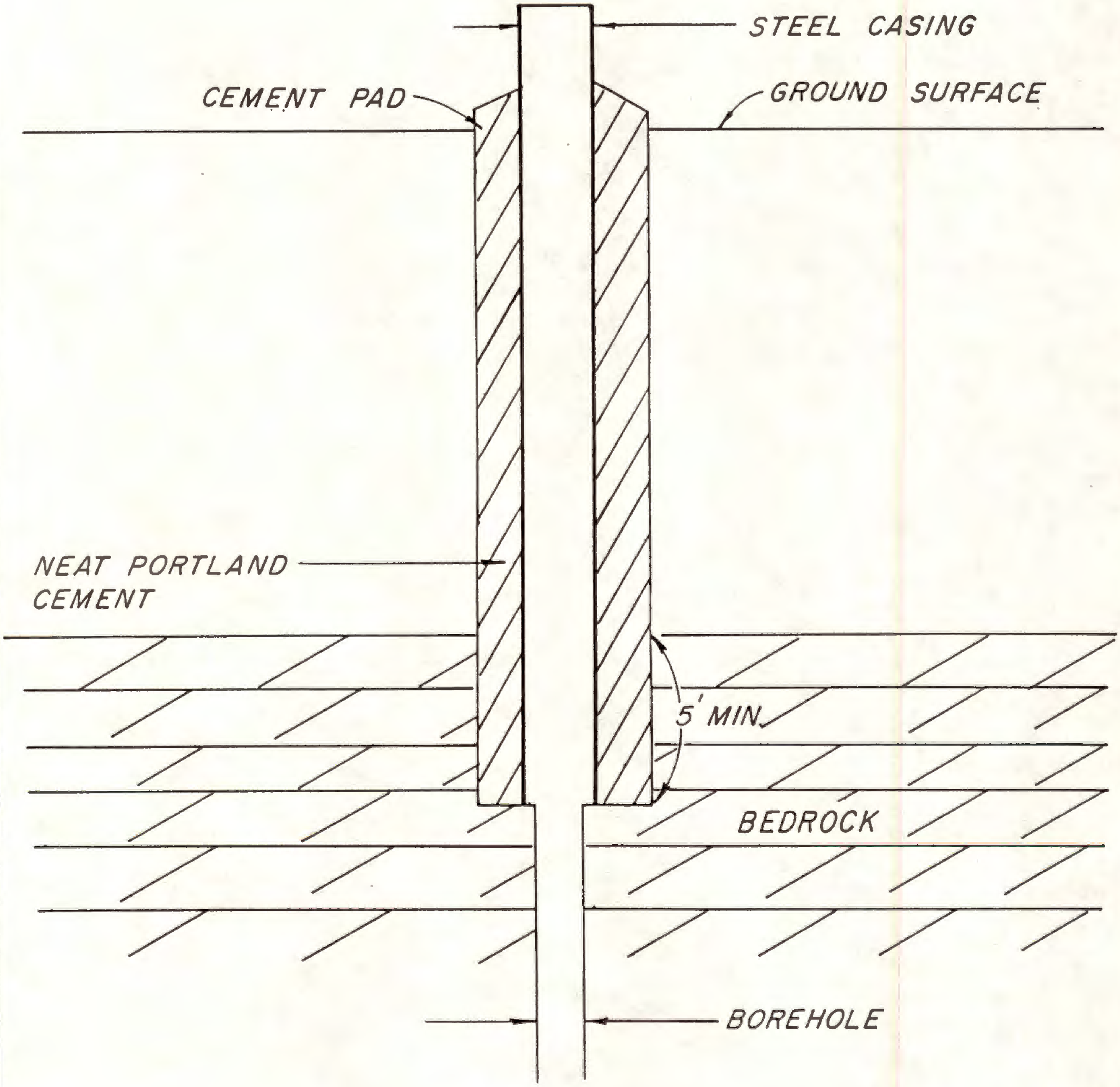
GRIFFIN TECHNOLOGY INC.
VICTOR, NEW YORK

PROPOSED SOIL BORING AND MONITORING WELL LOCATIONS

SCALE

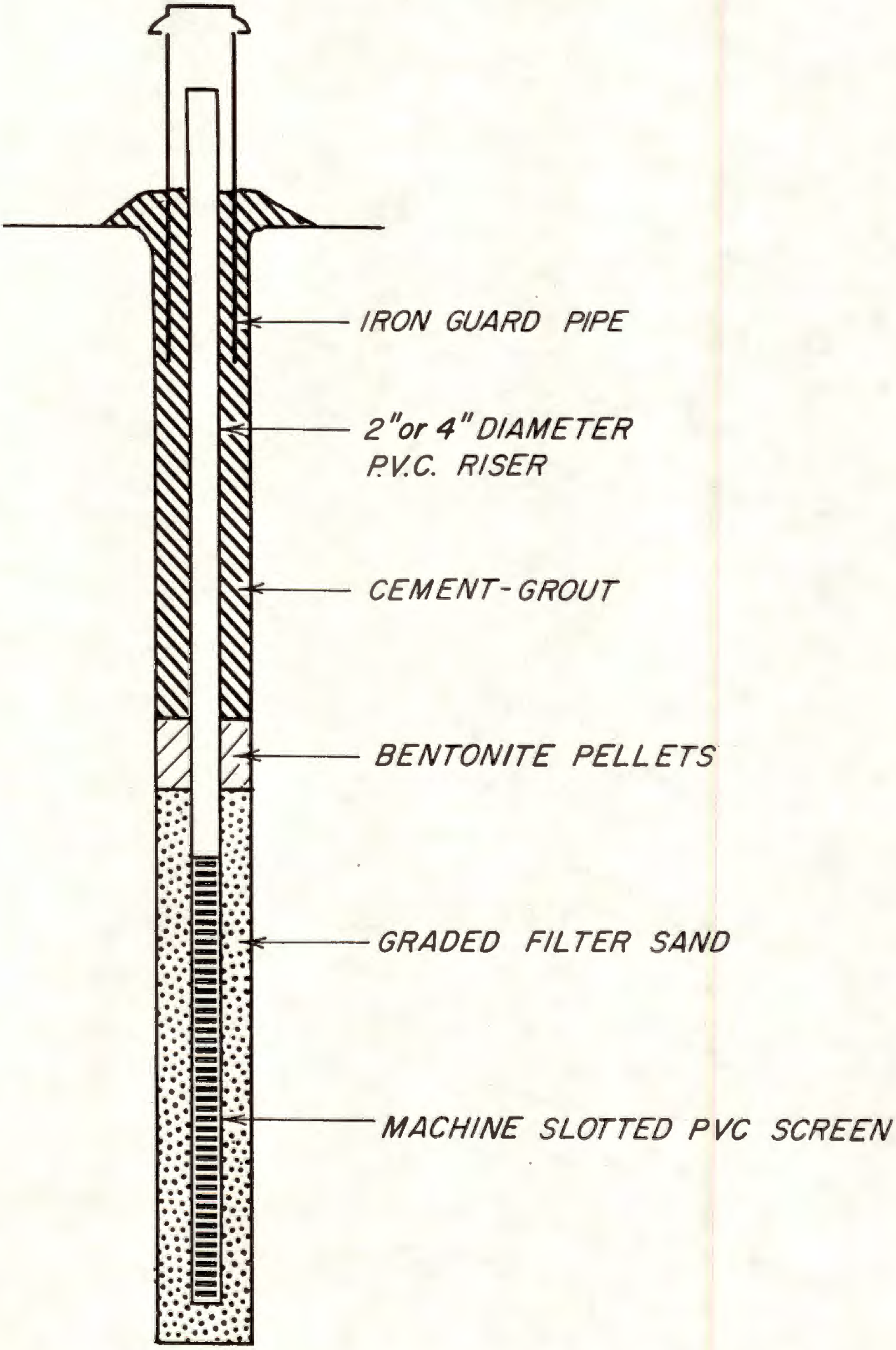
60' 0 60'

BLASLAND & BOUCK ENGINEERS, P.C.



TYPICAL OPEN HOLE MONITORING WELL COMPLETION DETAIL

BLASLAND & BOUCK ENGINEERS, P.C.



TYPICAL OVERBURDEN MONITORING WELL COMPLETION DETAIL

BLASLAND & BOUCK ENGINEERS, P.C.

CHAIN OF CUSTODY RECORD

PAGE ______ OF ______

FILE NO. ______	LABORATORY ______
PROJECT ______	ADDRESS ______
B & B CONTACT ______	CONTACT ______

B & B SAMPLE NO.	LABORATORY SAMPLE NO.	SAMPLING DATE	SAMPLING TIME	SAMPLE DEPTH	SAMPLE TYPE	ANALYSES										NO. OF CONTAINERS	COMMENTS (SPECIAL INSTRUCTIONS, CAUTIONS, ETC.)

I. SAMPLED AND RELINQUISHED BY	I. RECEIVED BY
SIGN	SIGN
PRINT	PRINT
FIRM	FIRM
DATE TIME	DATE TIME
II. RELINQUISHED BY	II. RECEIVED BY
SIGN	SIGN
PRINT	PRINT
FIRM	FIRM
DATE TIME	DATE TIME
III. RELINQUISHED BY	III. RECEIVED BY
SIGN	SIGN
PRINT	PRINT
FIRM	FIRM
DATE TIME	DATE TIME
IV. RELINQUISHED BY	IV. RECEIVED BY
SIGN	SIGN
PRINT	PRINT
FIRM	FIRM
DATE TIME	DATE TIME

LIQUID	VOA VIAL										
	GLASS BOTTLE										
	PLASTIC BOTTLE										
	PRESERVATIVE										
	CONTAINER VOLUME										
SOLID	VOA VIAL										
	GLASS JAR										
	PLASTIC JAR										
	PRESERVATIVE										
	CONTAINER VOLUME										

REMARKS: (SAMPLE STORAGE, NONSTANDARD SAMPLE BOTTLES)

NOTE: SAMPLE BOTTLES SUPPLIED BY LAB, UNLESS INDICATED

EVIDENCE SAMPLES TAMPERED WITH ☐ NO ☐ YES ☐ N/A

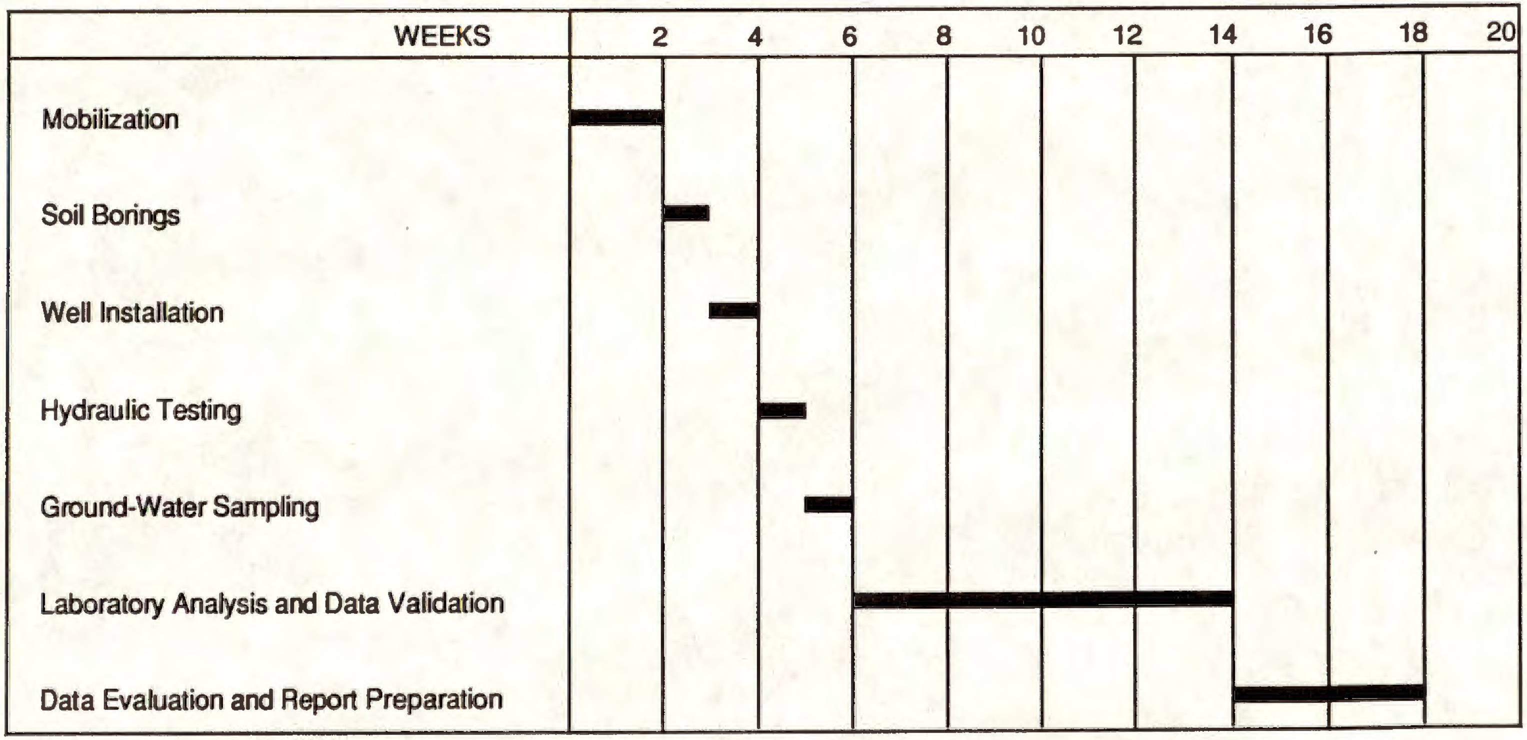
IF YES EXPLAIN IN REMARKS

PRESERVATION KEY: A - SAMPLE CHILLED, B - FILTERED, C - ACIDIFIED WITH ______ D - NaOH, E - Na THIOSULFATE, F - OTHER

FIGURE 5

PHASE II INVESTIGATION SCHEDULE

GRIFFIN TECHNOLOGY, INC.
VICTOR, NEW YORK

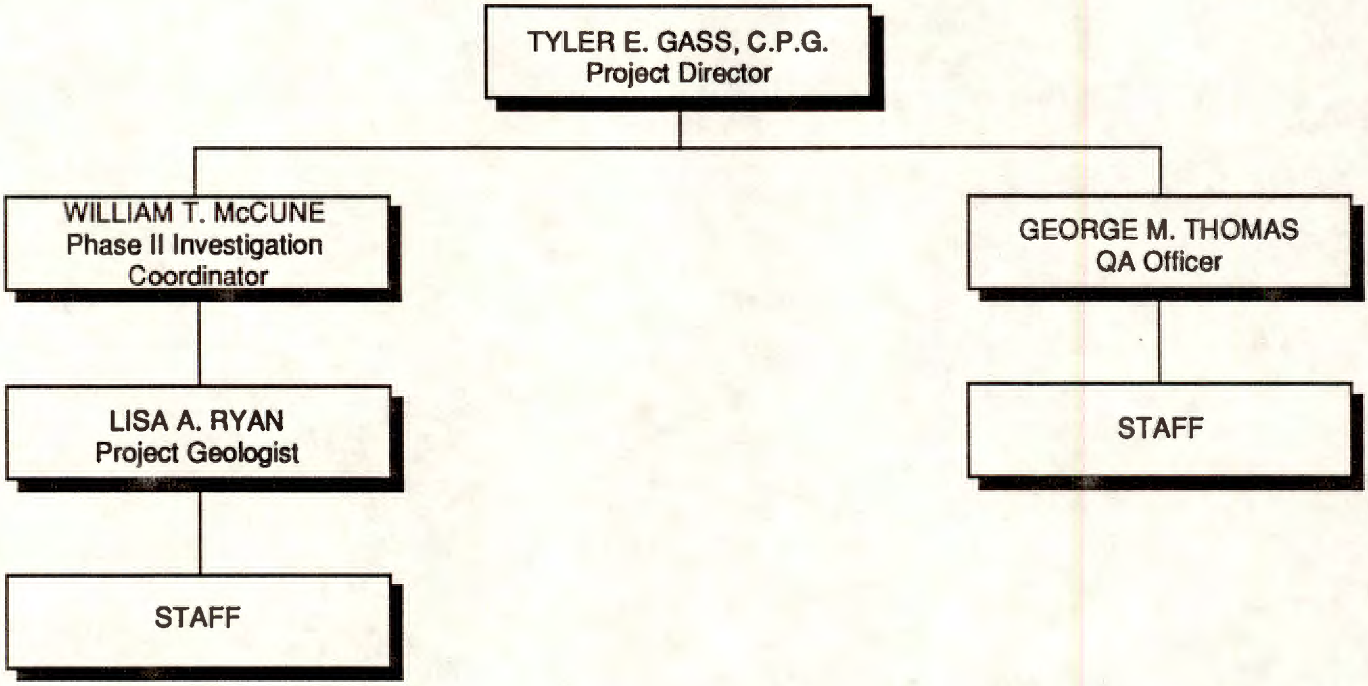


1/25/91
291222PMB

FIGURE 7

PROJECT ORGANIZATION

PHASE II INVESTIGATION
GRIFFIN TECHNOLOGY, INC.
VICTOR, NEW YORK



Appendices

APPENDIX A

DRILLING/SAMPLING PROTOCOL

DRILLING/SAMPLING PROTOCOL FOR SOIL BORINGS

I. Drilling/Sampling Procedures

Test borings shall be completed using the hollow-stem auger drilling method until bedrock material is encountered. The minimum inside diameter of the augers shall be 6¼ inches. The auger stem is to be turned by a rotary drive head which is mounted on a hydraulic feed mechanism.

Samples of the encountered subsurface materials shall be collected continuously. The sampling method employed shall be ASTM D-1586/Split-Barrel Sampling (Attachment 1) using a standard 2.5 foot long, 2-inch outside diameter split-spoon sampler. The sample will be placed in glass jars, labeled, and transmitted to the appropriate testing laboratory or storage facility. A geologist will be on-site during the drilling operations to fully describe each soil sample including: 1) soil type; 2) color; 3) percent recovery; 4) moisture content; 5) texture; 6) grain size and shape; 7) consistency; 8) odor; and 9) miscellaneous observations. All information will be recorded in a bound field book with indelible ink. The on-site geologist will be responsible for retaining a representative portion of each sample in a one-pint glass jar labeled with: 1) site; 2) boring number; 3) interval sample/interval preserved; 4) date; 5) time of sample collection; and 6) sampling personnel. Soil descriptions will be in accordance with the Unified Soil Classification Format.

The drilling contractor will be responsible for obtaining accurate and representative samples, informing the on-site geologist of changes in drilling pressure, loss of circulation, and keeping a separate general log of soils encountered during blow counts (i.e., the number of blows from a soil sampling drive weight (140 pounds) required to drive the 2-inch split-spoon sampler in 6-inch increments). The on-site geologist will direct the drilling, modifying depth and design of the monitoring well to best accomplish the objectives of this program.

A water level measurement will be taken at the completion of the borehole to determine the position of the water table.

II. Equipment Decontamination

All drilling equipment and associated tools including augers, drill rods, wrenches, and any other equipment or tools that may have come in contact with contaminated materials shall be decontaminated using high pressure, hot water cleaning equipment prior to commencing each soil boring and before leaving the site. Control water shall be obtained from a source approved by the on-site geologist.

DRILLING/SAMPLING PROTOCOL FOR ROCK CORING

Bedrock test borings in rock will be completed using a double-tubed core barrel with a NX size core diameter in accordance with ASTM D-2113, "Standard Practice for Diamond Core Drilling for Site Investigation," Attachment 2.

Continuous two, five, or ten-foot bedrock core samples will be obtained, labeled, preserved, and classified as outlined below. These tasks will be documented upon completion in the field.

Obtaining Rock Core Samples

Prior to core barrel introduction into the hole, circulation of water will be maintained for a short time to remove any cuttings that may clog the barrel. Drilling rods will be carefully centered to prevent core breakage. Drilling bit pressure and water pressure will be maintained at a consistent level throughout completion, and runs will be completed without interruption so penetration rates can be determined.

Labeling and Preserving Rock Core Samples

Core samples will be rinsed with clean water and placed in wood boxes with increasing depths aligned left to right and core runs separated by wood blocks. Man-made breaks will be marked with a pen across the break. Wood blocks will be labeled and placed at the end of each core run. A wooden spacer will be inserted if no sample is recovered and labeled "L.C." (lost core) with corresponding depth. The core box will be labeled on the outside top and inside lid with: 1) client; 2) date; 3) job number; 4) boring number; 5) run number; 6) run interval; and 7) box number/total box number.

Sample Classification

The supervising geologist will be responsible for recording rock core mechanical and geological characteristics. The mechanical characteristics will include: 1) penetration rates; 2) RQD (rock quality degree); 3) percent recovery; 4) water loss; and 5) bit type and size.

A geological classification will include the following parameters: 1) lithology; 2) color; 3) grain size and shape; 4) estimated percent porosity; 5) presence of interstitial water; 6) bedding planes; 7) mineralogy; 8) properties of fractures; 9) properties of joints; 10) nature of voids, vugs, cavities; 11) hardness; 12) degree of weathering; 13) degree of solution enlargement; and 14) degree of crystallinity.

Equipment Decontamination

Equipment decontamination will occur between each separate work site. All drilling equipment and associated tools including core barrels, drill rods, sampling equipment, wrenches, and any other equipment or tools that may have come in contact with contaminated materials shall be decontaminated using high pressure, hot water (steam cleaner) cleaning equipment with a control water rinse.

The drilling equipment will be contaminated for each coring in an area designated by the supervising geologist. No equipment will leave a drilling site at any time without first being decontaminated as described above, unless otherwise specified in the field by the geologist.

The rinsate generated through the equipment decontamination activities will be collected in an appropriate container for proper disposal by GTI at the conclusion of the field investigation program.

Documenting Field Events

A supervising geologist will be responsible for documenting drilling events using a daily field log. A documentation of drilling events will include: 1) start and finish dates of drilling; 2) name and location of job; 3) job number, client and site location; 4) sample number and depths; 5) type and size of samples; 6) depth to water; 7) type of drilling machine; 8) size of casing; 9) names of contractors, drillers, inspectors, or people on-site; and 10) weather conditions.

ATTACHMENT 1

Designation: D 1586 – 84

Standard Method for
PENETRATION TEST AND SPLIT-BARREL SAMPLING OF SOILS[1]

This standard is issued under the fixed designation D 1586; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This method has been approved for use by agencies of the Department of Defense and for listing in the DOD Index of Specifications and Standards.

1. Scope

1.1 This method describes the procedure, generally known as the Standard Penetration Test (SPT), for driving a split-barrel sampler to obtain a representative soil sample and a measure of the resistance of the soil to penetration of the sampler.

1.2 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For a specific precautionary statement, see 5.4.1.

1.3 The values stated in inch-pound units are to be regarded as the standard.

2. Applicable Documents

2.1 *ASTM Standards:*

D 2487 Test Method for Classification of Soils for Engineering Purposes[2]

D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)[2]

D 4220 Practices for Preserving and Transporting Soil Samples[2]

3. Descriptions of Terms Specific to This Standard

3.1 *anvil*—that portion of the drive-weight assembly which the hammer strikes and through which the hammer energy passes into the drill rods.

3.2 *cathead*—the rotating drum or windlass in the rope-cathead lift system around which the operator wraps a rope to lift and drop the hammer by successively tightening and loosening the rope turns around the drum.

3.3 *drill rods*—rods used to transmit downward force and torque to the drill bit while drilling a borehole.

3.4 *drive-weight assembly*—a device consisting of the hammer, hammer fall guide, the anvil, and any hammer drop system.

3.5 *hammer*—that portion of the drive-weight assembly consisting of the 140 ± 2 lb (63.5 ± 1 kg) impact weight which is successively lifted and dropped to provide the energy that accomplishes the sampling and penetration.

3.6 *hammer drop system*—that portion of the drive-weight assembly by which the operator accomplishes the lifting and dropping of the hammer to produce the blow.

3.7 *hammer fall guide*—that part of the drive-weight assembly used to guide the fall of the hammer.

3.8 *N-value*—the blowcount representation of the penetration resistance of the soil. The *N*-value, reported in blows per foot, equals the sum of the number of blows required to drive the sampler over the depth interval of 6 to 18 in. (150 to 450 mm) (see 7.3).

3.9 ΔN—the number of blows obtained from each of the 6-in. (150-mm) intervals of sampler penetration (see 7.3).

3.10 *number of rope turns*—the total contact angle between the rope and the cathead at the

[1] This method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.02 on Sampling and Related Field Testing for Soil Investigations.

Current edition approved Sept. 11, 1984. Published November 1984. Originally published as D 1586 – 58 T. Last previous edition D 1586 – 67 (1974).

[2] *Annual Book of ASTM Standards*, Vol 04.08.

beginning of the operator's rope slackening to drop the hammer, divided by 360° (see Fig. 1).

3.11 *sampling rods*—rods that connect the drive-weight assembly to the sampler. Drill rods are often used for this purpose.

3.12 *SPT*—abbreviation for Standard Penetration Test, a term by which engineers commonly refer to this method.

4. Significance and Use

4.1 This method provides a soil sample for identification purposes and for laboratory tests appropriate for soil obtained from a sampler that may produce large shear strain disturbance in the sample.

4.2 This method is used extensively in a great variety of geotechnical exploration projects. Many local correlations and widely published correlations which relate SPT blowcount, or *N*-value, and the engineering behavior of earthworks and foundations are available.

5. Apparatus

5.1 *Drilling Equipment*—Any drilling equipment that provides at the time of sampling a suitably clean open hole before insertion of the sampler and ensures that the penetration test is performed on undisturbed soil shall be acceptable. The following pieces of equipment have proven to be suitable for advancing a borehole in some subsurface conditions.

5.1.1 *Drag, Chopping, and Fishtail Bits*, less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm) in diameter may be used in conjuction with open-hole rotary drilling or casing-advancement drilling methods. To avoid disturbance of the underlying soil, bottom discharge bits are not permitted; only side discharge bits are permitted.

5.1.2 *Roller-Cone Bits*, less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm) in diameter may be used in conjunction with open-hole rotary drilling or casing-advancement drilling methods if the drilling fluid discharge is deflected.

5.1.3 *Hollow-Stem Continuous Flight Augers*, with or without a center bit assembly, may be used to drill the boring. The inside diameter of the hollow-stem augers shall be less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm).

5.1.4 *Solid, Continuous Flight, Bucket and Hand Augers*, less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm) in diameter may be used if the soil on the side of the boring does not cave onto the sampler or sampling rods during sampling.

5.2 *Sampling Rods*—Flush-joint steel drill rods shall be used to connect the split-barrel sampler to the drive-weight assembly. The sampling rod shall have a stiffness (moment of inertia) equal to or greater than that of parallel wall "A" rod (a steel rod which has an outside diameter of 1⅝ in. (41.2 mm) and an inside diameter of 1⅛ in. (28.5 mm).

NOTE 1—Recent research and comparative testing indicates the type rod used, with stiffness ranging from "A" size rod to "N" size rod, will usually have a negligible effect on the *N*-values to depths of at least 100 ft (30 m).

5.3 *Split-Barrel Sampler*—The sampler shall be constructed with the dimensions indicated in Fig. 2. The driving shoe shall be of hardened steel and shall be replaced or repaired when it becomes dented or distorted. The use of liners to produce a constant inside diameter of 1⅜ in. (35 mm) is permitted, but shall be noted on the penetration record if used. The use of a sample retainer basket is permitted, and should also be noted on the penetration record if used.

NOTE 2—Both theory and available test data suggest that *N*-values may increase between 10 to 30 % when liners are used.

5.4 *Drive-Weight Assembly:*

5.4.1 *Hammer and Anvil*—The hammer shall weigh 140 ± 2 lb (63.5 ± 1 kg) and shall be a solid rigid metallic mass. The hammer shall strike the anvil and make steel on steel contact when it is dropped. A hammer fall guide permitting a free fall shall be used. Hammers used with the cathead and rope method shall have an unimpeded overlift capacity of at least 4 in. (100 mm). For safety reasons, the use of a hammer assembly with an internal anvil is encouraged.

NOTE 3—It is suggested that the hammer fall guide be permanently marked to enable the operator or inspector to judge the hammer drop height.

5.4.2 *Hammer Drop System*—Rope-cathead, trip, semi-automatic, or automatic hammer drop systems may be used, providing the lifting apparatus will not cause penetration of the sampler while re-engaging and lifting the hammer.

5.5 *Accessory Equipment*—Accessories such as labels, sample containers, data sheets, and groundwater level measuring devices shall be provided in accordance with the requirements of the project and other ASTM standards.

6. Drilling Procedure

6.1 The boring shall be advanced incrementally to permit intermittent or continuous sampling. Test intervals and locations are normally stipulated by the project engineer or geologist. Typically, the intervals selected are 5 ft (1.5 mm) or less in homogeneous strata with test and sampling locations at every change of strata.

6.2 Any drilling procedure that provides a suitably clean and stable hole before insertion of the sampler and assures that the penetration test is performed on essentially undisturbed soil shall be acceptable. Each of the following procedures have proven to be acceptable for some subsurface conditions. The subsurface conditions anticipated should be considered when selecting the drilling method to be used.

6.2.1 Open-hole rotary drilling method.

6.2.2 Continuous flight hollow-stem auger method.

6.2.3 Wash boring method.

6.2.4 Continuous flight solid auger method.

6.3 Several drilling methods produce unacceptable borings. The process of jetting through an open tube sampler and then sampling when the desired depth is reached shall not be permitted. The continuous flight solid auger method shall not be used for advancing the boring below a water table or below the upper confining bed of a confined non-cohesive stratum that is under artesian pressure. Casing may not be advanced below the sampling elevation prior to sampling. Advancing a boring with bottom discharge bits is not permissible. It is not permissible to advance the boring for subsequent insertion of the sampler solely by means of previous sampling with the SPT sampler.

6.4 The drilling fluid level within the boring or hollow-stem augers shall be maintained at or above the in situ groundwater level at all times during drilling, removal of drill rods, and sampling.

7. Sampling and Testing Procedure

7.1 After the boring has been advanced to the desired sampling elevation and excessive cuttings have been removed, prepare for the test with the following sequence of operations.

7.1.1 Attach the split-barrel sampler to the sampling rods and lower into the borehole. Do not allow the sampler to drop onto the soil to be sampled.

7.1.2 Position the hammer above and attach the anvil to the top of the sampling rods. This may be done before the sampling rods and sampler are lowered into the borehole.

7.1.3 Rest the dead weight of the sampler, rods, anvil, and drive weight on the bottom of the boring and apply a seating blow. If excessive cuttings are encountered at the bottom of the boring, remove the sampler and sampling rods from the boring and remove the cuttings.

7.1.4 Mark the drill rods in three successive 6-in. (0.15-m) increments so that the advance of the sampler under the impact of the hammer can be easily observed for each 6-in. (0.15-m) increment.

7.2 Drive the sampler with blows from the 140-lb (63.5-kg) hammer and count the number of blows applied in each 6-in. (0.15-m) increment until one of the following occurs:

7.2.1 A total of 50 blows have been applied during any one of the three 6-in. (0.15-m) increments described in 7.1.4.

7.2.2 A total of 100 blows have been applied.

7.2.3 There is no observed advance of the sampler during the application of 10 successive blows of the hammer.

7.2.4 The sampler is advanced the complete 18 in. (0.45 m) without the limiting blow counts occurring as described in 7.2.1, 7.2.2, or 7.2.3.

7.3 Record the number of blows required to effect each 6 in. (0.15 m) of penetration or fraction thereof. The first 6 in. is considered to be a seating drive. The sum of the number of blows required for the second and third 6 in. of penetration is termed the "standard penetration resistance", or the "*N*-value". If the sampler is driven less than 18 in. (0.45 m), as permitted in 7.2.1, 7.2.2, or 7.2.3, the number of blows per each complete 6-in. (0.15-m) increment and per each partial increment shall be recorded on the boring log. For partial increments, the depth of penetration shall be reported to the nearest 1 in. (25 mm), in addition to the number of blows. If the sampler advances below the bottom of the boring under the static weight of the drill rods or the weight of the drill rods plus the static weight of the hammer, this information should be noted on the boring log.

7.4 The raising and dropping of the 140-lb

(63.5-kg) hammer shall be accomplished using either of the following two methods:

7.4.1 By using a trip, automatic, or semi-automatic hammer drop system which lifts the 140-lb (63.5-kg) hammer and allows it to drop 30 ± 1.0 in. (0.76 m ± 25 mm) unimpeded.

7.4.2 By using a cathead to pull a rope attached to the hammer. When the cathead and rope method is used the system and operation shall conform to the following:

7.4.2.1 The cathead shall be essentially free of rust, oil, or grease and have a diameter in the range of 6 to 10 in. (150 to 250 mm).

7.4.2.2 The cathead should be operated at a minimum speed of rotation of 100 RPM, or the approximate speed of rotation shall be reported on the boring log.

7.4.2.3 No more than 2¼ rope turns on the cathead may be used during the performance of the penetration test, as shown in Fig. 1.

NOTE 4—The operator should generally use either 1¾ or 2¼ rope turns, depending upon whether or not the rope comes off the top (1¾ turns) or the bottom (2¼ turns) of the cathead. It is generally known and accepted that 2¾ or more rope turns considerably impedes the fall of the hammer and should not be used to perform the test. The cathead rope should be maintained in a relatively dry, clean, and unfrayed condition.

7.4.2.4 For each hammer blow, a 30-in. (0.76-m) lift and drop shall be employed by the operator. The operation of pulling and throwing the rope shall be performed rhythmically without holding the rope at the top of the stroke.

7.5 Bring the sampler to the surface and open. Record the percent recovery or the length of sample recovered. Describe the soil samples recovered as to composition, color, stratification, and condition, then place one or more representative portions of the sample into sealable moisture-proof containers (jars) without ramming or distorting any apparent stratification. Seal each container to prevent evaporation of soil moisture. Affix labels to the containers bearing job designation, boring number, sample depth, and the blow count per 6-in. (0.15-m) increment. Protect the samples against extreme temperature changes. If there is a soil change within the sampler, make a jar for each stratum and note its location in the sampler barrel.

8. Report

8.1 Drilling information shall be recorded in the field and shall include the following:

8.1.1 Name and location of job,

8.1.2 Names of crew,

8.1.3 Type and make of drilling machine,

8.1.4 Weather conditions,

8.1.5 Date and time of start and finish of boring,

8.1.6 Boring number and location (station and coordinates, if available and applicable),

8.1.7 Surface elevation, if available,

8.1.8 Method of advancing and cleaning the boring,

8.1.9 Method of keeping boring open,

8.1.10 Depth of water surface and drilling depth at the time of a noted loss of drilling fluid, and time and date when reading or notation was made,

8.1.11 Location of strata changes,

8.1.12 Size of casing, depth of cased portion of boring,

8.1.13 Equipment and method of driving sampler,

8.1.14 Type sampler and length and inside diameter of barrel (note use of liners),

8.1.15 Size, type, and section length of the sampling rods, and

8.1.16 Remarks.

8.2 Data obtained for each sample shall be recorded in the field and shall include the following:

8.2.1 Sample depth and, if utilized, the sample number,

8.2.2 Description of soil,

8.2.3 Strata changes within sample,

8.2.4 Sampler penetration and recovery lengths, and

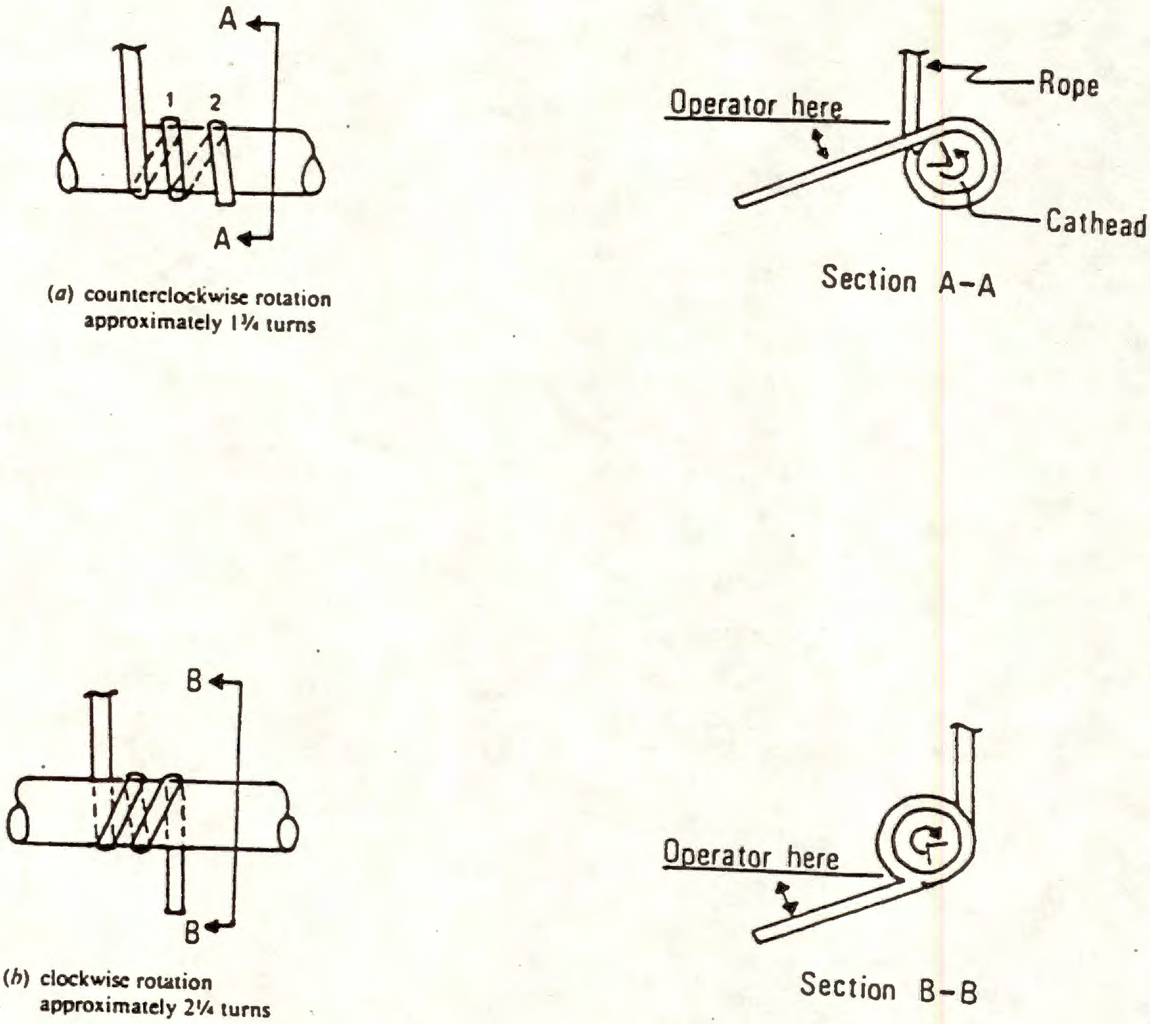
8.2.5 Number of blows per 6-in. (0.15-m) or partial increment.

9. Precision and Bias

9.1 Variations in *N*-values of 100 % or more have been observed when using different standard penetration test apparatus and drillers for adjacent borings in the same soil formation. Current opinion, based on field experience, indicates that when using the same apparatus and driller, *N*-values in the same soil can be reproduced with a coefficient of variation of about 10 %.

9.2 The use of faulty equipment, such as an extremely massive or damaged anvil, a rusty cathead, a low speed cathead, an old, oily rope, or massive or poorly lubricated rope sheaves can significantly contribute to differences in *N*-values obtained between operator-drill rig systems.

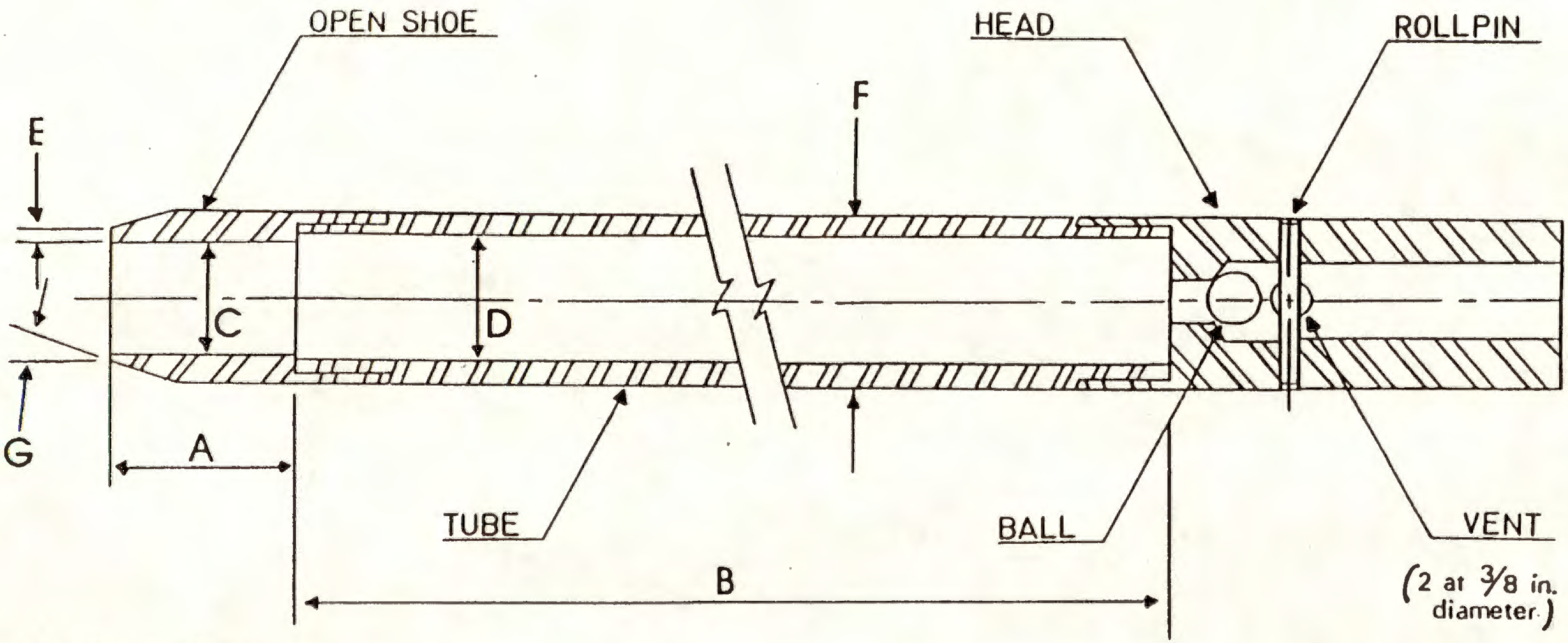
9.3 The variability in *N*-values produced by different drill rigs and operators may be reduced by measuring that part of the hammer energy delivered into the drill rods from the sampler and adjusting *N* on the basis of comparative energies. A method for energy measurement and *N*-value adjustment is currently under development.



(*a*) counterclockwise rotation approximately 1¾ turns

(*b*) clockwise rotation approximately 2¼ turns

FIG. 1 Definitions of the Number of Rope Turns and the Angle for (*a*) Counterclockwise Rotation and (*b*) Clockwise Rotation of the Cathead



A = 1.0 to 2.0 in. (25 to 50 mm)
B = 18.0 to 30.0 in. (0.457 to 0.762 m)
C = 1.375 ± 0.005 in. (34.93 ± 0.13 mm)
D = 1.50 ± 0.05 − 0.00 in. (38.1 ± 1.3 − 0.0 mm)
E = 0.10 ± 0.02 in. (2.54 ± 0.25 mm)
F = 2.00 ± 0.05 − 0.00 in. (50.8 ± 1.3 − 0.0 mm)
G = 16.0° to 23.0°

The 1½ in. (38 mm) inside diameter split barrel may be used with a 16-gage wall thickness split liner. The penetrating end of the drive shoe may be slightly rounded. Metal or plastic retainers may be used to retain soil samples.

FIG. 2 Split-Barrel Sampler

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This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, Pa. 19103.

ATTACHMENT 2

Standard Practice for
DIAMOND CORE DRILLING FOR SITE INVESTIGATION[1]

This standard is issued under the fixed designation D 2113; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes equipment and procedures for diamond core drilling to secure core samples of rock and some soils that are too hard to sample by soil-sampling methods. This method is described in the context of obtaining data for foundation design and geotechnical engineering purposes rather than for mineral and mining exploration.

2. Applicable Documents

2.1 *ASTM Standards:*

D 1586 Method for Penetration Test and Split-Barrel Sampling of Soils[2]

D 1587 Practice for Thin-Walled Tube Sampling of Soils[2]

D 3550 Practice for Ring-Lined Barrel Sampling of Soils[2]

3. Significance and Use

3.1 This practice is used to obtain core specimens of superior quality that reflect the in-situ conditions of the material and structure and which are suitable for standard physical-properties tests and structural-integrity determination.

4. Apparatus

4.1 *Drilling Machine,* capable of providing rotation, feed, and retraction by hydraulic or mechanical means to the drill rods.

4.2 *Fluid Pump or Air Compressor,* capable of delivering sufficient volume and pressure for the diameter and depth of hole to be drilled.

4.3 *Core barrels* as required:

4.3.1 *Single Tube Type, WG Design,* consisting of a hollow steel tube, with a head at one end threaded for drill rod, and a threaded connection for a reaming shell and core bit at the other end. A core lifter, or retainer located within the core bit is normal, but may be omitted at the discretion of the geologist or engineer.

4.3.2 *Double Tube, Swivel-Type, WG Design*—An assembly of two concentric steel tubes joined and supported at the upper end by means of a ball or roller-bearing swivel arranged to permit rotation of the outer tube without causing rotation of the inner tube. The upper end of the outer tube, or removable head, is threaded for drill rod. A threaded connection is provided on the lower end of the outer tube for a reaming shell and core bit. A core lifter located within the core bit is normal but may be omitted at the discretion of the geologist or engineer.

4.3.3 *Double-Tube, Swivel-Type, WT Design,* is essentially the same as the double tube, swivel-type, WG design, except that the WT design has thinner tube walls, a reduced annular area between the tubes, and takes a larger core from the same diameter bore hole. The core lifter is located within the core bit.

4.3.4 *Double Tube, Swivel Type, WM Design,* is similar to the double tube, swivel-type, WG design, except that the inner tube is threaded at its lower end to receive a core lifter case that effectively extends the inner tube well into the core bit, thus minimizing exposure of the core to the drilling fluid. A core lifter is contained within the core lifter case on the inner tube.

4.3.5 *Double Tube Swivel-Type, Large-Diameter Design,* is similar to the double tube, swivel-type, WM design, with the addition of a

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[1] This practice is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.02 on Sampling and Related Field Testing for Soil Investigations.

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[2] *Annual Book of ASTM Standards,* Vol 04.08.

ball valve, to control fluid flow, in all three available sizes and the addition of a sludge barrel, to catch heavy cuttings, on the two larger sizes. The large-diameter design double tube, swivel-type, core barrels are available in three core per hole sizes as follows: 2¾ in. (69.85 mm) by 3⅞ in. (98.43 mm), 4 in. (101.6 mm) by 5½ in. (139.7 mm), and 6 in. (152.4 mm) by 7¾ in. (196.85 mm). Their use is generally reserved for very detailed investigative work or where other methods do not yield adequate recovery.

4.3.6 *Double Tube, Swivel-Type, Retrievable Inner-Tube Method,* in which the core-laden inner-tube assembly is retrieved to the surface and an empty inner-tube assembly returned to the face of the borehole through the matching, large-bore drill rods without need for withdrawal and replacement of the drill rods in the borehole. The inner-tube assembly consists of an inner tube with removable core lifter case and core lifter at one end and a removable inner-tube head, swivel bearing, suspension adjustment, and latching device with release mechanism on the opposite end. The inner-tube latching device locks into a complementary recess in the wall of the outer tube such that the outer tube may be rotated without causing rotation of the inner tube and such that the latch may be actuated and the inner-tube assembly transported by appropriate surface control. The outer tube is threaded for the matching, large-bore drill rod and internally configured to receive the inner-tube latching device at one end and threaded for a reaming shell and bit, or bit only, at the other end.

4.4 *Longitudinally Split Inner Tubes*—As opposed to conventional cylindrical inner tubes, allow inspection of, and access to, the core by simply removing one of the two halves. They are not standardized but are available for most core barrels including many of the retrievable inner-tube types.

4.5 *Core Bits*—Core bits shall be surface set with diamonds, impregnated with small diamond particles, inserted with tungsten carbide slugs, or strips, hard-faced with various hard surfacing materials or furnished in saw-tooth form, all as appropriate to the formation being cored and with concurrence of the geologist or engineer. Bit matrix material, crown shape, water-way type, location and number of water ways, diamond size and carat weight, and bit facing materials shall be for general purpose use unless otherwise approved by the geologist or engineer. Nominal size of some bits are shown in Table 1.

NOTE 1—Size designation (letter symbols) used throughout the text and in Tables 1, 2, and 3 are those standardized by the Diamond Core Drill Manufacturers' Assoc. (DCDMA). Inch dimensions in the tables have been rounded to the nearest hundredth of an inch.

4.6 *Reaming Shells,* shall be surface set with diamonds, impregnated with small diamond particles, inserted with tungsten carbide strips or slugs, hard faced with various types of hard surfacing materials, or furnished blank, all as appropriate to the formation being cored.

4.7 *Core Lifters*—Core lifters of the split-ring type, either plain or hard-faced, shall be furnished and maintained, along with core-lifter cases or inner-tube extensions or inner-tube shoes, in good condition. Basket or finger-type lifters, together with any necessary adapters, shall be on the job and available for use with each core barrel if so directed by the geologist or engineer.

4.8 *Casings:*

4.8.1 *Drive Pipe or Drive Casing,* shall be standard weight (schedule 40), extra-heavy (schedule 80), double extra-heavy (schedule 160) pipe or W-design flush-joint casing as required by the nature of the overburden or the placement method. Drive pipe or W-design casing shall be of sufficient diameter to pass the largest core barrel to be used, and it shall be driven to bed rock or to firm seating at an elevation below water-sensitive formation. A hardened drive shoe is to be used as a cutting edge and thread protection device on the bottom of the drive pipe or casing. The drive shoe inside diameter shall be large enough to pass the tools intended for use, and the shoe and pipe or casing shall be free from burrs or obstructions.

4.8.2 *Casing*—When necessary to case through formations already penetrated by the borehole or when no drive casing has been set, auxiliary casing shall be provided to fit inside the borehole to allow use of the next smaller core barrel. Standard sizes of telescoping casing are shown in Table 2. Casing bits have an obstruction in their interior and will not pass the next smaller casing size. Use a casing shoe if additional telescoping is anticipated.

4.8.3 *Casing Liner*—Plastic pipe or sheet-metal pipe may be used to line an existing large-diameter casing. Liners, so used, should not be driven, and care should be taken to maintain true alignment throughout the length of the liner.

4.8.4 *Hollow Stem Auger*—Hollow stem auger may be used as casing for coring.

4.9 *Drill Rods:*

4.9.1 *Drill Rods of Tubular Steel Construction* are normally used to transmit feed, rotation, and retraction forces from the drilling machine to the core barrel. Drill-rod sizes that are presently standardized are shown in Table 3.

4.9.2 Large bore drill rods used with retrievable inner-tube core barrels are not standardized. Drill rods used with retrievable inner-tube core barrels should be those manufactured by the core-barrel manufacturer specifically for the core barrel.

4.9.3 *Composite Drill Rods* are specifically constructed from two or more materials intended to provide specific properties such as light weight or electrical nonconductivity.

4.9.4 *Nonmagnetic Drill Rods* are manufactured of nonferrous materials such as aluminum or brass and are used primarily for hole survey work. Some nonmagnetic rods have left-hand threads in order to further their value in survey work. No standard exists for nonmagnetic rods.

4.10 *Auxiliary Equipment*, shall be furnished as required by the work and shall include: roller rock bits, drag bits, chopping bits, boulder busters, fishtail bits, pipe wrenches, core barrel wrenches, lubrication equipment, core boxes, and marking devices. Other recommended equipment includes: core splitter, rod wicking, pump-out tools or extruders, and hand sieve or strainer.

5. Transportation and Storage of Core Containers

5.1 *Core Boxes*, shall be constructed of wood or other durable material for the protection and storage of cores while enroute from the drill site to the laboratory or other processing point. All core boxes shall be provided with longitudinal separators and recovered cores shall be laid out as a book would read, from left to right and top to bottom, within the longitudinal separators. Spacer blocks or plugs shall be marked and inserted into the core column within the separators to indicate the beginning of each coring run. The beginning point of storage in each core box is the upper left-hand corner. The upper left-hand corner of a hinged core box is the left corner when the hinge is on the far side of the box and the box is right-side up. All hinged core boxes must be permanently marked on the outside to indicate the top and the bottom. All other core boxes must be permanently marked on the outside to indicate the top and the bottom and additionally, must be permanently marked internally to indicate the upper-left corner of the bottom with the letters UL or a splotch of red paint not less than 1 in.^{2}. Lid or cover fitting(s) for core boxes must be of such quality as to ensure against mix up of the core in the event of impact or upsetting of the core box during transportation.

5.2 Transportation of cores from the drill site to the laboratory or other processing point shall be in durable core boxes so padded or suspended as to be isolated from shock or impact transmitted to the transporter by rough terrain or careless operation.

5.3 Storage of cores, after initial testing or inspection at the laboratory or other processing point, may be in cardboard or similar less costly boxes provided all layout and marking requirements as specified in 5.1 are followed. Additional spacer blocks or plugs shall be added if necessary at time of storage to explain missing core. Cores shall be stored for a period of time specified by the engineer but should not normally be discarded prior to completion of the project for which they were taken.

6. Procedure

6.1 Use core-drilling procedures when formations are encountered that are too hard to be sampled by soil-sampling methods. A 1-in. (25.4-mm) or less penetration for 50 blows in accordance with Method D 1586 or other criteria established by the geologist or engineer, shall indicate that soil-sampling methods are not applicable.

6.1.1 Seat the casing on bedrock or in a firm formation to prevent raveling of the borehole and to prevent loss of drilling fluid. Level the surface of the rock or hard formation at the bottom of the casing when necessary using the appropriate bits. Casing may be omitted if the borehole will stand open without the casing.

6.1.2 Begin the core drilling using an N-size double-tube swivel-type core barrel or other size or type approved by the engineer. Continue core drilling until core blockage occurs or until the net length of the core barrel has been drilled in. Remove the core barrel from the hole and disassemble it as necessary to remove the core. Reassemble the core barrel and return it to the hole. Resume coring.

6.1.3 Place the recovered core in the core box with the upper (surface) end of the core at the upper-left corner of the core box as described in 5.1. Continue boxing core with appropriate markings, spacers, and blocks as described in 5.1. Wrap soft or friable cores or those which change materially upon drying in plastic film or seal in wax, or both, when such treatment is required by the engineer. Use spacer blocks or slugs properly marked to indicate any noticeable gap in recovered core which might indicate a change or void in the formation. Fit fracture, bedded, or jointed pieces of core together as they naturally occurred.

6.1.4 Stop the core drilling when soft materials are encountered that produce less than 50 % recovery. If necessary, secure samples of soft materials in accordance with the procedures described in Method D 1586, Practice D 1587, or Practice D 3550, or by any other method acceptable to the geologist or engineer. Resume diamond core drilling when refusal materials as described in 6.1 are again encountered.

6.2 Subsurface structure, including the dip of strata, the occurrence of seams, fissures, cavities, and broken areas are among the most important items to be detected and described. Take special care to obtain and record information about these features. If conditions prevent the continued advance of the core drilling, the hole should be cemented and redrilled, or reamed and cased, or cased and advanced with the next smaller-size core barrel, as required by the geologist or engineer.

6.3 Drilling mud or grouting techniques must be approved by the geologist or engineer prior to their use in the borehole.

6.4 *Compatibility of Equipment:*

6.4.1 Whenever possible, core barrels and drill rods should be selected from the same letter-size designation to ensure maximum efficiency. See Tables 1 and 3.

6.4.2 Never use a combination of pump, drill rod, and core barrel that yields a clear-water up-hole velocity of less than 120 ft/min.

6.4.3 Never use a combination of air compressor, drill rod, and core barrel that yields a clear-air up-hole velocity of less than 3000 ft/min.

7. Boring Log

7.1 The boring log shall include the following:

7.1.1 Project identification, boring number, location, date boring began, date boring completed, and driller's name.

7.1.2 Elevation of the ground surface.

7.1.3 Elevation of or depth to ground water and raising or lowering of level including the dates and the times measured.

7.1.4 Elevations or depths at which drilling fluid return was lost.

7.1.5 Size, type, and design of core barrel used. Size, type, and set of core bit and reaming shell used. Size, type, and length of all casing used. Description of any movements of the casing.

7.1.6 Length of each core run and the length or percentage, or both, of the core recovered.

7.1.7 Geologist's or engineer's description of the formation recovered in each run.

7.1.8 Driller's description, if no engineer or geologist is present, of the formation recovered in each run.

7.1.9 Subsurface structure description, including dip of strata and jointing, cavities, fissures, and any other observations made by the geologist or engineer that could yield information regarding the formation.

7.1.10 Depth, thickness, and apparent nature of the filling of each cavity or soft seam encountered, including opinions gained from the feel or appearance of the inside of the inner tube when core is lost. Record opinions as such.

7.1.11 Any change in the character of the drilling fluid or drilling fluid return.

7.1.12 Tidal and current information when the borehole is sufficiently close to a body of water to be affected.

7.1.13 Drilling time in minutes per foot and bit pressure in pound-force per square inch gage when applicable.

7.1.14 Notations of character of drilling, that is, soft, slow, easy, smooth, etc.

8. Precision and Accuracy

8.1 This practice does not produce numerical data; therefore, a precision and accuracy statement is not applicable.

NOTE 2—Inclusion of the following tables and use of letter symbols in the foregoing text is not intended to limit the practice to use of DCDMA tools. The table and text references are included as a convenience to the user since the vast majority of tools in use do meet DCDMA dimensional standards. Similar equipment of approximately equal size on the metric standard system is acceptable unless otherwise stipulated by the engineer or geologist.

TABLE 1 Core Bit Sizes

Size Designation	Outside Diameter		Inside Diameter	
	in.	mm	in.	mm
RWT	1.16	29.5	0.375	18.7
EWT	1.47	37.3	0.905	22.9
EWG, EWM	1.47	37.3	0.845	21.4
AWT	1.88	47.6	1.281	32.5
AWG, AWM	1.88	47.6	1.185	30.0
BWT	2.35	59.5	1.750	44.5
BWG, BWM	2.35	59.5	1.655	42.0
NWT	2.97	75.3	2.313	58.7
NWG, NWM	2.97	75.3	2.155	54.7
2¾ × 3⅞	3.84	97.5	2.69	68.3
HWT	3.89	98.8	3.187	80.9
HWG....	3.89	98.8	3.000	76.2
4 × 5½	5.44	138.0	3.97	100.8
6 × 7¾	7.66	194.4	5.97	151.6

TABLE 2 Casing Sizes

Size Designation	Outside Diameter		Inside Diameter		Threads per in.	Will Fit Hole Drilled with Core Bit Size
	in.	mm	in.	mm		
RW	1.144	36.5	1.19	30.1	5	EWT, EWG, EWM
EW	1.81	46.0	1.50	38.1	4	AWT, AWG, AWM
AW	2.25	57.1	1.91	48.4	4	BWT, BWG, BWM
BW	2.88	73.0	2.38	60.3	4	NWT, NWG, NWM
NW	3.50	88.9	3.00	76.2	4	HWT, HWG
HW	4.50	114.3	4.00	101.6	4	4 × 5½
PW	5.50	139.7	5.00	127.0	3	6 × 7¾
SW	6.63	168.2	6.00	152.4	3	6 × 7¾
UW	7.63	193.6	7.00	177.8	2	...
ZW	8.63	219.0	8.00	203.2	2	...

TABLE 3 Drill Rods

Size Designation	Rod and Coupling Outside Diameter		Rod Inside Diameter		Coupling Bore, Threads		
	in.	mm	in.	mm	in.	mm	per in.
RW	1.09	27.7	0.72	18.2	0.41	10.3	4
EW	1.38	34.9	1.00	25.4	0.44	11.1	3
AW	1.72	43.6	1.34	34.1	0.63	15.8	3
BW	2.13	53.9	1.75	44.4	0.75	19.0	3
NW	2.63	66.6	2.25	57.1	1.38	34.9	3
HW	3.50	88.9	3.06	77.7	2.38	60.3	3

APPENDIX B

PROTOCOL FOR COMPLETION OF MONITORING WELLS IN BEDROCK

PROTOCOL FOR COMPLETION OF MONITORING WELLS IN BEDROCK

I. Open-Hole Bedrock Monitoring Well Completion

The rock monitoring wells shall be drilled using the methods outlined in Appendix A. A borehole will be initially drilled through the overburden approximately five feet into bedrock. Once the borehole is drilled, a cement grout will be tremie piped into the borehole. A four-inch PVC riser, capped at the end, will be placed into the borehole. The augers will be pulled as additional cement grout is tremie piped into the borehole. Grout will continue to be added during the extraction of the augers until the entire aquifer thickness has been sufficiently sealed off from horizontal and vertical flow. The grout and riser material will be allowed to set for 24 hours. The borehole will then be drilled through the PVC riser cap to the desired depth into bedrock. The rock portion of the hole will be left open.

A vented protective steel casing shall be placed over the PVC riser extending approximately one to two feet below grade and two to three feet above grade, secured by a cement seal. The cement seal shall extend laterally at least one foot in all directions from the protective casing and slope gently away to drain water away from the well. A vented steel cap will be fitted on the protective casing and a steel hasp shall be welded on one side of each steel casing to the cap may be secured with a keyed lock.

A typical open-hole bedrock monitoring well detail is shown on Figure 3. The on-site geologist shall specify the monitoring well design to the drilling contractor before installation.

The on-site geologist is responsible for recording the exact well details as relayed by the drilling contractor and actual measurement. Both the on-site geologist and drilling contractor are responsible for tabulating all well materials, used such as footage of casing and screen or bags of grout, pellets, cement, or sand.

II. Monitoring Well Development

All monitoring wells will be developed or cleared of all fine-grained materials and sediments that have settled in or around the well during installation. The development will be by pumping, or bailing ground water from the monitoring well until it yields relatively sediment-free water.

III. Equipment Decontamination

All drilling equipment and associated tools including augers, drill rods, wrenches, and any other equipment or tools that may have come in contact with contaminated materials shall be decontaminated using high pressure, hot water cleaning equipment using a controlled water source. The control water shall be obtained from a source approved by the on-site geologist. The primary choice of a controlled water source will be a municipal supply.

The drilling equipment will be decontaminated for each well in an area designated by the on-site geologist. No equipment will be permitted to leave a drilling site at any time without first being decontaminated as described above unless otherwise specified in the field by the geologist.

The rinsate generated through the equipment decontamination activities will be collected in an appropriate container for proper disposal by GTI at the conclusion of the field investigation program.

APPENDIX C

PROTOCOL FOR COMPLETION OF MONITORING WELLS IN OVERBURDEN

PROTOCOL FOR COMPLETION OF MONITORING WELLS IN OVERBURDEN

I. Overburden Monitoring Well Completion

Overburden monitoring wells will be installed in completed soil borings advanced during sampling procedures outlined in Drilling/Sampling Protocol for Soil Borings. Overburden monitoring wells will be installed through hollow stem augers with a minimum inside diameter of 6¼ inches.

All monitoring wells installed in unconsolidated deposits will be constructed of PVC flush-joint threaded screen and riser (Schedule 40) that will extend from the screened interval to two to three feet above existing grade. Screens will be capped on the bottom with a threaded PVC plug of appropriate size. Other materials utilized for completion will be washed silica sand, bentonite, Portland Cement, and a locking protective steel well casing and cap.

The installation method for the monitoring wells shall be to place the screen and riser assembly through the auger string. Screen length, screen slot size, and filter pack will be specified based on geologic conditions. At that time, a washed silica sand pack will be placed to prevent screen plugging to at least one-foot above the top of the well screen. Bentonite pellets will be placed above the pack material to prevent the cement grout from infiltrating into the well pack. Cement grout will then be added to the annulus between the riser and the inside auger wall via a tremie pipe to insure proper sealing. Grout will continue to be added during the extraction of the augers until the entire aquifer thickness has been sufficiently sealed off from horizontal and/or vertical flow above the screened interval. During placement of sand, bentonite, and cement grout, frequent measurements will be made to check the height of the sand pack and thickness of a bentonite-layer by a weighted tape measure.

A vented protective steel casing shall be located over the PVC standpipe extending one to two feet below grade and two to three feet above grade secured by a concrete seal. The cement seal shall extend laterally at least one foot in all directions from the protective casing, and shall slope gently away to drain water away from the monitoring well. A vented steel cap will be fitted on the protective casing and a steel hasp shall be welded on one side of each steel casing so the cap may be secured with a keyed lock.

A typical overburden monitoring well detail is shown in Figure 4 of this report. The on-site geologist shall specify the monitoring well design to the drilling contractor before installation.

The on-site geologist is responsible for recording the exact well details as relayed by the drilling contractor and actual measurement. Both the on-site geologist and drilling contractor are responsible for tabulating all well materials used, such as footage of casing and screen or bags of grout, pellets, cement, or sand.

II. Monitoring Well Development

All monitoring wells will be developed or cleared of all fine-grained materials and sediments that have settled in or around the well during installation. The development will be by pumping, or bailing ground water from the monitoring well until it yields relatively sediment-free water.

III. Equipment Decontamination

All drilling equipment and associated tools including augers, drill rods, wrenches and any other equipment or tools that may have come in contact with contaminated materials shall be decontaminated using high pressure, hot water cleaning equipment (steam cleaner) using a controlled water source. The control water shall be obtained from a source approved by the on-site geologist. The primary choice of a controlled water source will be a municipal supply.

The drilling equipment will be decontaminated for each well in an area designated by the on-site geologist. No equipment will be permitted to leave a drilling site at any time without first being decontaminated as described above, unless otherwise specified in the field by the geologist.

APPENDIX D

IN-SITU HYDRAULIC CONDUCTIVITY TEST AND DATA REDUCTION PROTOCOL

IN-SITU HYDRAULIC CONDUCTIVITY TEST AND DATA REDUCTION PROTOCOL

I. Introduction

An in-situ hydraulic conductivity test will be performed on the unconsolidated monitoring wells. The test will be conducted by adding or removing a solid cylinder slug to the well to create a potential hydraulic difference between the well and the surrounding aquifer.

Water levels will be measured and recorded at specific time intervals as indicated below. These measurements will monitor the rate of recovery which is a function of the hydraulic conductivity of the aquifer material.

All water level measurements will be recorded to the nearest one hundredth of a foot.

Values for the hydraulic conductivity will be calculated using a digital computer program that uses the Bouwer-Rice formulae.

II. Materials

- Cement slug
- New polypropylene rope
- Water level indicator
- Waterproof marker
- Engineer's rule
- Stopwatch
- Alconox
- Appropriate solvent(s)

III. Procedures

1. Identify site and well number in the bound field book with indelible ink, along with date, time, personnel, and weather conditions.
2. Record the static water level of the well with the decontaminated water level recorder.
3. Remove the cable and probe from the well and place it in the plastic sheeting.
4. Measure out a length of rope ten feet greater than the depth to static water level.
5. Decontaminate the slug and the rope according to the decontamination protocol and place on a plastic sheet near the well.
6. Secure one end of the rope to the slug and the other end to the well casing.
7. Lower the slug into the well slowly until water level is reached. Before lowering the slug into the water, lower the water level probe into the well to the top of the slug.
8. Set stopwatch.
9. Lower the slug into the well, start the stopwatch at the same time.
10. Measure and record the water levels at approximately five second intervals for approximately 3 minutes.
11. After 3 minutes, measure water levels at approximately 15 second intervals for 5 minutes, and then at 1 minute intervals for 10 minutes. When the readings start to stabilize, they may be taken at longer time increments until the water level reaches static level.
12. Repeat the procedure by removing the slug from the well.

APPENDIX E

WATER LEVEL MEASUREMENT PROTOCOL (WELLS)

WATER LEVEL MEASUREMENT PROTOCOL (WELLS)

I. Introduction

Water levels will be obtained from each well for the development of piezometric maps. The water levels will be obtained using an electric well probe or an oil/water interface probe.

II. Materials

- Appropriate protective clothing and gear.
- Water level probe.
- Water (record time and day).
- Alconox.
- Appropriate decontamination solvent(s).
- Paper towels.
- Distilled water.
- Two plastic buckets.
- Plastic sheeting.
- Utility knife.
- Indelible ink.

III. Procedures

A detailed procedure for obtaining water levels will be as follows:

1. Identify site and well number. Record well number, date, time, personnel, and weather conditions in the bound field book with indelible ink.
2. Follow the proper requirements for personnel protection.

3. Decontaminate the oil-water interface level probe and/or water level probe and cable in accordance with the decontamination protocol (Step 12).

4. Unlock and open the well cover.

5. Locate the measuring reference point on the well casing. If one is not found, initiate a reference point by marking the outer casings with an indelible ink pen. This new reference will be surveyed and its elevation determined to the nearest 0.01 foot. All down-hole measurements will be taken from the reference points. The acronym TIC will designate the top of inner casing, and the acronym TOC will designate top of outer casing. If a well has both inner and outer casings, use the top of inner casing as the reference point.

6. Measure to the nearest hundredth of a foot and record the height of the inner and outer casing from reference point to ground level.

7. If product is suspected to be present in the well, lower a decontaminated oil-water interface probe into the casing. Feed the cable or tape into the casing until the probe indicates the top of product. (Make sure the cable or tape is straight and is not kinked). Measure to the nearest hundredth of a foot and record the depth to product from the reference point. Lower the oil-water interface probe or water level indicator until the probe indicates the top of water. Measure to the nearest hundredth of a foot and record the depth to water from the reference point.

8. Lower the water level recorder to the bottom of the well. Measure to the nearest hundredth of a foot and record the depth of the well from the reference point. Again, record the reference point

used. If weights are suspended from the water level probe, record the total length of the weights and add to the total depth.

9. Remove cable or tape and probe from the hole. Decontaminate the instrument (Step 12).

10. Compare the depth of well to previous records.

11. Lock the well when all activities are completed.

12. Decontaminate the probe and cable by wiping the probe and cable with disposable paper towels, rinsing with the appropriate solvent, followed by a distilled water rinse.

APPENDIX F

GROUND-WATER SAMPLING PROTOCOL FOR MONITORING WELLS

GROUND-WATER SAMPLING PROTOCOL FOR MONITORING WELLS

I. Materials

- Bound field book
- Indelible ink pens
- Hard hats
- Disposable gloves
- Disposable overalls
- Rubber boots
- Dual carbon respirators with appropriate filters, if required
- Safety glasses or goggles
- Plastic sheeting (10 feet by 10 feet minimum)
- Bailer (top filling) 1½-inch I.D. stainless steel
- New polypropylene rope
- Distilled water
- Appropriate decontamination solvent(s)
- Clean disposable towels
- Electric well probe
- Six-foot rule with graduations in tenths and hundredths of a foot
- Rinsing basins
- Alconox
- Graduated pail
- SCT meter
- pH meter
- Thermometer
- Appropriate sampling containers
- Glass container

- Insulated transport containers with wet ice

II. General Notes

The following general notes must be adhered to during all well developing and sampling operations:

1. Eye protection must be worn at all times during well development or sampling to prevent splashing of potentially contaminated water into the eyes.
2. Sampling of wells must be discontinued during precipitation periods (rain or snow).

III. Ground-Water Well Development

Prior to obtaining ground-water samples for laboratory analysis, all monitoring wells must be developed.

IV. Procedures

To ensure that a representative sample of ground water is obtained, it is important to decontaminate all sampling apparatus prior to and between each sampling event. Decontamination procedures are given in Step 22 of this sampling procedures list.

A. Sampling Procedures

1. Identify the well and record the location in the bound field book with indelible ink.
2. Put on a new pair of disposable gloves.
3. Cut a slit in the center of the plastic sheet, and slip it over the well creating a clean surface onto which the sampling equipment

can be positioned. This clean working area should be a minimum of 10 feet by 10 feet.

4. Clean all meters, tools, equipment, etc., before placing on the plastic sheet.

5. Rubber boots should be placed over the sampler's shoes to prevent potential contamination from dirty shoes contacting the plastic sheet. Do not kick, transfer, drop, or in any way let soils or other materials fall onto this plastic sheet unless it comes from inside the well.

6. Clean the well cap with a clean towel and remove the well cap and plug placing both on the plastic sheet.

7. Using an electric well probe, measure the depth to the water table and the bottom of the well. Record this information in a bound field book with indelible ink.

8. Clean the well probe with methanol and rinse it with distilled water after use.

9. Compute the volume of water in the well and record this volume in the field book.

10. Attach enough new polypropylene rope to a decontaminated (Step 22) stainless steel bailer to reach the bottom of the well and lower the bailer slowly into the well, making certain to submerge it only far enough to fill it one-half full. The purpose for this is to recover any surface film if one is present on the water table.

11. Pull the bailer out of the well keeping the polypropylene rope on the plastic sheet. Empty the ground water from the bailer into a glass container and observe its appearance. <u>NOTE</u>: This sample

will not undergo laboratory analysis; it is collected to observe the physical appearance of the ground water only.

12. Record the physical appearance of the ground water in the field book.

13. Start the bailing of the well taking care not to agitate any sediment which may have accumulated after the well development procedure. Continue bailing until a sufficient volume of ground water in the well has been removed, or until the well is bailed dry. If the well is bailed dry, allow sufficient time for the well to recover before proceeding with Step 14. Record this information in the field book.

14. Remove the sampling bottles from their transport containers and prepare the bottles for receiving samples. Inspect all labels to ensure proper sample identification. Sample bottles should be kept cool with their caps on until they are ready to receive samples. Arrange the sampling containers to allow for convenient filling.

15. To minimize agitation of the water in the well, initiate sampling by lowering the bailer slowly into the well making certain to submerge it only far enough to fill it completely. Fill each sample container following the instructions from the laboratory. Return each sample bottle to its proper transport container.

16. If the sample bottle cannot be filled quickly, keep them cool with the caps on until they are filled. NOTE: Samples must not be allowed to freeze.

17. Record the physical appearance of the ground water observed during sampling in the field book.

18. After the last sample has been collected, record the date and time and empty one bailer of water from the surface of the water in the well into the glass container and measure and record the pH, conductivity, and temperature of the ground water following the procedures outlined in the equipment operation manuals. Record this information in the field book. The glass container must then be rinsed with distilled water prior to reuse.

19. Begin the Chain-of-Custody Record following guidelines from SW-846, Test Methods for Evaluating Solid Waste.

20. Replace the well plug and lock the well protection assembly before leaving the well location.

21. Place the rope, gloves, and sheeting into a plastic bag for disposal.

22. Decontaminate the bailer by washing with an Alconox/control water solution, followed by successive rinses of control water, distilled water, an acetone solution, and final rinse with distilled water.

APPENDIX G

SITE-SPECIFIC HEALTH & SAFETY PLAN

HEALTH AND SAFETY PLAN
GRIFFIN TECHNOLOGY SITE

PHASE II INVESTIGATION WORK PLAN

FEBRUARY 1990

PREPARED BY:
BLASLAND & BOUCK ENGINEERS, P.C.
6723 TOWPATH ROAD
SYRACUSE, NEW YORK 13214

DISCLAIMER

This Health and Safety Plan specifically applies to work performed by employees of Blasland & Bouck Engineers, P.C., and sets forth the minimum safety requirements pursuant to OSHA regulations. It should be acknowledged that the employees of other consulting and/or contracted companies will work in accordance with their own independent Health and Safety Plans; provided that the minimum requirements of this plan are fulfilled.

HEALTH AND SAFETY PLAN

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HEALTH AND SAFETY PLAN
(Continued)

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SECTION 1 - INTRODUCTION

1.1 General

This Health and Safety Plan (HSP) has been prepared to identify the health and safety procedures, methods, and requirements for the Phase II Site Investigation (SI) activities to be performed at the Griffin Technology Inc. (GTI) site. The HSP applies to the activities to be performed by Blasland & Bouck Engineers, P.C., employees during the implementation of the SI. It should be noted that the contractors and/or vendors selected to perform the soils and ground-water remediation programs will be required to prepare separate HSPs for hazards associated with implementation of the remedies.

This HSP addresses those health and safety issues related to the potential for specific chemical hazards being present during the implementation of the SI. An Emergency Response/Contingency Plan (Section 9) has also been included in the HSP; this section outlines the procedures to be followed in the event of an emergency or unusual situation. During development of this plan, consideration was given to current health and safety standards as defined by the Occupational Safety and Health Administration and the National Institute for Occupations Safety and Health (OSHA/NIOSH), health effects data and standards for known contaminants, and by also consulting procedures designed to account for the potential for exposure to unknown substances. Specifically, this HSP has been prepared based on the document entitled "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities", written by NIOSH, OSHA, the United States Coast Guard (USCG), and the United States Environmental Protection Agency (USEPA) dated October 1985.

This document will be periodically reviewed to ensure that it is current and technically correct. Any changes in the site conditions and/or the scope of work of the SI activities will involve a review and modification to this HSP. Such changes will be completed in the form of an addendum.

1.2 Project Overview

Blasland & Bouck has been retained to develop and implement a Remedial Investigation (RI) associated with GTI's former on-site solvent disposal activities.

The GTI facility is located on the north side of Manchester Road (New York State Route 96) in the town of Farmington, Ontario County, New York (Figure 1). This facility is utilized for the manufacturing of plastic identification cards. The former operations at this facility included the on-site disposal of waste solvents (principally composed of trichloroethylene (TCE) to the ground surface between the years 1977 and 1986.

The proposed investigation activities will include the drilling and sampling of soil borings, as well as the installation and testing of monitoring wells. These field activities will be performed on the GTI property and the adjacent property to the west of the site. The adjacent property is currently a vacant lot. Based on our current understanding of the site, the soils and/or ground water encountered during this investigaiton may contain volatile organic compounds.

1.3 Definitions

The following definitions will apply to this Health and Safety Plan:

a. Buddy System - A system of grouping workers in hazardous areas so they can provide assistance, observe signs of chemical or heat exposure, and check the integrity of their partner's clothing.

b. Contamination Reduction Zone (CRZ) - Area between the Exclusion Zone and Support Zone that provides a transition between contaminated and clean areas. Decontamination stations are located in this zone.

c. Exclusion Zone - Any portion of the site where hazardous chemicals are, or may reasonably be suspected to be present in the air, water, or soil.

d. Health and Safety Officer (HSO) - The Health and Safety Officer .is a Blasland & Bouck Engineers, P.C. employee so designated and will be primarily responsible for the implementation and enforcement of the HSP. The HSO will have sound working knowledge of state and federal occupational safety and health regulations and formal training in occupational safety and health including the 40-hour hazardous waste site training as specified by the Occupational Safety and Health Administration (OSHA) in 29 CFR 1910.120.

e. Health and Safety Plan (HSP) - The Health and Safety Plan contained herein.

f. Monitoring - The use of field instrumentation to provide information regarding the levels of contaminants. Monitoring will be conducted to evaluate employee exposures to chemical and physical hazards.

g. On-Site Personnel - All Consultants, Remedial Contractors, and Subcontractor personnel involved with implementation of the SI or remedial activities.

h. Project - All on- and off-site work performed as part of the SI activities related to the GTI site.

i. Site - The area at the Fulton Terminal site where the work is to be performed.

j. Subcontractor - Includes Subcontractor personnel hired by the consultant.

k. Support Zone - The rest of the site apart from the CRZ and Exclusion Zone. Support equipment is located in this zone.

l. Visitor - All other personnel except the authorized on-site personnel.

SECTION 2 - IDENTIFICATION OF KEY HEALTH AND SAFETY PERSONNEL

2.1 Key Personnel

Implementation of this HSP will be accomplished through an integrated team effort. The names of key personnel involved with this project are provided in Table 1. These key personnel will be responsible for implementing the SI and Remedial Design Work Plan.

2.2 Assignment of Responsibilities

2.2.1 Griffin Technology Inc.'s (GTI's) Roles and Responsibilities

The GTI's roles and responsibilities will include the following:

- Ultimate responsibility for all site activities;
- Participate in accident/injury investigation; and
- Ensure that the HSP is followed, and furnish copies of the HSP to appropriate parties.

2.2.2 Blasland & Bouck Engineers, P.C. Roles and Responsibilities

Blasland & Bouck Engineers, P.C., will perform the on-site sampling, monitoring, and investigative activities work required by the SI in a safe and environmentally acceptable manner. Blasland & Bouck Engineers, P.C., will provide for the health and safety of all Blasland & Bouck Engineers, P.C., personnel on-site during any job requiring this HSP. It is the responsibility of Blasland & Bouck Engineers, P.C., personnel to:

- Name an HSO who has the health and safety responsibility for tasks listed in this HSP;
- Assure medical examinations and training requirements for all Subcontractor personnel on-site are current and comply with 29 CFR 1910.120 and 134;

- Be responsible for the pre-job indoctrination of all Blasland & Bouck Engineers, P.C., personnel with regard to this HSP and other safety requirements, including but not limited to (a) potential hazards; (b) personal hygiene principles; (c) personal protective equipment; (d) respiratory protection equipment usage; and (e) emergency procedures for dealing with fire and medical situations;
- Be responsible for the implementation of the HSP, special safety considerations, and the emergency response and contingency plan;
- Ensure that all Blasland & Bouck on-site personnel are properly protected and equipped;
- Alert appropriate emergency services before starting work and provide a copy of the Emergency Response/Contingency Plan to the respective emergency services;
- Comply with OSHA health and safety regulations; and
- Maintain a chronological log of Blasland & Bouck on-site personnel and visitors who enter the site during field activities (Attachment F).

The Blasland & Bouck designated HSO for this project is William T. McCune. Designated alternative is Lisa A. Ryan.

2.2.3 HSO Roles and Responsibilities

It is the responsibility of the HSO and/or designated alternate to:

- Maintain a daily log book for recording all significant health and safety activities and incidents;
- Have authority to suspend work due to health- and/or safety-related concerns;

- Provide on-site technical assistance;
- Conduct routine air monitoring, including equipment maintenance and calibration;
- Issue/obtain required work permits;
- Conduct periodic health and safety audits;
- Ensure that appropriate personnel have received the necessary training, including safety equipment and personal protective equipment;
- Provide regular pre-task health and safety briefings;
- Ensure that appropriate personnel have received the necessary physical examinations;
- Provide routine negative pressure respirator fit checks;
- Review the adequacy of the HSP;
- Draft necessary amendments to the HSP for review;
- Assure that all site, oversight, project and authorized personnel are made aware of the provisions of the HSP and have been informed of the nature of any physical and/or chemical hazards associated with the site activities; and
- Maintain control of required documents for recordkeeping purposes.

2.2.4 Subcontractors' Roles and Responsibilities

Subcontractors will perform all work required by the SI in a safe and environmentally acceptable manner. It is the responsibility of the subcontractor to provide the required health and safety training and medical surveillance for their employees prior to job start-up. The subcontractor will implement and maintain the requirements specified in their HSP, and will exercise sound judgment during the job in order to minimize risk to the community.

SECTION 3 - PHASE II INVESTIGATION HEALTH AND SAFETY RISK ANALYSIS

3.1 General

The purpose of this section is to identify the physical, chemical, and biological hazards associated with implementation of the SI. A detailed description of the sampling and analysis activities to be performed is presented in Sections 6 of the Phase II Investigation Work Plan. The following subsections discuss each task and/or operation in the SI in terms of specific hazards associated with it. Also identified are the protective measures to be implemented during the performance of each specific activity.

3.2 Risk Analysis

Presented below is a risk analysis for each of the activities to be performed during implementation of the SI.

3.3 Collection of Soil Samples

3.3.1 Description of Activity

The soil sampling program will consist of the collection of samples at various depths from soil borings. The subsurface samples will be collected utilizing a drill rig and a split-spoon sampling technique. All samples will be placed in appropriately labeled containers and shipped to an off-site laboratory for analysis on a daily basis.

3.3.2 Hazard Assessment

Chemical hazards associated with this task involve potential contact with soils containing organic and inorganic compounds. Skin absorption, inhalation, and ingestion are identified as potential routes of exposure.

3.3.3 Health and Safety Mitigative Measures

Workers will be required to wear modified Level D protection with the potential for upgrading to Level C as described in Section 4. The worker breathing zone will be monitored for organic vapors throughout the sampling procedure by the use of an organic vapor analyzer (OVA). If total organic vapor levels exceed 25 parts per million (ppm), use of a full-face air purifying respirator equipped with organic vapor cartridges will be required.

Chemical-resistant (nitrile) gloves will be worn while collecting subsurface soil samples and/or while handling potentially contaminated equipment. Workers will frequently check the integrity of their personal protective equipment by looking for any tears, rips, or holes in their clothing while they work.

Workers will receive instructions in prescribed work practices, such as not kneeling on bare ground or walking through stained soil. Instruction will also be provided regarding decontamination and personal hygiene (see Section 8 - Decontamination).

3.4 Monitoring Well Drilling and Installation

3.4.1 Description of Activity

This task will involve the drilling and installation of overburden and/or bedrock monitoring wells using a truck-mounted drilling rig. Procedure to be followed during drilling and installation will be in accordance with the Phase II Investigation Work Plan.

3.4.2 Hazard Assessment

Chemical hazards associated with this task involve potential contact with contaminated soil containing organic compounds. Skin absorption, inhalation, and ingestion are identified as potential routes of exposure.

3.4.3 Health and Safety Mitigative Measures

Workers will be required to wear modified Level D protection with possible upgrade to Level C as described in Section 4. The worker breathing zone will be monitored for organic vapors throughout the sampling procedure by the use of an OVA. If total organic vapor levels exceed 25 ppm, use of a full-face air purifying respirator equipped with organic vapor cartridges will be required.

Chemical-resistant (nitrile) gloves will be worn while collecting soil samples and/or while handling potentially contaminated equipment. Workers will frequently check the integrity of their personal protective equipment by looking for any tears, rips, or holes in their clothing while they work.

Workers will receive instruction in prescribed work practices such as not kneeling on bare ground or walking through stained soil. Instruction will also be provided regarding decontamination and personal hygiene (see Section 8 - Decontamination).

3.5 Collection of Ground-Water Samples

3.5.1 Description of Activity

Monitoring wells will be sampled as described in Section 6 of the SI. The ground-water monitoring well samples will be collected utilizing a bailer. All samples will be placed in appropriately labeled containers and shipped off site for analysis on a daily basis.

3.5.2 Hazard Assessment

Chemical hazards associated with this task involve potential contact with contaminated ground water containing organic and inorganic compounds. Skin absorption, inhalation, and ingestion are identified as potential routes of exposure.

3.5.3 Health and Safety Mitigative Measures

Workers will be required to wear modified Level D protection with possible upgrade to Level C as described in Section 4. The worker breathing zone will be monitored for organic vapors throughout the sampling procedure by the use of an OVA. If total organic vapor levels exceed 25 ppm, use of a full-face air purifying respirator equipped with organic vapor cartridges will be required.

Chemical-resistant (nitrile) gloves will be worn while collecting ground-water samples and/or while handling contaminated equipment. Workers will frequently check the integrity of their personal protective equipment by looking for any tears, rips, or holes in their clothing while they work.

Workers will receive instruction in prescribed work practices such as using plastic sheeting around the wells and standing upwind of the well. Instruction will also be given regarding decontamination and personal hygiene (see Section 8 - Decontamination).

3.6 Performance of In-Situ Hydraulic Conductivity Testing

3.6.1 Description of Activity

An in-situ hydraulic conductivity test will be performed on each of the monitoring wells installed in accordance with the protocols described in the Work Plan.

3.6.2 Hazard Assessment

Chemical hazards associated with this task involve potential contact with contaminated ground water containing organic compounds. Skin absorption, inhalation, and ingestion are identified as potential routes of exposure.

3.6.3 Health and Safety Mitigative Measures

Workers will be required to wear modified Level D protection with possible upgrade to Level C as described in Section 4. The worker breathing zone will be monitored for organic vapors throughout the sampling procedure by the use of an OVA. If total organic vapor levels exceed 25 ppm use of a full-face air purifying respirator equipped with organic vapor cartridges will be required.

Chemical-resistant (nitrile) gloves will be worn while collecting ground-water samples and/or while handling contaminated equipment. Workers will frequently check the integrity of their personal protective equipment by looking for any tears, rips, or holes in their clothing while they work.

Workers will receive instruction in prescribed work practices such as using plastic sheeting around the treatment equipment and standing upwind of the equipment. Instruction will also be given regarding decontamination and personal hygiene (see Section 8 - Decontamination).

3.7 Physical Hazards

Physical hazards and associated protective mechanisms are listed in Table 2. The purpose of this section is to provide additional information regarding health and safety approaches to general physical hazards associated with site activities.

3.7.1 Heat Stress

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. Because heat stress is one of the most common illnesses associated with hazardous waste site remedial activities, and in particular, because wearing personal protective equipment can increase the risk of developing heat stress, workers must be capable of recognizing the signs and symptoms of heat-related illnesses. Information on the types of heat-related illnesses as well as the signs and symptoms workers should be aware of in both themselves and their co-workers are described below.

Signs and Symptoms of Heat Stress

- Heat rash may result from continuous exposure to heat or humid air;
- Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:
  - muscle spasms
  - pain in the hands, feet, and abdomen;
- Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:
  - Pale, cool, moist skin
  - heavy sweating
  - dizziness
  - nausea
  - fainting

- Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are:
  - red, hot, usually dry skin
  - lack of or reduced perspiration
  - nausea
  - dizziness and confusion
  - strong, rapid pulse
  - coma

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or exhaustion, that person may be predisposed to additional heat injuries. To avoid heat stress, site personnel should implement the following:

- Train workers to recognize and treat heat stress
  - Workers should be familiar with and be capable of recognizing the signs and symptoms of heat stress in themselves and their co-workers. Workers should understand the significance of the work-rest cycle and be instructed to adhere to either a planned or self-paced work-rest cycle.

- Adjust work schedules
  - Modify work-rest schedules according to ambient temperature, solar load, workload, level of protection being worn (normal work ensemble vs. impermeable ensemble), and known physical condition and level of acclimatization of individuals.
  - Mandate work slowdowns as needed. Provide shelter or shaded areas to protect personnel during rest periods. Perform work during cooler hours of the day or at night.
- Maintain body fluids at normal levels.
  - The normal thirst mechanism is not sensitive enough to ensure that sufficient liquid be consumed to replace lost sweat. Subsequently workers should be encouraged to drink water to replace fluid loss.
- Encourage workers to maintain an optional level of physical fitness.
  - Allow time for workers to acclimatize to site conditions, such as, temperature, protective clothing, and workload.
- Provide cooling devices to aid natural body heat exchange during prolonged work or severe heat exposure, e.g., field showers or hose down areas, cooling jackets, vests, or suits.

Attachment A - Heat Stress Work/Rest Schedule, presents suggested frequencies of work and rest cycles based on ambient air temperatures.

3.7.2 Cold Stress

Persons working outdoors in temperatures at or below freezing may be frostbitten. Extreme cold for a short time may cause severe injury to exposed body surfaces, or result in profound generalized cooling, causing death. Areas of the body which have high surface area-to volume ratio such as fingers, toes, and ears, are the most susceptible.

Two factors influence the development of a cold weather injury: ambient temperature and the velocity of the wind. Wind chill is used to describe the chilling effect of moving air in combination with low temperature. For instance, 10 degrees Fahrenheit (°F) with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F. An equivalent chill temperature chart relating the actual dry bulb temperature and wind velocity is presented in Table 3.

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of damage. Frostbite of the extremities can be categorized into:

- Frost nip or incipient frostbite: characterized by suddenly blanching or whitening of skin.
- Superficial frostbite: skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- Deep Frostbite: tissues are cold, pale, and solid; extremely serious injury.

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. It can be fatal. Its symptoms are usually exhibited in five stages: 1) shivering, 2) apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F, 3) unconsciousness, glassy stare, slow pulse, and slow respiratory rate, 4) freezing of the extremities, and finally, 5) death. Trauma sustained in freezing or subzero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues in addition to providing for first aid treatment. To avoid cold stress, site personnel must wear protective clothing appropriate for the level of cold and physical activity. In addition, the following should be implemented:

- Personal Protection
  - For air temperatures of 0°F or less, the hands should be protected by mittens. For exposed skin, continuous exposure should not be permitted when air speed and temperature results in a wind chill temperature of -25°F.
  - At air temperatures of 36°F or less, workers who become immersed in water or whose clothing becomes wet must be immediately provided a change of clothing and be treated for hypothermia.
  - If work is done at normal temperature or in a hot environment before entering the cold, the worker must ensure that his clothing is not wet as a consequence of sweating. If wet, the worker must change into dry clothes prior to entering the cold area.
  - If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work must be modified

or suspended until adequate clothing is made available or until weather conditions improve.

- Workers handling evaporative liquid, e.q., gasoline, alcohol, or cleaning fluids, at air temperatures below 40°F must take special precaution to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.

° Work Practices

- Avoid direct contact between bare skin and cold surfaces (20°F). Metal handles of tools and/or equipment controls should be covered by thermal insulating material.
- For work performed in a wind chill temperature at or below 10°F, workers should be under constant protective observation (buddy system). The work rate should be established to prevent heavy sweating that will result in wet clothing. For heavy work, rest periods must be taken in heated shelters and an opportunity for changing into dry clothing provided.
- Workers should be provided the opportunity to become accustomed to cold weather working conditions and required protective clothing.
- Work should be arranged in such a way that sitting or standing still for long periods is minimized. Unprotected metal on tools, seats, and equipment should be thermal insulated, and direct contact with bare skin avoided.

° Training

Workers must receive training and instruction in the following:

- Proper rewarming procedures and appropriate first aid
- Proper clothing practice
- Proper eating and drinking habits
- Recognition of impending frostbite
- Recognition of signs and symptoms of impending hypothermia or excessive cooling of the body level when shivering does not occur.
- Safe work practices.

During the warming regimen (rest period), workers should be encouraged to remove outer clothing to permit sweat evaporation or to change into dry work clothing. Dehydration, or loss of body fluids, occurs insidiously in the cold environment and may increase the susceptibility of the worker to cold injury due to a significant change in blood flow to the extremities. Fluid replacement with warm, sweet drinks and soups is recommended. The intake of coffee should be limited because of the diuretic and circulatory effects.

3.8 Potential Contaminants of Concern

Table 4 lists the chemical contaminants known to be potentially present on site, their physical properties and characteristics, exposure limits, potential routes of exposure, and an indication of acute exposure symptomology. If necessary, this listing will be updated to reflect new information.

SECTION 4 - PERSONAL PROTECTIVE EQUIPMENT (PPE) AND EQUIPMENT REASSESSMENT PROGRAM

4.1 PPE Selection Criteria

PPE ensembles chosen for each individual task were specified in Section 3 - Task/Operation Health and Safety Risk Analysis. Equipment selection was based upon the mechanics of the task and the nature of the hazards which were anticipated. The following criteria were used in the selection of equipment ensembles:

- chemical hazards known or suspected to be present;
- routes of entry through which the chemicals could enter the body, e.g., inhalation, ingestion, skin contact; and
- potential for contaminant/worker contact while performing the specific task or activity.

4.2 Selected PPE Ensembles

Based on available data, field personnel involved with work activities will wear modified Level D Protection as detailed below. Level C and Level B Protection is also defined below in the event that an upgrade in the level of personal protection is warranted based on air monitoring as discussed in Section 4.3.

Modified Level D Protection

Field personnel shall wear:

- Hard hat with protective face shield;
- Chemical-resistant outer gloves;
- Cotton or leather, or other inner gloves;
- Steel-toed work boots;

- Protective outer boots (reusable neoprene); and
- Disposable outer Saranex-coated TYVEK coveralls.

Level C Protection (if required)

This level will be identical to Modified Level D Protection with the addition of the following:

- A full-face air-purifying respirator equipped with organic vapor cartridges; and
- Seal all garment interconnections with duct tape.

Level B Protection

Field personnel shall wear:

- Hard hat with protective face shield;
- Chemical-resistant outer gloves;
- Cotton or leather, or other inner gloves;
- Steel-toed work boots;
- Protective outer boots (reusable neoprene);
- Pressure-demand, full face piece, self-contained breathing apparatus (SCBA), or pressure-demand supplied air respirator with escape SCBA (NIOSH approved);
- Hooded disposable outer Saranex-coated TYVEK coveralls; and
- All garment interconnections will be sealed with duct tape.

4.3 PPE Reassessment Program

The level of protection provided by selected PPE may be upgraded or downgraded based upon a change in site conditions or findings of investigations. When a significant change occurs, the hazards will be remeasured. Some indicators of the need for reassessment are:

- Commencement of a new work phase, such as the start of work that begins on a different portion of the site.
- Change in job tasks during a work phase.
- Appearance of new contaminants other than those previously identified.
- Change in ambient levels of contaminants.
- Change in work scope which effects the degree of contact with contaminants.

Upgrading or downgrading the level of protection based upon changes in ambient levels of contaminants in the worker breathing zone will be determined by use of portable direct-reading instruments for total organic vapor and particulate concentrations. Instrumentation will consist of a flame ionization detector (FID) otherwise known as an organic vapor analyzer (OVA). Action levels for such area monitoring have been established for the project and are summarized in Table 5. In comparing measured values to the action levels listed in the table, the background contribution must be accounted for.

Background vapor levels will be established daily at each work station, as necessary. Continuous monitoring with an OVA will take place in the worker breathing zones. Each day, a minimum of four readings will be taken upwind and downwind at the perimeter of the work area. If, during the perimeter or work area monitoring, a release in excess of the action level is noted, any impacted workers or other persons without proper protection will be removed from the work area. During the release, the HSO or designee will implement continuous monitoring with the OVA between the active operations area and the perimeter to provide input for determining source strength and downwind impacts.

4.4 Recordkeeping

A daily log documenting the findings of all direct-reading measurements will be maintained by the HSO and/or the designated alternate. The daily log will document the task, time, meter reading, and level of protection being worn by workers involved with the activity. Actions taken in response to releases and/or recordings above pre-established action levels will also be recorded in the daily log.

SECTION 5 - PERSONNEL TRAINING REQUIREMENTS

5.1 Training Requirements

All Blasland & Bouck Engineers, P.C., personnel and visitors will be trained commensurate with their job responsibilities. Such training will be provided prior to being allowed to engage in site activities which could expose personal to health and safety hazards. The Health and Safety Officer (HSO) or designated alternate has the responsibility to assure that this training is provided, reflective of site conditions, and updated, as needed.

5.1.1 Site Orientation

The following is a listing of general site training required for all personnel during an initial site orientation:

- names of all site health and safety personnel and alternates;
- work rules and safe work practices;
- use of personal protective equipment;
- site chemical and physical hazards;
- safe use of engineering controls and site equipment;
- medical surveillance requirements;
- symptoms associated with exposure to site hazards;
- site control measures;
- decontamination procedures;
- provisions of the emergency response plan;
- standard operating procedures, e.g., confined space entry, spill containment, etc.

5.1.2 Preassigned Training

Blasland & Bouck Engineers, P.C., personnel and visitors entering the Exclusion and/or Contamination Reduction Zones will have preassignment training in accordance with the provisions outlined in 29 CFR 1910.120(e) Training. These requirements are as follows:

A. General site workers, such as labors and equipment operators, engaged in activities which expose or potentially expose them to hazardous substances and health hazards are required to complete:

- 40-hours of off-site instruction;
- Three days of on-the-job training under direct supervision of a trained, experienced supervisor;
- Eight hours of annual refresher training;

B. Workers on-site only occasionally for a specific limited task (for example, ground water monitoring, and surveying, etc.) and who are unlikely to experience exposure in excess of applicable limits are required to complete:

- 24-hours of off-site instruction;
- One day on-the-job training under direct supervision of a trained, experienced supervisor;
- Eight hours of annual refresher training.

C. Workers regularly on site who work in areas which have been monitored and fully characterized, indicating that no PPE is required and that emergencies are unlikely to develop (for example, the Site Support Zone) have the same training requirements as listed in B above.

D. On-site management and supervisors directly responsible for personnel engaged in on-site activities must complete:

- The same (or equivalent) training as required for the employees they supervise;

- Eight additional hours of specialized supervisory training; and
- Eight hours of annual refresher training.

The HSO or designated alternate is responsible for ensuring that personnel assigned to this site are trained in accordance with the above requirements. The HSO will ensure that all training certificates are current and that copies of these documents are filed on-site with this HSP.

5.1.3 Equivalent Training

29 CFR 1910.120 (e) Training provides that employers may show by documentation or certification that an employee's work experience and/or training has resulted in training equivalent to the initial 24- or 40-hour training requirements. Equivalent training includes any academic training or training that existing workers have already received from actual hazardous waste site work experience. Declaration of equivalent training must be examined on a case-by-case basis by the HSO. A Supplemental Training Acknowledgment form must be completed by the individual declaring equivalent training status, and approved by the HSO (Attachment B).

Equivalent training does not preclude an individual from a 8-hour annual refresher requirement. Workers approved as having had equivalent training must receive the appropriate, site specific training before site entry and have the appropriate supervised field experience at the new site.

5.2 Periodic Health and Safety Meetings

The HSO or designated alternate will conduct periodic health and safety meetings. These meetings will be a review of existing protocols as well as a means to update personnel on new site requirements or conditions. The meetings will also provide an opportunity for site personnel to express any health and safety concerns. Topics for discussion would include, but not be limited to, the following:

- review of available analytical or relevant process data which may relate to the potential for worker exposure during task execution;
- review of the type and frequency of environmental and personal monitoring (if any) to be performed;
- task-specific levels of protection and anticipated potential for upgrading;
- review of emergency procedures;
- review of existing and/or new health and safety issues.

5.3 Subcontractor Training Requirements

Prior to arrival on-site, each subcontractor will be responsible for certifying that their employees meet the training requirements contained in Section 5.1.2. Each subcontractor employee will be required to provide a document certifying the dates of their training attendance and latest annual refresher. Subcontractor personal will also be required to attend the site health and safety orientation as well as any other periodic health and safety meeting specified by the HSO.

5.4 Documentation/Recordkeeping

Attachment B contains a Health and Safety Training Acknowledgement Form. This form will be utilized to document compliance with the training requirements specified in this section. All on-site Blasland & Bouck Engineers, P.C., personnel, visitors, and subcontractors are required to sign this acknowledgment form. The form together with the training certificates will be retained on-site with this HSP.

SECTION 6 - MEDICAL SURVEILLANCE

6.1 General Medical Program

Medical surveillance for this project will reflect the provisions established under Title 29 CFR 1910.120(f), OSHA's medical surveillance requirements for hazardous waste operations. (Medical clearance is not required for visitors who will visit the Support Zone and/or any other site zone where an exposure at or above the PEL/TVL does not exist or where respiratory protection is not required).

Verification of the examining physician's written opinion regarding the health status of any workers assigned to this project must be provided to the HSO prior to the individual's first day at the site. Such verification must also be retained on-site by the HSO. Attachment C - Physical Verification Form, presents an example of a physical verification form that may be used to document verification of a physician.

6.2 Respirator Certification

Prior to authorizing the use of any air purifying or air-supplied respirator, OSHA, under 29 CFR 1910.134 and 29 CFR 1926.58, requires that a determination be made regarding the prospective wearer's physical ability to safely use such equipment. Consequently, individuals scheduled to work in areas that require the use of a respirator must provide the HSO with current documentation (not older than 24 months) regarding the individual's physical abilities to wear a respirator, signed by a qualified physician. The inability to provide current or complete documentation will be sufficient grounds to preclude any individual from areas or tasks requiring such protection. Attachment D - Respirator Suitability Form, presents an example of a respirator suitability form that may be used to document a physician's determination regarding an employees suitability to wear a respirator.

6.3 Exposure/Injury Medical Emergency

As a follow-up to an injury or illness or as a result of possible excessive exposure to either a chemical or physical hazard, all employees are entitled to and encouraged to seek appropriate medical attention. The HSO or designated alternate must be appraised of the need for seeking such medical attention and assist in determining the immediacy of the situation.

During and immediately following the emergency medical situation, the HSO or designated alternate have the following responsibilities:

- Ensure that the examining medical facility is fully appraised of the site condition and/or hazard which caused the medical emergency;
- Conduct an investigation of the site condition which caused the medical situation prior to reassigning the task;
- Complete an Accident Investigation Form (Attachment E):
- Ensure the injured/ill worker receives written medical clearance prior to return to the site;
- Ensure a copy of the medical clearance and accident investigation form are maintained on site for the duration of the project; and
- Provide a copy of the medical clearance and accident investigation form for the employee's medical records.

Injuries/illnesses and/or possible excessive exposure to either a chemical or physical hazard requiring emergency medical treatment and hospitalization must be reported within 24 hours to the Manager, Environmental Health and Industrial Hygiene, Syracuse, New York. Fatalities must be reported immediately.

SECTION 7 - SITE CONTROL MEASURES

7.1 Site Control

Site control will minimize potential contamination of workers and observers, protect the public from potential on-site hazards, and prevent vandalism of equipment and materials. Site control measures also enhance response in emergency situations.

When appropriate and/or necessary, the site of field operations will be divided into three distinct areas. The actual extent of the areas are considered task and location specific and will be determined on a task-specific basis. Generally these areas include:

A. Exclusion Zone - the area where the highest potential for exposure by dermal or inhalation routes exists. Personal protective equipment is required and a daily log must be kept by the HSO of all personnel entering this zone. The Exclusion Zone must be marked off by barricades or barrier tape which will be placed a minimum of 30 feet from the edge of the active operation. Some situations may necessitate a distance less than the recommended minimum. These circumstances should be reviewed by the HSO.

   Visitors are not permitted into controlled zones (Exclusion Zone and CRZ) without the approval of management. Additionally, visitors must have satisfactorily completed the required OSHA training course(s), be properly fitted with respiratory protection, and have medical clearance, if necessary.

B. Contamination Reduction Zone (CRZ) - the area immediately adjacent to and surrounding the Exclusion Zone. The probability of dermal and inhalation exposure is lower than in the Exclusion Zone.

Typically, Contamination Reduction Zones include facilities for personnel or equipment decontamination. Personal protective equipment worn in the Exclusion Zone may not be worn outside the CRZ except during emergencies.

C. Support Zone - all areas outside the CRZ. The exposure potential in these zones is minimal. Support zones provide a changing area for personnel entering the Contamination Reduction and Control Zones, a lunch area, office spaces, and clean equipment and material storage. Protective clothing worn in the Exclusion Zone may not be worn in a Support Zone except in emergencies.

In some instances, field operations will involve activities in "clean" locations where such subdivisions will not be necessary. The final locations of these zones will be determined and modified as necessary in the field. In addition, it will be necessary to make modifications as weather and site conditions change.

Movement of personnel between the three zones should be limited through specific Access Control Points to prevent cross contamination from contaminated areas to clean areas.

7.2 Site Access Control

It is the responsibility of the HSO to control access to the site and to assure proper security. Any evidence of unauthorized entry should be noted in the daily field log, and the HSO will be immediately notified.

Effective site security will prevent the following:

- exposure of unauthorized, unprotected people to site hazards;
- increased hazards from vandals or persons seeking to abandon other wastes on the site;

- theft; and
- interference with safe working procedures.

Currently, the GTI site is enclosed by a fence and access is limited. This fence will be maintained during all site activities and access will be allowed through the gate only. Site visitors as well as on-site workers will be required to sign a Daily Site Sign-In/Sign-Out Log as shown on Attachment F.

7.3 Buddy System

Most activities in contaminated or otherwise hazardous areas should be conducted with a "buddy" who is able to perform the following activities:

- 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; and
- Notify the Command Post Supervisor or others if emergency help is needed.

The Access Control Point for personnel entrance to the Exclusion Zone is a convenient location for enforcing the buddy system for two reasons: enforcement is the responsibility of the Project Team Leader, who is stationed in the CRZ, and all personnel who enter the contaminated areas must pass through the control point.

The buddy system alone may not be sufficient to ensure that help will be provided in an emergency. At all times, workers in the Exclusion Zone should be in line-of-sight contact or communication contact with a backup person in the Support Zone.

7.4 Site Communications

Two sets of communication systems will be established prior to initiating SI activities: internal communication among personnel on site and external communication between on-site and off-site personnel. Internal communication alerts team members to emergencies; passes along safety information, such as the amount of air time left before the next rest period (if Level B protection is required), air change, or heat stress check; communicates changes in the work to be accomplished; and maintains site control. An external communication system between on-site and off-site personnel is necessary to coordinate emergency response, report to management, and maintain contact with essential off-site personnel.

On-site internal communication will be conducted through verbal communications. Non-verbal communication will be conducted when background noise or respirators impede verbal communications and will utilize standard visual hand signals as presented on Table 6.

External communication during the SI activities and will be accomplished by the use of the nearest public telephone. The location of this phone will be confirmed prior to inititation of the SI activities.

7.5 Safe Work Practices

To maintain a strong safety awareness and enforce safe procedures at a site, a list of standing orders has been developed stating the practices that must always be followed and those that must never occur in the Exclusion and Contamination Reduction Zones on site. The list of standing orders is as follows:

1. No smoking, drinking, eating, or gum chewing will be permitted in the Exclusion Zone or in the Contamination Reduction Zone;

2. Field work will only be conducted during daylight hours unless adequate artificial lighting is provided;
3. Sampling activities will be performed in two-person teams at all times;
4. Personnel involved in sampling activities are required to attend a daily safety meeting, read the HSP, and sign all appropriate forms prior to initiating work;
5. Personnel will be advised of the precautions to be taken against cold and heat stress; and
6. Walkways will be kept clear of equipment, sampling materials, or other obstructions.

To ensure that everyone who enters the site is aware of these orders and familiar with their content, the list will be made available in the following ways:

- Distributed to everyone who enters the site;
- Posted conspicuously at the site entrance and at the entrance to the Contamination Reduction Zone and/or the Exclusion Zone; and
- Reviewed by the HSO with the field crew at the beginning of each work day, thereby informing personnel of any new standing orders resulting from a change in site conditions or work activities.

In addition to the standing orders, a hazardous substance information form (see Table 4) that lists the names and properties of chemicals present on site will be posted conspicuously. Employees will be briefed on this information at the beginning of the project or whenever they first join the work team. Daily safety meetings will be held for all employees prior to initiating work for the day.

Working with tools and heavy equipment (i.e, drilling rig) is a major hazard at sites. Injuries can result from equipment hitting or running over personnel, impacts from flying objects, burns from hot objects, and damage to PPE. The following precautions will be followed to help prevent injuries from such hazards:

- Personnel will be trained in proper operating procedures.
- Equipment and tools that are intrinsically safe and not capable of sparking will be used.
- All non-essential people will be kept out of the work area.
- Loose-fitting clothing or loose long hair around moving machinery will be prohibited.
- Equipment operators will be instructed of any abnormalities, such as equipment failure, leaking liquids, unusual odors, etc.
- Tools and equipment will be stored in clean, secure areas so that they will not be damaged, lost, or stolen.
- All heavy equipment that is used in the Exclusion Zone (i.e., drilling rig) will remain in that zone until the job is done. Such equipment will be decontaminated before moving it into the Support Zone.

7.6 Visitors

Visitors will be permitted in the immediate area of active operations only with approval from site management. Approval for entry into Exclusion Zones and Contamination Reduction Zones will require physical examination and compliance with training requirements (OSHA 29 CFR 1910.120). All site visitors must be briefed on appropriate sections of the Health and Safety Plan. A visitors log will be kept on site (see Attachment F). Visitor vehicles are restricted to Support Zones. Subcontractor and vendor equipment will not be permitted to enter the Exclusion Zone without prior authorization and will be subject to site decontamination procedures.

7.7 Nearest Medical Assistance

The nearest medical assistance is the F.F. Thompson Hospital and is located at 350 Perish Street, Canandaigua, New York. The emergency room number at the facility is (315) 396-6600. Additional information regarding medical assistance, evacuation routes, emergency procedures, etc., are contained in Section 10, the Emergency Response/Contingency Plan.

SECTION 8 - DECONTAMINATION

8.1 Decontamination Plan

Section 3 - Health and Safety Risk Analysis lists the various activities and specific levels of protection required for each activity. Consistent with the levels of protection required, Figures 1 and 2, and Tables 7 and 8 provide a step-by-step representation of the personnel decontamination process for Modified Level D and Levels C and B protection.

8.2 Level of Protection Required for Decontamination Personnel

The level of protection required for personnel assisting with decontamination will be Level D. Modifications include:

- Chemical-resistant outer gloves;
- Cotton, leather, or other inner gloves;
- Protective outer boots (reusable neoprene); and
- Disposable outer Saranex-coated TYVEK coveralls.

If necessary, the level of protection required will be upgraded to Level C or Level B. This decision will be made by the HSO.

8.3 Equipment Decontamination

Any equipment used inside the Exclusion Zone will be considered contaminated and must be cleaned before leaving the Exclusion Zone. Decontamination of all large equipment, including generators, backhoes, and other equipment will be performed on site (prior to personnel decontamination). An equipment decontamination area will be established prior to the outset of field activities. The decontamination of equipment is discussed in detail in the SI Work Plan.

8.4 Personnel Decontamination

Reusable equipment will be cleaned with a detergent and water washing of interior and exterior surfaces. Personal equipment includes respirators, overboots, hard hats, safety glasses, and face shields. Personnel completing activities within a work zone shall proceed directly to the Contamination Reduction Zone upon completion of work.

Prior to removal of protective gear, personnel will remove soils from boots and gloves using designated wash basins. If other protective gear or clothing is thoroughly soiled, the HSO may decide to dispose of this equipment, rather than clean it. Table 7 presents the equipment and materials needed for Levels B, C, and Modified D decontamination. Table 8 presents the minimum measures required for Level B, C, and Modified D decontamination.

8.5 Disposition of Decontamination Waste

All used cleaning water and solvents generated during any decontamination procedure will be collected and disposed of in accordance with applicable regulations.

Solids (e.g., disposable gloves, disposable clothing, and other disposable equipment) resulting from personal cleaning and sampling activities will be placed in labeled plastic bags. These bags will be transferred into appropriately labeled containers for appropriate disposal.

SECTION 9 - EMERGENCY RESPONSE/CONTINGENCY PLAN

9.1 General

The following Emergency Response/Contingency Plan has been developed to include instruction and procedures for personnel evacuation, and procedures for medical emergencies that may occur during implementation of the SI. All personnel emergency conditions require concise and timely actions conducted in a manner that minimizes the health and safety risks. All on-site personnel must be familiar with the Emergency Response/Contingency Plan described herein.

9.2 Response Considerations

Due to the nature of this site, the emergencies or extraordinary conditions that may arise are more than likely limited to personnel accidents requiring first aid, exposure to soils and ground water with chemical constituents, potential fire near mechanical equipment, and water-related incidents (e.g., on-site flooding). The following procedures must be implemented in the event of an emergency:

1. On-site personnel must report all accidents and unusual events to the HSO.
2. The HSO and other on-site personnel are responsible for conducting the emergency response in an efficient, rapid, and safe manner. The HSO will decide if off-site assistance and/or medical treatment is required and must be responsible for alerting off-site authorities and arranging for their assistance.
3. Basic first-aid or other appropriate initial action will be administered by those closest to the accident/event. This

assistance will be coordinated by the ranking individual on-site and will be conducted in a manner so that those rendering assistance are not placed in a situation of unacceptable risk.

4. The HSO will complete an Accident Report (Attachment E) which includes the following:

   a. A description of the emergency (including date, time and duration);

   b. Date, time, and name of all persons/agencies notified and their response; and

   c. A description of corrective actions implemented or other resolution of the incident.

5. All on-site personnel are responsible for conducting themselves in a mature, calm manner in the event of an accident. All personnel must conduct themselves in a manner to avoid spreading the danger to themselves and to surrounding personnel.

9.3 Responsibilities

The HSO or a designated alternate has responsibility for directing response activities in the event of an emergency. The HSO will:

1. Assess the situation;
2. Determine required response measures;
3. Notify appropriate response teams; and
4. Determine and direct on-site personnel during the emergency.

The HSO or designated alternate must coordinate the response activities of on-site personnel with those of public agencies.

9.4 Public Response Agencies

A list of public response agencies to be contacted and who may, depending on the nature of the situation, assume authority for emergency response is included as Table 9. Table 9 presents local emergency numbers, including local hospitals, the local health department, ambulance service, fire and police departments, and others. In addition, nationwide hotline numbers provided by the EPA for emergency assistance are listed. These telephone lists should be retained on-site.

The routes to the hospital, fire, and police departments will be driven by the HSO prior to work being conducted at the site. The HSO will provide direction and/or maps to these facilities to all on-site personnel. The HSO will notify and establish emergency procedures with local public emergency officials (i.e. police and fire departments) prior to starting any field activities.

9.5 Accidents and Non-Routine Events

Every accident is a unique event that must be dealt with by trained personnel working in a calm, controlled manner. In the event of an accident the prime consideration is to provide the appropriate initial response to assist those in jeopardy without placing additional personnel at unnecessary risk. Several types of emergencies are outlined in the following subsections. These are not intended to cover all potential situations.

9.5.1 On-site Personnel Injury

If a person working on the site is physically injured, basic first aid procedures must be followed. Depending on the severity of the injury, emergency medical response may be sought. If the person can be moved, he/she will be taken to the edge of the work area where PPE will be removed, and emergency first aid administered. If necessary, transportation to a local emergency medical facility will be provided as soon as possible.

If the person can only be moved by emergency medical personnel, the HSO will decide what protective equipment (if any) is required to be worn by emergency personnel. Each work area will have extra equipment available for emergencies.

If the injury to on-site personnel involves chemical exposure, the following first aid procedures must be initiated as soon as possible:

1. Eye Exposure - If solid or liquid gets into the eyes, wash eyes immediately at the emergency eyewash station using water and lifting the lower and upper eye lids occasionally. Obtain medical attention immediately.

2. Skin Exposure - If solid or liquid gets on the skin, wash skin immediately at the emergency eyewash station using water. Obtain medical attention immediately.

3. Inhalation - If a person inhales large amounts of (organic vapor, dust, etc.) move him/her to fresh air at once. Obtain medical attention immediately. If breathing has stopped, appropriately trained personnel and/or medical personnel should perform cardio-pulmonary resuscitation. Keep the affected person warm and at rest.

4. Ingestion - If solid or liquid is swallowed, medical attention must be obtained immediately and the Poison Control Center consulted.

The HSO must inform the Project Director of the injury/accident, and a written report detailing the accident, its causes, and consequences must be submitted to the Project Director within 48 hours of the incident.

9.5.2 Temperature-Related Problems

Temperature related problems are discussed in Section 3.6 with respect to monitoring and mitigation.

First-aid for all forms of heat stress includes cooling the body by removing PPE, moving to an area outside the exclusion area and Contamination Reduction Zones, and allowing the person to rest in a cooler environment.

First-aid for frostbite will include protecting the frozen area from further injury, bringing the victim indoors, warming the affected areas quickly with luke warm water, and maintaining respiration according to first aid procedures. Medical help must be called immediately.

9.5.3 Hospital Route

The HSO will provide a map to all on-site personnel showing the route from the GTI site to the F.F. Thompson Hospital in Canandaigua.

9.5.4 Emergency Evacuation

In extraordinary circumstances, emergency evacuation of the site may be necessary. On-site personnel will be notified of the need to evacuate verbally. If the situation is deemed an emergency, personnel will be instructed to leave the site immediately, using the closest available evacuation route. Otherwise, personnel will be expected to go through normal cleaning procedures before leaving the site. In either case, personnel will be instructed to rendezvous at a central location. A head count will be made to ensure that all personnel are safe and accounted for. The HSO or designated alternate will contact other appropriate response agencies, as warranted.

Engines and motorized equipment will be shut off before the site is evacuated.

TABLES

TABLE 1

IDENTIFICATION OF KEY PERSONNEL

HEALTH AND SAFETY PLAN
GRIFFIN TECHNOLOGY INC. SITE

Griffin Technology Key Personnel

Company	Name/Title	Address	Telephone
To be provided by Griffin Technology			

Blasland, Bouck & Lee Key Personnel

Name/Title	Address	Telephone
Tyler E. Gass Vice President	6723 Towpath Road Syracuse, NY 13214	(315) 446-9120
William T. McCune Senior Project Geologist	6723 Towpath Road Syracuse, NY 13214	(315) 446-9120
Lisa A. Ryan Senior Project Geologist	6723 Towpath Road Syracuse, NY 13214	(315) 446-9120

TABLE 2

PHYSICAL HAZARDS

HEALTH AND SAFETY PLAN
GRIFFIN TECHNOLOGY INC. SITE

Physical Hazard	OSHA Regulation	Protection Mechanism
Noise	29 CFR 1910.95	Hearing protection when elevated noise levels exist
Heat Stress Cold Stress		Follow guidelines in Section 3.6.1 Follow guidelines in Section 3.6.2
Housekeeping	29 CFR 1926.25	Store equipment properly Remove rubbish/scrap material from work area
Compressed Gasses (calib. gas)	29 CFR 1910.101	Store properly
Using Ladders/Stairs	29 CFR 1910.27/ 1910.24	Examine for defects prior to use
Materials Handling	29 CFR 1910.176-190	Material stacked/stored to prevent collapsing Machinery properly braced
Haz. Mat Storage	29 CFR 1910.176-190	Segregate flam./combust liq from ignition sources Store in approved containers Solvent waste, oily rags and liquids kept in fire resistant containers
Fire Prevention and	29 CFR 1926.151(a)(3)	Training in fire extinguisher use and classes
Fire Extinguisher	29 CFR 1910.38	Properly marked and inspected
Electrical	29 CFR 1910.137	Approved grounding and bonding procedures Electric lines/cords/cables guarded and maintained Damaged equipment tagged/removed from service
Hand/Power Tools	29 CFR 1926.301	Guards and safety devices in place Defective tools tagged/removed from service Tools maintained and inspected; intrinsically safe Proper eye protection used
Trenching	29 CFR 1926.652	Shoring is required for trenches more than five feet deep
Excavation	29 CFR 1926.651	Precautions must be taken to protect worker safety and underground utilities.

TABLE 3

HEALTH AND SAFETY PLAN
GRIFFIN TECHNOLOGY INC. SITE

Estimated Wind Reading Speed (mph)	Actual Temperature Reading											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148

(Wind speeds greater than 40 mph have little additional effect)	LITTLE DANGER In chr with dry skin Maximum danger of false sense of security.	INCREASING DANGER Danger from freezing of exposed flesh within one minute.	GREAT DANGER Flesh may freeze within 30 seconds.

Trenchfoot and immersion foot may occur at any point on this chart.

TABLE 4
CONTAMINANTS OF CONCERN

HEALTH AND SAFETY PLAN
GRIFFIN TECHNOLOGIES INC.

Hazardous Substance	Physical Properties and Characteristics: Characteristics[1]	State[2]	BP	MP	Auto Ig.	LEL/ UEL	Incompatible With	Vapor Density (g/l)	Vapor Pressure	Water Solubility	Density (g/mc^3)	Exposure Limits (ppm unless otherwise noted): PEL[3]	IDLH[4]	Routes of Exposure and Symptoms[5]
Trichloroethene	ORMA	L	188°F	-123°F	None	11%/ 41%	strong caustics, when acidic reacts with aluminum	4.53	58 mm	0.01%	1.4649	100	1,000	INH, ING, CON
1,1,1-Trichloroethane		L	165°F	-36°F	None	7%/ 16%	strong caustics; strong oxidizers; chemically active metals	ND	100 mm	0.07%	-	350	1,000	INH, ING, CON

Notes

[1]Characteristics: O = Oxidizer
F = Flammable
ORMA = Material has an anesthetic, irritating, noxious, toxic, or other similar property
Poison = Toxic to man

[2]State: S = Solid
L = Liquid
G = Gas

[3]PEL: Permissible Exposure Limit

[4]IDLH: Immediate Danger to Life and Health

[5]ND: No Data Available

[6]NA: Not Applicable

HEALTH AND SAFETY PLAN
Griffin Technology Inc. SITE

TABLE 5

ACTION LEVELS FOR TOTAL ORGANIC VAPORS (TOV)

Breathing Zone Level*	Required Action
Less than 2 5 ppm	° Modified Level D protection ° Respirators (with appropriate cartridge) are optional, but must be available.
25-100 ppm	° Determine possible interference, e.g., vehicle exhaust. ° Level C protection with mandatory respirator use (requires appropriate cartridge/canister). ° Monitor area for determining respirator use boundaries and mark limits. ° Evacuate personnel without respirators from on-site downwind areas. ° Continue routine monitoring. ° Downgrade to Modified Level D if total organic vapor level drops below 5 ppm in worker breathing zone (requires HSO approval).
Greater than 100 ppm	° Evaluate for interference. ° Level B protection required in immediate area for work to continue in that area. ° Determine Level B boundaries and need for perimeter monitoring. ° Evacuate personnel for whom Level B is unavailable or stop work. ° Continue personal monitoring for organic vapors. ° Return to Level C or Modified D requires HSO approval.
Greater than 400 ppm	° Cease operations. ° Establish level at downwind property boundary and site control zone.

Note: It is important to note that transient peaks may exceed action levels, especially when measured at ground levels or in close proximity to the source. This may not indicate a hazardous condition since these peaks are not breathing zone measurements.

*For five consecutive minutes, at breathing zone height, measured with a calibrated OVA flame ionization detector. These levels are in excess of background levels, as measured either prior to activity on-site or off-site.

TABLE 6

HEALTH AND SAFETY PLAN
GRIFFIN TECHNOLOGY INC. SITE

STANDARD HAND SIGNALS

Hand Signal	Meaning
Hand gripping throat:	out of air/can't breath
Hands on top of head:	need assistance
Thumbs up:	OK/I'm all right/ I understand
Thumbs down:	No/negative

Grip partner's wrist or both hands around partner's waist: leave area immediately.

TABLE 7

HEALTH AND SAFETY PLAN
GRIFFIN TECHNOLOGY INC. SITE

EQUIPMENT NEEDED TO PERFORM MINIMUM DECONTAMINATION MEASURES FOR LEVELS OF PROTECTION B, C, AND MODIFIED D
(See Figure 1 and 2)

Station 1:
a. Various Size Containers
b. Plastic liners
c. Plastic drop cloths

Station 2:
a. Various size containers
b. Plastic liners
c. Plastic drop cloths

Station 3:
a. Containers (20-30 gallons)
b. Decon solution
c. 2-3 long-handled, soft-bristled scrub brushes
d. Rinse water

Station 4:
a. Containers (20-30 gallons)
b. Plastic liners
c. Bench or stools

Station 5:
a. Air tanks or face masks and cartridge depending on level
b. Tape
c. Boot covers
d. Gloves

Station 6:
a. Containers (20-30) gallons
b. Plastic liners
c. Bench or stools

Station 7:
a. Plastic sheets
b. Basin or bucket
c. Soap and towels
d. Bench or stools

Station 8:
a. Water
b. Soap
c. Tables
d. Wash basin or bucket

TABLE 8

HEALTH AND SAFETY PLAN
GRIFFIN TECHNOLOGY INC. SITE

DECONTAMINATION MEASURES

MINIMUM MEASURES FOR LEVEL B CONTAMINATION

Station 1: Equipment Drop	1. Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths.
Station 2: Outer Garment, Boots, Gloves, Wash, and Rinse	2. Scrub outer boots, outer gloves, and chemical resistant splash suit with decon solution or detergent and water. Rinse off using copious amounts of water.
Station 3: Outer Boot and Glove Removal	3. Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4: Tank Change	4. If worker leaves Exclusion Zone to change air tank this is the last step in the decontamination procedure. Worker's air tank is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5: Boot, Gloves, and Garment Removal	5. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastics.
Station 6: SCBA Removal	6. SCBA backpack and face piece are removed. Avoid touching face with fingers. SCBA deposited on plastic sheet.
Station 7: Field Wash	7. Hands and face thoroughly washed. Shower as soon as possible.

MINIMUM MEASURES FOR LEVEL C AND MODIFIED D DECONTAMINATION

Station 1: Equipment Drop	1. Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths.
Station 2: Outer Garment, Boots, Gloves, Wash and Rinse	2. Scrub outer boots, outer gloves, chemical-resistant splash suit with decon solution or detergent and water. Rinse off using copious amounts of water.
Station 3: Outer Boot and Glove Removal	3. Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4: Cartridge/Canister or Mask Change (Level C Only)	4. If worker leaves Exclusion Zone to change cartridge/canister (or mask), this is the last step in the decontamination procedure. Workers's cartridge/canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5: Boot, Gloves, and Garment Removal	5. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.

TABLE 8 (Cont'd)

DECONTAMINATION MEASURES

MINIMUM MEASURES FOR LEVEL C AND MODIFIED D DECONTAMINATION (Cont'd)

Station 6: Face Piece Removal	6. Face piece is removed. Avoid touching face with fingers. Face piece deposited on plastic sheet.
Station 7: Field Wash	7. Hands and face are thoroughly washed. Shower as soon as possible.

TABLE 9

HEALTH AND SAFETY PLAN
GRIFFIN TECHNOLOGY INC. SITE

EMERGENCY RESPONSE/CONTINGENCY PLAN CONTACT TELEPHONE LIST

1. Local Emergency Contacts	Phone No.	Location
Fire Department	(716) 394-2383	Farmington, NY
Police	(716) 394-4560	Ontario County Sheriff's Dept.
2. Medical Emergency Contacts		
Hospital - F.F. Thompson Hospital	(716) 396-6600	350 Perish Street, Canandaigua, NY
Ambulance Service (24 hr.)	(716) 924-2400	Farmington, NY
3. Project Contacts		
Griffin Technology, Inc.	(716) 924-7121	6132 Victor-Manchester Rd. Victor, NY 14564
Blasland & Bouck Engineers, P.C.	(315) 446-9120	6723 Towpath Road, Syracuse, NY 13214
NYSDEC - Region 7 Project Contact: Thadeous Maskal	(716) 847-4582	
4. Other	**Phone No.**	**Address**
Onatrio County Health Department	789-8702	Geneva, NY
Poison Control Center of CNY	(800) 252-5655 476-4766	
State Health Department	(518) 474-2121 (716) 423-8064	Albany, NY office Rochester, NY office
5. National Organizations		
USEPA, Emergency Response Team	(201) 321-6660	New Jersey
US Coast Guard, National Response Team	(800) 424-8802 or (202) 267-2675	Washington, D.C.
CHEMTREC, Chemical Emergencies	(800) 424-9300	Washington, D.C.
National Foam Center, Emergency Response	(215) 363-1400	Pennsylvania

FIGURES

Figure 2

MINIMUM DECONTAMINATION LAYOUT

LEVEL C AND MODIFIED D PROTECTION

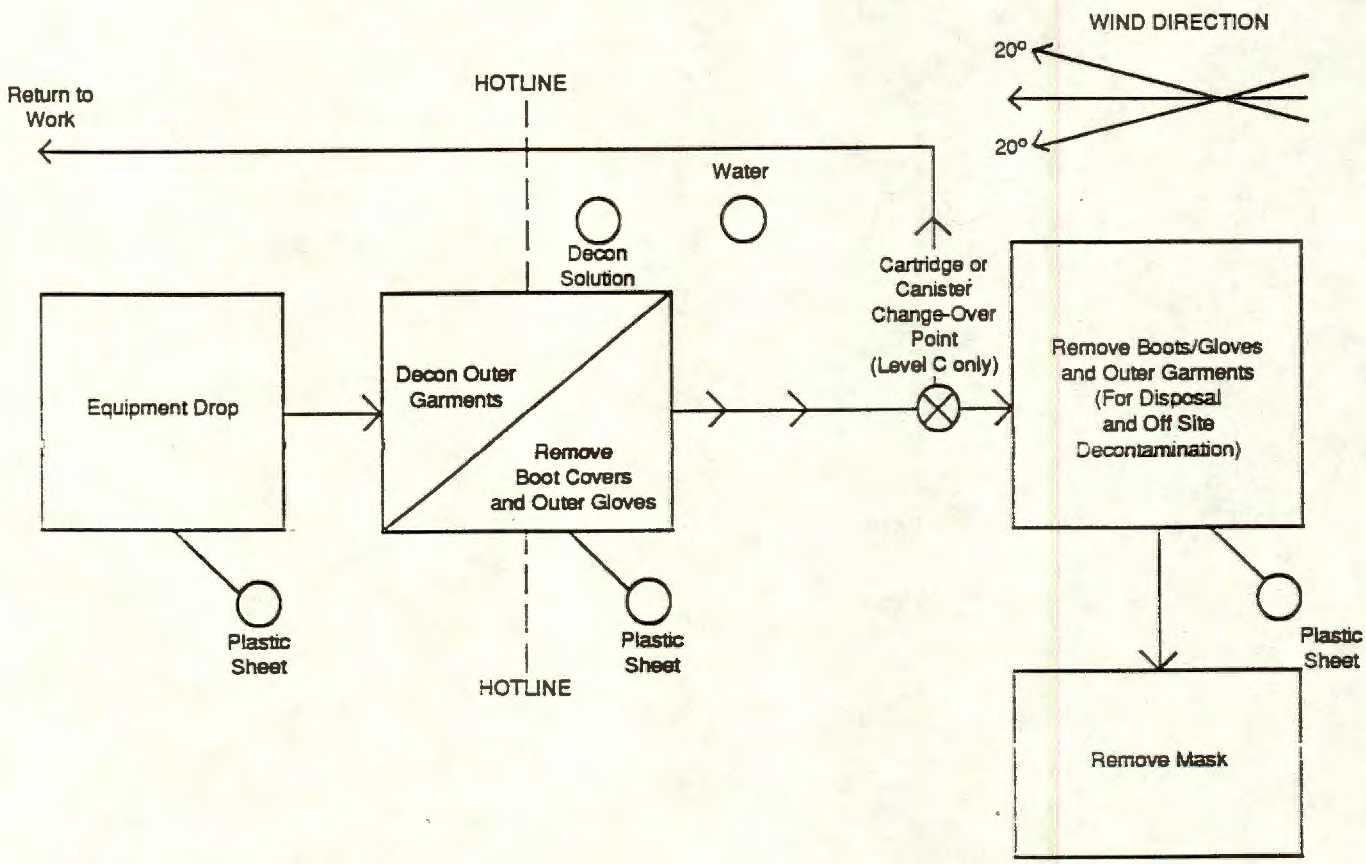

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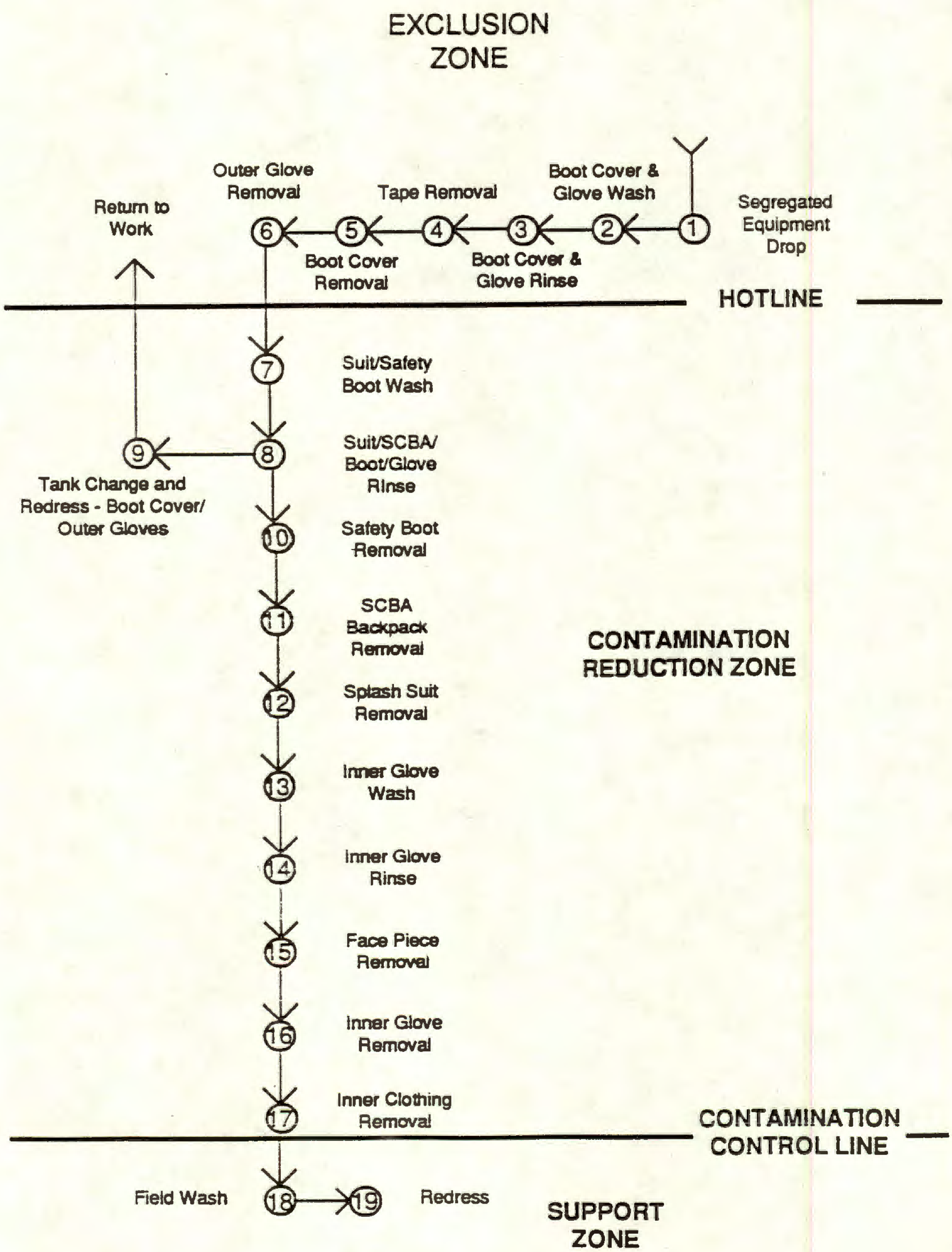
Figure 1

MAXIMUM DECONTAMINATION LAYOUT

LEVEL B PROTECTION



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ATTACHMENTS

ATTACHMENT A

HEAT STRESS WORK/REST SCHEDULE

ATTACHMENT A

HEAT STRESS WORK-REST SCHEDULE AND PHYSIOLOGICAL MONITORING FREQUENCY

Information Guidance Note

The American Conference of Governmental Industrial Hygienist, Threshold Limit Value (ACGIH, TLV) requires the use of the Wet Bulb Globe Temperature Index (WBGT) for measuring heat stress. Based upon the WBGT values and an assessment of workload (Light-Moderate-Heavy), a work-rest regimen is established. These TLVs as well as the work-rest regimen are based on workers wearing permeable clothing, e.g., standard cotton or synthetic work clothes, and not impermeable protective clothing. Future editions of the ACGIH, TLV booklets will contain adjustments factors for workers wearing different types of protective clothing. For instance, a minus 10 WBGT correction factor will apply for workers wearing fully encapsulating suits, glasses, boots, and hood. Nevertheless, measurement of WBGT still remains an obstacle.

Alternatively, the enclosed physiological monitoring protocol could be used to monitor workers as well as to establish the work-rest regimen. This protocol allows for identification of an individual's heat response, and subsequently, provides a parameter for establishing the work-rest cycle. These provisions are quite rigorous and should be considered for work in temperatures exceeding 85°F.

Proper training in recognition of the signs and symptoms of heat-related illness as well as encouragement to self-pace the work-rest cycle based upon physical conditioning and level of acclimatization should be adequate to protect workers and prevent heat stress. The use of Table 3.8.2 as a guideline for establishing the initial work-rest regimen at the specified temperatures and attire levels is recommended. These schedules will have to be adjusted for poorly conditioned workers, as well as individuals not fully heat acclimatized. Additionally, the level of protective clothing being worn must be considered in designing the work-rest cycle.

ATTACHMENT A

HEAT STRESS WORK-REST SCHEDULE

SUGGESTED HEAT STRESS WORK-REST SCHEDULE FOR FIT AND ACCLIMATIZED WORKERS[a]

ADJUSTED TEMERATURE[b]	WORK-REST REGIMEN NORMAL WORK ENSEMBLE[c]	WORK-REST REGIMEN IMPERMEABLE ENSEMBLE
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (30.8°-32.2°C)	After each 150 minutes of work	After each 120 minutes of work

[a] For work levels of 250 kilocalories/hour (Light-Moderate Type of Work)

[b] Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

[c] A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

Monitoring Protocol

To monitor the worker, measure:

- Heart rate. Count the radial pulse during a 30-second period as early as possible in the rest period.

  If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.

  If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third [12].

- Oral temperature. Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).

  If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period.

  If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next work period, shorten the following work cycle by one-third [12].

  Do ***not*** permit a worker to wear a semipermeable or impermeable garment when his/her oral temperature exceeds 100.6°F (38.1°C)[12].

- 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 to prevent dehydration. Weights should be taken while the employee wears similar clothing or, ideally, is nude. ***The body water loss should not exceed 1.5 percent total body weight loss in a work day*** [12].

Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work. <u>The length of the work cycle will be governed by the frequency of the required physiological monitoring</u>.

ATTACHMENT B

TRAINING AND SUPPLEMENTAL TRAINING ACKNOWLEDGEMENT FORMS

ATTACHMENT B

TRAINING AND SUPPLEMENTAL TRAINING ACKNOWLEDGEMENT FORMS

TRAINING ACKNOWLEDGEMENT FORM

Name: ______________________________

Address: ______________________________

Social Security No: ______________________________

Employer: ______________________________

Site Involvement: ______________________________

____

I have completed and understand the training program(s) for work to be performed at this project site. I have received training on the following subjects during my initial site orientation:

_______ A. Names of Site Health and Safety Personnel and Alternates.

_______ B. Work Rules and Safe Work Practices.

_______ C. Personal Protective Equipment.

_______ D. Site Chemical and Physical Hazards.

_______ E. Safe Use of Engineering Controls and Site Equipment.

_______ F. Medical Surveillance Requirements.

_______ G. Symptoms which may indicate overexposure to site hazards.

_______ H. Site Control Measures

_______ I. Decontamination Procedures

_______ J. Emergency Response Plan

_______ K. Standard Operating Procedures

Other (List): ______________________________

____

____

Additionally, I certify that I have completed the necessary training required by 29CFR 1910.120 (e) Training as indicated below:

Level of Training:

24-hour _____ 40-hour _____ 8-hour Supervisory _____

Equivalent* _____

Certificate(s) Attached _____ Yes _____ No

Date(s) Completed: ______________________________

Annual Refresher (8-hour) Date: ______________________________

Certificate Attached: _____ Yes _____ No

Site Training Completed: _______ 3-day _______ 1-day

Date: _________

Employee Signature: ______________________________ Date: ________

HSO Signature: ______________________________ Date: ________

* See attached Supplemental Training Acknowledgment

SUPPLEMENTAL TRAINING ACKNOWLEDGEMENT

This form is to be completed as a supplement to the Training Acknowledgement Form and retained along with the training form on site with the HASP. See Section 5.6 - Equivalent Training.

Name: ______________________________

Social Security No.: ____________________

Provide details which demonstrate your academic and/or work experience as it pertains to activities on hazardous waste sites (be specific):

Signature: ___________________________________

Date: _______________

ATTACHMENT C

PHYSICAL VERIFICATION FORM
(EXAMPLE ONLY)

ATTACHMENT C

PHYSICAL VERIFICATION FORM

PHYSICAL VERIFICATION FORM

Employer's Name: ______________________________

Employee Name: ______________________________

Social Security No: ____________________

Division: __________ Location: ______________

The above named individual has been medically examined for pre-placement/periodic purposes. The individual's health status is as follows:

( ) A. Individual is fit for work without restriction. No significant pre-existing disabilities have been identified.

( ) B. Individual is fit for work without restriction. Pre-existing/existing medical conditions have been documented.

( ) C. Individual is unfit for work at this time due to a medical condition which is correctable.

( ) D. Individual is considered not qualified for the job described.

______________________________ M.D. Date: ____________

ATTACHMENT D

RESPIRATOR SUITABILITY FORM

ATTACHMENT D

RESPIRATOR SUITABILITY FORM

In compliance with OSHA regulation 29 CFR 1910.134, ______(name)______ was examined on ___(Date)___ and the above named individual's suitability for respirator use is as classified below:

__________ Class 1 - No restriction on respirator use.

__________ Class 2 - Respirator use restricted as outlined below.

Restrictions: ____

____

____

____

__________ Class 3 - No respirator use under any circumstances.

Remarks: ____

____

____

____

Physician: ______________________________

Date: ______________________________

ATTACHMENT E

ACCIDENT INVESTIGATION FORM

CAUSES	DEFINITION OF CAUSE	SUGGESTED CORRECTIVE MEASURES
ENVIRONMENTAL		
1. UNSAFE PROCEDURE	HAZARDOUS PROCESS: MANAGEMENT FAILED TO MAKE ADEQUATE PLANS FOR SAFETY.	A. JOB ANALYSIS B. FORMULATION OF SAFE PROCEDURE
2. DEFECTIVE EQUIPMENT THROUGH USE	MACHINES OR EQUIPMENT THAT HAVE BECOME ROUGH, SLIPPERY, SHARP EDGED, WORN, CRACKED, BROKEN OR OTHERWISE DEFECTIVE THROUGH USE OR ABUSE.	A. INSPECTION B. PROPER MAINTENANCE
3. IMPROPERLY GUARDED EQUIPMENT	MACHINES OR EQUIPMENT THAT ARE UNGUARDED OR INADEQUATELY GUARDED.	A. INSPECTION B. CHECKING PLANS, BLUEPRINTS, PURCHASE ORDERS, CONTRACTS, AND MATERIALS FOR SAFETY C. INCLUDE GUARDS IN ORIGINAL DESIGN, AND CONTRACT D. PROVIDE GUARDS FOR EXISTING HAZARDS
4. DEFECTIVE EQUIPMENT THROUGH DESIGN	FAILURE TO PROVIDE FOR SAFETY IN THE DESIGN, CONSTRUCTION, AND INSTALLATION OF BUILDINGS, MACHINERY AND EQUIPMENT. TOO LARGE, TOO SMALL, NOT STRONG ENOUGH.	A. SOURCE OF SUPPLY MUST BE RELIABLE B. CHECKING PLANS, BLUEPRINTS, PURCHASE ORDERS, CONTRACTS, AND MATERIALS FOR SAFETY C. CORRECTION OF DEFECTS
5. UNSAFE DRESS OR APPAREL	MANAGEMENT'S FAILURE TO PROVIDE OR SPECIFY THE USE OF GOGGLES, RESPIRATORS, SAFETY SHOES, HARD HATS, AND OTHER ARTICLES OF SAFE DRESS OR APPAREL.	A. PROVIDE SAFE DRESS OR APPAREL OR PERSONAL PROTECTIVE EQUIPMENT IF MANAGEMENT COULD REASONABLE BE EXPECTED TO PROVIDE IT B. SPECIFY THE USE OR NONUSE OF CERTAIN DRESS OR APPAREL OR PROTECTIVE EQUIPMENT ON CERTAIN JOBS
6. UNSAFE HOUSEKEEPING FACILITIES	NO SUITABLE LAYOUT OR EQUIPMENT THAT ARE NECESSARY FOR GOOD HOUSEKEEPING-SHELVES, BOXES, BINS, AISLE MARKERS, ETC.	A. PROVIDE SUITABLE LAYOUT AND EQUIPMENT NECESSARY FOR GOOD HOUSEKEEPING
7. IMPROPER VENTILATION	POORLY VENTILATED OR NOT VENTILATED AT ALL.	A. IMPROVE THE VENTILATION
8. IMPROPER ILLUMINATION	POORLY ILLUMINATED OR NO ILLUMINATION AT ALL.	A. IMPROVE THE ILLUMINATION
BEHAVIORISTIC		
9. LACK OF KNOWLEDGE OR SKILL	UNAWARE OF SAFE PRACTICE; UNPRACTICED; UNSKILLED; NOT PROPERLY INSTRUCTED OR TRAINED.	A. JOB TRAINING
10. IMPROPER ATTITUDE	WORKER WAS PROPERLY TRAINED AND INSTRUCTED, BUT HE FAILED TO FOLLOW INSTRUCTIONS BECAUSE HE WAS WILLFUL, RECKLESS, ABSENTMINDED, EXCITABLE OR ANGRY.	A. SUPERVISION B. DISCIPLINE C. PERSONNEL WORK
11. BODILY DEFECTS	WORKER HAS POOR EYESIGHT, DEFECTIVE HEARING, HEART TROUBLE, HERNIA, ETC.	A. PRE-PLACEMENT PHYSICAL EXIMINATION B. PERIODIC PHYSICAL EXAMINATION C. PROPER PLACEMENT OF WORKER D. IDENTIFICATION OF WORKERS WITH TEMPORARY BODILY DEFECTS

ATTACHMENT F

DAILY SITE SIGN IN/OUT LOG

DAILY SITE SIGN IN/OUT LOG

DATE	TIME IN	TIME OUT	NAME	REPRESENTING

10/19/90
390515PME

ATTACHMENT G

SAFE WORK PRACTICES

ATTACHMENT G

SAFE WORK PRACTICES

The emphasis of the Health and Safety Plan is to provide site personnel with a safe and healthy work environment. The plan, implemented by project management, will establish and adequate level of practices for personnel involved in field activities. Towards this end, OSHA regulations 29 CFR 1910, 29 CFR 1926 as well as the standard practices and procedures listed below will be followed. Compliance with these practices will remain mandatory throughout the course of all activities conducted on-site.

General Practices

1. Eating, drinking, chewing gum or tobacco, smoking, or any other activity that increases the probability of hand-to mouth transfer of contaminated material shall not be permitted except in areas designated for such activities by the HSO.
2. All personal safety equipment and protective clothing shall be worn, carried by, or be available to all personnel at all times.
3. Disposable outer coveralls, boots and gloves shall be secured at the wrists and legs, and there shall be closure of the suit around the neck.
4. Individuals getting wet to the skin with liquids which may be chemically contaminated must remove clothing and wash the affected area immediately. Clothes wet with such liquids, must be changed. Any skin contact with such liquids, whether considered safe or not, will be dealt with immediately and as completely as possible. If irritation or redness develops, medical attention should be sought immediately.

5. Hands must be washed before eating, drinking, smoking and before using toilets at the facilities provided.

6. Practice contamination avoidance. Avoid contact with surfaces either suspected or known to be contaminated. Walking through puddles, mud and other discolored surfaces is to be avoided. Equipment is to be stored on elevated or protected surfaces to reduce the potential of incidental contamination.

7. Personal protective equipment will be doffed in the site contamination reduction area.

8. Dispose of all disposable coveralls, soiled gloves and cartridges in receptacles designated for this purpose, at the end of every shift or sooner, if deemed necessary by the HSO.

9. A shower must be taken whenever decontamination procedures for outer protective garments are required.

10. Jewelry, including watches, shall not be worn within the hot zone.

11. All non-disposable clothing (i.e. hard hat liner, work gloves, cotton overalls) will be inspected for contamination in the contamination reductions zone. Any clothing found to be contaminated will be deconed or disposed of in a manner approved by the HSO.

12. Emergency signals by portable air-horn are as follows: two short blasts, personal injury; continuous blast, emergency requiring hot zone evacuation.

13. All first-aid treatments will be reported to the HSO.

14. Medicine and alcohol can increase the adverse effects of exposure to toxic substances. Unless given written approval by the appropriate medical consultant, drugs shall not be taken by personnel assigned to tasks with the potential for absorption,

inhalation, or ingestion of toxic substances. The presence or consumption of alcoholic beverages or illicit drugs during the work day is strictly forbidden.

15. All operations requiring personal protective equipment (Level C to Level A) require the use of the "buddy system" throughout the duration of the operation.

16. In the event personal protective equipment is ripped or torn, stop work and replace the damaged garment.

17. Be alert to any unusual changes in your own condition; never ignore warning signs. Notify the HSO of any suspected exposures or accidents.

18. Note wind direction. Personnel must remain upwind whenever possible during on-site activities.

19. Safety practices with hazardous chemicals can be summed up in a few words:

DON'T BREATH IN CHEMICAL ODORS AND DON'T EXPOSE SKIN TO LIQUID, CHEMICALS OR SOIL. IF YOU DO GET DIRTY OR WET, CLEAN UP IMMEDIATELY USING PLENTY OF CLEAN WATER.