INTERNATIONAL TECHNOLOGY CORPORATION

WORK PLAN
FOR CONTAMINATION EVALUATION AT THE
FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

Prepared for:

DEPARTMENT OF THE ARMY,
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE
AND
HUNTSVILLE DIVISION, CORPS OF ENGINEERS
HUNTSVILLE, ALABAMA

DERP PROJECT NO. G05OH001800

Prepared by:

IT Corporation
Knoxville, Tennessee
IT Project Number 409658

September 1989

Regional Office
312 Directors Drive ▪ Knoxville, Tennessee 37923 ▪ 615-6

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08/30/89 F2

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Prepared by:

IT Corporation
312 Directors Drive
Knoxville, Tennessee 37923
615-690-3211

Approved: _____ Date: 9/1/89
Project Manager, IT Corporation

Approved: _____ Date: 9/5/89
Program Manager, IT Corporation

Approved: _____ Date: 1 SEP 89
Quality Assurance Officer, IT Corporation

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CONTENTS

	Page
LIST OF TABLES/FIGURES	ii
1.0 INTRODUCTION	1-1
1.1 Purpose and Scope of Work	1-1
1.2 Summary of Field Work	1-2
2.0 PROJECT ORGANIZATION	2-1
2.1 Key Personnel	2-1
2.2 Subcontractors	2-1
3.0 SITE INFORMATION	3-1
3.1 Location	3-1
3.2 Topography and Physiography	3-1
3.3 Soil Conditions	3-1
3.4 Geology	3-3
3.5 Hydrogeology	3-3
3.6 Site History	3-4
3.6.1 Ownership and Prior Use	3-4
3.6.2 Suspected Contamination	3-5
4.0 SAFETY PROGRAM PLAN	4-1
5.0 MONITORING WELLS AND SOIL BORINGS	5-1
5.1 Monitoring Wells	5-1
5.1.1 Monitoring Well Design	5-1
5.1.2 Well Development	5-1
5.1.3 Monitoring Well Monument Location	5-1
5.2 Soil Borings	5-2
6.0 ENVIRONMENTAL SAMPLING	6-1
6.1 Soil/Subsoil Sampling for Geotechnical Testing	6-1
6.1.1 Soil Classification	6-1
6.1.2 Laboratory Analyses	6-1
6.2 Soil/Subsoil Sampling for Chemical Analyses	6-2
6.3 Ground Water Sampling	6-2
6.4 Surface Water Sampling	6-2
7.0 ANALYTICAL SERVICES AND DATA EVALUATION	7-1
8.0 SCHEDULE	8-1

APPENDICES

A. SAFETY PROGRAM PLAN
B. MONITORING WELL INSTALLATION PLAN
C. SAMPLING/ANALYSIS - QUALITY ASSURANCE/QUALITY CONTROL PLAN

TABLES

Number		Follows Page
1-1	Scope of Work Summary of Tasks	1-1
3-1	Underground Storage Tank Inventory	3-5
7-1	Samples To Be Collected and Analyzed for Chemical Contaminants	7-1
7-2	Required Laboratory Chemical Analyses and Approved Methods	7-1
7-3	Summation of Analyses By Sample Type and Analytical Parameters	7-1

FIGURES

Number		Follows Page
1-1	Vicinity Map	1-1
2-1	Project Organization	2-1
3-1	Localized Physiography and Topography	3-1
3-2	Predominant Soil Types	3-2
3-3	Water Resources Map	3-3
3-4	Site Plan and Sampling Locations	3-5
8-1	Project Schedule	8-1

JAMES DAVID MARSHALL

Professional Qualifications

With experience and educational training in the field of chemistry, Mr. Marshall is an analytical chemist in our organic preparation laboratory. This position mainly consists of properly preparing incoming samples, both waters and soils, so that they may be analyzed either by GC or by GC/MS.

Education

B.S., Chemistry, East Tennessee State University, Johnson City, Tennessee; 1985

Certification

American Chemical Society

Experience and Background

1987 - Present: Laboratory Technician, IT Corporation, Knoxville, Tennessee. Responsible for preparing samples of various matrices for analysis of organic constituents.

1986 - 1987: Chemist, Tateho America, Inc., Greeneville, Tennessee. Responsible for analyzing both physically and chemically manufactured products of MgO and SiO_2. Responsible for carrying out proper adjustments on products if a problem occurred where the products did not meet specified requirements.

1.0 INTRODUCTION

The U.S. Army is conducting a study of the environmental impact of suspected hazardous waste sites at previously owned U.S. Department of Defense (DOD) properties. This work is being pursued by the U.S. Army Corps of Engineers (COE) under the Defense Environmental Restoration Program (DERP). This project is being managed by the Nashville, Tennessee COE District Office.

Chemical contamination caused by DOD activities may exist at the former Plum Brook Ordnance Works in Sandusky, Ohio (Figure 1-1). Primary interest is focused to address the possible chemical contamination at the wastewater (red water) retention areas and the suspect burial and burn areas site. The work effort involves the investigation of the remaining DOD structures and the contiguous ground water, surface water, and soil for possible contamination by any hazardous substances associated with the operation, maintenance, and deactivation of the Plum Brook Ordnance Works site.

1.1 PURPOSE AND SCOPE OF WORK

The purpose of this project is to conduct a preliminary investigation to confirm or deny the presence or absence of residual chemical contamination (if any) from operational activities conducted at the site during DOD control. This work is being done under Delivery Order 0004 of COE Contract No. DACA87-87-D-0089.

Table 1-1 is a summary of tasks from the final Statement of Work (SOW). This Work Plan is concerned with Tasks 3 through 23. Tasks 1 and 2 were previously accomplished; Tasks 21 through 23 will be performed following completion of Task 20.

The preparation of this Work Plan constituted Tasks 3, 4, and 5. The Safety Program Plan (SPP), Monitoring Well Installation Plan (MWIP), and Sampling and Analysis Plans are included, respectively, as Appendices A, B, and C to this Work Plan. The Sampling and Analysis Plan (as required by the SOW) also contains the Quality Assurance/Quality Control Plan, and, therefore, is entitled "Sampling/Analysis - Quality Assurance/Quality Control Plan (S/A-QA/QC Plan)."

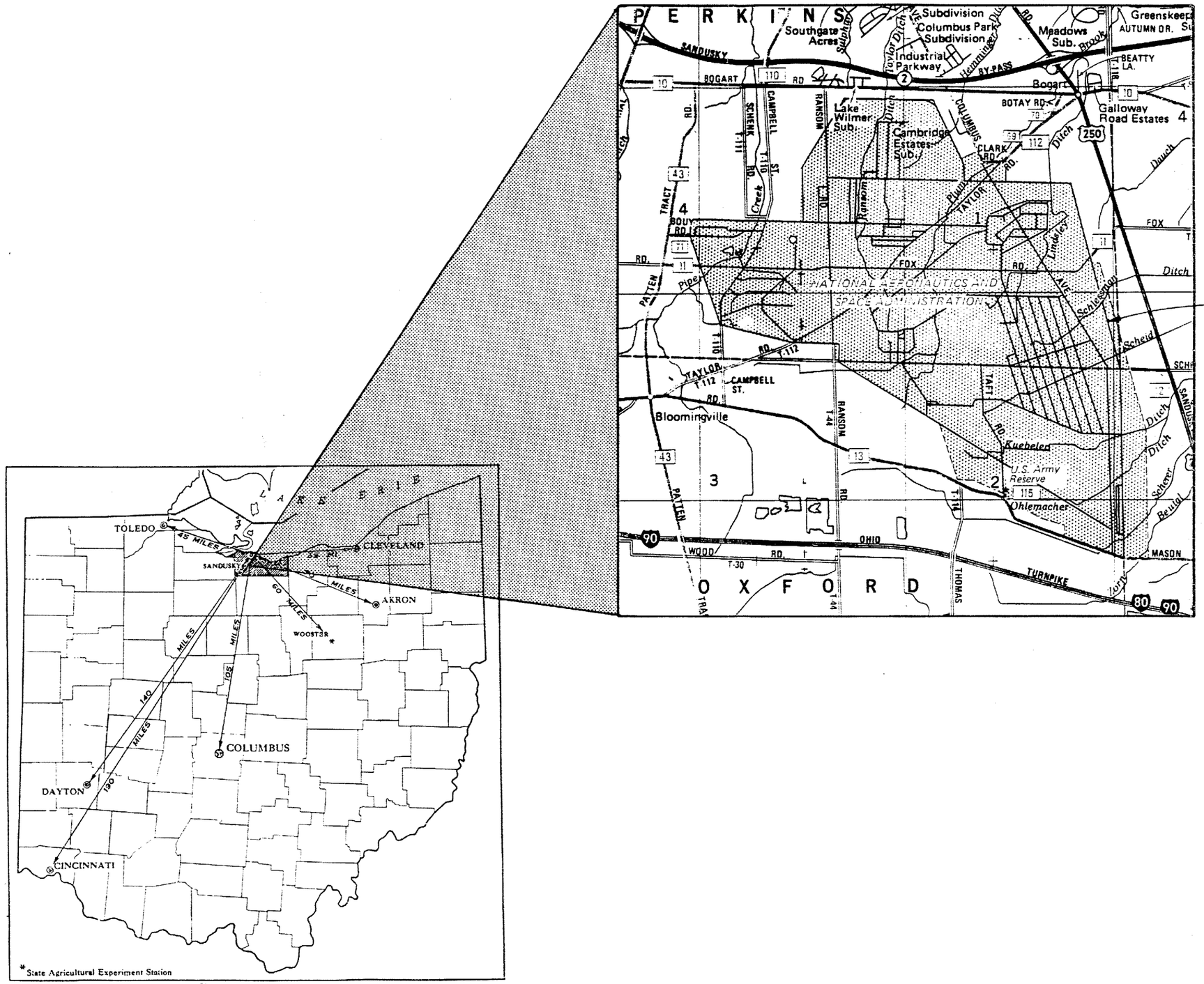

FIGURE 1-1
VICINITY MAP

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

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Table 1-1. Scope of Work Summary of Tasks

Task Number	SOW Paragraph Number	Description
1	3.1	Records review and evaluation
2	3.2	Site inspection
3	3.3	Safety plan
4	3.4.1	S/A-QA/QC plan
5	3.4.2	Monitoring well installation plan
6	3.5	Well installation
7 (Option 1)	3.5.13.1	Additional well drilling
8 (Option 2)	3.5.13.2	Additional well drilling
9 (Option 3)	3.5.13.3	Additional well drilling
10 (Option 4)	3.5.13.4	Additional well drilling
11 (Option 5)	3.5.13.5	Additional well drilling
12 (Option 6)	3.5.13.6	Additional well drilling
13	3.6	Well development
14	3.7	In situ permeability
15	3.8	Collection and testing of potentially hazardous materials
16	3.9.1	Ground water sampling
17	3.9.2	Soil sampling
18	3.9.3	Surface water sampling
19	3.9.6.1	Field sample analysis
20	3.9.6.2	QA/QC sample analysis
21	3.10.1	Engineering report
22	3.10.2	Presentation
23	3.12	HRS form completion

The SOW requires that the program be conducted in an environmentally acceptable manner conforming to the implementing regulations of the Resource Conservation and Recovery Act (RCRA) of 1976, as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984. The U.S. Environmental Protection Agency (EPA) regulations implementing RCRA/HSWA are published in Title 40 Code of Federal Regulations Parts 260 through 281 (40 CFR 260-281).

1.2 SUMMARY OF FIELD WORK

The field work will consist of the following activities:

- Construction of six shallow (approximately 25 feet deep) ground water monitoring wells
- Collection of ground water samples from the six new ground water monitoring wells for analysis
- Collection of 36 soil/subsoil samples (six per well) during monitoring well construction for physical testing for engineering properties
- Collection of composite soil/subsoil samples at 19 locations to a depth of 2 feet for chemical contaminant analytical testing (one of these location will be for a background sample; the other 18 will be for contamination evaluation)
- Calculation of in situ hydraulic permeability for the monitoring well zones
- Collection of individual surface water samples from each of the four streams that drain the site.

Details of ground water monitoring well installation, development, and in situ permeability testing are given in Appendix B. The S/A-QA/QC Plan (Appendix C) contains details for sample collection and handling and analytical testing requirements.

2.0 PROJECT ORGANIZATION

2.1 KEY PERSONNEL

IT Corporation (IT) has identified technical personnel who will participate in the contamination evaluation at the Plum Brook Ordnance Works site. The key program personnel identified below will participate in this task as required for satisfactory project execution:

- C. E. Vaughan - Program Manager
- D. C. Burton - Project Manager.

The project organization is identified in Figure 2-1.

2.2 SUBCONTRACTORS

The selection of qualified subcontractors will be in accordance with the IT Procurement and Quality Assurance procedures. Subcontractors, such as drillers, geophysical specialists, surveyors, and environmental monitoring specialists, must meet predetermined qualifications developed by the Project Manager that are defined in the procurement bid packages. Each subcontractor bid submittal is reviewed by technical, purchasing, and quality assurance to verify that the bidders are qualified and can satisfy bid requirements. Before starting work, IT will perform a quality check to determine if the subcontractor has fulfilled the procurement requirements necessary to begin activities. Subcontractors involved in environmental measurements will be monitored by the Project Manager to verify the use of calibrated equipment and qualified operators.

All subcontractors will be required to follow all aspects of the procedures of the Safety Program Plan and S/A-QA/QC. Ongoing observation and monitoring of subcontractor performance during the field investigation will be the responsibility of the Project Manager or his designee. Periodic quality control inspections of each subcontractor will be performed and documented. Inspection will include (as appropriate):

- Type and condition of equipment
- Calibration procedures
- Personnel qualifications
- Documentation.

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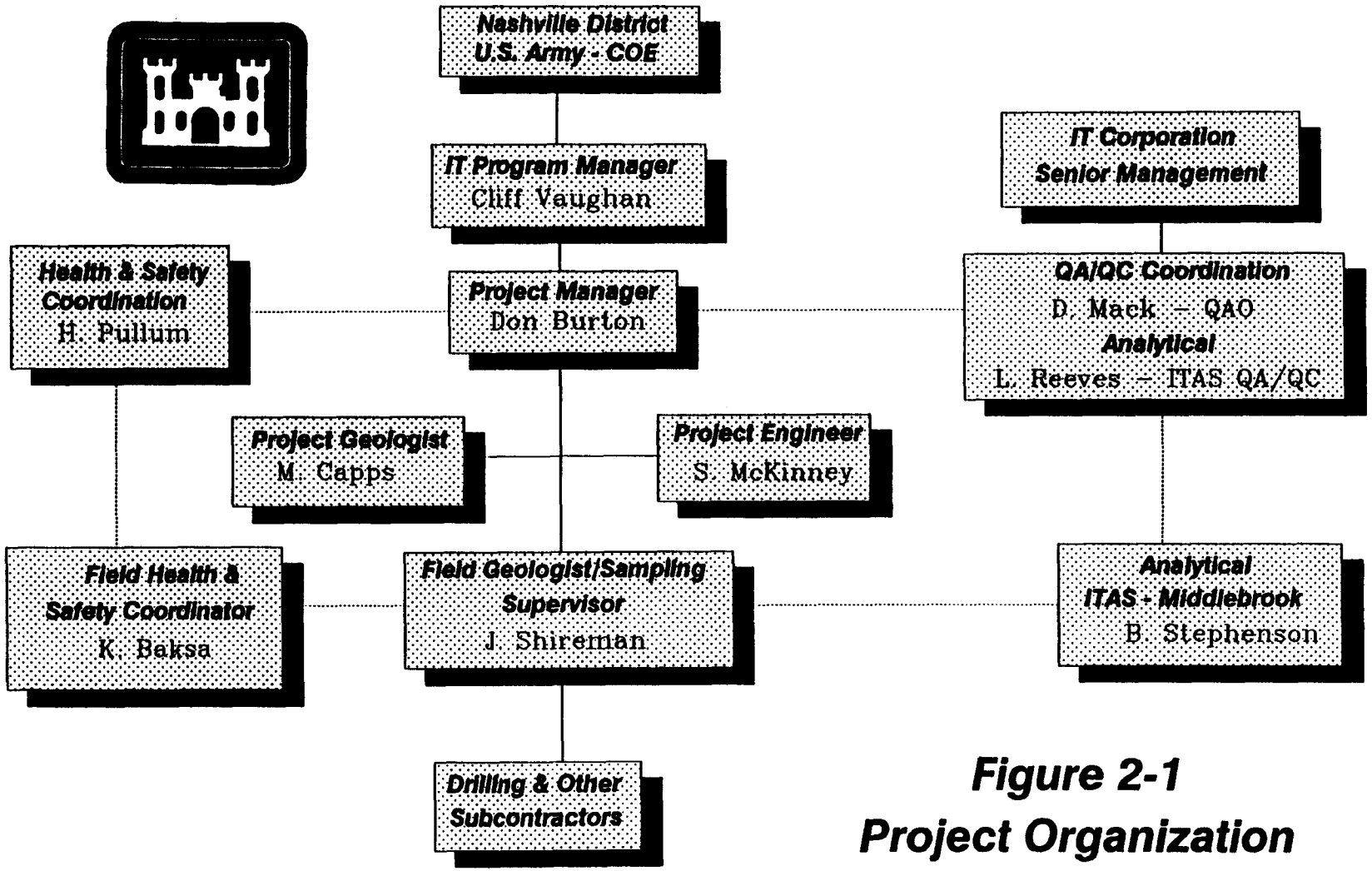

Figure 2-1
Project Organization
Former Plum Brook Ordnance Works
Sandusky, Ohio

PLUMOC.DRW

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3.0 SITE INFORMATION

3.1 LOCATION

The former Plum Brook Ordnance Works is located approximately 4 miles south of Sandusky, Ohio and is specifically located in the Perkins and Oxford Townships. The site is bounded on the north by Bogart Road, on the south by Mason Road, on the east by U.S. Highway 250, and on the west by County Road 43 (Figure 1-1). The former Plum Brook Ordnance Works site consists of 9009 acres and lies in an area that is primarily rural and agricultural with low population density.

3.2 TOPOGRAPHY AND PHYSIOGRAPHY

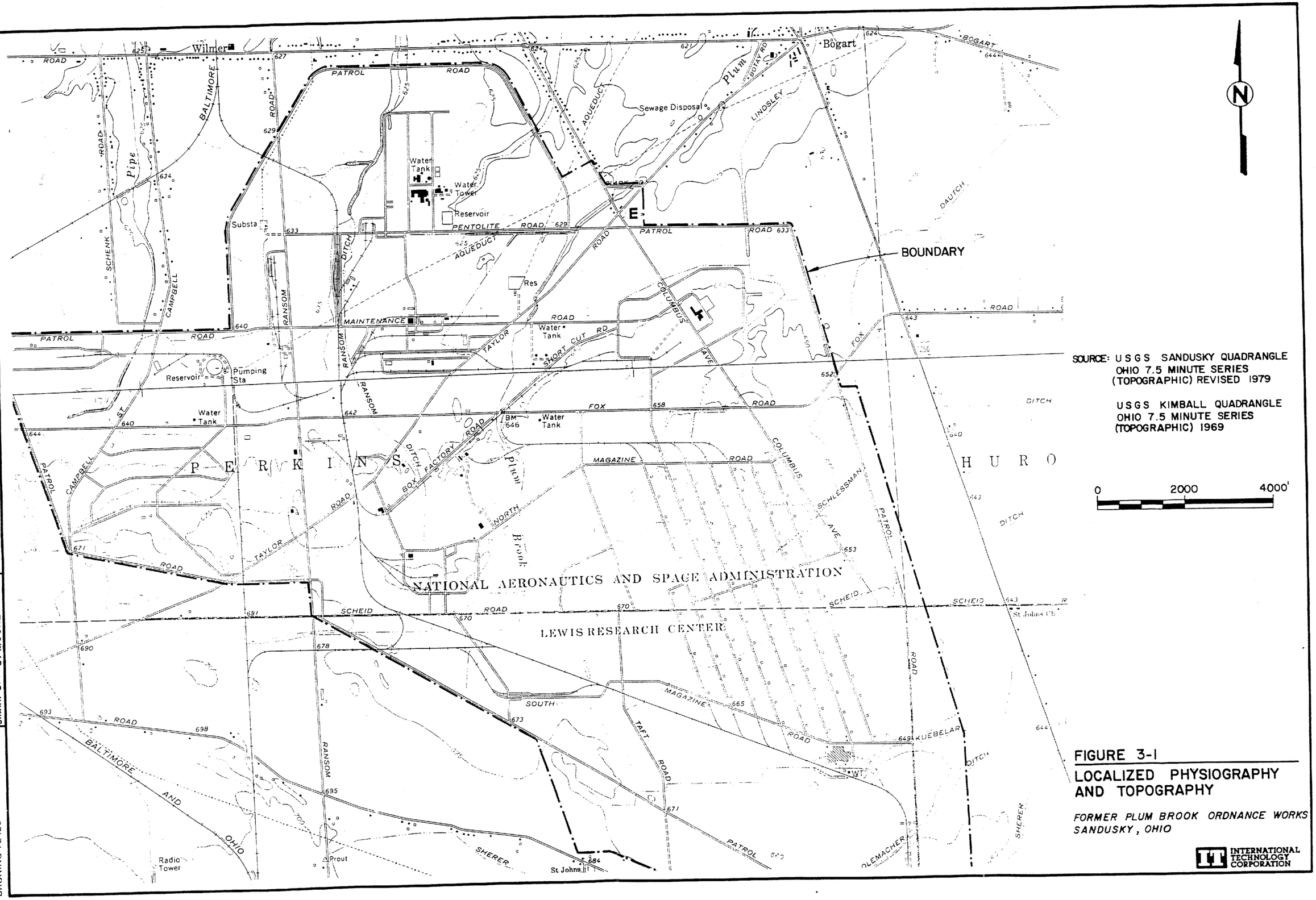
The Plum Brook Ordnance Work site is located on what was originally a flat lake bottom from glacial melt waters. The ground surface slopes gradually northward toward Lake Erie at an average slope less than 6 percent. Elevations at the site range from 675 feet above mean sea level (msl) at the southwest edge of the site to 625 feet msl in the northern portion of the property at Bogart Road. A topographic map of the site is presented in Figure 3-1.

The former Plum Brook Ordnance Works derives its name from the major stream passing through its boundaries. Eleven streams, six of which originate within the site boundaries, flow northerly or north-easterly into Lake Erie. Plum Brook and Pipe Creek originate south of the site and flow independently into Lake Erie, east and west of the airport, respectively. Kuebeler Ditch, Ohlemacher Ditch, Scherer Ditch, and Zorn Beutal Ditch originate at the southwest edge of the property and connect into Harris Ditch south of Fox Road.

3.3 SOIL CONDITIONS

Most of the soils at the former Plum Brook Ordnance Works site were formed from deposits from glaciers or from glacial melt waters. The dominant soil material was deposited as glacial till, outwash, and lacustrine deposits.

Glacial till is material laid down directly from glaciers with minimum water action. Typically, it consists of particles of different sizes. Some smaller



SOURCE: USGS SANDUSKY QUADRANGLE OHIO 7.5 MINUTE SERIES (TOPOGRAPHIC) REVISED 1979

USGS KIMBALL QUADRANGLE OHIO 7.5 MINUTE SERIES (TOPOGRAPHIC) 1969

0 2000 4000'

FIGURE 3-1

LOCALIZED PHYSIOGRAPHY AND TOPOGRAPHY

FORMER PLUM BROOK ORDNANCE WORKS SANDUSKY, OHIO

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pebbles in glacial till have sharp corners, indicating that they have not been rounded or worn by water.

Outwash materials were deposited by running water from melting glaciers. The size of the particles that make up the outwash material varies according to the speed of the water in which particles were carried. Outwash deposits generally consist of layers of particles of similar size, such as sand and gravel.

Lacustrine deposits, material settled from still, ponded glacial melt water, contain only the finer particles such as very fine sand, silt, and clay because the coarser material dropped out as outwash.

The U.S. Department of Agriculture (USDA) Soil Conservation Service Soil Survey (1971) identifies the majority of soils at the site as being from the Arkport-Galen association (Figure 3-2). Arkport soils consist of gently sloping to moderately sloping, well-drained soils formed in the sandy material deposited at the edge of a glacial lake. Arkport soils are generally loamy fine sand and fine sand. Galen soils are mostly level and moderately well-drained formed as small sandy deposits on outwash plains and deltas. Galen soils have a fine sand or sandy loam surface layer, a subsurface of fine sand and loamy fine sand that is underlain by silt or clay. Runoff is slow, permeability is rapid, and the available moisture capacity is low. Wind erosion is a problem in this soil association.

The southern portion of the station has soils in the Prout association. Prout soils are moderately deep to deep, nearly level to gently sloping, somewhat poorly drained soils that have a subsoil of heavy silt loam to silty clay loam. These soils are commonly on uplands, with runoff and permeability slow.

The Lewisburg association occupies a small isolated part of the Plum Brook Ordnance Works site. The soils are moderately deep to deep, nearly level in depressions, and are narrow strips along natural drainageways. Runoff is slow, permeability is moderately slow, and the available moisture capacity is high.

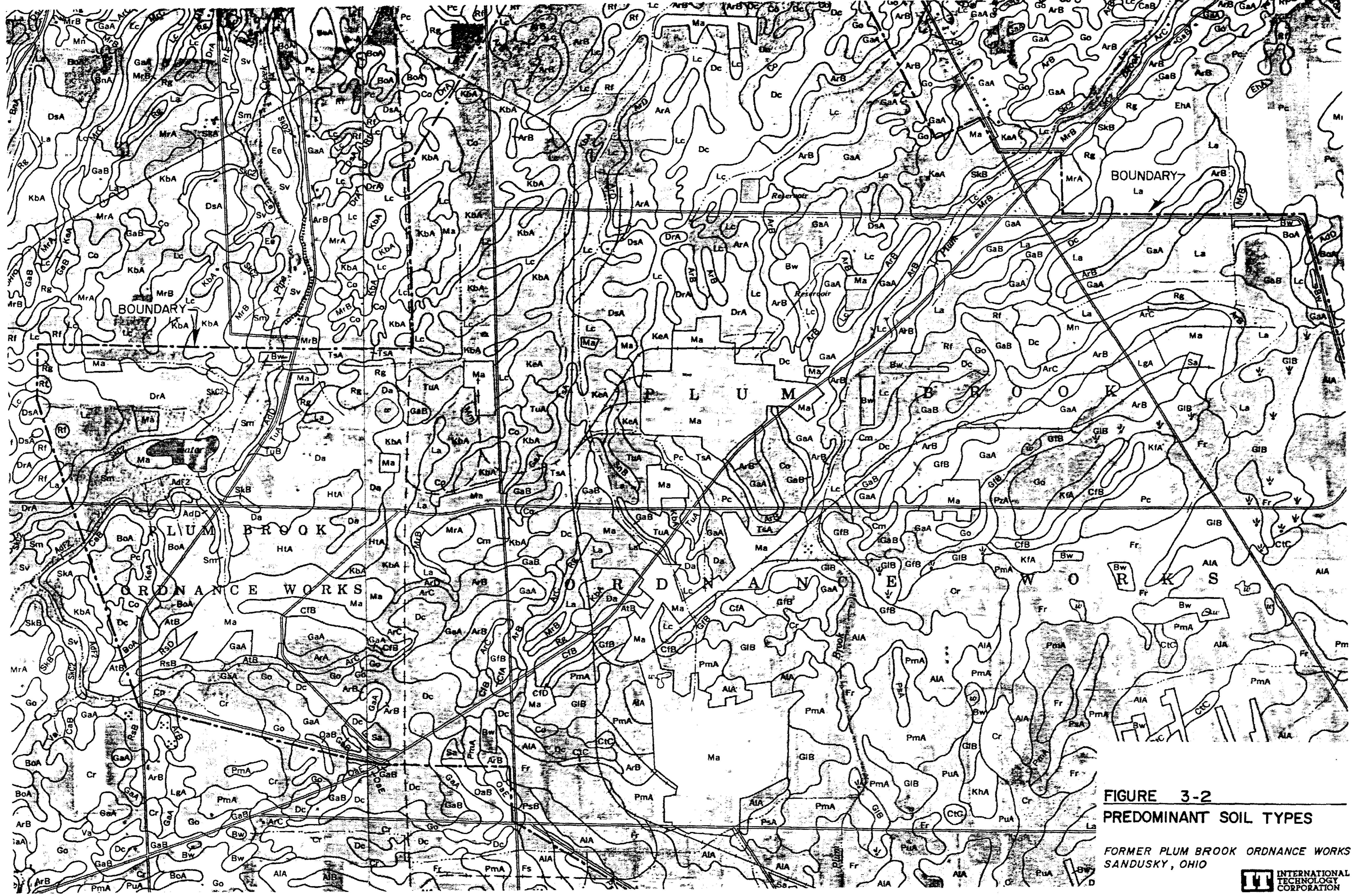

FIGURE 3-2

PREDOMINANT SOIL TYPES

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

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3.4 GEOLOGY

In the Paleozoic Era, large tropical inland seas covered the Plum Brook Ordnance Works site. As the seas began to recede, deposits of carbonate material slowly lithofied into thick layers of limestone and dolomite. Likewise, deposits of mud and clay formed shales and quartz, while other silicate materials formed sandstone.

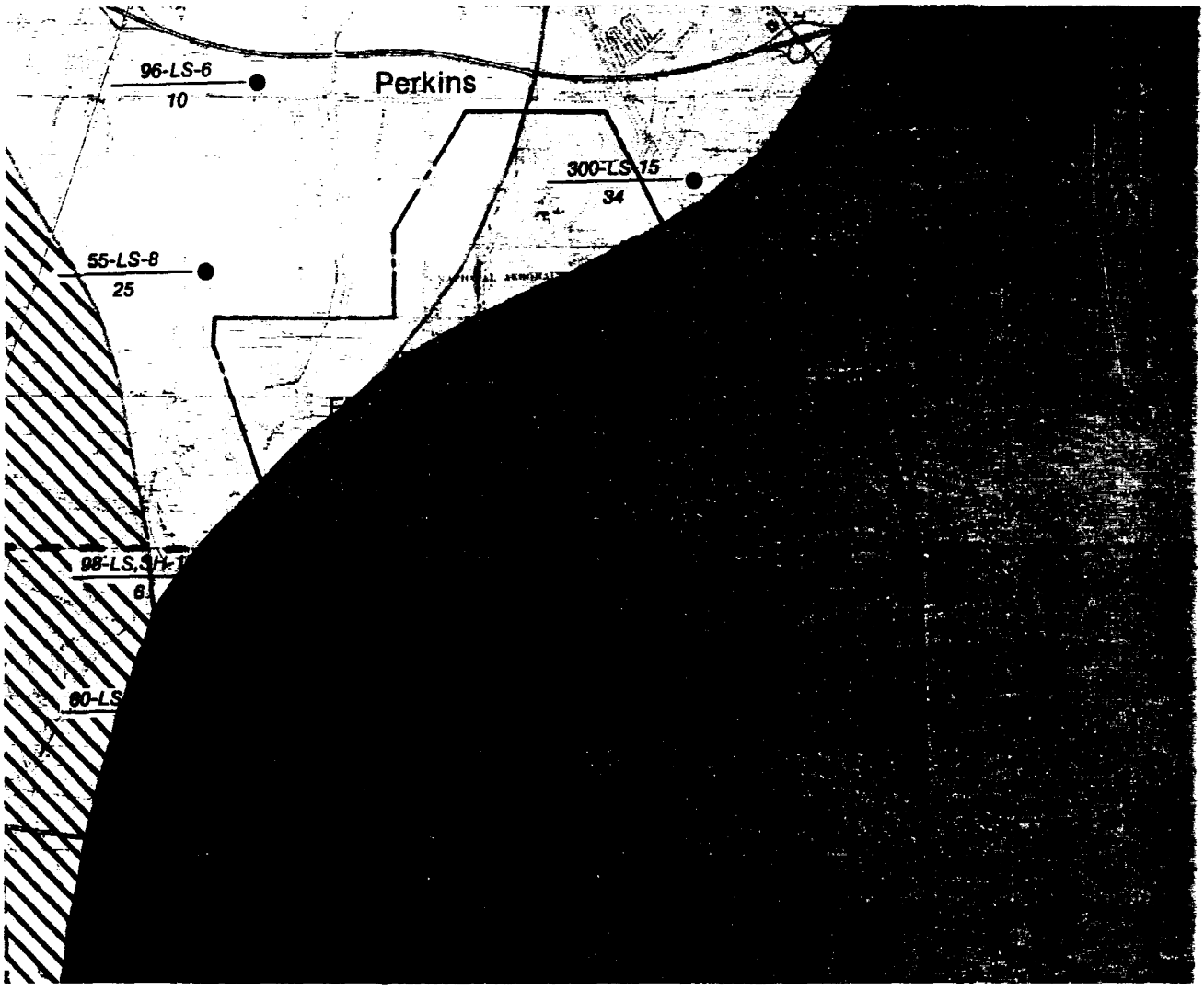
Later in geologic time, glacial ice scoured the area, cutting out the river valleys. The resistant bedrock that covers most of the area was not deeply cut by the glaciers.

The majority of the site is underlain by lacustrine glacial deposits making up the Huron shale. The shale is grayish black, hard, dense and abundantly carbonaceous. The area is also underlain by Plum Brook shale and Delaware and Prout limestones. The shales are low in porosity, while the limestones are massive with calcareous shale partings and are moderately porous. The bedrock is limestone in the western part of the site and shale in the eastern part. The regional dip is easterly, and younger rocks crop out progressively from west to east (USGS, 1954).

3.5 HYDROGEOLOGY

Ground water in the area of the Plum Brook Ordnance Works site has its source in local precipitation. The limestone beds underlying the site are the principal aquifer. Yields from limestone deposits range generally between 5 and 25 gallons per minute (Figure 3-3). Water in limestone beds occurs principally in joint cracks along bedding planes and in other openings. Most wells in the limestone deposits in the vicinity of the station range between 50 and 80 feet in depth. The quality of the water deteriorates rapidly with increased depth, and wells deeper than approximately 100 feet generally yield sulfur water. There are no wells used as a source of water supply within the Plum Brook Ordnance Works site.

Surface water leaves the site through naturally occurring surface creeks. All streams may have zero flow in severe winter freezes and extended summer droughts. The NASA Plum Brook Ordnance Works site currently monitors three streams for National Pollutant Discharge Elimination System (NPDES) discharge



LEGEND

AREAS IN WHICH YIELDS OF 100 TO 500 GALLONS PER MINUTE MAY BE DEVELOPED.

Yields of more than 500 gallons per minute have been developed at depths of less than 200 feet in cavernous limestone and dolomite. Domestic supplies are generally obtained at depths of around 100 feet.

Hydrogen sulfide, in varying amounts, may be encountered in the bedrock.

Areas in which there is a potential concentration of contamination due to the underground disposal of storm wastes from Bellevue.

AREAS IN WHICH YIELDS OF 5 TO 25 GALLONS PER MINUTE MAY BE DEVELOPED.

Yields of 15, or less, gallons per minute are developed from wells drilled into the limestone. Hydrogen sulfide may be present in varying amounts.

AREAS IN WHICH YIELDS SELDOM EXCEED 3 GALLONS PER MINUTE

Limited quantities of ground water are obtained from thin, discontinuous sand and gravel deposits interbedded in fine, sandy clay or from the underlying shale. Drilling deeper than 30 feet into the shale is not recommended. Occasional gas or salt noted in the eastern half of the county.

Larger yields may be obtained in western Huron and Oxford townships and southeastern Perkins Township. Wells may encounter water-bearing limestone beneath as much as 60 feet of impervious shale.

● Existing Domestic Wells

SCALE

1 0 1 mile

FIGURE 3-3

GROUND WATER RESOURCES

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

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criteria. The three streams are Plum Book, Ransom Brook, and Kuebeler Ditch. The impacts on the surface or ground water hydrology resulting from the operations of the Plum Brook Ordnance Works site are minimal. The existence of buildings, roads, parking lots, and other impervious areas has caused an insignificant increase in the amount of storm water runoff during rainfall events.

3.6 SITE HISTORY

3.6.1 Ownership and Prior Use

The federal government entered into a contract with E.B. Badger and Sons Company (Badger) on December 21, 1940 to build the Plum Brook Ordnance Works. On December 28, 1940, a subsequent contract was signed with Trojan Powder Company (Trojan) for the purpose for manufacturing trinitrotoluene (TNT), dinitrotoluene (DNT), pentolite, and nitric and sulfuric acids. Badger started surveying the 9009-acre site on February 3, 1941, with ground breaking activities following on April 15, 1941. The first TNT and DNT processing lines were completed and ready for operation on December 9, 1941. Operations for the manufacturing of TNT originally started on December 16, 1941. Production of explosives ceased 2 weeks after V-J Day, having manufactured in excess of 1,000,000,000 pounds of explosives during the 4-year operating period.

Between V-J Day and September 22, 1945, the entire Ordnance Inspection Department was abolished. Decontamination of TNT, acid, pentolite, and DNT manufacturing lines were completed during the last quarter of 1945. On December 17, 1945, the physical custody of the plant was transferred from Trojan to the Ordnance Department. At this time, the Ordnance Department assumed liability and the U.S. Engineers assumed responsibility for maintenance and custodial duties. U.S. Engineers maintained stand-by operations from December 1945 to September 1946. The property was subsequently transferred to the War Assets Administration after it was certified by the U.S. Army to be decontaminated.

Matthew-Levio and Sons served as the protection and maintenance contractor from September 1946 to May 1949. The property was then transferred to the General Services Administration (GSA).

NASA acquired the Plum Brook Ordnance Works on March 15, 1963 and is presently using the site. On April 18, 1978. NASA declared approximately 2152 acres of land as excess. The Perkins Board of Education acquired 46 acres of the excess and utilizes its area as a bus transportation center. GSA retains the remaining acreage and currently has a use agreement with the Ohio National Guard for 604 acres of the land. NASA presently controls 6453.5 acres and is currently using its site to conduct space research as a satellite operation of NASA's Lewis Research Center in Cleveland, Ohio.

3.6.2 Suspected Contamination

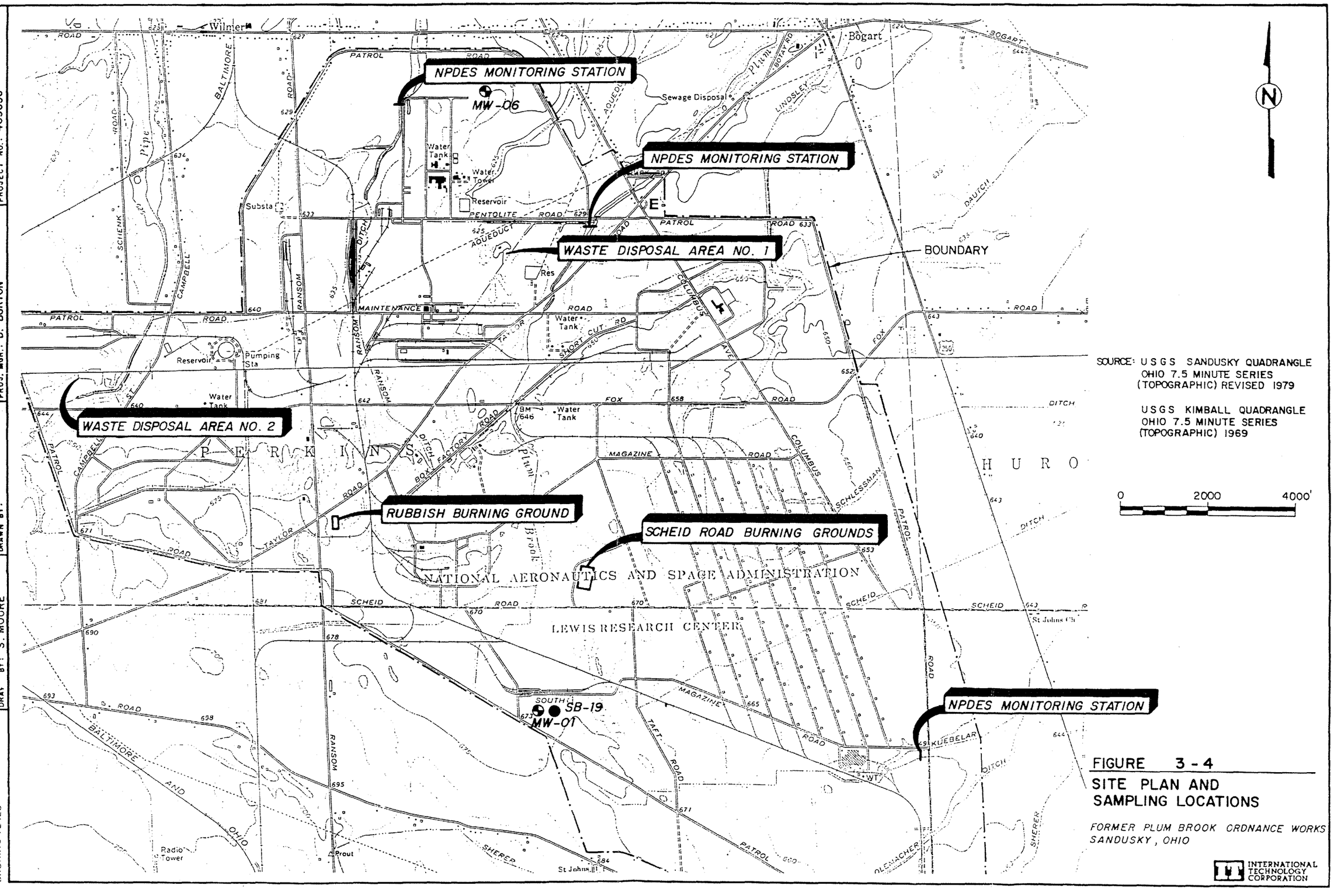
Types of potential hazardous waste and disposal facilities associated with the operation, maintenance, and deactivation of the site are as follows:

- Containerized facilities
- Landfill disposals
- Seepage lagoons.

Four specific sites have been targeted for investigation to confirm or deny the presence or absence of residual chemical contamination from operational activities during DOD control (Figure 3-4).

Containerized Facilities

A search of existing records of the Plum Brook Ordnance Works revealed that six underground storage tanks (USTs), installed during the period of DOD control, are inventoried. Three of the six tanks are currently in use and two of the three hold waste oil and solvents. Two tanks, installed in 1942, are permanently out of use and are located at the former vehicle service station, Building 7132. Current contents of the abandoned USTs are water and gasoline or diesel (Table 3-1).



SOURCE: USGS SANDUSKY QUADRANGLE OHIO 7.5 MINUTE SERIES (TOPOGRAPHIC) REVISED 1979

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FIGURE 3-4

SITE PLAN AND SAMPLING LOCATIONS

FORMER PLUM BROOK ORDNANCE WORKS SANDUSKY, OHIO

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Table 3-1. Former Plum Brook Ordnance Works Site
Sandusky, Ohio

Department of Defense Underground Storage Tank Inventory
(Current as of December 1988)

Tank ID	Status of Tank	Bldg	Location	Date Installed	Capacity	Construction Material	Current Contents	Previous Contents	Interior Protection	Exterior Protection
7121-1	Currently in use	7121	E side of bldg between roads	1942	3,000	Steel	Waste oil and solvent	Waste oil and solvent	None	None
7131-1	Currently in use	7131	NE side of bldg	1942	1,500	Steel	Waste oil and solvent	Waste oil and solvent	None	None
7132-1	Permanently out of use	7132	North tank	1942	9,000	Steel	Water and gasoline	Gasoline	None	None
7132-2	Permanently out of use	7132	Center tank	1942	9,000	Steel	Water and diesel fuel	Diesel fuel	None	None
7132-3	Currently in use	7132	South tank	1942	9,000	Steel	Gasoline	Gasoline	None	None
8133-2	Permanently out of use	8133	W side	1942	250	Steel	Water	Unknown, gasoline, possibly a waste oil	None	None

The Lewis Research Center has in effect an approved Spill Prevention Control and Countermeasure Plan in compliance with 40 CFR 112. This plan establishes procedures, methods, and equipment to prevent the discharge of oils into navigable waters of the site.

The waste oil tanks are checked weekly and when they are approximately three-quarters full, they are pumped out by an authorized service contractor. The contractor disposes of the material in accordance with Ohio EPA regulations or by reclamation.

It was decided after consulting COE that USTs will not be considered part of this contamination evaluation.

Landfill Disposals

During the period of U.S. Army ordnance manufacturing operations at the site, many underground drain lines were constructed by the U.S. Army for carrying process water to the settling basins. These wooden flume lines became contaminated with TNT residue and, on many occasions, were completely plugged. The lines that became plugged were not cleaned, but rather by-pass lines were then constructed around the blocked area to provide continual drainage of the red water wash.

The original wooden flume lines constructed were identified on construction drawings for that period. However, the by-pass drain lines, when constructed, were not recorded on any drawings and, therefore, their locations are not precisely known. All known and identified drain lines were excavated, removed, and burned by a contractor hired by NASA to complete this decontamination effort. During the removal of the identified drain lines, excavations were performed approximately 20 feet on either side of the known line to remove as many by-pass lines as possible. Many of the by-pass lines were encountered by this operation and were removed and burned.

Additional wooden underground flume lines have subsequently been encountered during NASA construction activity. These unidentified drain lines were also completely removed and burned. There were some small deposits of TNT encountered during the removal of the underground drain lines. There is

reason to believe, therefore, that there are small additional buried deposits of TNT and associated drainlines still present at the site, the locations of which are unknown.

During the records search, a former rubbish pit and TNT burning ground were identified on selected maps. A rubbish burning ground located approximately 300 feet east of Ransom Road and 300 feet southeast of Tayor Road was revealed. The rubbish burning area was approximately 140 feet by 100 feet surrounded by a 3-foot-high earthen berm. Tiles were installed through the embankment at natural low points in the ground for drainage.

The former TNT burning ground was located approximately 1100 feet north of Scheid Road and was approximately 100 feet by 200 feet surrounded by a 4-foot-high earthen berm. Burning spots, consisting of a 4-inch sand base and 4-inch cinder top approximately 10 feet square in size, were located throughout the burning area on 25-foot centers. The burning grounds were sloped south to north to a drainage tile in the northeast corner of the area. The burning grounds were subsequently graded after use.

Seepage Lagoons

During the period of ordnance manufacturing, two red water retention basins were established by the U.S. Army. TNT-contaminated water, produced from the former wash houses, contained all the impurities removed by washing the crude TNT product. This water eventually turned red or pink in color because of the presence of an organic dye and of the occurrence of small quantities of photodecomposition products. The main ingredient of normal red water is sodium sulphate and traces of sodium nitrate. Other chemicals used in quantity as part of the explosives manufacturing process include:

- Nitric acid
- Sulfuric acid
- Ammonia
- Soda ash (Na_2CO_3, $NaHCO_3$, NaOH, Na O)
- Sulfur
- Sodium sulfite
- Acetone
- Toluene.

Red water retention basins are identified as Waste Disposal Area No. 1, south of Pentolite Road, and Waste Disposal Area No. 2 also referred to as the Twin Lakes area, located south to southeast of Acid Area No. 2.

Waste Disposal Area No. 1 is located slightly north of the central part of the site, just south of Pentolite Road. During the site inspection of January 18, 1989, some water was standing in the area, but consisted primarily of marshy soil, grasses, and reeds. There was no visual evidence of red water or stressed vegetation at the disposal area.

In 1978, red water from Waste Disposal Area No. 1 permeated the soil and commenced seeping through the banks of a drainage ditch approximately 50 yards east of the basin. This ditch connects with a ditch parallel to Pentolite Road and discharges into Plum Brook, thus leaving the site. To prevent the flow of seepage, large metal pipes were placed in the ditch and a by-pass ditch around the area of seepage was excavated. Once completed, the culverts were removed from the original ditch and backfilled. Dirt excavated from the by-pass ditch was used to berm the retention basin. Since then, there was a breakthrough of red water from the mounded depression. Presently, there is little evidence of the berm or the point of breakthrough.

An existing 6-inch discharge line from Waste Disposal Area No. 1 was found discharging to the ditch parallel to Pentolite Road. Visual inspection of the outfall showed possible signs of staining and red residue.

Waste Disposal Area No. 2 is located in the westernmost part of the site, south of the former Acid Area No. 2 and adjacent to Pipe Creek. Waste Disposal Area No. 2 consists of two red water retention basins. The west ponded area comprises an area of approximately 8 acres and is bermed three quarters around the perimeter of the basin. The ponded area contains a overflow tile to prevent breaching of the southernmost berm. During the site investigation, one area of berm appeared as if the pond had breached to Pipe Creek. There was no visual evidence of red water in the westernmost retention basin.

The easternmost retention basin contained very little water, but there was a significant amount of red water and residue standing in areas where deer had been present. The east ponded area was also bermed, separating Waste Disposal Area No. 2 from Pipe Creek. There was no evidence of an overflow from the easternmost retention basin.

Analytical results of water samples from the westernmost ponded area contain magnesium, strontium, and zinc. Soil samples collected from the area had concentrations of 2,4-DNT and 2,6-DNT at 0.2 parts per million (ppm) and 11.6 ppm, respectively. Other records show results of aqueous solutions that were analyzed for TNT after oxidation to nitrate. The following results were obtained:

Nitrate	TNT
2003 ppm	3295 ppm
853 ppm	1403 ppm

4.0 SAFETY PROGRAM PLAN

Appendix A is the project SPP. The SPP will be administered by the Project Manager, the Health and Safety Coordinator, and the Field Geologist. The SPP meets relevant requirements of the Occupational Safety and Health Administration (OSHA), EPA, and COE. The SPP addresses the following to the relevant level of detail:

- Standard operating procedures
- Identification of hazards
- Personnel protection equipment
- Safety and health training
- Hazards monitoring
- Emergency procedures
- Medical surveillance
- First aid
- Accident reporting and record keeping
- Safety inspections
- Site layout for contamination containment during site work
- Confined space entry.

Site work will be performed in Level D protective clothing, unless directed otherwise by the Health and Safety Coordinator or her designees, the Project Manager, or the Field Geologist. Sample collection for chemical analyses will be performed in Level D clothing, unless a higher level of protection is directed.

5.0 MONITORING WELLS AND SOIL BORINGS

5.1 MONITORING WELLS

Appendix B is the detailed MWIP. The SOW specifies that the design and construction of the six ground water monitoring wells will follow, as closely as practical, that of a low-yield domestic water supply well as described in EPA's Manual of Water Well Construction Practices (EPA 570/9-75-001) and Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities (EPA 530/SW-611). Well construction permits (if required) will be obtained by IT before well construction. In addition, IT will obtain necessary approvals or permits for conducting the evaluation at the site. Copies of any required permits or certification shall be furnished to the Contracting Officer. A qualified and experienced IT geologist will be on site to supervise well construction, collect soil and water samples, and develop and test the wells.

5.1.1 Monitoring Well Design

Details of monitoring well design are provided in the MWIP.

5.1.2 Well Development

Well development will be performed after each well has been constructed, but no sooner than 48 hours after well grouting. Following well development, in situ permeability testing will be performed. Details are given in the MWIP.

5.1.3 Monitoring Well Monument Location

Coordinates and elevations will be established for each monitoring well. The coordinates will be to the closest 1.0 foot and referenced to the State Plane Coordinate System. If the State Plane Coordinate System is not readily available, an existing local grid system will be used. A survey marker (control monument) composed of brass, bronze, or aluminum alloy will be permanently set in the pad surrounding each well. Elevations to the closest 0.1 foot will be provided for the survey marker and the top of the casing at each well. These elevations will be referenced to the National Geodetic Vertical Datum of 1929. If the 1929 datum is not readily available, the existing local vertical datum will be used. Two permanent control monuments with brass, bronze, or aluminum alloy caps will be set in accessible locations within the limits of

the work. These monuments will be separated by a minimum of 500 feet. Coordinates and elevations to third order (1 to 5000) accuracies or better will be established to the closest 0.01 foot for each monument. The location, identification, coordinates, and elevations of the wells and monuments will be plotted on maps with a scale large enough to show their location with reference to other structures at the individual sites. A tabulated list of the monitoring wells and monuments, including their coordinates and elevations, all field books, and all computation sheets will be prepared and submitted to the Nashville District and marked ATTN: ORNED-R with a copy to the Huntsville Division, ATTN: HNDED-CS. The tabulation will consist of the designated number of the well or monument, the X and Y coordinates, and all the required elevations. These items will be submitted to ORN and HND no later than the draft report submission date.

5.2 SOIL BORINGS

Soil borings from a depth of 2 feet will be performed at 18 investigation site locations and one background location for collection of composite soil/subsoil environmental samples for chemical analyses. Refer to the Monitoring Well Installation Plan (Appendix B) or the S/A-QA/QC Plan (Appendix C). The background soil sample will be from an area near the site and is considered to represent uncontaminated soil from the area. The borings will be performed by IT; either a hand auger or the auger drilling rig for monitoring well construction will be used.

The approximate sampling locations (monitoring wells and boreholes) for this project were determined in part by the COE requirements stated in the SOW. Sampling locations will be finalized in the field based on the judgment of the Sampling Team Leader.

6.0 ENVIRONMENTAL SAMPLING

6.1 SOIL/SUBSOIL SAMPLING FOR GEOTECHNICAL TESTING

Soil/subsoil samples will be collected for geotechnical testing during construction of the monitoring wells. Soil samples will be collected continuously for the first 10 feet and at 5-foot intervals or stratum changes thereafter. Samples will be collected as described in the MWIP (Appendix B). Samples will be stored in airtight glass jars until tested or until the project contract is completed.

6.1.1 Soil Classification

All soil samples will be visually classified by the Unified Soil Classification System (USCS).

6.1.2 Laboratory Analyses

The following tests will be performed on two soil samples from each monitoring well boring, using the current method revisions:

Analysis	Method
Grain-size distribution	American Society for Testing and Materials (ASTM) D422-63, "Particle-Size Analysis of Soils," preparation by ASTM D421-85, "Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants"
Atterberg limits	ASTM D4318-84, "Liquid Limit, Plastic Limit, and Plasticity Index of Soils" (replaced ASTM D423 and ASTM D424 in 1983)
Moisture content	ASTM D2216-80, "Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures."

The specific soil sample to be tested from each boring is described in the S/A-QA/QC Plan.

6.2 SOIL/SUBSOIL SAMPLING FOR CHEMICAL ANALYSES

Soil/subsoil samples will be collected from 18 investigation site locations and one background location. The proposed locations will be finalized in the field by the Field Geologist/Sampling Team Leader. Analytical requirements, necessary sample collection and preservation requirements, and quality assurance/quality control (QA/QC) requirements are given in the S/A-QA/QC Plan (Appendix C).

6.3 GROUND WATER SAMPLING

One round of ground water samples will be collected from each of the new wells installed by IT. No other wells will be sampled. Details are given in the S/A-QA/QC Plan.

6.4 SURFACE WATER SAMPLING

One surface water sample will be collected from each of the four streams that drain the site.

7.0 ANALYTICAL SERVICES AND DATA EVALUATION

Table 7-1 is a summary of samples (including the number of required QA/QC samples specified in the SOW) to be collected for analysis. Table 7-2 is a listing of analytical methods to be employed. Table 7-3 is a summation of analyses by sample type (ground water, soil, surface water, and QA/QC) and tested parameters. A detailed breakdown of chemical analyses required for each sample is given in the S/A-QA/QC Plan. Details of sample collection, presentation, packaging, and shipment are also given in the S/A-QA/QC Plan.

Table 7-1. Samples To Be Collected and Analyzed for Chemical Contaminants

Types of Samples	Field Samples To Be Collected and Analyzed by IT	Control Samples To Be Analyzed by IT	Control Samples To Be Analyzed by QA Laboratory
Soils			
Samples	18	--	--
Splits/duplicates	--	2	2
Rinsates	--	1	1
Travel blanks[a]	--	1	1
Matrix spike[b]	--	2	--
Background sample	--	1	1
Ground water			
Samples	6	--	--
Splits/duplicates	--	1	1
Sampling blank	--	1	1
Travel blanks[a]	--	1	1
Matrix spike[b]	--	2	--
Surface water			
Samples	4	--	--
Travel blanks	--	1	1
Splits/duplicates	--	1	1
Matrix spike[b]		2	--
Total	28	16	10

[a]Samples for volatile organic analysis only.
[b]To be performed by laboratory; laboratory spike not field spike.

Note: Shipping address for IT laboratory analyzing for chemical analyses:

IT Analytical Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
Attn: Robyn Wagner/Beth Monroe
Telephone: (615) 588-6401

Shipping address for QA laboratory analyzing for chemical analyses:

U.S. Army Engineer Division, Missouri River
Attn: Laboratory
420 South 18th Street
Omaha, Nebraska 68102
Telephone (402) 444-4304

Table 7-2. Required Laboratory Chemical Analyses and Approved Methods

Analysis	EPA Methods		
	Soil Samples	Surface Water Samples	Ground Water Samples
Volatile organics	EPA 8240/CLP	EPA 624/CLP	EPA 8240/CLP
Base/neutral and acid extractables	EPA 8250	EPA 625	EPA 8250
Total Metals[a] (Ag, Ba, Cd, Cr, Pb, Fe, Mn, Na)	EPA 3050/6010	EPA 200.7	EPA 3005/601
Hg	EPA 7471	EPA 245.1/245.2	EPA 7470
As	EPA 7060	EPA 206.2	EPA 7060
Se	EPA 7740	EPA 270.2	EPA 7740
Total sulfates	EPA 9035	EPA 375.3	EPA 9035
Nitrates	EPA 9200	EPA 353.3	EPA 9200
	EPA 9045	EPA 150.1	EPA 9040
Explosives[b]	THAMA[c] 7W or 8H	THAMA 8G or 8D	THAMA 8G or 8D

[a]Fe, Mn, and Na to be analyzed on ground water and surface water samples only.
[b]Mono-, di-, tri-nitro benzenes and toluenes.
[c]U.S. Army Toxic and Hazardous Materials Agency.

Table 7-3. Summation of Analyses By Sample Type and Analytical Parameters

Soils

Parameter	Soil	Clean B-Ground	Matrix Spike	Travel Blank	Rinsates	Split Duplicate	Total
Volatiles	18	1	2	1	1	2	25
BNAs[a]	18	1	2	0	1	2	24
Total metals	18	1	0	0	1	2	22
Total mercury	18	1	0	0	1	2	22
Total arsenic	18	1	0	0	1	2	22
Total selenium	18	1	0	0	1	2	22
Total sulfate	18	1	0	0	1	2	22
Nitrates	18	1			1	2	22
pH	18	1			1	2	22
Explosives	18	1			1	2	22

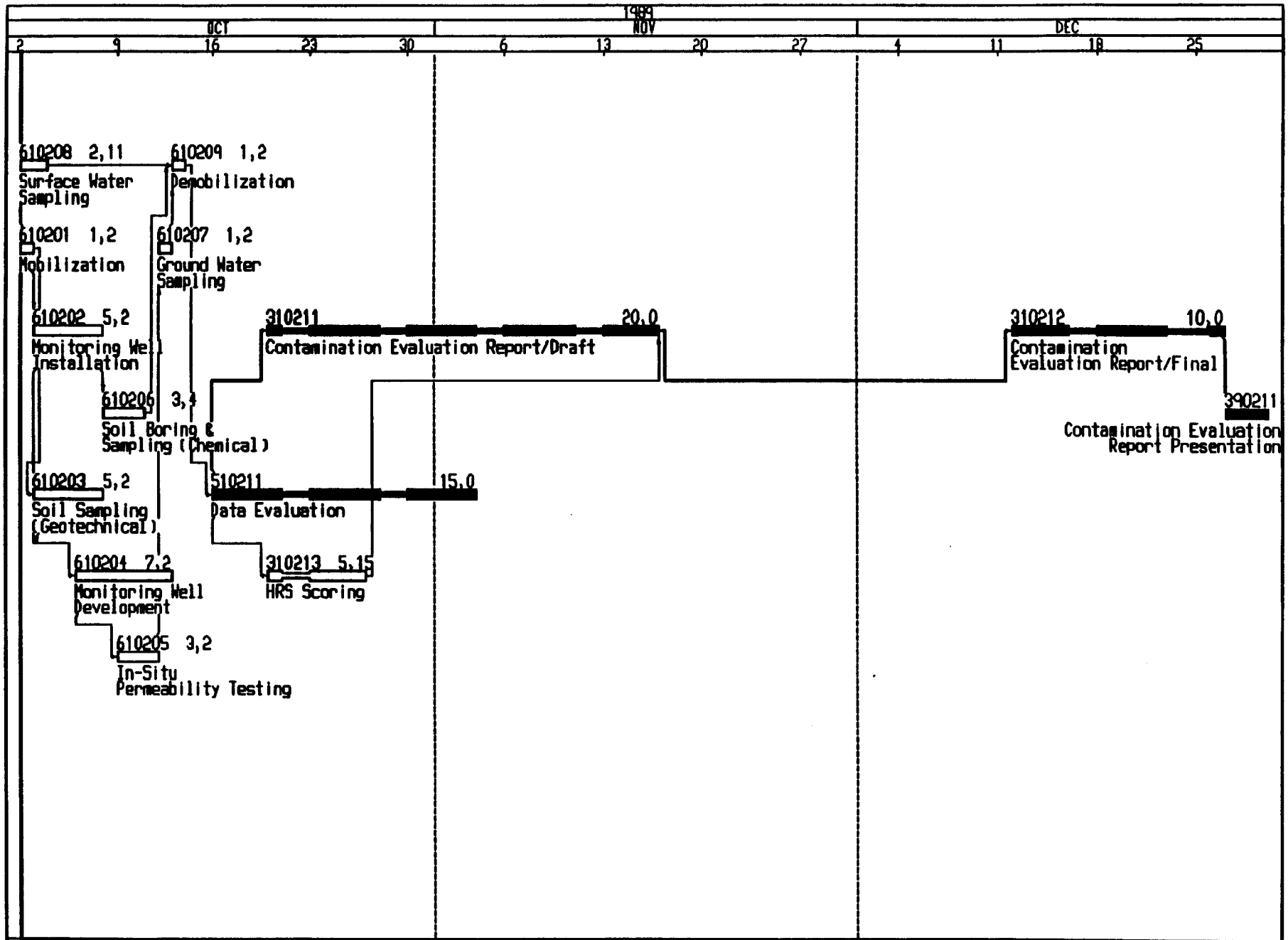
Water

Parameter	Surface Water	Ground Water	Matrix Spike	Travel Blank	Sampling Blank	GW Split/ Duplicate	SW/Split Duplicate	Total
Volatiles	4	6	4	2	1	1	1	19
BNAs	4	6	4	0	1	1	1	17
Total metals	4	6	0	0	1	1	1	13
Total mercury	4	6	0	0	1	1	1	13
Total arsenic	4	6	0	0	1	1	1	13
Total selenium	4	6	0	0	1	1	1	13
Total sulfates	4	6	0	0	1	1	1	13
Nitrates	4	6			1	1	1	13
ph	4	6			1	1	1	13
Explosives	4	6			1	1	1	13

[a]Base/neutrals and acid extractables.

8.0 SCHEDULE

Preparation for field work will begin within 1 week of receipt of notice to proceed, and mobilization will begin within 2 weeks of the notice to proceed. Field work should be completed within 3 weeks of initiation. A draft engineering report will be completed within 5 weeks of completion of analytical work. Figure 8-1 shows the schedule for key field tasks.


1989
OCT
NOV
DEC
2
9
16
23
30
6
13
20
27
4
11
18
25
610208 2,11
Surface Water Sampling
610209 1,2
Demobilization
610201 1,2
Mobilization
610207 1,2
Ground Water Sampling
610202 5,2
Monitoring Well Installation
310211
20.0
Contamination Evaluation Report/Draft
310212
10.0
Contamination Evaluation Report/Final
610206 3,4
Soil Boring & Sampling (Chemical)
390211
Contamination Evaluation Report Presentation
610203 5,2
Soil Sampling (Geotechnical)
510211
15.0
Data Evaluation
610204 7,2
Monitoring Well Development
310213 5,15
HRS Scoring
610205 3,2
In-Situ Permeability Testing
Activity Bar/Early Dates
Critical Activity
Progress Bar
Project Start : 20CT89
International Technology Corporation
Former Plum Brook Ordnance Works
NON END-TO-END ACTIVITY PLACEMENT
Sheet 1 of 1
Data Date: 20CT89
Former Plum Brook Ordnance Works
Date
Revision
Checked
Approved

APPENDIX A

SAFETY PROGRAM PLAN FOR CONTAMINATION EVALUATION AT THE FORMER PLUM BROOK ORDNANCE WORKS SANDUSKY, OHIO

Prepared for:

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE
AND
HUNTSVILLE DIVISION, CORPS OF ENGINEERS
HUNTSVILLE, ALABAMA

DERP PROJECT NO. G050H001800

Prepared by:

IT Corporation
Knoxville, Tennessee
IT Project Number 409658

September 1989

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APPENDIX A

SAFETY PROGRAM PLAN FOR THE

FORMER PLUM BROOK ORDNANCE WORKS

SANDUSKY, OHIO

U.S. ARMY CORPS OF ENGINEERS

DEFENSE ENVIRONMENTAL RESTORATION PROGRAM

Prepared By:

IT Corporation
Knoxville, Tennessee

September 1989

Prepared by: Kristin K. Baksa, CIH

Reviewed by: Kenneth M. Smith

Approved:

IT Health and Safety Officer

IT Project Manager

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CONTENTS

		Page
LIST OF FIGURES		A-iii
1.0	INTRODUCTION	A1-1
2.0	RESPONSIBILITIES	A2-1
2.1	Program Manager	A2-1
2.2	Project Manager	A2-1
2.3	Site Health and Safety Coordinator	A2-1
2.4	Field Personnel	A2-2
2.5	Subcontractor Personnel	A2-3
3.0	SITE CHARACTERIZATION	A3-1
4.0	HAZARD COMMUNICATION AND EMPLOYEE TRAINING	A4-1
4.1	General Information	A4-1
4.2	Comprehensive Health and Safety Training	A4-1
4.3	Preentry Briefings; Informational Materials	A4-2
4.4	Postinvestigation Health and Safety Briefing	A4-3
5.0	MEDICAL SURVEILLANCE	A5-1
5.1	Physical Examination	A5-1
5.2	Medical Records	A5-2
5.3	Injury and Illness Treatment	A5-2
6.0	ENGINEERING AND WORK PRACTICE CONTROLS	A6-1
7.0	HAZARD EVALUATION	A7-1
7.1	Traffic	A7-1
7.2	Exposure to the Elements	A7-2
7.3	Hearing Conservation	A7-4
7.4	Fire	A7-5
7.5	Buried Utilities	A7-5
7.6	Chemical Exposure	A7-5
7.7	Ordnance Materials	A7-6
8.0	PERSONNEL PROTECTIVE EQUIPMENT	A8-1
8.1	Respiratory Protection	A8-1
8.2	Levels of Protection	A8-2
9.0	SAFE WORK PRACTICES	A9-1
10.0	DRILLING AND SAMPLING SAFETY	A10-1
10.1	Site Inspection	A10-1
10.2	Well Installation, Soil Boring, and Logging	A10-1
11.0	SITE MONITORING	A11-1
11.1	Airborne Contaminants	A11-1
11.2	Monitoring Frequency	A11-1

CONTENTS (Continued)

		Page
	11.3 Personnel Monitoring	A11-2
	11.4 Monitoring Record Keeping	A11-2
	11.5 Calibration	A11-2
12.0	DECONTAMINATION	A12-1
	12.1 Regulated Areas	A12-1
	12.2 Employee Decontamination	A12-2
	12.3 Equipment Decontamination	A12-7
	12.4 Decontamination Zone General Rules	A12-8
13.0	EMERGENCY PROCEDURES	A13-1
	13.1 General	A13-1
	13.2 Responses to Specific Situations	A13-1
	13.3 Emergency Telephone Numbers	A13-3
14.0	ACCIDENT REPORTING AND RECORD KEEPING	A14-1
15.0	ILLUMINATION	A15-1
16.0	CONFINED SPACE ENTRY	A16-1

FIGURES

Number		Follows Page
4-1	Example Tailgate Safety Meeting Form	A4-2
4-2	Example Material Safety Data Sheet Form	A4-2
5-1	Example Preemployment Examination Form	A5-1
5-2	Example Update/End-of-Project/Termination Examination Form	A5-1
5-3	Example Medical Examination Report Form	A5-2
5-4	Example Physical Activity Restriction Form	A5-2
5-5	Example Supervisor's Employee Injury Report Form	A5-2
5-6	Example Return to Work Authorization Following Medical Absence Form	A5-3
13-1	Emergency Routing Plan	A13-3

1.0 INTRODUCTION

This Safety Program Plan (SPP) has been prepared for use in a contamination evaluation at the former Plum Brook Ordnance Works site near Sandusky, Ohio. This plan addresses the requirements identified in Section 3.0 of the Scope of Work (SOW). This plan also summarizes applicable safety and accident prevention procedures and outlines standard operating procedures (SOPs) adapted to site-specific requirements to ensure the safety of personnel involved in field aspects of this investigation. This SOP also provides for the protection of the general public and the environment. Included within the emergency contingency procedures are the identities of appropriate local medical, law enforcement, and fire fighting resources. The plan is also intended to comply with the U.S. Army Corps of Engineers (COE) Safety and Health Requirements Manual (EM 385-1-1), the COE Safety and Occupational Health Requirements for Hazardous Waste Site Remedial Actions (ER 385-1-92), the Occupational Safety and Health Administration (OSHA) requirements Title 29 Code of Federal Regulations Parts 1910 and 1926 (29 CFR 1910 and 1926), and the U.S. Environmental Protection Agency (EPA) hazardous waste requirements (40 CFR 260-281). In addition to the above, field practices will comply with applicable federal, state, and local laws and health and safety requirements.

This site-specific SPP has also been developed in accordance with the general health and safety program established by IT Corporation (IT) and is coupled with an ongoing corporate philosophy relating to accident prevention. Compliance with this plan by all workers is mandatory. The IT Project Manager, with the assistance of his respective discipline managers and the Health and Safety Coordinator (HSC), will determine and enforce compliance accordingly.

This SPP has been developed in consideration of projected health hazards with only minimal documentation of current, actual hazards. Hazard characterization will be performed on a task-specific basis in an effort to continuously refine this document to pertinent areas of concern.

2.0 RESPONSIBILITIES

Health and safety responsibilities are shared by the project participants and organized as outlined below.

2.1 PROGRAM MANAGER

The responsibilities of the Program Manager (Clifford Vaughan, IT Corporation) include:

- Review and approve the health and safety plan.
- Coordinate with the HSC to verify that health and safety requirements are properly performed.
- Designate the availability of company resources for the implementation of necessary aspects of the plan.

2.2 PROJECT MANAGER

The responsibilities of the Project Manager (Don Burton, IT Corporation) include:

- Interpret safety requirements as outlined in the SOW and communicate these requirements to responsible project participants.
- Allocate resources necessary to implement the plan during the duration of the project.
- Furnish the approved plan to subcontractors for their use.

The Project Manager has full responsibility for implementing and executing an effective program of employee protection and accident prevention. He may delegate authority to expedite and facilitate any application of the program.

It is recognized that strong support and active participation by the Project Manager is an essential element in a successful health and safety program.

2.3 SITE HEALTH AND SAFETY COORDINATOR

The project HSC (Kristin Baksa, IT Corporation) is an industrial hygienist who is knowledgeable in safety with a command of worker protection techniques specific to the Plum Brook Ordnance Works project. Responsibilities include

ensuring the compliance of work to this SPP, balancing it with the flexibility to adapt quickly to needed changes or additions required by a potentially dynamic working environment. She will provide technical assistance to project management on problems relating to industrial hygiene and health and safety at a hazardous waste site.

The HSC or her designee will be responsible for monitoring personal exposures of workers to chemical toxicants as required. This will consist of performing workplace air sampling (personnel monitoring, ambient organic vapor sampling, etc.), procuring the services of and coordinating with a qualified analytical laboratory [i.e., American Industrial Hygiene Association (AIHA) accredited] for sample analysis, as well as interpreting all data generated. As data are received and evaluated, the HSC or her designee will modify the SPP to fit current worker protection needs, as indicated.

In the absence of the HSC, the Field Geologist will serve as the on-site Health and Safety Officer and will be present during field operations on a full-time basis. This individual will be responsible for the implementation of the SPP and will have on-site quality assurance/quality control (QA/QC) and safety responsibilities for the field operations. If hazardous or potentially hazardous situations arise, the Field Geologist will notify the HSC immediately for guidance. Approved copies of the SPP will be on site at all times. The Field Geologist will report directly to the Project Manager.

2.4 FIELD PERSONNEL

Personnel involved in the on-site activities associated with this project are required to follow the instructions of the Field Geologist, comply with the aspects of this plan, and notify the Field Geologist of any hazardous or potentially hazardous working situations.

All field activities will be conducted in pairs to avoid accidents resulting from unsafe practices and to ensure that immediate assistance is available in case of accident or need for first aid.

2.5 SUBCONTRACTOR PERSONNEL

The responsibilities of the subcontractors include:

- Designate a project leader in charge of on-site projects being performed by subcontractor crews.
- Review all aspects of this health and safety plan.
- Implement and adhere to all aspects of this plan.

3.0 SITE CHARACTERIZATION

Initial site entry and site walks will be conducted in Level D protection (see Section 8.0). Based on the preliminary site inspection trip, the likelihood of exposure to hazardous contaminants appears minimal, other than direct contact with possible contaminated soil and water samples. Accordingly, Level D protection will be used to begin initial site activities.

During initial entry for field investigations, air monitoring will be conducted with a photoionization detector and a combustible gas indicator as precautionary measures to confirm the selection of protective equipment. Monitoring will also be conducted during the sampling and drilling activities at the former Plum Brook Ordnance Works. If readings exceed the action levels specified in Section 11.0, the level of protection must be upgraded. All decisions on protective clothing will be made by the HSC.

If explosive contamination or unexpected ordnance is discovered at any time during the confirmation study operations at the site, the location will be marked, operations in the affected area will immediately be stopped, and the Contracting Officer will be notified.

4.0 HAZARD COMMUNICATION AND EMPLOYEE TRAINING

4.1 GENERAL INFORMATION

Although no work at a site with possible chemical contamination can be considered completely risk-free, logical and reasonable precautions may be implemented to provide an adequate level of protection for workers. Training of workers relative to chemical hazards, baseline medical evaluations, employee monitoring, safe work practices, and appropriate decontamination procedures are all part of an integrated approach for protecting on-site personnel.

4.2 COMPREHENSIVE HEALTH AND SAFETY TRAINING

A comprehensive health and safety training program will be provided for all IT personnel associated with work at the Plum Brook Ordnance Works site. The program will focus upon the potential hazards present at the site and the implementation of a health and safety program specific to the site. Emphasis will be placed on the use of personnel protective equipment, routine safe work practices, and emergency procedures.

All employees subject to exposure to on-site contaminants shall be trained in accordance with OSHA Standard 1910.120. All employees will have received a minimum of 40 hours of training off site and a minimum of 3 days of actual field experience under the direct supervision of a trained, experienced supervisor.

On-site managers and supervisors shall receive a minimum of 8 hours of additional training.

All employees who have completed the required 40 hours of classroom training and 3 days of field experience will receive a certificate from the instructor. A copy of the certificate shall be kept on site at all times.

It is necessary for each hazardous waste operations employee to receive 8 hours annually of refresher training on the items outlined in this section.

The 40-hour training program will include the following topics:

- Basic safety (slip, trip, and fall hazards and safe lifting)
- Toxic hazards
- Chemical hazards and properties
- Respiratory protection
- Hazard recognition
- Protective clothing, levels of protection
- Decontamination procedures
- Site control
- Air monitoring instruments
- Heat stress
- Noise
- Medical surveillance.

In addition, one person shall be on site at all times who has completed the Red Cross First Aid and Cardiopulmonary Resuscitation class.

4.3 PREENTRY BRIEFINGS; INFORMATIONAL MATERIALS

The understanding of basic, precautionary concepts is essential for personnel assigned to sites where chemical contamination may be known or suspected of being present. The following training sessions and informational materials will be provided on site:

- Tailgate Safety Meetings - A tailgate safety meeting will be conducted at the beginning of each shift or whenever new employees arrive at the job site once the job commences. The health and safety considerations for the day's activities will be discussed, and the necessary protective equipment will be outlined. The Tailgate Safety Meeting form is included as Figure 4-1.

- Material Safety Data Sheets (MSDSs) - Completed MSDSs for the toxic materials present at the site shall be posted at the job site. Figure 4-2 is an example of a completed MSDS.

- Site Safety Plan - All persons entering the site shall be informed of the contents of the site safety and health plan.

Health and safety briefings will be conducted daily for employees by the site HSC or her designee. Problems relative to respiratory protection, inclement weather, or the interpretation of newly available environmental monitoring data will be topics covered during these briefings.

TAILGATE SAFETY MEETING

Division/Subsidiary _____ Facility _____

Date _____ Time _____ Job Number _____

Customer _____ Address: _____

Specific Location _____

Type of Work _____

Chemicals Used _____

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment _____

Chemical Hazards _____

Physical Hazards _____

Emergency Procedures _____

Hospital / Clinic _____ Phone ( ) _____ Paramedic Phone ( ) _____

Hospital Address _____

Special Equipment _____

Other _____

ATTENDEES

NAME PRINTED	SIGNATURE

Meeting conducted by:

_____ NAME PRINTED _____ SIGNATURE

Supervisor _____ Manager _____

ITC Form 9640-1C (Revised 10/84)

FIGURE 4-1

FOR ILLUSTRATIVE PURPOSES ONLY--NOT PROJECT SPECIFIC

ROHM AND HAAS COMPANY

CORPORATE PRODUCT INTEGRITY DEPARTMENT
INDEPENDENCE MALL WEST
PHILADELPHIA, PA 19106

EMERGENCY TELEPHONE
215-592-3000 (ROHM AND HAAS)
800-424-9300 (CHEMTREC)

HAZARD RATING
4=EXTREME
3=HIGH
2=MODERATE
1=SLIGHT
0=INSIGNIFICANT
*=SEE SECTION IV

TOXICITY 2 | REACTIVITY 1 | SPECIAL 0

MATERIAL SAFETY DATA SHEET

NOT OSHA HAZARDOUS

LIST 7

MATERIAL	CODE	KEY	DOT HAZARD CLASS
AMBERLITE® IRN-78 Resin	69837	892428-4	NONREGULATED
	DATE ISSUED 10/04/85		

FORMULA	CHEMICAL NAME OR SYNONYMS
Not applicable	Styrene/divinylbenzene ion exchange resin (hydroxide form)

I - COMPOSITIONAL INFORMATION

	CAS Reg. No.	APPROX WT %	TWA/TLV R&H	OSHA	ACGIH
Styrene/divinylbenzene anion exchange resin	NONHAZ		NE	NE	NE
Water	NONHAZ		NE	NE	NE

II - PHYSICAL PROPERTY INFORMATION

APPEARANCE · ODOR · pH			VISCOSITY
Clear beads/slight amine odor; pH (aqueous slurry) 9.5-11			NA
MELTING OR FREEZING POINT	BOILING POINT	VAPOR PRESSURE mm Hg	VAPOR DENSITY (AIR=1)
0C/32F (water)	NA	17 (water) 20C/68F	0.62 (water)
SOLUBILITY IN WATER	PERCENT VOLATILE (BY WEIGHT)	SPECIFIC GRAVITY (WATER=1)	EVAPORATION RATE (BUTYL ACETATE=1)
Negligible		1.11	<1 (water)

III - FIRE AND EXPLOSION HAZARD INFORMATION

FLASH POINT	AUTO IGNITION TEMPERATURE	LOWER EXPLOSION LIMIT (%)	UPPER EXPLOSION LIMIT (%)
NA	427C/800F est.	NA	NA

EXTINGUISHING MEDIA

☐ FOAM ☐ "ALCOHOL" FOAM ☒ CO_2 ☒ DRY CHEMICAL ☒ WATER SPRAY ☐ OTHER

SPECIAL FIRE FIGHTING PROCEDURES

Wear MSHA/NIOSH-approved, pressure demand, self contained breathing apparatus or equivalent, and full protective gear.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Toxic combustion products include oxides of nitrogen.

IV - HEALTH HAZARD INFORMATION

ROHM AND HAAS RECOMMENDED WORK PLACE EXPOSURE LIMITS

None established

EFFECTS OF OVEREXPOSURE

Eye Contact: Product, as supplied, can cause eye irritation.

EMERGENCY AND FIRST AID PROCEDURES

Eye Contact: Flush eyes with large amounts of water for at least 15 minutes. Get prompt medical attention.

FIGURE 4-2
(page 1 of 2)

FOR ILLUSTRATIVE PURPOSES ONLY--NOT PROJECT SPECIFIC

V - REACTIVITY INFORMATION

STABILITY	CONDITIONS TO AVOID
[X] STABLE [ ] UNSTABLE	Temperatures over 60C/140F

HAZARDOUS DECOMPOSITION PRODUCTS
Styrene, divinylbenzene monomer and alkylamines

HAZARDOUS POLYMERIZATION	CONDITIONS TO AVOID
[ ] MAY OCCUR [X] WILL NOT OCCUR	None known

INCOMPATIBILITY (MATERIALS TO AVOID) [ ] WATER [X] OTHER
Avoid contact with concentrated nitric acid and other strong oxidizing agents at all times.

VI - SPILL OR LEAK PROCEDURE INFORMATION

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Floor may be slippery. Use care to avoid falls. Sweep up and transfer to containers for recovery or disposal.

WASTE DISPOSAL METHODS
Dispose of according to local, state, and federal regulations.

VII - SPECIAL PROTECTION INFORMATION

VENTILATION TYPE
Normal room ventilation

RESPIRATORY PROTECTION
None required for normal operations

PROTECTIVE GLOVES	EYE PROTECTION
Impervious	Splash goggles

OTHER PROTECTIVE EQUIPMENT
Eyewash facility

VIII - STORAGE AND HANDLING INFORMATION

STORAGE TEMPERATURE	INDOOR	HEATED	REFRIGERATED	OUTDOOR
MAX 49C/120F MIN. 2C/35F	YES	NO	NO	YES

NOTE: Maximum operating temperature is 60C/140F

FOOTNOTE TO SECTION I: NE= None established.

IX - TOXICITY INFORMATION

Toxicity studies have not been conducted on this specific strong base anion exchange resin. However, this product should be treated as a potential eye irritant since a finely ground form of a structurally related strong acid cation exchange resin did produce severe irritation in the rabbit eye.

X - MISCELLANEOUS INFORMATION

Caution: Do not pack column with dry ion exchange resins. Dry beads expand when wetted; this expansion can cause a glass column to shatter.
Caution: Nitric acid and other strong oxidizing agents can cause explosive-type reactions when mixed with ion exchange resins. Proper design of equipment to prevent rapid build-up of pressure is necessary if use of an oxidizing agent such as nitric acid is contemplated. Before using strong oxidizing agents in contact with ion exchange beads, consult sources knowledgeable in handling these materials.

AMBERLITE® IS A TRADEMARK OF ROHM AND HAAS COMPANY OR ONE OF ITS SUBSIDIARIES OR AFFILIATES.

NA = NOT APPLICABLE C = CEILING VALUE	KEY	DATE OF ISSUE	SUPERSEDES
	892428-4	10/04/85	NEW

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF

ROHM AND HAAS COMPANY ASSUMES NO RESPONSIBILITY FOR PERSONAL INJURY OR PROPERTY DAMAGE TO VENDEES, USERS OR THIRD PARTIES CAUSED BY THE MATERIAL. SUCH VENDEES OR USERS ASSUME ALL RISKS ASSOCIATED WITH THE USE OF THE MATERIAL.

FIGURE 4-2
(page 2 of 2)

Consequently, a review of the following provisions during a preentry briefing may be warranted if deemed relevant to site-specific tasks:

- Names of health and safety personnel and alternates.
- The hands and face must be thoroughly washed upon leaving the work area and before engaging in any activity indicated below.
- Whenever decontamination procedures for outer garments are in effect, the entire body will be thoroughly washed as soon as possible after the protective garment is removed.
- Any required respiratory protective devices and clothing must be worn by all personnel going on site. No excessive facial hair, which interferes with satisfactory fit of the mask-to-face-seal, is allowed for personnel required to wear respiratory protective equipment.
- All personnel will be familiar with standard operating safety procedures and additional instructions contained in the formal IT Site Health and Safety Plan.
- All personnel going on site will be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures, and communications.
- Personnel on site will use the "buddy" system when wearing respiratory protective equipment. At a minimum, a third person, suitably equipped as a safety backup, is required during initial entries.
- Only the personnel and equipment needed for effective site operations will be utilized in the contaminated area. All equipment taken into the contaminated area will require decontamination when it is removed.

4.4 POSTINVESTIGATION HEALTH AND SAFETY BRIEFING

A postinvestigative health and safety briefing will be held if, in the opinion of the HSC, site conditions warrant.

5.0 MEDICAL SURVEILLANCE

5.1 PHYSICAL EXAMINATION

As required by IT Policies and Procedures 9410.10 and 9410.2B, all IT personnel on site will have successfully completed a preemployment or periodic/update physical examination (Figures 5-1 and 5-2). This examination has been designed to comply with OSHA 1910.120 requirements for hazardous waste site operations.

The IT medical surveillance program examination consists of:

- Medical and occupational history form (detailed questionnaire for new employees, short questionnaire for periodic exams)
- Physical examination
- Complete blood count with differential
- SMAC 23
- Urinalysis (dipstick and microscopic)
- Chest x-ray
- Pulmonary function test (FEV/FVC)
- Audiogram
- Electrocardiogram for persons older than 45 years of age, or if medically indicated
- Drug and alcohol screening
- Visual acuity.

The following information is provided to the examining physician:

- Description of employee's duties
- Anticipated exposure levels
- Description of the personnel protective equipment to be used
- Information from previous medical exams.

A copy of the medical examination is provided to the employee at his/her request. The employee shall be informed of any medical conditions that would

INTERNATIONAL TECHNOLOGY CORPORATION

PREEMPLOYMENT EXAMINATION

IT Location _____
IT Division _____
PC No. _____
Project NO. _____
Temporary or Subcontractor _____

Name _____ Sex _____ Age _____ Birth Date _____ Soc. Sec. No. _____

Address _____ City _____ State _____ Zip _____ Telephone No. ( ) _____

APPLICANT NOTE - READ CAREFULLY This information is to help place you in a job best to yourself and to others depending to your physical ability. Answer every question (yes)

DO YOU OR HAVE YOU EVER HAD: (CHECK EVERY ITEM)

	YES	YEAR	NO		YES	YEAR	NO		YES	YEAR	NO
1 GLASSES FOR READING				35 CHANGE IN SKIN COLOR				69 MORNING COUGH			
2 GLASSES FOR DISTANCE				36 A GOITER				70 KIDNEY TROUBLE			
3 EYE TROUBLE Other than glasses				37 CHEST PAIN				71 URINARY BLADDER TROUBLE			
4 EYE IRRITATION				38 BREAST TROUBLE				72 VENERAL DISEASE			
5 NOSE TROUBLE				39 CHRONIC CHEST CONDITION				73 SWOLLEN FACE OR ANKLES			
6 BROKEN NOSE				40 LUNG DISEASE				74 RUPTURE OR HERNIA			
7 SINUS INFECTION				41 SHORTNESS OF BREATH				75 BROKEN BONES OR DISLOCATIONS			
8 HAY FEVER				42 A FEELING OF TIGHTNESS IN CHEST				76 PAINFUL OR SWOLLEN JOINTS			
9 MOUTH TROUBLE				43 ASTHMA				77 RHEUMATISM			
10 CONSIDERABLE TEETH TROUBLE				44 NIGHT SWEATS				78 ARTHRITIS			
11 BAD HEARING				45 TUBERCULOSIS				79 A KNEE INJURY			
12 EAR TROUBLE				46 SILICOSIS				80 SWOLLEN ANKLES			
13 RUNNING EAR				47 CHRONIC COUGH				81 FOOT TROUBLE OR PAINFUL FEET			
14 RINGING IN THE EAR				48 COUGHING UP OF BLOOD				82 BACK TROUBLE			
15 PUNCTURED EAR DRUM				49 HEART TROUBLE OR A HEART ATTACK				83 SPINE TROUBLE			
16 SORE THROAT				50 FREQUENT COLDS				84 OSTEOMYELITIS (Bone infection)			
17 FATIGUE				51 HIGH BLOOD PRESSURE				85 ALCOHOLISM			
18 FREQUENT HEADACHES				52 GAINED OR LOST WEIGHT PAST YEAR				86 DIABETES			
19 HEAD INJURY				53 BLEEDING OR BRUISING TENDENCY				87 MALARIA			
20 SKULL FRACTURE				54 FREQUENT NAUSEA				88 ANEMIA OR OTHER BLOOD CONDITION			
21 BRAIN CONCUSSION				55 FREQUENT VOMITING				89 CANCER			
22 DIZZY SPELLS				56 ULCERS				90 GROWTHS OR TUMORS			
23 FAINTING SPELLS				57 STOMACH TROUBLE				91 ANY CHRONIC AILMENT			
24 CONVULSIONS				58 CHRONIC INDIGESTION				92 BLOOD DISORDERS IN FAMILY			
25 EPILEPSY				59 ABDOMINAL PAIN				93 TETANUS SHOT LAST 10 YEARS FOR EMPLOYEE OR SPOUSE(S)			
26 LIGHT HEADED				60 APPENDICITIS				94 NUMBER OF PREGNANCIES			
27 MENINGITIS				61 GALL BLADDER TROUBLE				95 NUMBER OF MISCARRIAGES			
28 A "STROKE"				62 JAUNDICE				96 FEMALE SURGERY			
29 PARALYSIS				63 BOWEL TROUBLES				97 DATE LAST PREGNANCY FOR FEMALE APPLICANTS			
30 NERVOUS ATTACK				64 COLITIS				98 ARE YOUR PERIODS REGULAR?			
31 MENTAL TROUBLE				65 PILES				99 DATE LAST PERIOD			
32 SHOCK TREATMENT				66 DARK URINE							
33 ALLERGIES				67 DO YOU SMOKE?							
34 SKIN TROUBLE OR RASHES				68 HAVE YOU EVER SMOKED?							

Explain fully items checked YES: _____

What illness have you had in the past 5 years: _____

When did you last see a doctor? _____ For What? _____

Name and address of personal physician _____ Date of last visit _____ Reason _____

What medicines are you now taking? _____

Have you ever been rejected because of medical reason for military service? ☐ YES ☐ NO Date _____ Reason _____

For insurance? ☐ YES ☐ NO Date _____ Reason _____

For employment? ☐ YES ☐ NO Date _____ Reason _____

ITC Form 9410.1 (2/86)

FIGURE 5-1
(page 1 of 4)

Occupational History

Last Kinds of Work Done	What Machines and Materials Have You Handled?	No. of Years

All Occupational Illness and Injuries

Date	Nature of Illness or Injuries	Name of Company and City

Military Service — Connected Disabilities

Nature of Disability	%	Amt. Rec. Per Mo.	Branch of Service	Serial No.	Claim No.	V.A. Regional Office

Hospitalization _____ Why _____ When _____ Where _____

All Hospitalizations — Accidents — Sicknesses — (Except Occupational)

Date	Nature	Date	Nature
1.		3.	
2.		4.	

All Physical Defects or Abnormalities at This Time

Parts of Body	Extent of Defect

I hereby certify that to the best of my knowledge the foregoing answers are complete and correct and I understand that any falsification of this record is cause for termination. I further understand that this physical examination is conducted for the employer as a prerequisite to employment. I agree that this form and any information obtained as a result of this examination will become the property of the employer. I hereby grant permission to obtain records from my previous physician(s) or hospital(s) where I have been treated. Upon my termination of employment I agree to participate in a company medical examination.

Job Position _____ Date _____ Signature _____

Physician's Review of the Above History _____

FIGURE 5-1
(page 2 of 4)

Physical Examination by Medical Doctor
(For Physicians Use Only)

Height	Weight	Blood Press.	PULSE At Rest	After Exercise	2 Min. After Exercise	Temp.	Resp.	☐ Ambidextrous ☐ Right Handed ☐ Left Handed

Normal Yes	Normal No	Clinical Evaluation	Note: Describe every abnormality in detail. Enter paragraph item no. before each comment.
		1. GENERAL APPEARANCE	
		2. HEAD, FACE AND SCALP	
		3. EYES, PUPILS, SCLERA	
		4. EYES, FUNDOSCOPIC AND MOTILITY	
		5. EYES, OCULAR TENSION	
		6. EARS, CANALS AND DRUMS	
		7. NOSES, SINUSES	
		8. MOUTH, TEETH AND PHARYNX	
		9. NECK	
		10. THORAX	
		11. LUNGS	
		12. HEART AND BLOOD VESSELS	
		13. BREASTS	
		14. ABDOMEN	
		15. HERNIA	
		16. GENITALIA	
		17. AND RECTAL	
		18. SPINE, LUMBAR AREA	
		19. UPPER EXTREMITIES	
		20. LOWER EXTREMITIES	
		21. SKIN, LYMPHATICS	
		22. NEUROLOGIC	
		23. PSYCHIATRIC	

Additional Tests Indicated (Lab, X-Ray, EKG, etc.)

FIGURE 5-1
(page 3 of 4)

For Physicians Use Only

URINALYSIS

Spec GR	Albumin	Sugar
Microscopic		pH

X-RAY

Chest	70 mm		14 x 17		Negative Finding	

Summary of positive findings: _____

VISION

	Left Eye		Right Eye	
Distance	Unaer-rected	Cor-rected	Unaer-rected	Cor-rected
	20/	20	20/	20/
Near Designate Jaeger # Seen at 12"	Unaer-rected	Cor-rected	Unaer-rected	Cor-rected
	20/	20	20/	20/

Depth Perception ☐ Good ☐ Poor ☐ None

Color Vision ☐ Normal ☐ Abnormal

	Normal	Abnormal
CBC	☐	☐
CHEMISTRY	☐	☐
SPIROMETRY	☐	☐
EKG	☐	☐
AUDIO	☐	☐
CHEST X-RAYS	☐	☐
URINALYSIS	☐	☐
SUITABLE FOR WORK WITH CARCINOGENS	☐	☐
SUITABLE FOR WORK WITH CARCINOGENS WITH APPROPRIATE PROTECTIVE MEASURES	☐	☐
OTHER:		
_____	☐	☐
_____	☐	☐
_____	☐	☐
_____	☐	☐
_____	☐	☐
_____	☐	☐

RESTRICTIONS

As Noted Below ☐ None ☐

LIMITATIONS. Not to be assigned to any job requiring:

- ☐ 1. ANYTHING OTHER THAN SEATED WORK.
- ☐ 2. REPEATED BENDING, STOOPING, TWISTING OR LIFTING OVER _____ POUNDS.
- ☐ 3. PROLONGED KNEELING OR SQUATTING.
- ☐ 4. ANY KNEELING OR SQUATTING.
- ☐ 5. WALKING UP ANY STEPS.
- ☐ 6. WORK ON LADDERS OR OVERHEAD.
- ☐ 7. ARMS ABOVE SHOULDER LEVEL.
- ☐ 8. EXPOSURE TO DUST OR OTHER PARTICLES.
- ☐ 9. EXPOSURE TO AIRBORNE CHEMICALS.
- ☐ 10. NO WORK WITH OR EXPOSURE TO CHEMICALS.
- ☐ 11. HIGH BLOOD PRESSURE.
- ☐ 12. WORK REQUIRING USE OF OCCLUSIVE CLOTHING.
- ☐ 13. ACCURATE FAR VISION.
- ☐ 14. ACCURATE NEAR VISION.
- ☐ 15. TRUE COLOR PERCEPTION.
- ☐ 16. TRUE DEPTH PERCEPTION.
- ☐ 17. GOOD HEARING.
- ☐ 18. EXPOSURE TO EXCESSIVE NOISE.
- ☐ 19. WORK AROUND MOVING MACHINERY.
- ☐ 20. OPERATION OF MOVING MACHINERY.
- ☐ 21. OPERATION OF MOTOR VEHICLE.
- ☐ 22. EXPOSURE TO SOLVENTS OR THINNERS.
- ☐ 23. EXPOSURE TO OILS, RESINS, OR FIBERGLASS.
- ☐ 24. MENTAL TENSION OR RESPONSIBILITY.
- ☐ 25. ANY INDUSTRIAL TYPE OF PHYSICAL ACTIVITY
- ☐ 26. ALTITUDE OVER _____ FT.
- ☐ 27. LIMIT USE OF _____

THIS PERSON MUST WEAR:

- ☐ PROPERLY FITTED GLASSES
- ☐ PROPERLY FITTED GOGGLES
- ☐ PROPERLY FITTED TRUSS

REMARKS _____

EXAMINING PHYSICIAN

Name (please print) _____ Professional Degree

Signature _____

Address _____ City _____ State _____

Phone Number _____

:37 · 2 86

FIGURE 5-1
(page 4 of 4)

INTERNATIONAL TECHNOLOGY CORPORATION

IT LOCATION _____
IT DIVISION _____
PC NO. _____
PROJECT NO. _____

UPDATE/END-OF-PROJECT/TERMINATION EXAMINATION

NAME _____ JOB TITLE _____ SEX _____ AGE _____
ADDRESS _____ CITY _____ STATE _____ ZIP _____
BIRTH DATE _____ SS NO. _____ PHONE NO. ( )

It is important to bring to the attention of the doctor any changes in your health status occurring since your last health examination. Therefore, please carefully answer the following questions. Explain all items checked yes below.

	YES	NO
1. Have you had any injury or illness other than colds?		
2. Have you been hospitalized for any reason?		
3. Have you had any surgery in or out of the hospital?		
4. Have you had any abnormal x-rays or electrocardiograms: any abnormal blood, urine, or laboratory tests?		
5. Have you been nervous, depressed, or tense or had any emotional trouble?		
6. Have you had headaches, dizzy spells or black-outs?		
7. Have you had trouble with your eyes — change in vision, blurring, seeing double, pain or glaucoma?		
8. Have you had trouble with nose and throat — persistent hoarseness, voice change?		
9. Have you had trouble with ears — pain, change in hearing, noise exposure?		
10. Have you had chronic cough: any sputum that was bloody, excessive or colored: any pain on breathing?		
11. Have you had shortness of breath, difficulty breathing, any swelling of the ankles?		
12. Have you had any chest pain, or history of heart trouble or high blood pressure?		
13. Have you had abdominal pain (or distress) or persistent vomiting?		
14. Have you had any change in bowel habits: any bloody or tarry black stools?		
15. Have you had trouble starting, stopping, or holding urine, any bloody or very dark urine: any discharge?		
16. Are you now taking any medication?		
17. Have you had skin rashes, sores, new or growing lumps, or changing moles?		
18. Have you gained or lost 10 pounds or more?		
19. Have you had any pain, swelling or stiffness of back or joints?		
20. Have you been bleeding or bruising more than at time of last examination?		
21. Has there been any change in the family medical history, such as appearance of diabetes, heart disease, strokes, blood problems or conditions that you think may be inherited?		
22. Are you a Diabetic?		
23. Are you pregnant?		
24. Have you had a Tetanus Immunization within the last 10 years?		

25. If you still smoke, how much? _____ How many years have you smoked? _____
26. Present use of alcohol: social _____ moderate _____ heavy _____
27. For employee or spouse(s), number of pregnancies _____ number of miscarriages _____
28. If you have any medical problems you wish to discuss, please write them in.

Explain items checked yes

_____
_____
_____
_____

I hereby certify that to the best of my knowledge the foregoing answers are complete and correct and I understand that any false statement or incorrect information may result in my termination. I agree that this form and any information acquired as a result of this examination will become the property of the employer. I hereby grant permission to obtain records from all physician(s) or hospital(s) where I have been or am receiving medical treatment.

SIGNATURE _____ DATE _____

ITC FORM 9410 2 (2/86)

FIGURE 5-2
(page 1 of 2)

MEDICAL EXAMINATION

HEIGHT_____ WEIGHT_____ RESPIRATORY_____ B.P._____ PULSE _____ TEMPERATURE _____

	WITHOUT GLASSES		GLASSES / CONTACTS	
	RIGHT	LEFT	RIGHT	LEFT
1. DISTANT VISION SNELLEN	20/	20/	20/	20/
2. NEAR VISION SLOAN	20/	20/	20/	20/

	NORMAL YES / NO		TEST NOT PERFORMED	MEDICAL EXAMINER'S FINDINGS
1. Psychiatric — Neurologic				
2. General Appearance — Physique				
3. Head & Neck				
4. Chest				
5. Cardiovascular				
6. Abdomen				
7. Back				
8. Hernia — Genitalia				
9. Arms — Legs				
10. Skin				
11. Rectal				
LABORATORY				
1. Urinalysis				
2. Complete Blood Count				
3. Chemistry Panel				
4. Audiometry				
5. Spirometry				
6. EKG				
7. Chest X-ray				
8. DOT/DMV				
9. May wear respirator				
10. May work with carcinogens				

SUMMARY OF EXAMINATION — WORK RESTRICTIONS — RECOMMENDATIONS

_____

_____

_____

_____

_____

EXAMINING PHYSICIAN

NAME (Please Print) _____

PROFESSIONAL DEGREE

SIGNATURE_____ DATE_____ PHONE NO._____

ADDRESS_____ CITY _____ STATE_____ ZIP_____

FIGURE 5-2
(page 2 of 2)

result in work restrictions or that would preclude him/her from working at hazardous waste sites. Examples of a Medical Examination Report and a Physical Activity Restriction report are included as Figures 5-3 and 5-4, respectively.

All subcontractor personnel who have potential for exposure to hazardous materials shall have successfully completed an examination similar to the preplacement physical. The cost for medical surveillance will be paid by the subcontractor. All physicals will be approved by a physician who is Board Certified in Occupational Medicine.

5.2 MEDICAL RECORDS

Medical and personnel exposure monitoring records will be maintained in accordance with the requirements of 29 CFR 1910.20 and shall be kept for 30 years. Employee confidentiality shall be maintained.

5.3 INJURY AND ILLNESS TREATMENT

- A physician familiar with occupational medicine will be identified before job startup. This physician will be familiar with the effects of the chemicals on site and will be used as a consultant in the event of a job-related illness.

- If an injury/illness is the result of a chemical exposure, a supervisor shall promptly initiate the steps necessary to identify the chemical(s). Chemical identification shall be accomplished through use of monitoring equipment (photoionization detectors in conjunction with detector tubes and/or conventional industrial hygiene monitoring) and any prior sampling results that are available. Such information shall be made available to the treating physician and to the HSC.

- Any injury or illness requires the completion of IT Form 9300.1-1, Supervisor's Employee Injury Report (Figure 5-5), in accordance with IT Procedure 9300.1.

- Any injury/illness not limited to a first-aid response requires that the project supervisor immediately notify the HSC. This notification allows the coordination of internal resources to assist the treating physician in rendering appropriate care.

- Any employee of IT or of a subcontractor who is suspected of having an overexposure to the chemicals on site will be given another complete physical examination. Any employee or contractor who develops a lost-time illness or sustains a lost-time injury will be reexamined. The physician will certify that the employee is fit to

INTERNATIONAL TECHNOLOGY CORPORATION

Medical Examination Report

_____
Date

To: _____

IT Division: _____

Location: _____

Name: _____ PC No. _____

has received the appropriate:

- ☐ Preemployment examination on _____ Date
- ☐ Periodic examination
- ☐ DOT/DMV examination
- ☐ Other _____

and has been found to be:

- ☐ Acceptable: no restriction.
- ☐ Acceptable: subject to the attached "Physical Activity Restriction"*
- ☐ Not acceptable.

_____
Health & Safety Department

* For "Physical Activity Restriction":

1. Have employee read and sign restriction
2. Provide manager signature
3. Return form intact to the Health & Safety Department

ITC FORM 9410-1A (11/84)

78A-9-85

FIGURE 5-3

INTERNATIONAL TECHNOLOGY CORPORATION

Physical Activity Restriction

EMPLOYEE'S NAME _____ DATE _____

DIVISION _____ LOCATION _____

DATE OF INJURY/EXAM _____ JOB TITLE _____

Employee is subject to the following physical activity restriction(s):

_____

_____

_____

_____

_____

_____

_____

☐ Acceptable for work under restriction stated above	By _____
☐ Not acceptable for work under restriction stated above	Date _____

_____
Employee Date

_____
Manager Date

_____
Health & Safety Date

Distribution: Health & Safety
Administration Manager

ITC Form 9410-1
(Rev. 1/85)

FIGURE 5-4

77-9-85

INTERNATIONAL TECHNOLOGY CORPORATION

SUPERVISOR'S EMPLOYEE INJURY REPORT

This is an official document to be initiated by the employee's supervisor. Please answer all questions completely. This report must be forwarded to the employee's Regional Health and Safety office within 24 hours of the injury.

Injured's Name _____ Sex ____ S.S. No _____ Birthdate _____

Home Address _____ City _____ State _____ Zip _____ Phone _____

Job title _____ Employee's P.C. _____ Hire date _____ Hourly wage _____

SUPERVISOR

Date of incident _____ Time _____ Time reported _____ To whom? _____

Client name _____ Client address _____ Time shift began _____

Exact location of incident _____ Did employee leave work? ☐ No ☐ Yes When _____

Has employee returned to work? ☐ No ☐ Yes When _____ Did employee miss a regularly scheduled shift? ☐ No ☐ Yes

Doctor/Hospital name _____ Address _____

Witness name(s) _____ Statements attached? ☐ No ☐ Yes

Nature of injury _____ Exact body part _____

Medical attention: ☐ None ☐ First aid on site ☐ Doctor's office ☐ Hospital ER ☐ Hospitalized

Job assignment at time of incident _____ Job: _____ Phase: _____ Task: _____ Subtask: _____

Describe incident _____

What unsafe physical condition or unsafe act caused the incident? _____

What corrective action has been taken to prevent recurrence? _____

Supervisor/Foreman _____ (Print) _____ Signature _____ Date

MANAGER

Comments on incident and corrective action _____

Manager's name _____ (Print) _____ Signature _____ Date

HEALTH AND SAFETY

Concur with action taken? ☐ No ☐ Yes Remarks _____

OSHA Classification:

☐ Incident only ☐ First aid ☐ No lost workdays ☐ Lost workdays ☐ Restricted activity ☐ Fatality

Days away from work _____ Days restricted work _____ Total days charged _____

☐ State jurisdiction ☐ Federal L&H ☐ Date ER submitted _____ Which claims office _____

Coding: A. Injury type or illness _____ B. Injured body parts _____ C. Activity at time of accident _____ D. Injury cause code _____

E. Agent code _____ F. Safety rule violated code _____ G. Accident prevention code _____

Name _____ (Print) _____ Signature _____ Date

ITC FORM 9300.1-1 (07/86)
Refer to ITC PRO 9300.1 for reporting procedures

White: Corporate Health and Safety Yellow: Regional Health and Safety Pink: Profit/Cost Center

FIGURE 5-5

return to work by completing the Return to Work Authorization Following Medical Absence form (Figure 5-6). If necessary, activity restrictions will be specified on the Physical Activity Restriction Report.

INTERNATIONAL TECHNOLOGY CORPORATION

RETURN TO WORK AUTHORIZATION FOLLOWING MEDICAL ABSENCE

_____
Date

To: _____

Division: _____

Location: _____

_____ has been absent from work due to a:

- ☐ work related illness or injury_____ (date of injury)
- ☐ nonindustrial illness or injury
- ☐ other

and has provided a satisfactory medical release certificate for:

- ☐ return to work, without restriction
- ☐ return to work subject to the attached "Physical Activity Restriction"*

_____
Health & Safety Department

* For "Physical Activity Restriction":

1. Have employee read and sign restriction
2. Provide manager signature
3. Return form intact to the Health & Safety Department

ITC FORM 9410.3
3-054

FIGURE 5-6

76-9-85

6.0 ENGINEERING AND WORK PRACTICE CONTROLS

Where feasible, engineering controls shall be used to maintain chemical exposures within the permissible exposure limits. This will be accomplished by the use of dust suppression techniques, air dilution, or other work practice controls (Section 9.0), coupled with protective clothing (Section 8.0) that is appropriate for the level of exposure.

7.0 HAZARD EVALUATION

This section outlines the analysis of possible hazards associated with each individual phase of field activities as specified in the COE Safety and Health Requirements Manual. Seven phases associated with the field aspects of this project have been identified and are listed below:

- Traffic
- Exposure to the elements
- Hearing conservation (excessive noise levels)
- Fire
- Buried utilities
- Chemical exposure
- Ordnance materials.

Each above-listed hazard is discussed in detail below with regard to the likelihood of incidences occurring in each individual phase of work, as well as applicable accident prevention guidelines.

7.1 TRAFFIC

The possibility of injury or accident is inherent to all aspects of field work. Accidents may occur during travel to or from the site as well as during site activities. However, the latter is not anticipated to be a major factor because the site traffic will be largely limited to that of vehicles directly associated with site work.

Vehicle operators will adhere to state and local regulations regarding the operation of a motor vehicle. Vehicle operations will comply with the provisions of EM 385-1-1, COE Safety and Health Requirements Manual. The number of passengers in a vehicle will not exceed the number that can be seated. Tools and equipment will be properly secured when transported with personnel. No vehicle will be loaded so as to obscure the driver's view ahead, to the side, or to the rear in a way that would interfere with the safe operation of the vehicle.

If a vehicle is not actively used in operations at the site, it will be parked so that it does not interfere with local traffic. When maneuvering vehicles with limited visibility in confined areas, assistance will be given to the operator by personnel from outside the vehicle.

7.2 EXPOSURE TO THE ELEMENTS

Site activities may take place during periods of hot weather. The potential for high temperature requires that personnel be closely monitored for signs of heat exhaustion or heat stroke. It may also be necessary to protect personnel from the effects of cold temperatures and wind, as well as from getting wet from field operations or precipitation.

7.2.1 Heat Stress

The heat stress of employees on site may be monitored by the Wet Bulb Globe Temperature (WBGT) index technique. This method will require the use of a heat stress monitoring device, such as the Wibget Heat Stress Monitor (Reuter Stokes).

The WBGT will be compared to the threshold limit value (TLV) outlined in the American Conference of Governmental Industrial Hygienists (ACGIH) TLV Manual and a work-rest regimen established, as necessary, according to the WBGT obtained.

One or more of the following control measures will be used to help control heat stress:

- Provision of adequate liquids to replace lost body fluids. Employees must replace water and salt lost from sweating. Employees will be encouraged to drink more than the amount required to satisfy thirst. Thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement.
- Replacement fluids can be a 0.1 percent salt-water solution, commercial mixes such as Gatorade® or Quick Kick®, or a combination of these with fresh water. Employees will be encouraged to salt their foods more heavily.
- A work regimen will be established that will provide adequate rest periods for cooling down. This may require additional shifts of workers.

- All breaks will be taken in a cool rest area (77°F is best).
- Employees will remove impermeable protective garments during rest periods.
- Employees will not be assigned other tasks during rest periods.
- All employees will be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress.

The causes and symptoms of heat stress are as follows:

- 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 illness. 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 immediately. Signs and symptoms are:

  - Red, hot, usually dry skin
  - Lack of or reduced perspiration
  - Nausea
  - Dizziness and confusion
  - Strong, rapid pulse
  - Coma.

7.2.2 Cold Stress

If a project extends into the winter, cold stress will be evaluated and controlled.

- Persons working outdoors in temperatures at or below freezing may be frostbitten. Extreme cold for a short time may cause severe injury

to the surface of the body or result in profound generalized cooling, causing death. Areas of the body that have a high surface-area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible.

- Two factors influence the development of a cold 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°F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F.

- As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air. Thus, the body cools suddenly when chemical-protective equipment is removed if the clothing underneath is perspiration soaked.

- 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 initial frostbite: characterized by sudden blanching or whitening of the 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. 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.

- Thermal socks, long cotton or thermal underwear, hard hat liners, and other cold weather gear can aid in the prevention of hypothermia.

- Blankets, warm drinks (other than caffeinated coffee), and warm break areas are essential.

- The overall goal is to keep from getting wet. If one does get wet, he/she should dry off and change clothes.

- Cold stress training is also appropriate for work at the site.

7.3 HEARING CONSERVATION

All on-site personnel shall wear hearing protection (EAR or equivalent) when noise levels exceed 85 dBA as per IT Procedure 9650. Hearing protection will

be required when working near the drilling rig. All personnel shall also receive baseline and annual audiograms and training as to the causes and prevention of hearing loss.

7.4 FIRE

The possibility of a fire hazard exists during the drilling of test borings, installation of monitoring wells. Gasoline or other fuels and flammable substances will be kept at a safe distance during the operation of the drill rig. Storage of gasoline will be accomplished using only approved steel gasoline containers. Refueling of equipment will be carried out only when engines are not operating and after a period of time has passed to allow sufficient cooling of the engine. Smoking will be prohibited within 50 feet of any refueling operation. Fire extinguishers will be provided by the drilling contractor and kept with the drill rig. Fire extinguishers will meet U.S. Department of Transportation (DOT) requirements and be approved by the National Board of Fire Underwriters.

7.5 BURIED UTILITIES

Site owners will be questioned before excavations at the site begin to ascertain the presence and location of underground cables, utility lines, and pipes. Utility companies will be notified of IT's intent to dig in the area through a utility clearance network. Companies not associated with the network will not be contacted. Borings will be laid out a sufficient time in advance of excavation to allow the approval of local authorities.

7.6 CHEMICAL EXPOSURE

Based on a review of the previous field investigations conducted at the site, minor contamination may exist in limited areas.

During the field work, the most likely mechanism for chemical exposure is through skin contact with water and soil. In addition, exposures could occur through inhalation of volatile organic compounds emanating from the wells and borings. It is unlikely that the level of organic vapors in the atmosphere above the wells and borings will be sufficient to require the use of respirators. However, as a precaution, air monitoring with a photoionization detector and a combustible gas indicator will be performed to measure organic

vapor and combustible gas levels (refer to Section 11.0). Full-face respirators equipped with organic vapor cartridges will be available for use by sampling or drilling personnel if the action levels specified in Section 11.0 are exceeded. Respiratory protection and protective clothing requirements are discussed in detail in Section 8.0.

Skin contact will be minimized through the use of nitrile or neoprene gloves during handling and sampling of potentially contaminated water and soil samples. Polyethylene Tyvek® or Saranex™ coveralls may be necessary, depending on air monitoring results (see Section 11.0).

7.7 ORDNANCE MATERIALS

During the period of ordnance manufacturing operations, wooden flumes are used to carry process water to the settling basins. Occasionally, these wooden flumes become plugged with trinitrotoluene (TNT) residue. The lines which become plugged are not cleaned to remove the obstructions, but rather by-pass lines are constructed around the obstructions to provide continual drainage of red water.

During the decontamination efforts conducted after ordnance operations cease, the identified drain lines are excavated, removed, and burned. Many of the by-pass lines which are not recorded on any drawings are also removed and burned. Some deposits of residual TNT may be encountered during the removal of the drain lines. There is reason to believe that additional buried deposits of TNT and associated drainlines are still present at the Plum Brook Ordnance Works site, which the locations are unknown.

The possibility of incomplete combustion of ordnance waste at the Plum Brook Ordnance Works site has not been ignored in this evaluation. If an unplanned detonation occurs during this investigation, the damage would not, in the opinion of IT's Ordnance Detonation Survey Manager, be life threatening. Physical damage to drilling equipment would be difficult to detect unless work ceased immediately and the equipment was examined for visible evidence of the detonation.

8.0 PERSONNEL PROTECTIVE EQUIPMENT

The personnel protective equipment outlined below will be selected according to the site characterization and analysis, job tasks, site hazards, intended use, and duration of potential employee exposures. Maintenance, storage, decontamination, donning, doffing, inspection, and limitations are outlined in the decontamination section (Section 12.0) of this plan. Personnel protective equipment training, proper fitting procedures, and limitations are outlined in the training section (Section 4.0) of this plan.

8.1 RESPIRATORY PROTECTION

- Only properly cleaned, maintained, National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration approved respirators will be used on site.
- Selection of respirators, as well as any decisions regarding upgrading or downgrading of respiratory protection, will be made by the HSC.
- Used air-purifying cartridges will be replaced at the end of each shift or when loadup or breakthrough occurs.
- A positive and negative pressure test will be performed each time the respirator is donned.
- Only employees who have had preissue qualitative fit tests, and semiannual fit tests thereafter, will be allowed to work in atmospheres where respirators are required.
- The user will be instructed in the proper use of respirators and their limitations (refer to Section 4.0).
- If an employee has demonstrated difficulty in breathing during the fit test or during use, he/she will have a physical examination to determine if a respirator can be worn while performing the required duty.
- No employee will be assigned to tasks requiring the use of respirators if, based upon the most recent examination, a physician determines that the employee will be unable to function normally wearing a respirator or that the safety or health of the employee or other employees will be impaired by use of a respirator.
- Contact lenses are not to be worn while using any type of respiratory protection.

- If air-supplied respirators are used, they will be assembled per manufacturer's specifications with regard to hose length, couplings, valves, regulators, manifolds, etc.

- Respirators will be regularly cleaned and disinfected after each use.

- Respirators will be stored in a convenient, clean, and sanitary location on site.

- Respirators will be inspected during cleaning, and worn or deteriorated parts will be replaced.

- Regular surveillance of the work area will be conducted by the HSC to determine the appropriateness of the respiratory protection being worn.

- Excessive facial hair (beards) prohibits proper face fit and effectiveness of respirators. Persons required to wear full-face or half-face respirators must not have beards, wide mustaches, goatees, extended sideburns, or Fu Manchu mustaches. All personnel wearing full-face or half-face respirators will be required to be clean shaven before each day's shift.

- Regular eyeglasses cannot be worn with full-face respirators because they interfere with the facepiece seal. Inserts must be utilized.

- The respiratory protection used on site will be in compliance with OSHA 29 CFR 1910.134.

- Where respirators are designated for protection against contaminants, the employee will be permitted to change canisters or cartridges whenever an increase in breathing resistance is detected.

- Self-contained breathing apparatus (SCBA) will be utilized for emergency procedures, as necessary, and as backup to confined space entry work. SCBAs will be inspected at least once a month, as well as before and after each use.

8.2 LEVELS OF PROTECTION

Level D protection is specified for these site activities. Level D protection will include the following:

- Tyvek disposable coveralls
- Nitrile or neoprene gloves
- Steel-toed chemical protective boots
- A hard hat
- Safety goggles.

If HNu readings between 5 to 20 parts per million (ppm) persists (see Section 11.0), Level C protection will be necessary. Level C protection includes:

- Hooded chemical-resistant clothing (polyethylene-coated Tyvek or Saranex), long sleeves, one or two pieces
- Nitrile or neoprene outer gloves
- Latex inner gloves
- Steel-toed chemical protective boots
- A hard hat
- Full-face air-purifying respirator with appropriate cartridges or canisters.

If HNu readings greater than 20 ppm persist, work activities will cease and the HSC will be notified.

9.0 SAFE WORK PRACTICES

- At least one copy of this plan will be available at the job work site.
- Contaminated protective equipment, such as respirators, hoses, boots, etc., will not be removed from the regulated area until cleaned or properly packaged and labeled.
- Legible and understandable precautionary labels will be affixed prominently to containers of contaminated scrap, waste, debris, and clothing.
- Removal of contaminated soil from protective clothing or equipment by blowing, shaking, or any other means which disperses dust into the air is prohibited.
- No food or beverages will be present or consumed in the regulated area.
- No tobacco products will be present or used, and cosmetics will not be applied in the regulated area.
- Contaminated materials will be stored in tightly closed containers in well-ventilated areas.
- Containers will be moved only with proper equipment and will be secured to prevent dropping or loss of control during transport.
- All areas that have been determined to be contaminated inside the regulated area will be clearly marked as such. No personnel, equipment, etc. will be in these areas until they have been decontaminated.
- All well drilling will be surveyed with a combustible gas meter, magnetometer, and HNu before drilling.
- Soil borings will be barricaded or covered during nonworking hours until the exploration is completed.
- Visitor inspection of the contaminated zone will be left to the discretion of the geotechnical task manager.
- Emergency equipment will be located outside contaminated areas in readily accessible locations.
- All crew personnel on site will use the buddy system (working in pairs). Buddies will prearrange hand signals for communication. Visual contact will be maintained between crew members at all times, and crew members must observe each other for signs of toxic exposure. Indication of adverse effects include, but are not limited to:

- Changes in complexion and skin discoloration
- Changes in coordination
- Changes in demeanor
- Excessive salivation and pupillary response
- Changes in speech pattern.

Also, employees will inform each other of nonvisual effects of toxic exposure such as:

- Headaches
- Dizziness
- Nausea
- Blurred vision
- Cramps
- Irritation of eyes, skin, or respiratory tract.

• Visitors to the site will abide by the following rules:

- All visitors will be instructed to stay outside the contaminated zone and remain within the clean zone during the extent of their stay. Visitors will be cautioned to avoid skin contact with contaminated or suspected contaminated surfaces. During visitation, hand-to-mouth transfers should be reduced with special precautions not to eat, drink, smoke, or chew gum or tobacco. The use of alcohol or medicine is prohibited.

- Visitors requesting to observe work conducted in the exclusion zone must wear all appropriate personnel protective devices before entering the contaminated zone. Visitors will be required to sign in and out of the job site. If respiratory protective devices are necessary, visitors who wish to enter the contaminated zone must produce evidence that they have had a complete physical examination and respiratory protection training, including respiratory fitting, within the past 12 months. Visitors will receive tailgate safety meeting training and will be escorted while in the exclusion zone.

10.0 DRILLING AND SAMPLING SAFETY

10.1 SITE INSPECTION

Determination of drilling locations at the site will take into account available information on buried ordnance, utility pipes, wires, conduits, tanks, or other potentially dangerous structures as well as overhead power lines or other overhead obstructions.

10.2 WELL INSTALLATION, SOIL BORING, AND LOGGING

During the drilling/soil sampling operations and rig setup and breakdown, personnel involved in the operations or near the rig will wear a hard hat, steel-toed shoes, and gloves. Full-face respirators will be available for immediate use during drilling activities. Before raising the mast, the overhead area and area surrounding the rig will be checked for the presence of power lines or other overhead obstructions. This safety procedure will be done by both the drilling foreman and the crew member operating the controls that raise the mast. The drilling rig will not be moved from one well location to the next with the mast raised.

During drilling, unexploded ordnance or containers holding potentially hazardous substances may be encountered. If there is any indication that ordnance may be encountered, drilling will be halted immediately, and the field geologist will notify COE. In no case will drill rods be stacked more than 1 to 1½ times the height of the mast during drilling.

Routine safety protective care will be taken during the sampling activities at the site. Sampling may include the use of electrical equipment and gasoline. It is required that all sampling personnel wear hard hats, hard shoes, gloves, and protective eye wear. Smoking will be permitted only in areas away from where gasoline and electrical equipment are used. If an unforeseen situation arises that would endanger the sampling crew in any way, the site operations manager will direct necessary steps to address the situation.

NIOSH Sampling and Analytical Methods will be followed when evaluating chemical hazards at the site. The amount of sampling activity will vary according to the type and location of sample.

11.0 SITE MONITORING

Air monitoring will be conducted throughout the course of the investigation to determine employee exposure to airborne contaminants. The monitoring results will dictate the selection of personnel protective equipment.

11.1 AIRBORNE CONTAMINANTS

During drilling and sampling, organic vapors will be monitored using a photoionization detector or similar organic vapor monitoring equipment. The following action levels will be used to upgrade or downgrade personnel protective equipment requirements:

- Breathing zone HNu readings below 5 ppm - Level D protection (see Section 8.0).
- Breathing zone HNu readings between 5 to 20 ppm - Level C protection (see Section 8.0). The HSC will be notified and an attempt made to identify the contaminant with detector tubes.
- If HNu readings exceed 20 ppm, the area will be evacuated until the levels dissipate. If the levels do not decrease below 20 ppm, the HSC will be notified.

Combustible gases will be monitored at the borehole with a combustible gas indicator. Work activity will be stopped and the area evacuated if combustible gas levels exceed 10 percent of the LEL. The HSC and geotechnical task manager will be contacted to evaluate the situation and take appropriate action.

All air monitoring equipment will be calibrated before use each day.

11.2 MONITORING FREQUENCY

Breathing zone monitoring for organic vapors will be conducted by the HSC or her designee within the exclusion zone and results recorded every 30 minutes during drilling, trenching, and all sampling operations. Monitoring shall also be conducted whenever there is the potential for increased employee exposures, or if new contaminants have been encountered. All employees shall be assigned work functions within a single personnel protective level zone, when possible, to minimize the movement of personnel to and from the contaminated zone. Visitors and employees in a service capacity who remain in the support zone will not

receive periodic exposure monitoring, and they will not be required to wear personnel protection.

11.3 PERSONNEL MONITORING

Traditional industrial hygiene monitoring will be conducted as necessary if indicated by the HSC. Monitoring activity will vary according to location, tasks performed, contaminant concentration, etc. Monitoring will be conducted frequently enough to adequately characterize employee exposure.

11.4 MONITORING RECORD KEEPING

The HSC will be responsible for establishing and maintaining records of all monitoring required as described below:

- Employee name and task description
- The date, time, pertinent task information (such as boring number, depth of hole, meter reading, etc.), and relevant comments shall be written in an instrument logbook that shall be available for inspection at all times
- A description of the analytical methods, equipment used, and calibration data
- Type of personnel protective equipment worn
- Any engineering controls used to reduce exposure.

11.5 CALIBRATION

Organic vapor analyzers, combustible gas/O_2 meters, sound level meters, and personnel pumps will be calibrated daily per manufacturer's directions before use by the HSC or Field Geologist.

12.0 DECONTAMINATION

12.1 REGULATED AREAS

12.1.1 Delineated Zones

Each site will be divided into three zones, as follows:

- Contaminated Zone - This zone includes the actual areas of contamination. This zone has the highest inhalation exposure potential and/or presents a high probability of skin contact with cutaneous or percutaneous effecting chemicals.
- Contamination Reduction Zone - This zone includes the areas immediately surrounding the contamination zone. This zone has the next highest inhalation hazard, but does not have a high probability of skin contact with cutaneous or percutaneous effecting chemicals.
- Clean Zone - This zone covers all areas outside the contamination reduction zone. Adverse exposure to chemicals is unlikely.

The HSC, the Project Manager, and the Field Geologist will establish these zones based on the amount and nature of contamination present and the specific work activities.

12.1.2 Access

Access to contaminated work areas (contaminated and contamination reduction zones) will be regulated and limited to authorized persons. A daily roster will be kept of all persons entering such areas.

12.1.3 Posting

Warning signs will be affixed in readily visible locations in or near contaminated work areas. The information contained thereon will be arranged as in the following example:

CAUTION

CONTAMINATED AREA

AUTHORIZED PERSONNEL ONLY

12.1.4 Site Entry Procedures

- A controlled access to the regulated area will be established. The controlled access will be through the decontamination unit.
- Only authorized personnel will be permitted to enter the regulated area. No one will be allowed to enter the site without appropriate authorization.
- All persons entering the regulated area will be equipped with appropriate personnel protective devices.
- The employees will be informed in writing and orally of the nature of the hazardous substance to which they may be exposed, the potential risks which the hazardous substances pose, and the procedures to be used in the safe and proper handling of the hazardous substances. See the training section of the Health and Safety Program Plan for more details.

12.2 EMPLOYEE DECONTAMINATION

The purpose of decontamination is primarily to limit the spread of contaminated materials from the contaminated zone. This is accomplished through a step-by-step procedure whereby the protective clothing and equipment is either washed or disposed of. The HSC should exercise judgment in the establishment of the contamination reduction zone. Monitoring during work activities may indicate the need for additional stations under certain conditions. It is also possible that stations may be combined. Allowances must be made for the type of protective equipment being worn; for example, nondisposable, steel-toed outer boots need not be removed if properly decontaminated.

The decontamination procedures presented herein for Levels D, C, and B are very similar; the only difference between the three levels is that extra stations are present in Levels C and B decontamination to account for respirator/SCBA change or removal.

12.2.1 Level D Decontamination

Station 1: Segregated Equipment Drop

Deposit equipment used on site (tools, sampling devices and containers,

monitoring equipment, radios, clipboards, etc.) on a plastic drop cloth or in separate containers with plastic liners.

Equipment:	Various sized containers
	Plastic liners

Station 2: Outer Garment, Boots, and Gloves Wash and Rinse
Scrub outer boots and gloves with decontamination solution or detergent/ water. Rinse gloves, boots, and garment with hand pump spray device.

Equipment:	Two containers (30- to 50-gallon)
	Hand pump spray device
	Water
	Detergent
	Scrub brushes

Station 3: Boots, Gloves, and Outer Garment Removal
Boots and outer gloves are removed and placed outside the decontamination zone. Inner gloves and Tyvek suits are deposited in the same containers with the drill cuttings.

Equipment:	Containers (30- to 50-gallon)
	Plastic liners

Station 4: Field Wash and/or Decontamination Unit
Thoroughly wash hands and face. Shower as soon as possible.

Equipment:	Water, wash basin/bucket, soap or decontamination trailer

12.2.2 Level C Decontamination

Station 1: Segregated Equipment Drop
Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in separate

containers with plastic liners. Each piece of equipment will be contaminated to a different degree. Segregation at the drop reduces the probability of cross contamination.

Equipment: Various sized containers
Plastic liners
Plastic drop cloths

Station 2: Outer Garment, Boots, and Gloves Wash and Rinse
Scrub outer boots, gloves, and chemical-resistant suit with decontamination solution or detergent/water. Rinse gloves, boots, and garment with clean water into plastic bucket.

Equipment: Two containers (30- to 50-gallon)
Water
Detergent
Scrub brushes, long-handle

Station 3: Outer Boots and Gloves Removal
Remove outer boots (if worn) and gloves with accompanying tape. Tape should be placed in a container with a plastic liner.

Equipment: One container (30- to 50-gallon)
Plastic liner
Bench or stool

Station 4: Canister/Cartridge Change
If a worker leaves the contaminated zone to change a canister/cartridge on his/her respirator, this is the last step in the decontamination procedure. Once the worker's canister/cartridge is exchanged, the outer gloves and boot covers are donned with the joints taped. The worker may then return to the contamination zone. All used canisters or cartridges will be disposed of at the end of the work day and a fresh one installed before work starts.

Equipment: Respirator canisters/cartridges
Tape
Extra gloves
Boot covers (if worn)

Station 5: Boots, Gloves, and Outer Garment Removal

Remove boots, gloves (inner), and outer garment. The outer chemically resistant garment and inner gloves should be deposited in a plastic-lined container with the drill cuttings.

Equipment: Container (30- to 50-gallon)
Bench or stool
Plastic liners

Station 6: Respiratory Protection Removal

Remove the facepiece respirator, deposit used cartridges in a plastic-lined container, and wipe the facepiece with clean water and paper towels.

Equipment: Container (30- to 50-gallon)
Plastic liners
Paper towels
Detergent solution
Rinse water

Station 7: Field Wash and/or Decontamination Unit

Wash hands and face and shower as soon as possible.

Equipment: Water
Soap
Wash basins/buckets

12.2.3 Minimum Decontamination Levels A and B

12.2.3.1 Layout

EXCLUSION ZONE

Station 1. Equipment Drop

Station 2. Decon Outer Garments

Station 3. Remove Booties/Gloves

HOTLINE

Station 4. Re-Entry - Tank Change

Station 5. Remove Protective Clothing CLEAN ZONE

Station 6. Remove SCBA

Station 7. Field Wash

12.2.3.2 Procedures

Station 1:

Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool-down stations may be set up within this area.

Station 2:

Scrub outer boots, outer gloves, and fully encapsulating suit with decontamination solution or detergent and water. Rinse off using copious amount of water.

Station 3:

Remove outer boots and gloves. Deposit in container with plastic liner.

Station 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:

Boots, fully encapsulating suit, and inner gloves are removed and deposited in separate containers lined with plastic.

Station 6:

SCBA backpack and facepiece is removed (avoid touching face with fingers). SCBA is deposited on plastic sheets.

Station 7:

Hands and face are thoroughly washed. Shower as soon as possible.

12.3 EQUIPMENT DECONTAMINATION

12.3.1 Personnel Protective Equipment

- In a designated area within the contamination reduction zone, all reusable protective equipment will be decontaminated and reconditioned for reuse.
- If protective clothing is removed from the contamination reduction zone for cleaning or laundering, it will be bagged and appropriately labeled to inform receiver of the potentially harmful effects of exposures to hazardous substances.
- All disposable protective clothing will be bagged and labeled to identify the hazardous substances that may potentially be found on the clothing. These bags will be treated as hazardous waste.

12.3.2 Equipment Decontamination

Before leaving the site, potentially contaminated equipment will be decontaminated or containerized. Disposal is the responsibility of COE. The equipment/vehicles will be held for a short time before leaving the site to allow for the drippings to be retained in the collection basin. Verification that equipment has been adequately decontaminated is the responsibility of the Field Geologist.

12.4 DECONTAMINATION ZONE GENERAL RULES

- An area in the decontamination zone will be designated as the break areas. Employees will wash their face and hands before eating, drinking, or smoking.
- All entry to and exit from the decontamination zone will be strictly controlled.
- The HSC will monitor the effectiveness of the decontamination procedures and, if found ineffective, will take appropriate steps to correct any deficiencies or modify the plan if needed.

13.0 EMERGENCY PROCEDURES

This SPP has been established to allow site operations to be conducted without adverse impacts on worker health and safety. In addition, supplementary emergency response procedures have been developed to cover extraordinary conditions that might possibly occur at the site.

13.1 GENERAL

All incidents will be dealt with to minimize adverse health risks to site workers. If an incident occurs, the following procedures will be followed:

- First aid or other appropriate initial action will be administered by properly trained personnel who are closest to the incidents. This assistance will be conducted to ensure that those rendering assistance are not placed in a situation of unacceptable risk.
- All incidents will be reported to the Field Geologist and/or HSC. They are responsible for coordinating the emergency response in an efficient, rapid, and safe manner. They will decide if off-site assistance and medical treatment are required and will arrange for assistance.
- All workers on site are responsible for conducting themselves in a mature, calm manner in the event of an incident event.
- If the Field Geologist or HSC determine that evacuation is necessary, all personnel will assemble in the support zone. All personnel will be accounted for at that time.

The following emergency equipment will be available at the site:

- A first-aid kit
- A fire extinguisher and blanket.

The Field Geologist will document all health and safety risk incidents.

13.2 RESPONSES TO SPECIFIC SITUATIONS

Emergency procedures for specific situations are given in the following paragraphs.

13.2.1 Worker Injury or Illness

If an employee working in a contaminated area is physically injured, Red Cross first-aid procedures will be followed. Depending on the severity of the injury, emergency medical response may be sought. If the employee can be moved, he/she will be removed from the source of contamination. Decontamination procedures, additional first aid, or preparation for transportation will be conducted at a safe distance from the work site.

Personnel decontamination procedures will be conducted as practical. Modification or omission of decontamination procedures may be necessary, depending on the severity of the injury.

If the injury to the worker is chemical in nature (e.g., overexposure), the following first-aid procedures are to be instituted:

- Eye exposure - If contaminated solids or liquids get into the eyes, wash eyes immediately at the emergency station using large amounts of potable water and lifting the lower and upper lids occasionally. Wash for at least 15 minutes. Obtain medical attention immediately. Contact lenses will not be worn when working on the site.
- Skin exposure - If contaminated solids or liquids get on the skin, promptly wash the contaminated skin using soap or mild detergent and water for at least 15 minutes. Obtain medical attention immediately when exposed to concentrated solids or liquids. Wash face and hands before eating or before leaving the site.

13.2.2 Fires

As a fire prevention measure, no smoking or fires are permitted wherever there may be dry grass or other flammable material. Vehicles and equipment will not be left idling or parked in or around areas where catalytic converters may cause grass fires.

Dry chemical A:B:C fire extinguishers will be provided. If a localized fire breaks out, dry chemical fire extinguishers will be used to bring the fire under control. If necessary and feasible, a fire blanket, soil, or other

inert materials will be placed on the burning area to extinguish the flames and to minimize the potential for spreading. If appropriate, the fire department will be contacted for assistance.

If an uncontrolled fire develops that releases potentially toxic gases, all persons in the immediate vicinity will be evacuated. The fire department will be contacted immediately.

13.2.3 Spills

In the event of a spill at the site, the area will be isolated from traffic by the Field Geologist. Spilled solids will be removed and loaded into appropriate containers for subsequent placement or taken to the original destination. Liquid spills will be contained with absorbent material and then the absorbent will be loaded into appropriate containers for disposal.

13.3 EMERGENCY TELEPHONE NUMBERS

Maps showing routes to the hospital will be located in support vehicles and at various locations on the site along with the emergency telephone numbers (See Figure 13-1).

Emergency telephone numbers are as follows:

Fire	(419) 626-1242
Police	(419) 627-0824
Erie County Sheriff	(419) 625-7951
State Police	(419) 625-6565
Ambulance	(419) 627-1555
Providence Hospital	(419) 625-8450
Firelands Community Hospital	(419) 626-7455
U.S. Army Corps of Engineers	(615) 736-5966
National Response Center	(800) 424-8802
Ohio Environmental Protection Agency	(419) 352-8461
24-Hour Spill Reporting	(317) 633-0144

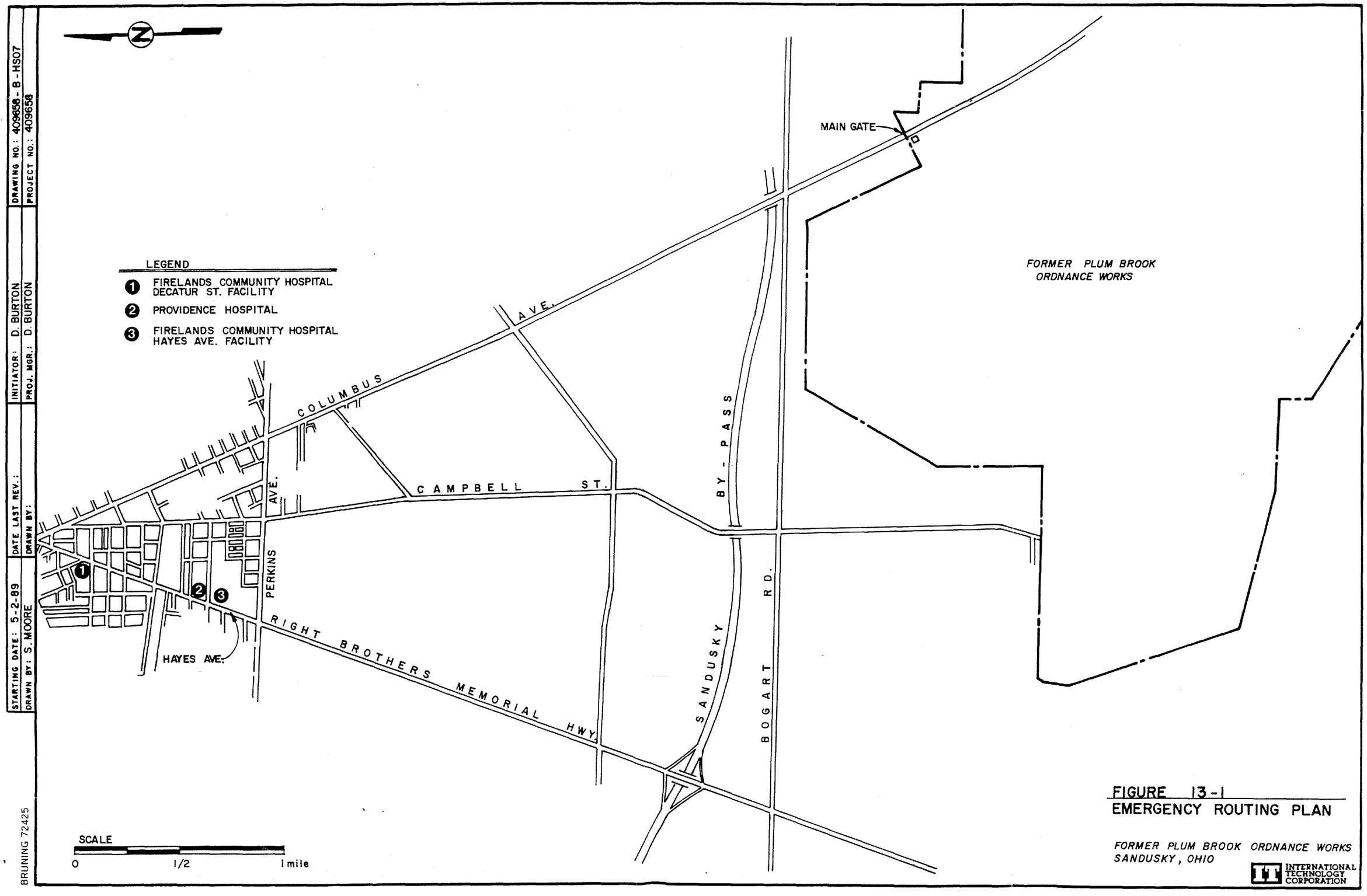


FIGURE 13-1
EMERGENCY ROUTING PLAN

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

INTERNATIONAL TECHNOLOGY CORPORATION

The Field Geologist will be responsible for notifying COE if an incident occurs (see Section 14.0).

If fire department or paramedic emergency services are required, the emergency team will provide transportation to the hospital. For less serious circumstances, the Field Geologist, HSC, or designated representative will provide transportation.

Emergency communications will be established before active on-site operations begin. Air horns or similar warning devices will be located in the area of each work crew. Two blasts of the warning system will indicate an injury or illness. A continuous blast means the site needs to be evacuated.

14.0 ACCIDENT REPORTING AND RECORD KEEPING

Accidents will be reported to the Contracting Officer by using ENG Form 3394, COE Accident Investigation Report. The report requires immediate notification (within 24 hours), and notification will be the responsibility of the Field Geologist. Accidents and incidents that require the above reporting procedures include: fatalities, lost-time injuries, admission of people to the hospital, spill of or exposure to hazardous materials, theft of hazardous materials, fire, explosion, property damage in excess of $300, and loss of a 1-day scheduled activity. The following format will be used to transmit the report to the contracting officer:

- Name, organization, telephone number, and location of contractor
- Name and title of person(s) reporting
- Date and time of accident or incident
- Location of accident or incident
- Brief summary of accident or incident giving pertinent details including type of operation ongoing at the time of the accident or incident
- Cause of accident or incident (if known)
- Casualties
- Details of existing chemical hazard or contamination
- Estimated property damage (if applicable)
- Nature of damage; effect on contract schedule
- Action taken by contractor to ensure safety and security
- Other damage or injuries sustained (public or private).

Information releases will not be made without approval of the Contracting Officer.

Accidents/incidents involving fatal injury, admission of five or more people to the hospital, lost work day, or significant property damage will be investigated to identify all hazards and recommended hazard control measures.

The HSC will keep a record of the work hours during which employees and subcontractor employees are exposed to toxic materials and harmful physical agents, as well as maintaining a record of occupational injuries and illnesses (OSHA Form 200 or equivalent as prescribed by 29 CFR 1904).

In addition to the above, IT's policy regarding accidents will be followed in all cases using ITC Form 9300.1-1, Supervisor's Employee Injury Report (Figure 5-5).

15.0 ILLUMINATION

Most activity at the site is performed outdoors during daylight hours. If work is necessary inside buildings, tanks, or other poorly lit areas, a minimum of 5-foot candles is required. Note that a minimum of 10-foot candles is required in general shop areas, first-aid stations, infirmaries, and offices.

16.0 CONFINED SPACE ENTRY

Confined space entry is very unlikely at the former Plum Brook Ordnance Works site. If there is a need for confined space entry at a specific site, IT Procedure 9531.1B will be included with the site-specific health and safety information. Also, employees will be trained in the use of confined space entry procedures.

APPENDIX B

MONITORING WELL INSTALLATION PLAN FOR CONTAMINATION EVALUATION AT THE FORMER PLUM BROOK ORDNANCE WORKS SANDUSKY, OHIO

Prepared for:

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS,
NASHVILLE, TENNESSEE
AND
HUNTSVILLE DIVISION, CORPS OF ENGINEERS

DERP PROJECT NO. G05OH001800

Prepared by:

IT Corporation
Knoxville, Tennessee
IT Project Number 409658

September 1989

MONITORING WELL INSTALLATION PLAN FOR
CONTAMINATION EVALUATION AT THE FORMER
PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

Prepared by:

IT Corporation
312 Directors Drive
Knoxville, Tennessee 37923
615-690-3211

Approved: _____ Date: 9/1/89
Project Manager, IT Corporation

Approved: _____ Date: 9/5/89
Program Manager, IT Corporation

Approved: _____ Date: 1 SEP 89
Quality Assurance Officer, IT Corporation

Approved: _____ Date: 9/5/89
Project Geologist, IT Corporation

CEE2193COV
08/30/89 F2

CONTENTS

		Page
LIST OF FIGURES		B-ii
1.0	INTRODUCTION AND BACKGROUND	B1-1
2.0	WELL LOCATIONS AND DEPTHS	B2-1
	2.1 Well Locations	B2-1
	2.2 Well Depths	B2-1
3.0	SOIL SAMPLING LOCATIONS	B3-1
	3.1 Soil Samples for Geotechnical Testing	B3-1
	3.2 Soil Samples for Chemical Analyses	B3-1
4.0	DRILLING EQUIPMENT AND TECHNIQUES	B4-1
	4.1 Drilling Rig	B4-1
	4.2 Drilling Techniques	B4-1
5.0	DRILLING SUPPORT PROCEDURES	B5-1
	5.1 Initial Activities	B5-1
	5.2 Decontamination Protocol	B5-1
6.0	WELL INSTALLATION	B6-1
	6.1 Well Casing and Screen Materials	B6-1
	6.1.1 Well Casing (Riser)	B6-1
	6.1.2 Well Screen	B6-1
	6.1.3 Centralizers	B6-2
	6.2 Gravel Pack	B6-2
	6.3 Bentonite Seal	B6-2
	6.4 Grout Mixture	B6-2
	6.5 Well Protection	B6-3
	6.6 Well Construction Logs	B6-3
	6.7 Well and Monument Locations	B6-5
7.0	WELL DEVELOPMENT	B7-1
8.0	IN SITU PERMEABILITY TESTING	B8-1
9.0	WELL SAMPLING	B9-1
10.0	PROJECT ASSIGNMENTS	B10-1

FIGURES

Number		Follows Page
3-1	Site Plan and Sampling Location	B3-1
3-2	Rubbish Burning Ground at Taylor and Ransom Roads - Proposed Sampling Locations	B3-1
3-3	Scheid Road Burning Ground - Proposed Sampling Locations	B3-1
3-4	Waste Disposal Area No. 2 - Proposed Sampling Locations	B3-2
3-5	Waste Disposal Area No. 1 - Proposed Sampling Locations	B3-2
6-1	Well Construction Specifications	B6-1
6-2	Daily Drilling Activity Log Form	B6-1
6-3	Visual Classification of Soils Form	B6-1

1.0 INTRODUCTION AND BACKGROUND

This Monitoring Well Installation Plan (MWIP) was prepared to specifically address the requirements of the Scope of Work (SOW) for contamination evaluation at the former Plum Brook Ordnance Works site, Defense Environmental Restoration Program (DERP) Project No. G05OH001800.

This plan discusses well and soil sample locations and specifications; well depths; drilling equipment and materials; drilling and decontamination techniques; well installation and specifications; well development; in situ permeability testing; ground water, soil, and surface water sampling; and project task assignments.

2.0 WELL LOCATIONS AND DEPTHS

2.1 WELL LOCATIONS

Six shallow ground water monitoring wells will be installed at the Plum Brook Ordnance Works site as specified by the SOW. The approximate sampling locations of monitoring wells for this project were selected after reviewing existing records concerning the site and after visual site inspections. Five of the wells (MW-02 through MW-06) will be located downgradient from various sites at the facility to intercept possible contamination of ground water that may be polluted with residual chemicals or breakdown products emitting from point sources. Monitoring well MW-01 will be positioned upgradient of all known or suspected on-site contaminant sources and will be used to evaluate the quality of ground water as it enters the site (refer to Figure 3-1).

Monitoring wells MW-05 and MW-02 will be located downgradient from the red water retention basins (Waste Disposal Area No. 1 and Waste Disposal Area No. 2, respectively) (refer to Figures 3-5 and 3-4, respectively). The wells are positioned so that potential ground water contamination resulting from wastewater from trinitrotoluene (TNT) production operations will be intercepted. Monitoring wells MW-03 and MW-04 will be located downgradient from the former rubbish burning pit and TNT burning grounds, respectively (refer to Figures 3-2 and 3-3, respectively). The approximate locations of these disposal sites were established during the previously performed records search. Monitoring well MW-06 is to be located at the northern (downgradient) boundary of the site. The well is positioned so that the quality of ground water can be assessed as it exits the site. This will allow detection of potential ground water contamination resulting from activities not specifically related to the six targeted sites. In particular, the likelihood of intercepting potential contamination from underground drain lines connecting ordnance manufacturing operations and waste disposal areas will be increased by the positioning of monitoring well MW-06 (refer to Figure 3-1).

2.2 WELL DEPTHS

IT Corporation (IT) will install and survey six ground water monitoring wells. Typical well depths will be approximately 25 feet, in accordance with the SOW. The total number of linear feet drilled will not exceed 150 feet,

unless approved by the Contracting Officer. If directed by the Contracting Officer, IT will drill and install up to an additional 25 linear feet per well, with no individual well exceeding 50 linear feet. The wells will be installed so that the uppermost permanent aquifer will be sampled.

Final well depths will be determined by the Field Geologist based on subsurface conditions. Procedures for determining well depths in the field will be predicated on the depth of the water table. The depth of first encountered free water (fully saturated conditions) will be indicated on the drilling log. Drilling will continue penetrating into the saturated zone a minimum of 10 feet, at which point the boring will be terminated and the well will be installed. The well screen will be installed so that it extends above and below the water table.

The presence and thickness of any floating layer will be determined by continually sampling the boring and recording these findings on the drilling log. Once identified, the screen will be placed to intercept the floating layer. No well will exceed the total contract depth without specific concurrence by the Contracting Officer or his representative.

3.0 SOIL SAMPLING LOCATIONS

3.1 SOIL SAMPLES FOR GEOTECHNICAL TESTING

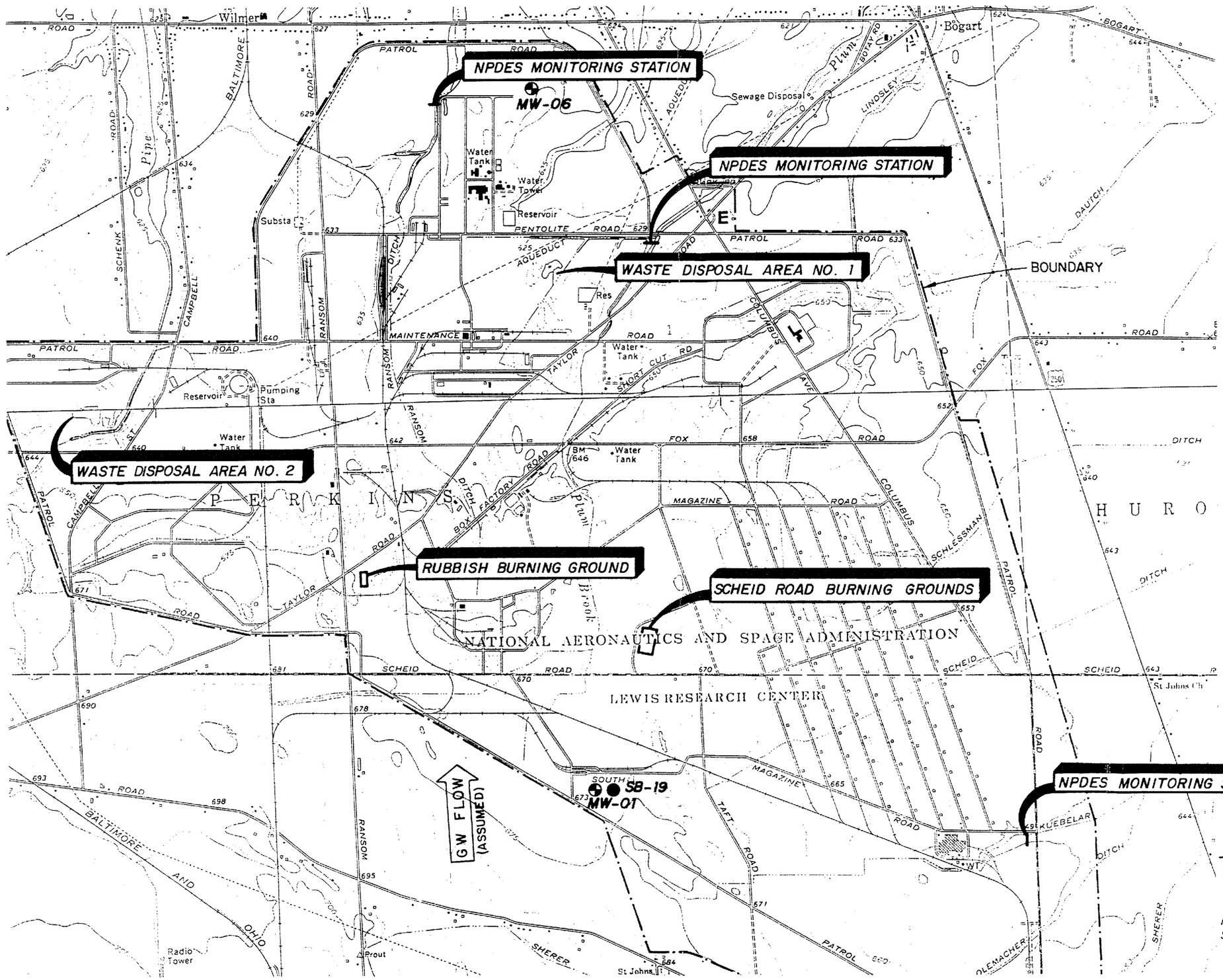
Soil samples for logging and for geotechnical testing will be collected during monitoring well construction. Samples for geotechnical analysis will be collected with a split spoon sampler [American Society for Testing and Materials (ASTM) D1586.67] or a thin-walled sampler (ASTM D1587.74) using standard geotechnical sampling techniques. Six soil samples will be collected from each boring (for a total of 36) for laboratory analysis of grain-size distribution (ASTM D421 and 422), Atterberg limits (ASTM D4318), and moisture content (ASTM D2216). Specific soil samples to be tested will be determined in the field by the Field Geologist/Sampling Team Leader.

Soil samples for geologic logging will be taken continuously for the first 10 feet and at 5-foot intervals or stratum changes thereafter. All representative material recovered by sampling will be stored in labeled glass jars until they are needed for testing or until the contract is complete. All soil samples shall be visually classified by the Unified Soil Classification System.

During sampling activities, an HNu and/or an organic vapor analyzer will be used to continuously monitor vapors emanating from both the boreholes and from the soil samples. These instruments will be used for personnel safety to monitor for the presence of flammable or other hazardous organic vapors. If site conditions are observed to be hazardous as indicated from HNu readings, samples will be considered hazardous and shipped accordingly. Procedures for packaging and shipping hazardous samples are listed in the Sampling and Analysis - Quality Assurance/Quality Control (S/A-QA/QC) Plan.

3.2 SOIL SAMPLES FOR CHEMICAL ANALYSES

Nineteen shallow (2 feet) soil borings will be installed for sample collection for chemical analysis at various locations on the Plum Brook Ordnance Works site as shown in Figures 3-1, 3-2, and 3-3. One boring will be installed to assess background soil conditions (SB-19), and 18 borings (SB-01 through SB-18) will be installed to determine the presence or absence of soil contamination resulting from past activities at the four targeted areas on the



LEGEND

- MONITORING WELL
- SOIL BORING

SOURCE: USGS SANDUSKY QUADRANGLE OHIO 7.5 MINUTE SERIES (TOPOGRAPHIC) REVISED 1979

USGS KIMBALL QUADRANGLE OHIO 7.5 MINUTE SERIES (TOPOGRAPHIC) 1969

FIGURE 3-1

SITE PLAN AND SAMPLING LOCATIONS

FORMER PLUM BROOK ORDNANCE WORKS SANDUSKY, OHIO

INTERNATIONAL TECHNOLOGY CORPORATION

DRAWING NO.: 409658-B-MW01	
PROJECT NO.: 409658	
INITIATOR: D. BURTON	
PROJ. MGR.: D. BURTON	
DATE LAST REV.:	
DRAWN BY:	
STARTING DATE: 4-26-89	
DRAFTED BY: S. MOORE	

BRUNING 72425

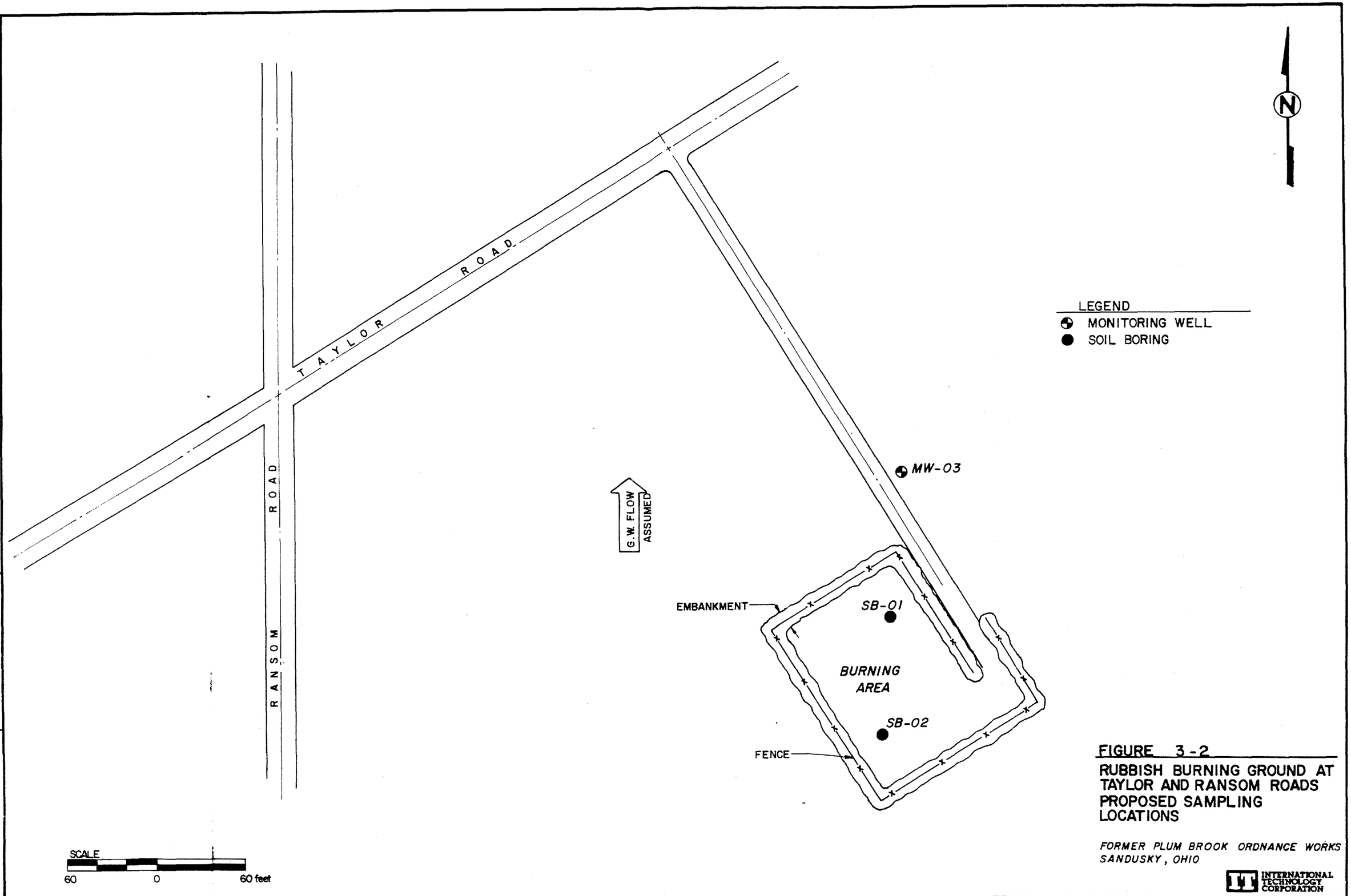


FIGURE 3-2

RUBBISH BURNING GROUND AT TAYLOR AND RANSOM ROADS PROPOSED SAMPLING LOCATIONS

FORMER PLUM BROOK ORDNANCE WORKS SANDUSKY, OHIO

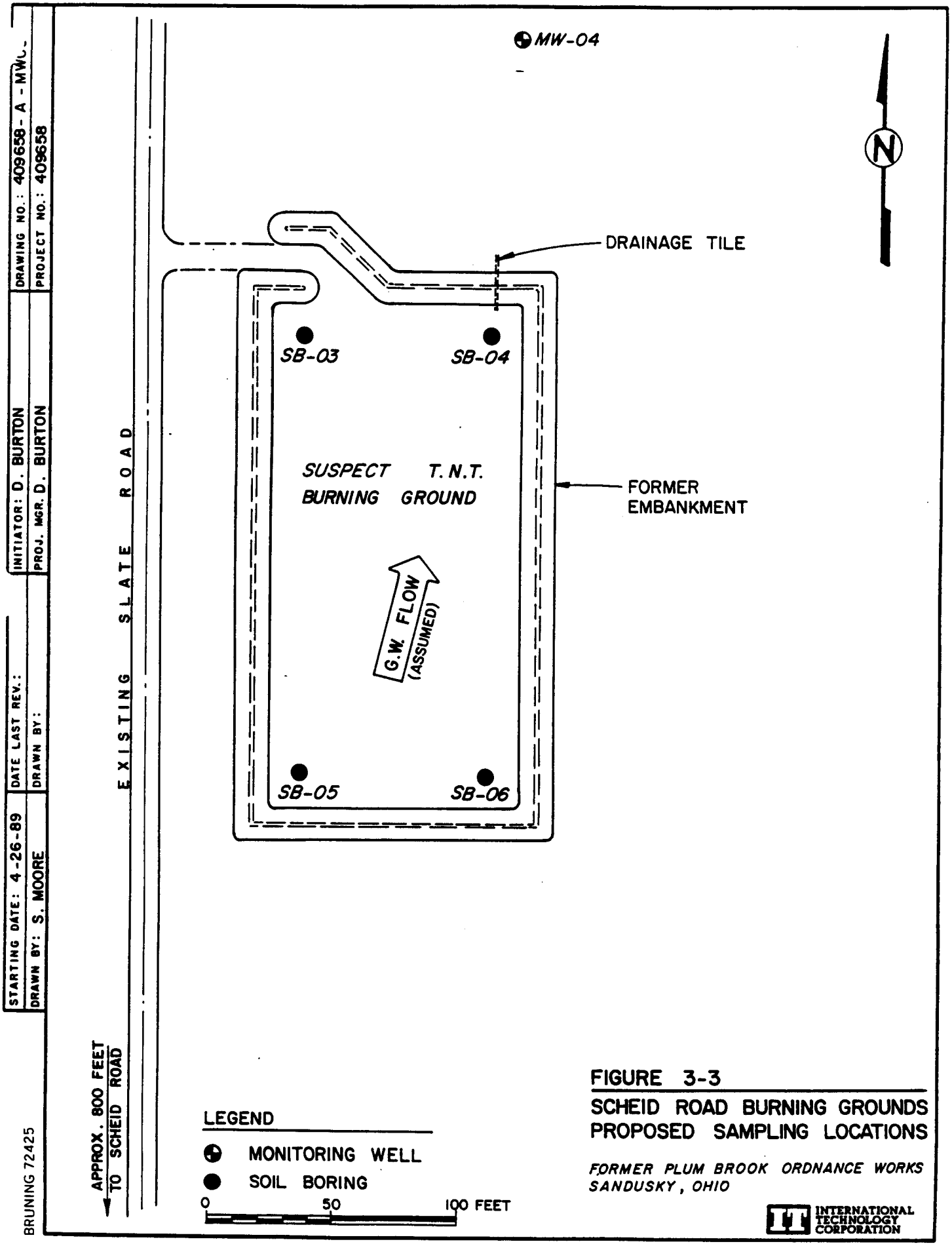
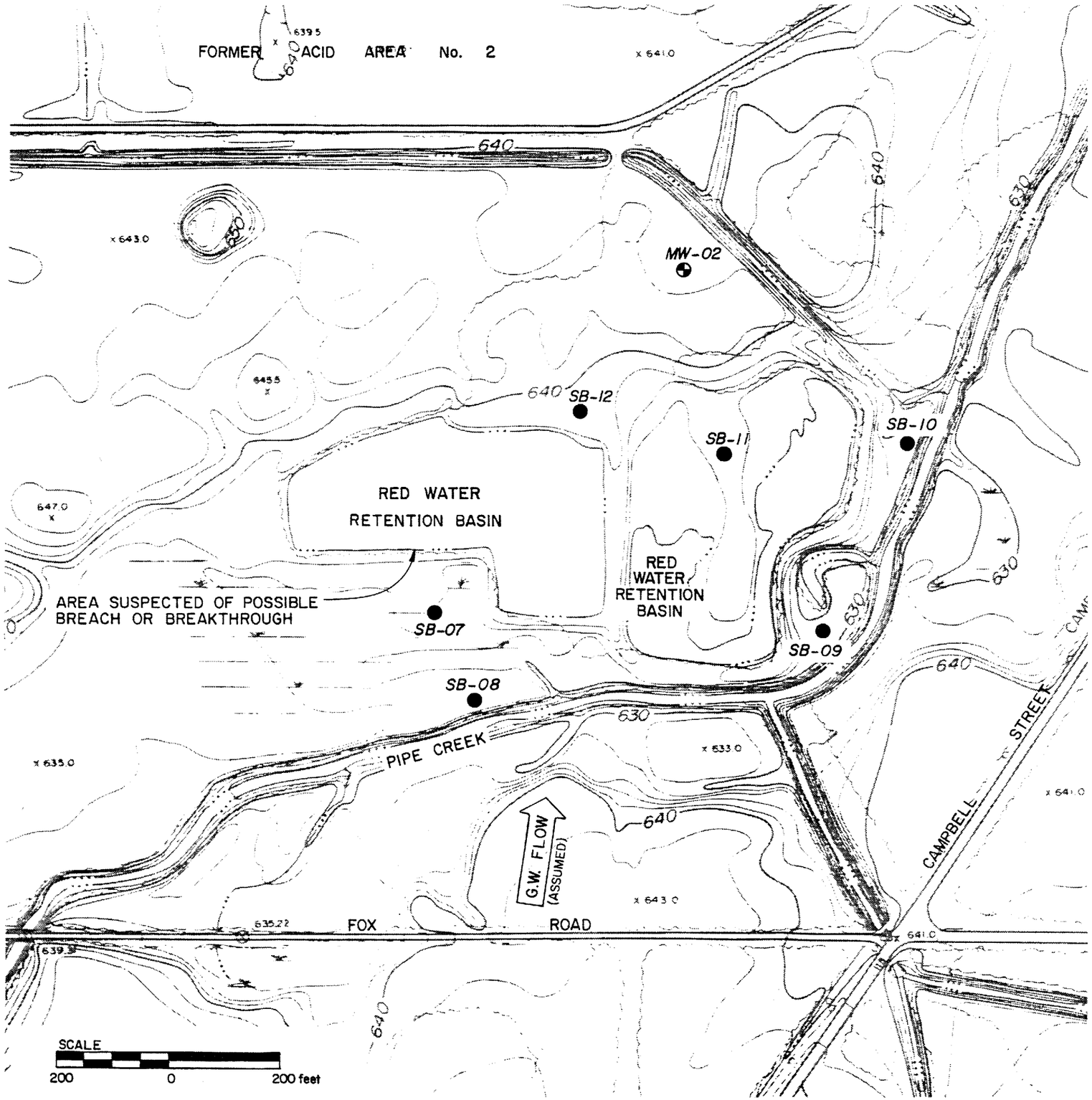


FIGURE 3-3

SCHEID ROAD BURNING GROUNDS
PROPOSED SAMPLING LOCATIONS

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO



LEGEND

- MONITORING WELL
- SOIL BORING
- SURFACE WATER

FIGURE 3-4

WASTE DISPOSAL AREA No. 2
PROPOSED SAMPLING LOCATIONS

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 4-27-89	DATE LAST REV.:	INITIATOR: D. BURTON	DRAWING NO.: 409658 - B - MW-04
DRAWN BY: S. MOORE	DRAWN BY:	PROJ. MGR.: D. BURTON	PROJECT NO.: 409658

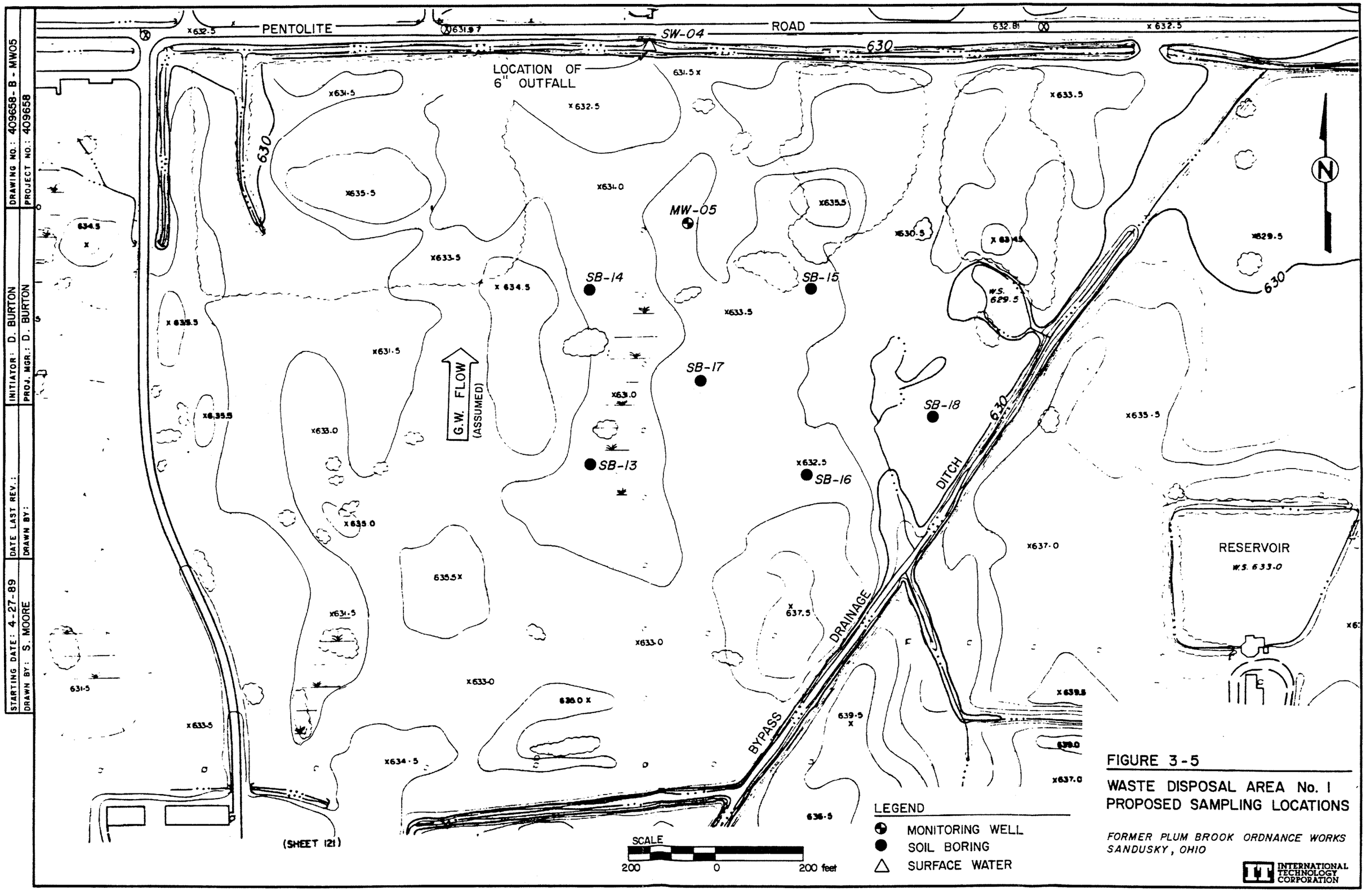


FIGURE 3-5

WASTE DISPOSAL AREA No. I
PROPOSED SAMPLING LOCATIONS

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

INTERNATIONAL TECHNOLOGY CORPORATION

site. Preliminary locations of the borings_were selected based on historic data from the literature review.

Boring SB-19 will be located near the southern property boundary in an area that has not been affected by known or suspected potentially hazardous wastes or substances (Figure 3-1). Results from analyses of samples collected from this boring will be used as a standard against which results from other borings will be compared to determine the impact that each targeted site has had on local soil conditions.

Borings SB-01 and SB-02 will be located on opposite ends of the preexisting rubbish burning ground (Figure 3-2). Borings SB-03, -04, -05, and -06 will be located on a grid pattern in the approximate area of the preexisting TNT burning ground as determined during the records search (Figure 3-3). Borings SB-07, -08, -09, -10, -11, and -12 will be located in the immediate vicinity of Waste Disposal Area No. 2 (Figure 3-4). Borings will be located in topographically low areas and in areas where wastewater may have escaped confinement through breaches in the berm. Borings S-13, -14, -15, -16, -17, and -18 will be located in the immediate vicinity of Waste Disposal Area No. 1 (Figure 3-5). Preliminary locations of the borings were selected based on the approximate location of the red water retention basins at the site as determined by an examination of historic maps of the area. Boring SB-18 will be installed to the east of the approximate location of the preexisting water retention basin in the area suspected to have been affected by leakage or seepage detected in 1978.

4.0 DRILLING EQUIPMENT AND TECHNIQUES

4.1 DRILLING RIG

IT will accomplish installation of the monitoring wells with a truck-mounted, water-rotary-capable drill rig (CME-550, CME-750 or equivalent).

4.2 DRILLING TECHNIQUES

Drilling will begin with a minimum of 6-3/8-inch diameter hollow stem augers to ensure the proper annulus around the hole. The augers will be attempted to be used to drill the bedrock, if encountered during drilling. If unsuccessful in drilling bedrock, well installation will be continued using an "H" size core barrel or using air or water rotary as the drilling method. It is likely that air rotary will be the preferred drilling method if hollow stem augers are unsuccessful in drilling the bedrock. There will be no oil or grease used on drill rod joints during any phase of drilling at the site.

During drilling with hollow stem auguers, soil samples will be collected individually for each well in 55-gallon drums and stored at the well location until analytical results are completed. If results of ground water and soil sample analyses indicate that regulated concentrations of hazardous contaminants are present in the drill cuttings, IT will determine the optimum method for disposal and furnish an estimated cost of disposal to the Contracting Officer. If the cuttings are determined not to be a regulated waste, IT will dispose of the material at no additional cost to the government.

Borings will be advanced by sampling the top 2 feet using the split spoon sampler (ASTM D1586-67). The split spoon will be driven using a 140-pound slide hammer. Hammer blows will be recorded for every 6-inch interval.

The split spoon will then be withdrawn from the bore, disconnected from the drill stem, and handed to the on-site geologist for sample extraction and classification. All representative material recovered by sampling will be stored in labeled plastic or glass jars until they are needed for testing or

until the contract is complete. All soil samples will be visually classified by the Unified Soil Classification System. IT will verify the classification by laboratory analysis, which consists of:

- Grain-size distribution (sieve only) (ASTM D421 and 422)
- Atterberg limits (ASTM D4318)
- Moisture content (ASTM D2216).

Soil samples will be taken continuously for the first 10 feet and at 5-foot intervals or stratum changes thereafter. The on-site geologist will choose total depths upon examination of samples and determination of static water levels.

5.0 DRILLING SUPPORT PROCEDURES

5.1 INITIAL ACTIVITIES

IT will obtain all necessary rights-of-entry and well drilling permits for the purpose of installing monitoring wells, taking samples, and gathering other engineering data. A copy of all permits and/or authorizations will be furnished to the Contracting Officer.

The drilling contractor, licensed in the State of Ohio, will comply with specific well construction design. The drilling contractor will submit a record of the well logs to the Ohio Department of Natural Resources Ground Water Resources Section. IT will ensure that the subcontractor complies with state or local regulations concerning construction of wells and submission of well logs. Each site area will be cleared and marked with a stake before drilling. A decontamination area will be set up at the drilling area.

5.2 DECONTAMINATION PROTOCOL

All drilling tools, equipment, and rigs will be decontaminated before being brought on site. Drilling equipment that comes into contact with soil material will be decontaminated between borings.

The following decontamination procedure will be used to decontaminate drilling equipment. This procedure will decontaminate the drilling tools and equipment between borings and before site departure, as well as monitoring wells before installation:

- Steam rinse.
- Steam wash using a brush with nonphosphate detergent.
- Steam rinse.
- Final rinse with distilled water.
- Air dry.

6.0. WELL INSTALLATION

Generalized well construction specifications are shown in Figure 6-1. Activity will be recorded on the Daily Drilling Activity Log Form (Figure 6-2) and the Visual Classification of Soils Form (Figure 6-3). Information recorded will include items listed in Subsection 6.6.

6.1 WELL CASING AND SCREEN MATERIALS

6.1.1 Well Casing (Riser)

Well risers will consist of new, threaded, flush-joint, polyvinyl chloride (PVC) pipe with a minimum 2-inch inside diameter. All well risers will, as a minimum, conform to the requirements of ASTM D1785 for Schedule 40 pipe. Each riser will bear markings identifying the material specified. The PVC casing will be National Sanitation Foundation (NSF) potable water grade and will be so marked. The riser will also be fitted with a slotted cap, permitting the venting of gases and equilibration to atmospheric conditions. No lead shot or lead wool will be used in sealing the bottom of the well or in producing seals at any point in the well.

6.1.2 Well Screen

The well screen will consist of new, threaded, flush joint, Schedule 40 PVC pipe with 0.010-inch screen openings. The well screen will conform to the requirements of ASTM-D1785 and will be so marked. The screen will be a noncontaminating, factory-constructed, continuous-wrap design and will be 10 feet in length. A 2-foot minimum length sand-sump will be installed on the bottom of the screen and will be constructed of a blank section of riser pipe. Flush-joint casing will be used to connect all sections of riser and screen together. Because both screen and riser will be threaded, it will not be necessary to use flush-joint couplings. Solvent PVC glue will not be used at any time in construction of the wells. The bottom of the deepest screen or casing will be sealed with a threaded PVC cap or plug.

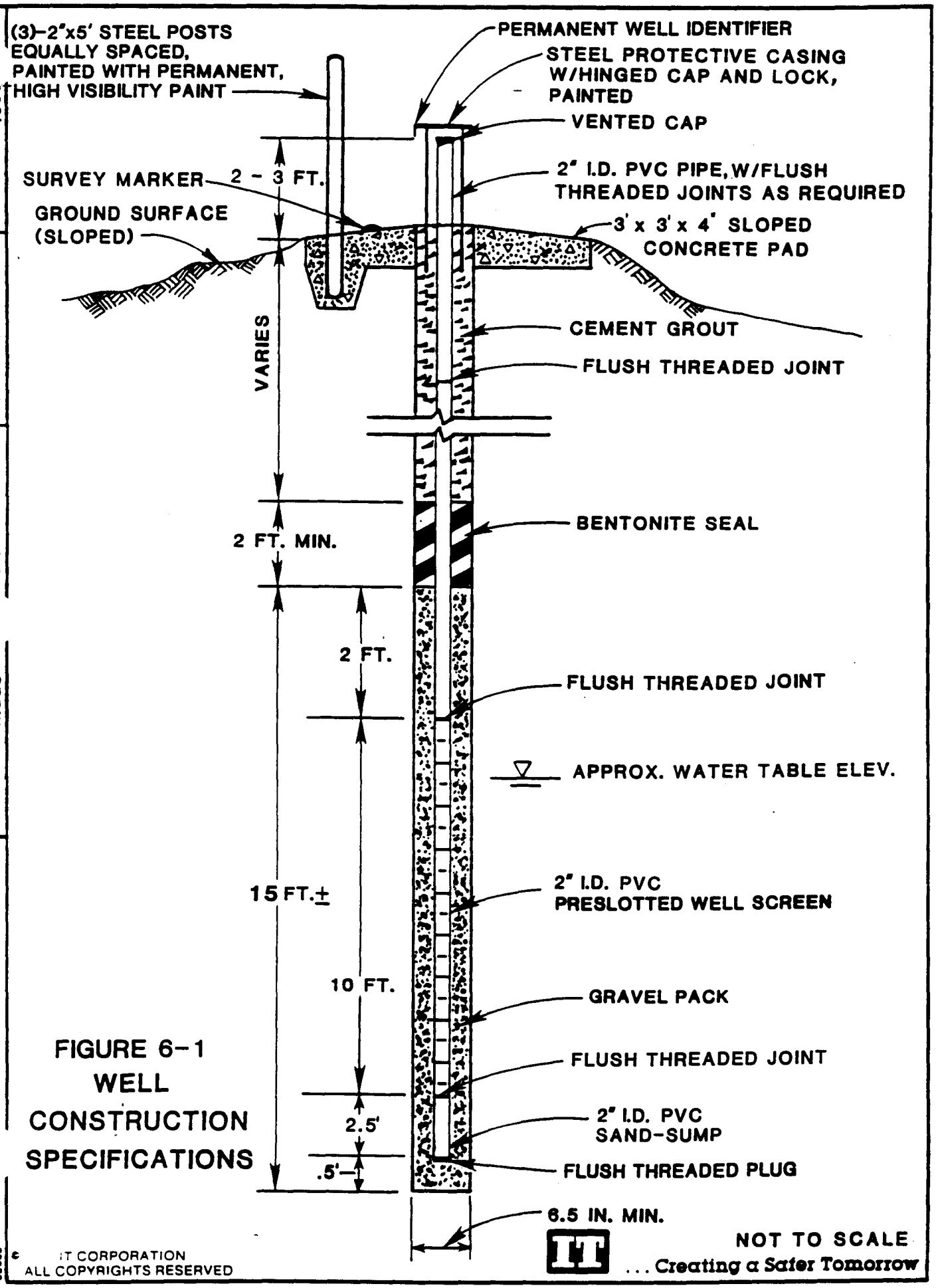


FIGURE 6-1
WELL
CONSTRUCTION
SPECIFICATIONS

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DRAWN BY: D. HIGGS
PROJECT NO.: 409
PROJ. ENGR.:

DAILY DRILLING ACTIVITY LOG

PROJECT NAME/NUMBER: _____

DATE: _____

TOTAL FEET DRILLED: _____

NUMBER OF BOREHOLES: _____

TOTAL HOURS ON-SITE: _____

DOWN TIME: _____

DELAY TIME: _____

NUMBER OF PERSONNEL: IT _____ DRILLER _____

METHOD OF DRILLING: _____

NUMBER OF SAMPLES TAKEN: _____

TYPE OF SAMPLES: SOIL _____ ROCK _____ WATER _____

PROTECTIVE CLOTHING: _____

MATERIALS USED:

CEMENT: _____

SAND: _____

BENTONITE PELLETS: _____

PVC PIPE/SIZE: _____

PVC SCREEN/SIZE: _____

OTHER MATERIALS: _____

FIELD TESTS/SURVEYS CONDUCTED: _____

PROBLEMS ENCOUNTERED: _____

_____

_____

COMMENTS: _____

_____

_____

CERTIFIED BY:

DRILLING CHIEF: _____ IT SUPERVISOR: _____

FIGURE 6-2

INTERNATIONAL TECHNOLOGY CORPORATION

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER:	PROJECT NAME:	
BORING NUMBER:	COORDINATES:	DATE
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS:		PAGE OF

DEPTH ( )	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER ( )	RECOVERY ( )	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS

NOTES:

FIGURE 6-3

6.1.3 Centralizers

Depending on the type of drilling technique and drilling depth, centralizers may be necessary to maintain the well casing and screen in the center of the boring. Centralizers will not be necessary at the Plum Brook Ordnance Works site because the well screen is set through the hollow stem auger. A plumb bob will be used to align the well screen in the hollow stem auger for installation in unconsolidated material. Because the proposed well depths are very shallow (25 feet each), it will not be difficult to ensure plumbness and alignment.

6.2 GRAVEL PACK

Clean, inert, well-sorted, noncarbonate materials will be used to construct a uniform and continuous gravel pack. For the glacial till soils and limestone bedrock at the Plum Brook Ordnance Works site, a 20/40-mesh sand mixture is preselected and planned for use as the gravel pack. The filter material will be compatible with the 0.010-inch screen openings. IT will provide a sieve analysis of one representative sample of the aquifier material in which the screen will be placed. The sieve analysis will be conducted in accordance with ASTM C117 and C136 and the results will be submitted with the field boring logs.

The gravel pack will be placed in the annulus from the bottom of the boring to approximately 2 feet above the top of the screen. The gravel pack will be placed by tremie pipe or by hollow stem auger from the bottom of the boring to approximately 2 feet above the top of the well screen.

6.3 BENTONITE SEAL

A minimum 2-foot seal consisting of tamped bentonite pellets will be placed into the annular space between the riser and well boring just above the gravel pack. If the bentonite seal is constructed above the ground water, it will be hydrated with clean, nonchlorinated water to prevent transmission of grout from above into the gravel pack or well screen.

6.4 GROUT MIXTURE

Cement grout will be placed by tremie pipe from the top of the bentonite seal to the ground surface. The cement grout will consist of a mixture of Portland

cement (ASTM C150) and water (not more than 7 gallons per bag of cement). Additionally, 3 percent by weight of bentonite powder will be added to form the grout mixture.

Placement techniques for the gravel pack, bentonite, and grout are such that bridges will not form in the materials when placing them in the well. The materials will be tremied in the annulus from the bottom of the boring. The hollow stem auger will be raised continuously slightly above the incoming material to prevent bridging in the auger. Material is carefully placed around the screen and riser as the auger is continually raised. When considered necessary, the auger may be agitated slightly to prevent bridging of materials.

6.5 WELL PROTECTION

The PVC well riser will be surrounded by a larger diameter steel casing set into a concrete pad and rising 24 to 36 inches above ground level. The steel casing will be provided with lock and cap. A minimum 3-foot-square, 4-inch-thick concrete pad sloped away from the well will be constructed around the well casing at the final ground level elevation. A survey marker (control monument) composed of brass, bronze, or an aluminum alloy will be permanently set in the concrete pad surrounding each well. Three steel posts that are 2 inches or larger in diameter will be equally spaced around the well and embedded in the concrete pad. The ground immediately surrounding the top of the well will be sloped away from the well. There will be no openings in the protective casing well below its top. The steel protective casing and posts will be painted with permanent, high visibility paint. A permanent marking or tag will be affixed to the outer steel casing of each well identifying the well number, COE, Huntsville Division, and the adjusted top of casing elevation.

6.6 WELL CONSTRUCTION LOGS

Suitable logs detailing construction practices will be completed and maintained for inclusion in the final engineering report. In accordance with the IT Manual of Practice "Visual Field Classification of Subsurface Materials, Classification Log Legend," the logs will be prepared by the Field Geologist, who will be present during all drilling operations. One copy of each well

construction log as specified in Section 7.Q, including the required color slides, will be submitted to the Contracting Officer no later than 10 calendar days after each well is completed. The well will not be accepted by the Contracting Officer until the logs are received and approved. Results of a sieve analysis, (in accordance with ASTM C117 and C136) of one representative sample of the aquifer material will be submitted to the Contracting Officer with the boring logs. Information provided in the logs will include, but not be limited to, the following:

- Reference elevation for all depth measurements
- Depth of each change of stratum
- Thickness of each stratum, including thin lenses and layers
- Identification of the material of which each stratum is composed according to the Unified Soil Classification System, or standard rock nomenclature, as necessary
- Depth interval from which each formation sample was taken
- Depth at which hole diameters (bit sizes) change
- Depth at which ground water is first encountered
- Depth to the static water level and changes in static water level with well depth
- Total depth of completed well
- Type of drilling equipment used
- Type of samplers used
- Location of any fractures, joints, faults, cavities, or weathered zones
- Depth of any grouting or sealing
- Nominal hole diameters
- Amount of cement used for grouting or sealing
- Depth and type of well casing
- Description (to include length, location, diameter, slot sizes, material, and manufacturer) of well screen(s)
- Any sealing off of water-bearing strata

- Static water level upon completion of the well and after development
- Drilling date or dates and start and completion times
- Construction details of monitoring well
- The manufacturer and quantities of all materials used in the wells
- Reason for boring termination.

6.7 WELL AND MONUMENT LOCATIONS

Coordinates and elevations will be established for each monitoring well. The coordinates will be to the closest 1.0 foot and referenced to the State Plane Coordinate System. If the State Plane Coordinate System is not readily available, an existing local grid system will be used. A survey marker (control monument) composed of brass, bronze, or aluminum alloy will be permanently set in the pad surrounding each well. Elevations to the closest 0.1 foot will be provided for the survey marker and the top of the casing at each well. These elevations will be referenced to the National Geodetic Vertical Datum of 1929. If the 1929 datum is not readily available, the existing local vertical datum will be used. Two permanent control monuments with brass, bronze, or aluminum alloy caps will be set in accessible locations within the limits of the work. These monuments will be separated by a minimum of 500 feet. Coordinates and elevations to third order (1:5000) accuracies or better will be established to the closest 0.01 foot for each monument. The location, identification, coordinates, and elevation of the wells and monuments will be plotted on maps with a scale large enough to show their location with reference to other structures at the individual sites. Two copies of a tabulated list of the monitoring wells and monuments, including their coordinates and elevations, all field books, and all computation sheets will be prepared and submitted to the Nashville District ATTN: CEORNED-R. The tabulation will consist of the designated number of the well or monument, the X and Y coordinates, and all the required elevations. These items will be submitted to CEORN no later than the draft report submission date.

7.0. WELL DEVELOPMENT

After each well has been constructed but no sooner than 48 hours after grouting is completed, IT will direct a program for the development of each well as required by the SOW. Wells will be developed by pumping or bailing without using acids or dispersing agents. Development will continue for a period of 4 hours (minimum) until ground water removed from the well is clear and free of sand. If after 4 hours of well development the ground water is not clear and free of sand, the Contracting Officer will be contacted for consultation and further instructions. No water or other liquid will be introduced into the well other than formation water from that well. After final development of each well, IT will collect approximately 1 liter of water from the well in a clear glass jar, label and photograph it with a 35mm color slide, and submit the slide as part of the well log. The photograph will be a suitably back-lit close up to show the clarity of the water. The development water sample will be archived until receipt of developed slides, in case of camera, film, or film processing failure.

8.0. IN SITU PERMEABILITY TESTING

After development of each monitoring well, IT will calculate the in situ permeabilities of the uppermost water-bearing strata. The rising head method will most likely be used. This test involves removing a known volume of water from the well, causing the water level to fall. The subsequent rise in head is measured as a function of time. Upon plotting these two variables, the value of the hydraulic conductivity at that particular point in the aquifer can be calculated. The method used to calculate the hydraulic conductivity was developed by Hvorslev (1951). This method is applicable to unconfined aquifers.

9.0. WELL SAMPLING

Procedures for ground water sampling from the monitoring wells are discussed in the S/A-QA/QC Plan (Appendix C).

10.0. PROJECT ASSIGNMENTS

The contamination evaluation will be conducted by IT of Knoxville, Tennessee. Outside assistance may be obtained from other IT offices as necessary, but project management responsibilities will be in the Knoxville office. The Project Manager is Mr. Don Burton, 312 Directors Drive, Knoxville, Tennessee, 37923; he can be reached at (615) 690-3211.

IT's Field Geologist will be an experienced field geologist from IT's Knoxville office. This geologist will have extensive experience with ground water monitoring well installations in addition to comprehensive safety training for hazardous waste site activities. The IT Field Geologist will be present on site for all drilling, installation, development, and testing operations. His/her responsibilities include logging of samples, monitoring of drilling operations, recording of water levels and other ground water data, preparing the boring logs and well diagrams, and recording the well installation procedures.

Additionally, the Project Manager (for overall project activities) and the Field Geologist (for site activities) will be responsible for ensuring that the intentions of the SOW and that best construction practices are carried out.

APPENDIX C

SAMPLING/ANALYSIS - QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR CONTAMINATION EVALUATION AT THE FORMER PLUM BROOK ORDNANCE WORKS SANDUSKY, OHIO

Prepared for:

DEPARTMENT OF THE ARMY,
NASHVILLE DISTRICT, CORPS OF ENGINEERS
NASHVILLE, TENNESSEE
AND
HUNTSVILLE DIVISION, CORPS OF ENGINEERS
HUNTSVILLE, ALABAMA

DERP PROJECT NO. G050H001800

Prepared by:

IT Corporation
Knoxville, Tennessee
IT Project No. 409658

September 1989

CEE2185CC
08/30/89

APPENDIX C

SAMPLING/ANALYSIS - QUALITY ASSURANCE/QUALITY CONTROL PLAN FOR CONTAMINATION EVALUATION AT THE FORMER PLUM BROOK ORDNANCE WORKS SANDUSKY, OHIO

Prepared by:

IT Corporation
312 Directors Drive
Knoxville, Tennessee 37923
615-690-3211

September 1989

Approved: _____ Date: 9/1/89
Project Manager, IT Corporation

Approved: Clifford E Vaughan Date: 9/5/89
Program Manager, IT Corporation

Approved: D. W. Mack Date: 1 SEP 89
Quality Assurance Officer, IT Corporation

Approved: _____ Date: 5 Sept 89
Laboratory Director, IT Analytical Services - Knoxville

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CONTENTS

	Page
LIST OF TABLES	C-iii
LIST OF FIGURES	C-iv
DEFINITIONS	C-v
1.0 INTRODUCTION AND BACKGROUND	C1-1
2.0 PROJECT ORGANIZATION AND RESPONSIBILITY	C2-1
3.0 SAMPLING	C3-1
3.1 Samples To Be Collected	C3-1
3.1.1 Soil Samples for Geotechnical Analysis	C3-1
3.1.2 Ground Water Samples	C3-2
3.1.3 Soil Samples for Chemical Analysis	C3-3
3.1.4 Surface Water Samples	C3-4
3.1.5 Summary - Types and Numbers of Samples	C3-5
3.2 Selection of Sampling Locations	C3-5
3.2.1 Soil Sampling Locations	C3-6
3.2.2 Ground Water Sampling Locations	C3-7
3.2.3 Surface Water Sampling Locations	C3-8
3.3 Sample Collection Methods	C3-8
3.3.1 Soil Samples	C3-8
3.3.2 Ground Water Samples	C3-9
3.3.3 Surface Water Samples	C3-9
3.4 Prevention of Cross Contamination	C3-10
3.4.1 Nonsampling Equipment	C3-10
3.4.2 Sampling Equipment	C3-10
3.5 Field Documentation Procedures	C3-11
3.5.1 Photographs	C3-11
3.5.2 Field Documentation	C3-12
3.5.3 Variance Log	C3-14
3.5.4 Field Data Management	C3-15
4.0 SAMPLING PROGRAM PLAN	C4-1
4.1 Sampling Program Organization	C4-1
4.1.1 Project Manager	C4-1
4.1.2 Program Manager	C4-2
4.1.3 Quality Assurance Officer	C4-2
4.1.4 Project Engineer	C4-2
4.1.5 Project Geologist	C4-3
4.1.6 Field Geologist	C4-3
4.1.7 Health and Safety Coordinator	C4-5
4.1.8 Laboratory Manager	C4-5
4.1.9 Subcontractor Activities	C4-6
4.1.10 Qualifications and Training of Field Personnel	C4-7
4.1.11 Qualifications and Training of Laboratory Personnel	C4-7
4.1.12 Description of Laboratory Facilities and Analytical Instrumentation	C4-7
4.2 Sample Classification	C4-8
4.3 Sample Containers	C4-9
4.4 Sample Preservation	C4-9

CONTENTS (Continued)

		Page
	4.4.1 Samples for Geotechnical Testing	C4-9
	4.4.2 Samples for Chemical Analyses	C4-10
4.5	Identification	C4-10
	4.5.1 Sample Labels	C4-10
	4.5.2 Sample Numbering System	C4-11
4.6	Transportation and Custody	C4-12
	4.6.1 Field Custody Procedures	C4-12
	4.6.2 Transfer of Custody and Shipment	C4-13
	4.6.3 Packaging, Labeling, and Shipping of Nonhazardous Samples	C4-14
	4.6.4 Packaging, Labeling, and Shipping of Hazardous Samples	C4-15
	4.6.5 Laboratory Receipt and Entry of Samples	C4-18
	4.6.6 Preanalysis Storage	C4-19
	4.6.7 Postanalysis Storage	C4-20
5.0	ANALYSES AND ANALYTICAL METHODS	C5-1
5.1	Soil Samples	C5-1
	5.1.1 Physical Analyses	C5-1
	5.1.2 Chemical Analyses	C5-1
5.2	Ground Water and Surface Water Samples	C5-2
5.3	Quality Assurance/Quality Control Samples	C5-2
6.0	DATA ANALYSIS AND REPORTING	C6-1
6.1	Quality Assurance Data Objectives	C6-1
6.2	Data Reduction and Validation	C6-2
6.3	Data Reports	C6-4
6.4	Assessment of Data Accuracy, Precision, and Completeness	C6-5
6.5	Nonconformances and Corrective Action	C6-7
6.6	Quality Assurance Reports to Management	C6-9
6.7	Project-Specific Requirements	C6-9
7.0	PROGRAM CONTROLS	C7-1
7.1	Calibration Procedures and Frequency	C7-1
	7.1.1 Calibration Failures	C7-1
	7.1.2 Calibration Records	C7-2
7.2	Quality Control Checks	C7-2
	7.2.1 Field Quality Control Procedures	C7-2
	7.2.2 Laboratory Quality Control Procedures	C7-3
7.3	System Audits	C7-7
7.4	Preventive Maintenance	C7-8
7.5	External Certification	C7-9
8.0	RESUMES OF KEY FIELD AND LABORATORY PERSONNEL	C8-1

TABLES

Number		Follows Page
3-1	Geotechnical (Engineering Properties) Samples	C3-1
3-2	Samples To Be Collected and Analyzed for Chemical Contaminants	C3-1
3-3	Required Analyses and Approved Methods	C3-1
3-4	Quality Assurance/Quality Control Samples: Analyses and Analytical Methods	C3-1
3-5	Summation of Analyses, Samples To Be Collected, Analytical Methods, Sampling Volumes, and Preservation Requirements for IT Laboratory	C3-1
4-1	Applicable Laboratory Equipment - IT Analytical Services Knoxville	C4-8
4-2	Container and Preservation Requirements for Geotechnical Testing of Soil Samples	C4-9
4-3	Limited Quantities	C4-15
6-1a-d	Hazardous Substance List and Contract Required Detection Limits	C6-2
6-1e	Estimated Detection Limits - Explosives	C6-2
6-2	Sample Precision, Accuracy, and Completeness Objectives	C6-2
7-1	Field Equipment Calibration Procedures	C7-1
7-2	Summary of Typical Calibration Requirements for ITAS Laboratory Operations	C7-1
7-3	Preventive Maintenance - Knoxville Laboratory Operations	C7-8

FIGURES

Number		Follows Page
1-1	Vicinity Map	C1-1
2-1	Project Organization Chart	C2-1
3-1	Site Plan and Sampling Location, Former Plum Brook Ordnance Works	C3-6
3-2	Rubbish Burning Ground at Taylor and Ransom Roads - Proposed Sampling Locations	C3-6
3-3	Scheid Road Burning Ground - Proposed Sampling Locations	C3-6
3-4	Waste Disposal Area No. 2 - Proposed Sampling Locations	C3-6
3-5	Waste Disposal Area No. 1 - Proposed Sampling Locations	C3-6
3-6	Example Field Activity Daily Log Form	C3-10
3-7	Example Variance Log Form	C3-14
4-1	Project Schedule	C4-1
4-2	Floor Plan of IT Analytical Services, Middlebrook Pike Laboratory, Knoxville, Tennessee	C4-7
4-3	Example Sample Container Label (X1.3) Form	C4-10
4-4	Example Chain-of-Custody Record Form	C4-12
4-5	Example Request for Analysis Form	C4-12
6-1	Example Nonconformance Memo Form	C6-7
6-2	Example Nonconformance Report Form	C6-7

Definitions. The terms and meanings taken from Section 3.4.1.8.1 of the July 1988 Scope of Work for the former Plum Brook Ordnance Works, Contamination Evaluation, Sandusky, Ohio are included, but not limited to, the following definitions:

Quality Control. As applied to chemical analysis, all procedures and precautions observed in the laboratory to generate valid results. Includes such routine matters as purity of reagents, cleaning of equipment and containers, and calibration of instruments, as well as the more specifically oriented activities of quality assurance.

Quality Assurance. As applied to chemical analysis, the demonstration and documentation of data quality. Includes the recording of all quality control activities, the assessment of analytical performance by analysis of internal and external control and audit samples (see below), and use of the results to evaluate such parameters as precision, accuracy, and sensitivity.

Field Control Sample. A trip blank, sampling blank, split sample, field replicate, or any other sample submitted with field samples for quality assurance/quality control purposes.

Trip Blank or Travel Blank. A container or set of containers filled with reagent water, transported to the sampling site, handled like a sample, but not opened in the field and returned to the laboratory for analysis, with the purpose of demonstrating that containers and samples are not contaminated in transit.

Sampling Blank, Sampling Rinsate, or Sampling Equipment Blank. Reagent water which is passed through the sampling equipment, transferred to sample containers, and returned to the laboratory for analysis, with the purpose of demonstrating that the sampling equipment is not causing contamination or cross contamination of samples.

Split Sample. A sample which after collection is divided into two or more parts that are sent to different laboratories for the same analyses, thus serving as an external quality assurance sample.

Field Duplicate Samples. Two or more examples collected at the same time and source, but submitted to one laboratory as separate samples, for the purpose of assessing the consistency of the overall sampling and analytical systems.

Internal Quality Control Samples or Laboratory Control. A reference standard, standard addition, replicate sample, a blank, or other sample in which the analyte concentration is known or can be calculated, which is placed among the

samples to be analyzed to evaluate or demonstrate validity of the analytical results.

Reference Standard. A sample prepared from pure reagents to contain one or more analytes at known concentrations.

Standard Addition or "Spiked" Sample. A field sample to which known concentrations of one or more analytes have been added.

Laboratory Duplicate Samples. Subsamples of a single field sample which are divided at the laboratory and analyzed as separate samples.

Replicate Analyses. Multiple analyses performed on the same sample.

Laboratory Blank. A sample prepared at the laboratory from pure materials containing none of the analyte. Laboratory blanks include method blanks, reagent blanks, and others.

External Quality Assurance Sample. A sample or subsample sent to an outline laboratory to permit comparison of analytical results.

Performance Audit Sample. A sample submitted to the laboratory by an external organization or agency which knows the expected analytical results.

System Audits. Methodical examinations by the laboratory using performance audit samples and/or analysis of split samples by an independent laboratory to determine if methods are within acceptable control limits.

1.0 INTRODUCTION AND BACKGROUND

This Sampling/Analysis - Quality Assurance/Quality Control (S/A-QA/QC) Plan was prepared to specifically address the requirements of the July 1988, Scope of Work (SOW) (Delivery Order No. 004) for contamination evaluation at the former Plum Brook Ordnance Works located near Sandusky, Ohio, Defense Environmental Restoration Program (DERP) Project No. G050H001800, Contract No. DACA87-87-D-0089 (Figure 1-1). The purpose of the S/A-QA/QC is to provide the rationale and detailed approach for conducting the contamination evaluation. Preparation of this plan was specified as Task 4 of the SOW and addresses the performance requirement for Tasks 6 and 15 through 20. The applicable portion of Task 6 addressed in this plan is collection of soil samples for geotechnical testing during monitoring well construction. The portions of Tasks 15 through 20 addressed are collection of potentially hazardous material samples, ground water samples, soil boring samples, and preparation of QA/QC samples.

Limited site background information is given in Section 3.0 of the Work Plan.

Additionally, the S/A-QA/QC has been prepared to provide assurance by IT and its subcontractors that the work performed will be of the quality required to satisfy the project objectives. This plan also will be responsive to requirements of the U.S. Army Corps of Engineers (COE).

The S/A-QA/QC focuses on the acquisition of environmental data of known and acceptable quality. Other aspects of the project such as engineering analysis, report preparation, and records will be controlled by the internal requirements of IT Corporation's (IT's) Quality Assurance Program.

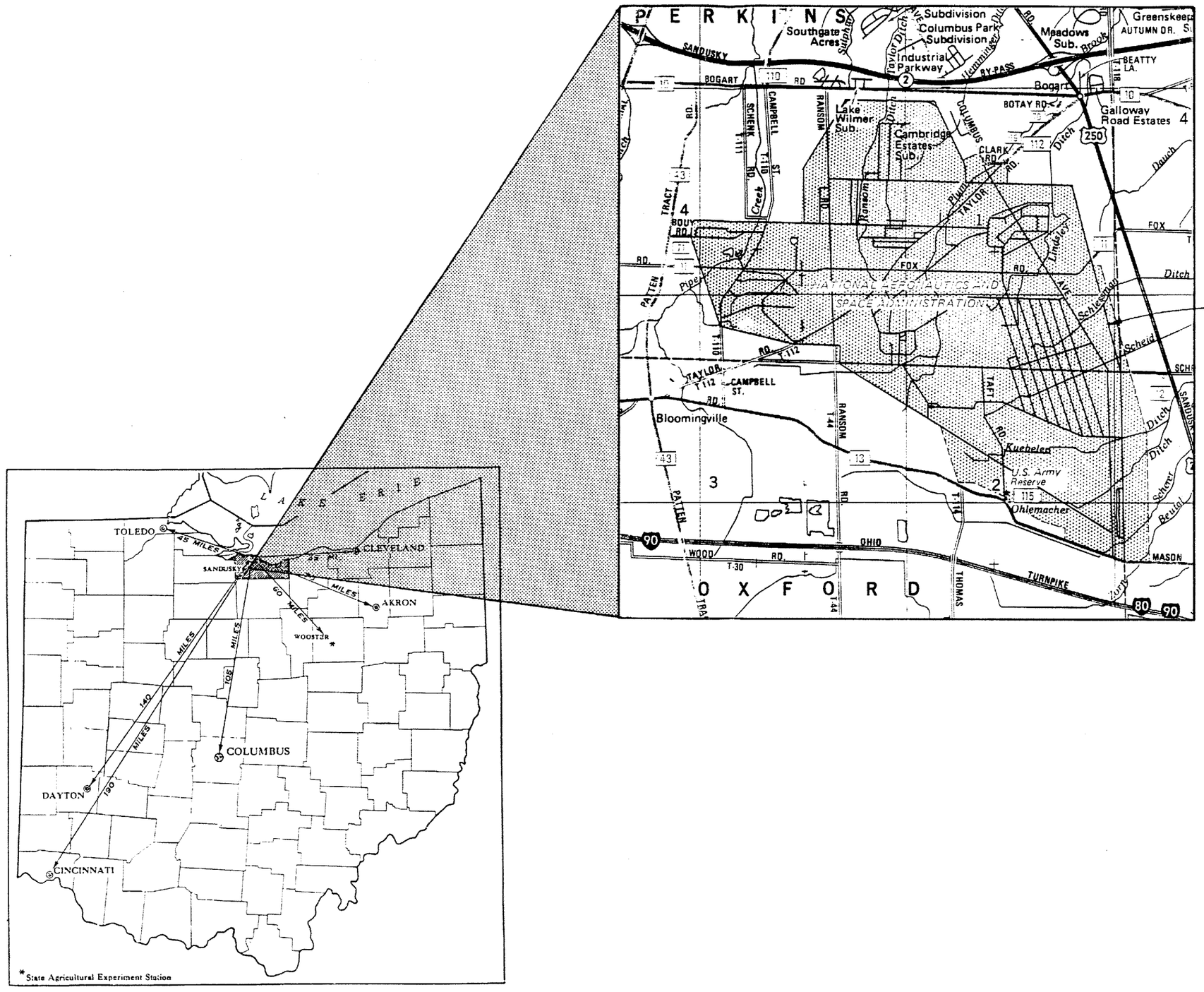


FIGURE 1-1
VICINITY MAP

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

INTERNATIONAL TECHNOLOGY CORPORATION

INITIATOR: D. BURTON	DRAWING NO.: 409658-B-WP08
PROJ. MGR.: D. BURTON	PROJECT NO.: 409658
STARTING DATE: 4-26-89	DATE LAST REV.:
DRAWN BY: S. MOORE	DRAWN BY:

BRUNING 72425

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Overall project organization and responsibility is presented in Section 2.0 of the Work Plan. The Field Geologist will be responsible for site work, including monitoring well construction, development, and testing. The Field Geologist will also be responsible for sampling collection, preservation, packaging, and shipment. Figure 2-1 is the Project Organization Chart.

BRUNING 72425

STARTING DATE: 5-2-89	DATE LAST REV.:	INITIATOR: D. BURTON	DRAWING NO.: 409658-A-WP18
DRAWN BY:	DRAWN BY:	PROJ. MGR. D. BURTON	PROJECT NO.: 409658

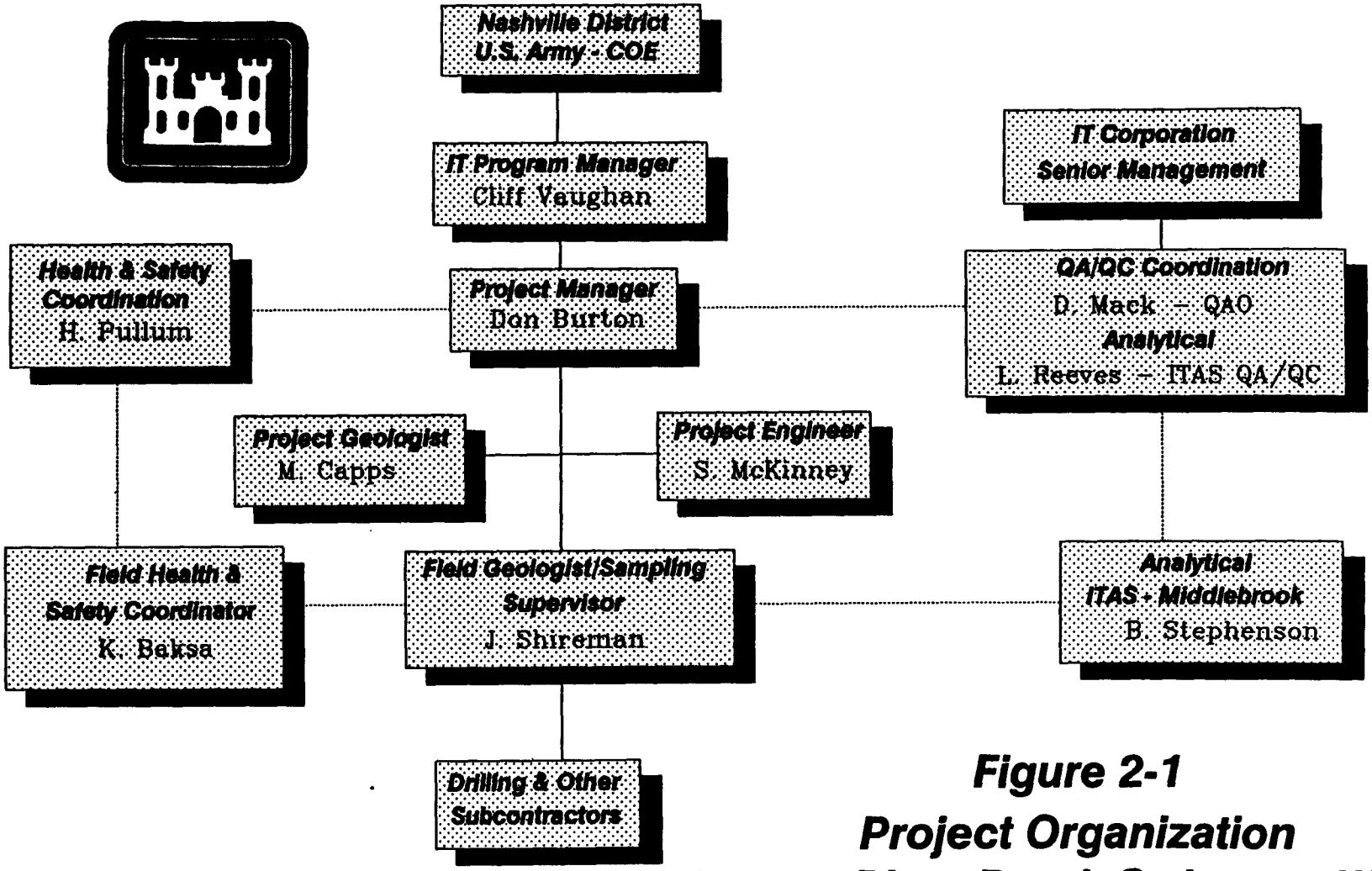


Figure 2-1
Project Organization
Former Plum Brook Ordnance Works
Sandusky, Ohio

PLUMOC.DRW

INTERNATIONAL TECHNOLOGY CORPORATION

3.0 SAMPLING

A summary of samples to be collected and the required analyses are given in Tables 3-1 through 3-5. The sampling and sample custody procedures contained in this S/A-QA/QC Plan are consistent with U.S. Environmental Protection Agency (EPA) guidelines and COE requirements. This plan, however, has not been reviewed by EPA Region V or the State of Ohio because neither the site grounds nor the ground water is known to be contaminated.

The format for this S/A-QA/QC Plan was provided by COE and was modified as necessary to address project-specific needs. Section 3.1 describes samples to be collected; Section 3.2 addresses selection of sampling locations; Section 3.3 describes sample collection methods; Section 3.4 discusses equipment decontamination procedures and other measures to be taken to prevent cross contamination; and Section 3.5 describes field documentation procedures. Sample preservation, packaging, and shipment are discussed in Section 4.0. Sample analyses are discussed in Section 5.0.

3.1 SAMPLES TO BE COLLECTED

Tables 3-1 and 3-2 are tabulations of the number and type of sample sets to be collected. The term "sample set" includes the samples collected from each location subdivided and placed in the various sampling containers according to the preservation requirement of the analytical methods employed. Tables 3-3 and 3-4 list the required analyses, approved analytical methods, and QA/QC requirements.

The Project Manager or Project Geologist will coordinate the sampling schedule with the IT Analytical Services (ITAS) laboratory to obtain bottles for all samples and will coordinate with the COE-designated QA laboratory to ensure that it will be able to process the QA samples within the specified maximum sample holding times. ITAS will furnish precleaned bottles and other necessary supplies for all samples.

3.1.1 Soil Samples for Geotechnical Analysis

Six soil samples from each of the six monitoring well borings will be selected for laboratory physical tests. The laboratory physical tests will include

Table 3-1.
Geotechnical (Engineering Properties) Samples
Former Plum Brook Ordnance Works
Sandusky, Ohio

Monitoring Well Number	Soil Sample Designation	Volume of each Sample	Approximate Sample Depth Below Ground Level (ft)
MW-01	MWB-01-G2	1 liter	2-4
MW-01	MWB-01-G4	1 liter	4-6
MW-01	MWB-01-G6	1 liter	6-8
MW-01	MWB-01-G8	1 liter	8-10
MW-01	MWB-01-G10	1 liter	10-12
MW-01	MWB-01-G15	1 liter	15-17
MW-01	MWB-01-G20	1 liter	20-22
MW-01	MWB-01-G25	1 liter	25-27
MW-01	MWB-01-G30	1 liter	30-32
MW-02	MWB-02-G2	1 liter	2-4
MW-02	MWB-02-G4	1 liter	4-6
MW-02	MWB-02-G6	1 liter	6-8
MW-02	MWB-02-G8	1 liter	8-10
MW-02	MWB-02-G10	1 liter	10-12
MW-02	MWB-02-G15	1 liter	15-17
MW-02	MWB-02-G20	1 liter	20-22
MW-02	MWB-02-G25	1 liter	25-27
MW-02	MWB-02-G30	1 liter	30-32
MW-03	MWB-03-G2	1 liter	2-4
MW-03	MWB-03-G4	1 liter	4-6
MW-03	MWB-03-G6	1 liter	6-8
MW-03	MWB-03-G8	1 liter	8-10
MW-03	MWB-03-G10	1 liter	10-12
MW-03	MWB-03-G15	1 liter	15-17
MW-03	MWB-03-G20	1 liter	20-22
MW-03	MWB-03-G25	1 liter	25-27
MW-03	MWB-03-G30	1 liter	30-32
MW-04	MWB-04-G2	1 liter	2-4
MW-04	MWB-04-G4	1 liter	4-6
MW-04	MWB-04-G6	1 liter	6-8
MW-04	MWB-04-G8	1 liter	8-10
MW-04	MWB-04-G10	1 liter	10-12
MW-04	MWB-04-G15	1 liter	15-17
MW-04	MWB-04-G20	1 liter	20-22
MW-04	MWB-04-G25	1 liter	25-27
MW-04	MWB-04-G30	1 liter	30-32
MW-05	MWB-05-G2	1 liter	2-4
MW-05	MWB-05-G4	1 liter	4-6
MW-05	MWB-05-G6	1 liter	6-8
MW-05	MWB-05-G8	1 liter	8-10
MW-05	MWB-05-G10	1 liter	10-12
MW-05	MWB-05-G15	1 liter	15-17
MW-05	MWB-05-G20	1 liter	20-22
MW-05	MWB-05-G25	1 liter	25-27
MW-05	MWB-05-G30	1 liter	30-32

Table 3-1 (continued).
Geotechnical (Engineering Properties) Samples
Former Plum Brook Ordnance Works
Sandusky, Ohio

Monitoring Well Number	Soil Sample Designation	Volume of each Sample	Approximate Sample Depth Below Ground Level (ft)
MW-06	MWB-06-G2	1 liter	2-4
MW-06	MWB-06-G4	1 liter	4-6
MW-06	MWB-06-G6	1 liter	6-8
MW-06	MWB-06-G8	1 liter	8-10
MW-06	MWB-06-G10	1 liter	10-12
MW-06	MWB-06-G15	1 liter	15-17
MW-06	MWB-06-G20	1 liter	20-22
MW-06	MWB-06-G25	1 liter	25-27
MW-06	MWB-06-G30	1 liter	30-32

Note 1: Final sample depth to be determined in the field

Note 2: Samples to be collected during construction of each specific monitoring well

Note 3: Samples to be shipped to IT's Pittsburg laboratory for analysis of particle-size distribution, Atterburg limits, limits and moisture content (ASTM D421/422; ASTM D4318; ASTM D2216).

Note 4: Each test listed in Note 3 will be performed twice for each specific monitoring well. Six samples from each well will be selected for analyses.

Note 5: Shipping address for IT's Laboratory for geotechnical testing

IT Corporation
5103 Old William Penn Highway
Export, Pennsylvania 15632
Attn: Barbara Hall
Phone (412) 731-8806

Table 3-2. Samples To Be Collected and Analyzed for Chemical Contaminants

Types of Samples	Field Samples To Be Collected and Analyzed by IT	Control Samples To Be Analyzed by IT	Control Samples To Be Analyzed by QA Laboratory
Soils			
Samples	18	--	--
Splits/duplicates	--	2	2
Rinsates	--	1	1
Travel blanks[a]	--	1	1
Clean background	--	1	1
Matrix spike[b]	--	2	--
Ground water			
Samples	6	--	--
Splits/duplicates	--	1	1
Rinsates	--	1	1
Travel blanks[a]	--	1	1
Matrix spike[b]	--	2	--
Surface water			
Samples	4	--	--
Travel blanks	--	1	1
Splits/duplicates	--	1	1
Matrix spike	--	2	--
Totals	28	16	10

[a]Samples for volatile organic analyses only.
[b]To be performed by laboratory.

Note: Shipping address for IT Laboratory for chemical analyses:

IT Analytical Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
Attn: Robyn Wagner/Beth Monroe
Phone: (615) 588-6401

Shipping address for QA Laboratory for chemical analyses of field duplicates:

U.S. Army Engineer Division, Missouri River
420 South 18th Street
Omaha, Nebraska 68102
Attn: Laboratory (Joseph Solsky)
Phone: (402) 221-3211

Table 3-3. Required Analyses and Approved Methods

Analysis	Analytical Methods		
	Soil Samples	Ground Water Samples	Surface Water Samples
Purgeables (volatile organics)	CLP[a]	CLP	CLP
Base/neutral and acid extractables	CLP	CLP	CLP
Total metals[b] (Ag, Ba, Cd, Cr, Pb Fe, Mn, Na)	EPA 3050/6010	EPA 3005/6010	EPA 200.7
As	EPA 3020/7060	EPA 3020/7060	EPA 206.2
Se	EPA 3020/7740	EPA 3020/7740	EPA 270.2
Hg	EPA 7471	EPA 7470	EPA 245.1/245.2
Total sulfates	EPA 9035	EPA 9035	EPA 375.3
ph	EPA 9045	EPA 9040	EPA 150.1
Nitrates	EPA 9200	EPA 9200	EPA 353.3
Explosives[c]	THAMA[d] 8H	THAMA 8G	THAMA 8G

[a]Contract Laboratory Program.
[b]Fe, Mn, and Na for ground water and surface water samples only.
[c]Mono-, di-, tri-nitro benzenes and toluenes.
[d]U.S. Army Toxic and Hazardous Materials Agency.

Table 3-4. Quality Assurance/Quality Control Samples: Analyses and Analytical Methods

Quality Assurance/ Quality Control Samples	Analyses	Analytical Methods
Soil rinsate (sampling) blanks	Same as ground water samples	Same as ground water samples
Ground water rinsate (sampling blanks)	Same as ground water samples	Same as ground water samples
Travel blanks	Volatile organics	Same as respective field sample[a]
Soil matrix spike (laboratory)	Same as soil samples	Same as soil samples
Surface water matrix spike (laboratory)	Same as surface water sample	Same as surface water sample
Ground water matrix spike (laboratory)	Same as ground water samples	Same as ground water samples
Ground water split sample	Same as ground water samples	Same as ground water samples
Surface water split sample	Same as surface water sample	Same as surface water sample
Soil split sample	Same as soil samples	Same as soil samples
Background sample	Same as soil samples	Same as soil samples

[a]Respective field sample: ground water or surface water.

Table 3-5. Summation of Chemical Analyses, Samples to be Collected, Analytical Methods
Sampling Volume and Preservation Requirements
for IT Laboratory

GROUND WATER

Sample Number	Volatiles	B/N&A Extractables	Total Metals	Arsenic	Selenium	Mercury	Total Sulfates	Nitrates	pH	Explosives
MW-01	1	1	1	1	1	1	1	1	1	1
MW-02	1	1	1	1	1	1	1	1	1	1
MW-03	1	1	1	1	1	1	1	1	1	1
MW-04	1	1	1	1	1	1	1	1	1	1
MW-05	1	1	1	1	1	1	1	1	1	1
MW-06	1	1	1	1	1	1	1	1	1	1
Matrix Spike 1	1	1	0	0	0	0	0	0	0	0
Matrix Spike 2	1	1	0	0	0	0	0	0	0	0
Travel Blank	1	0	0	0	0	0	0	0	0	0
Split,Duplicate (MW-02)	1	1	1	1	1	1	1	1	1	1
Rinsate	1	1	1	1	1	1	1	1	1	1
TOTAL SAMPLES	11	10	8	8	8	8	8	8	8	8
Analytical Method	CLP	CLP	EPA 3005/ 6010	EPA 3020/ 7060	EPA 3020/ 7740	EPA 7470	EPA 9035	EPA 9200	EPA 9040	THAMA 86 or 80
Container	Clear Glass Teflon-lined septum	Amber Glass Teflon-lined cap	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Amber Glass
Volume Req'd (ml)	2@ 40 ml ea	1@ 1000 ml	**********	1 @ 1000 ml		**********	1@ 1000 ml	1@ 1000 ml	measured in field	1@ 1000 ml
Preservation	Cool 4 C, HCl to pH 2	Cool 4 C, none req'd	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO to pH<2	Cool 4 C, none req'd	Cool 4 C, H2SO4 to pH<2	performed immediately	Cool 4 C, none req'd

NOTE: Shipping address for IT Laboratory for chemical analyses:

IT Analytical Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
Attn: Robyn Wagner
Phone: (615) 588-6401

Table 3-5 (cont.). Summation of Chemical Analyses, Samples to be Collected, Analytical Methods
Sampling Volume and Preservation Requirements
for QA Laboratory

GROUND WATER

Sample Number	Volatiles	B/NA Extractables	Total Metals	Arsenic	Selenium	Mercury	Total Sulfates	Nitrates	pH	Explosives
Travel Blank	1	0	0	0	0	0	0	0	0	0
Split,Duplicate (MW-02)	1	1	1	1	1	1	1	1	1	1
Rinsate	1	1	1	1	1	1	1	1	1	1
TOTAL SAMPLES	3	2	2	2	2	2	2	2	2	2
Analytical Method	CLP	CLP	EPA 3005/ 6010	EPA 3020/ 7060	EPA 3020/ 7740	EPA 7470	EPA 9035	EPA 9200	EPA 9040	THAMA 86 or 80
Container	Clear Glass Teflon-lined septum	Amber Glass Teflon-lined cap	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Amber Glass
Volume Req'd (ml)	2@ 40 ml ea	2@ 1000 ml	**********	1 @ 1000 ml	**********		1@ 1000 ml	1@ 1000 ml	measured in field	2@ 1000 ml
Preservation	Cool 4 C, HCl to pH 2	Cool 4 C, none req'd	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO to pH<2	Cool 4 C, none req'd	Cool 4 C, H2SO4 to pH<2	performed immediately	Cool 4 C, none req'd

NOTE: Shipping address for QA Laboratory for chemical analyses:

U.S. Army Engineer Division, Missouri River
Attn: Laboratory (Joseph Solsky)
420 South 18th Street
Omaha, Nebraska 68102
Phone: (402) 444-4304

Table 3-5 (cont.). Summation of Chemical Analyses, Samples to be Collected, Analytical Methods
Sampling Volume and Preservation Requirements
for IT Laboratory

S U R F A C E W A T E R

Sample Number	Volatiles	B/NA Extractables	Total Metals	Arsenic	Selenium	Mercury	Total Sulfates	Nitrates	pH	Explosives
SW-01	1	1	1	1	1	1	1	1	1	1
SW-02	1	1	1	1	1	1	1	1	1	1
SW-03	1	1	1	1	1	1	1	1	1	1
SW-04	1	1	1	1	1	1	1	1	1	1
Matrix Spike 1	1	1	0	0	0	0	0	0	0	0
Matrix Spike 2	1	1	0	0	0	0	0	0	0	0
Travel Blank	1	0	0	0	0	0	0	0	0	0
Split, Duplicate	1	1	1	1	1	1	1	1	1	1
TOTAL SAMPLES	8	7	5	5	5	5	5	5	5	5
Analytical Method	CLP	CLP	EPA 200.7	EPA 206.2	EPA 270.2	EPA 245.1/ 245.2	EPA 375.3	EPA 353.3	EPA 150.1	THAMA 86 or 80
Container	Clear Glass Teflon-lined septum	Amber Glass Teflon-lined cap	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Amber Glass
Volume Req'd (ml)	2@ 40 ml ea	1@ 1000 ml	**********	1 @ 1000 ml	**********		1@ 1000 ml	1@ 1000 ml	measured in field	1@ 1000 ml
Preservation	Cool 4 C, HCl to pH 2	Cool 4 C, none req'd	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO to pH<2	Cool 4 C, none req'd	Cool 4 C, H2SO4 to pH<2	performed immediately	Cool 4 C, none req'd

NOTE: Shipping address for IT Laboratory for chemical analyses:

IT Analytical Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
Attn: Robyn Wagner
Phone: (615) 588-6401

Table 3-5 (cont.). Summation of Chemical Analyses, Samples to be Collected, Analytical Methods
Sampling Volume and Preservation Requirements
for QA Laboratory

SURFACE WATER

Sample Number	Volatiles	B/N&A Extractables	Total Metals	Arsenic	Selenium	Mercury	Total Sulfates	Nitrates	pH	Explosives
Travel Blank	1	0	0	0	0	0	0	0	0	0
Split,Duplicate	1	1	1	1	1	1	1	1	1	1
TOTAL SAMPLES	2	2	2	2	2	2	2	2	2	2
Analytical Method	CLP	CLP	EPA 200.7	EPA 206.2	EPA 270.2	EPA 245.1/ 245.2	EPA 375.3	EPA 353.3	EPA 150.1	THAMA 86 or 80
Container	Clear Glass Teflon-lined septum	Amber Glass Teflon-lined cap	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Amber Glass
Volume Req'd (ml)	2@ 40 ml ea	2@ 1000 ml	**********	1 @ 1000 ml	**********		1@ 1000 ml	1@ 1000 ml	measured in field	2@ 1000 ml
Preservation	Cool 4 C, HCl to pH 2	Cool 4 C, none req'd	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO to pH<2	Cool 4 C, none req'd	Cool 4 C, H2SO4 to pH<2	performed immediately	Cool 4 C, none req'd

NOTE: Shipping address for QA Laboratory for chemical analyses:

U.S. Army Engineer Division, Missouri River
Attn: Laboratory (Joseph Solsky)
420 South 18th Street
Omaha, Nebraska 68102
Phone: (402) 444-4304

Table 3-5 (cont.). Summation of Chemical Analyses, Samples to be Collected, Analytical Methods
Sampling Volume and Preservation Requirements
for QA Laboratory

SOIL SAMPLES

Sample Number	Volatiles	B/N&A Extractables	Total Metals	Arsenic	Selenium	Mercury	Total Sulfates	Nitrates	pH	Explosives
SB-01	1	1	1	1	1	1	1	1	1	1
SB-02	1	1	1	1	1	1	1	1	1	1
SB-03	1	1	1	1	1	1	1	1	1	1
SB-04	1	1	1	1	1	1	1	1	1	1
SB-05	1	1	1	1	1	1	1	1	1	1
SB-06	1	1	1	1	1	1	1	1	1	1
SB-07	1	1	1	1	1	1	1	1	1	1
SB-08	1	1	1	1	1	1	1	1	1	1
SB-09	1	1	1	1	1	1	1	1	1	1
SB-10	1	1	1	1	1	1	1	1	1	1
SB-11	1	1	1	1	1	1	1	1	1	1
SB-12	1	1	1	1	1	1	1	1	1	1
SB-13	1	1	1	1	1	1	1	1	1	1
SB-14	1	1	1	1	1	1	1	1	1	1
SB-15	1	1	1	1	1	1	1	1	1	1
SB-16	1	1	1	1	1	1	1	1	1	1
SB-17	1	1	1	1	1	1	1	1	1	1
SB-18	1	1	1	1	1	1	1	1	1	1
Clean Background (SB-19)	1	1	1	1	1	1	1	1	1	1
Matrix Spike 1	1	1	0	0	0	0	0	0	0	0
Matrix Spike 2	1	1	0	0	0	0	0	0	0	0
Travel Blank	1	0	0	0	0	0	0	0	0	0
Split, Duplicate	1	1	1	1	1	1	1	1	1	1
Split, Duplicate	1	1	1	1	1	1	1	1	1	1
Rinsate	1	1	1	1	1	1	1	1	1	1
TOTAL SAMPLES	25	24	22	22	22	22	22	22	22	22
Analytical Method	CLP	CLP	EPA 3050/ 6010	EPA 3020 7060	EPA 3020 7740	EPA 7470	EPA 9035	EPA 9200	EPA 9040	THAMA 7N or 8H
Soil Sample	(see rinsate)	**********			Amber or clear glass, teflon-lined cap					**********
Rinsate Sample	Clear Glass Teflon-lined septum	Amber Glass Teflon-lined cap	Polyethylen	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Amber Glass
Volume Req'd (ml)										
Soil Sample	120 ml	**********	**********	**********	**********	2 @ 250 ml	**********	**********	**********	**********
Rinsate Sample	2@ 40 ml ea	2@ 1000 ml	**********	**********	1 @ 1000 ml	**********	1@ 1000 ml	1@ 1000 ml	field measured	2@ 1000 ml
Preservation										
Soil Sample	Refrigerate	**********	**********	**********	**********	**********	**********	**********	**********	**********
Rinsate Sample	Cool 4 C, HCl to pH 2	Cool 4 C, none req'd	Cool 4 C, HNO3 to pH<	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO to pH<2	Cool 4 C, none req'd	Cool 4 C, H2SO4 to pH<2	performed immediately	Cool 4 C, none req'd

NOTE: Shipping address for IT Laboratory for chemical analyses:

IT Analytical Services
5815 Middlebrook Pike
Knoxville, Tennessee 37921
Attn: Robyn Wagner
Phone: (615) 588-6401

Table 3-5 (cont.). Summation of Chemical Analyses, Samples to be Collected, Analytical Methods
Sampling Volume and Preservation Requirements
for QA Laboratory

SOIL SAMPLES

Sample Number	Volatiles	B/N&A Extractables	Total Metals	Arsenic	Selenium	Mercury	Total Sulfates	Nitrates	pH	Explosives
Clean Background (SB-19)	1	1	1	1	1	1	1	1	1	1
Travel Blank	1	0	0	0	0	0	0	0	0	0
Split, Duplicate	1	1	1	1	1	1	1	1	1	1
Split, Duplicate	1	1	1	1	1	1	1	1	1	1
Rinsate	1	1	1	1	1	1	1	1	1	1
TOTAL SAMPLES	5	4	4	4	4	4	4	4	4	4
Analytical Method	CLP	CLP	EPA 3050/ 6010	EPA 3020 7060	EPA 3020 7740	EPA 7470	EPA 9035	EPA 9200	EPA 9040	THAMA 7N or 8H
Soil Sample	(see rinsate)	**********			Amber or clear glass, teflon-lined cap				**********	
Rinsate Sample	Clear Glass Teflon-lined septum	Amber Glass Teflon-lined cap	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Polyethylene	Amber Glass
Volume Req'd (ml)										
Soil Sample	120 ml	**********	**********	**********	**********	2 @ 250 ml	**********	**********	**********	**********
Rinsate Sample	2@ 40 ml ea	2@ 1000 ml	**********	**********	1 @ 1000 ml	**********	1@ 1000 ml	1@ 1000 ml	field measured	1@ 1000 ml
Preservation										
Soil Sample	Refrigerate	**********	**********	**********	**********	**********	**********	**********	**********	**********
Rinsate Sample	Cool 4 C, HCl to pH 2	Cool 4 C, none req'd	Cool 4 C, HNO3 to pH<	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO3 to pH<2	Cool 4 C, HNO to pH<2	Cool 4 C, none req'd	Cool 4 C, H2SO4 to pH<2	performed immediately	Cool 4 C, none req'd

NOTE: Shipping address for QA Laboratory for chemical analyses:

U.S. Army Engineer Division, Missouri River
Attn: Laboratory (Joseph Solsky)
420 South 18th Street
Omaha, Nebraska 68102
Phone: (402) 444-4304

grain-size distribution, Atterburg limits, and moisture content. This sampled material is only intended for soil classification purposes, not for chemical analysis. The Field Geologist will select six soil samples from each boring for testing after reviewing the materials that have been logged. The samples will be selected to be representative for samples taken continuously for the first 10 feet and at 5-foot intervals or stratum changes thereafter.

3.1.2 Ground Water Samples

IT will collect and analyze ground water samples from each of the six wells. Wells will be purged and samples will be obtained, prepared, and shipped for laboratory analysis in accordance with procedures detailed in Section 3.3.2 and Section 4.0 of this plan. From one of the ground water monitoring wells, the volume of water collected shall be enough for three samples (field triplicate). One of these samples will be placed in a container and submitted to the QA laboratory. The other two will be separately identified and sent to IT's laboratory as field duplicates. The total number of samples to be collected and analyzed, including control samples, is listed in Table 3-2.

Field Control Samples - Ground Water

Field control ground water samples will include travel blanks, sampling (rinsate) blanks, and split (field) replicate samples, which are described in the following subsections. These terms are defined for this project on Page C-v of this plan.

Travel Blanks

One travel blank will be prepared and sent from the IT laboratory with the sample containers, handled like a sample collected at the site, and shipped back with the field samples to the IT laboratory. If the sampling sequence is such that more than one cooler containing ground water samples designated for analysis of volatile organics is required, one travel blank will be shipped with each cooler. A travel blank will also be sent to the COE-designated QA laboratory with the ground water split sample. Travel blanks will not be opened at the site.

Sampling (Rinsate) Blanks

One sampling (rinsate) blank will be collected and prepared in the field during sampling activities. Reagent water, which is passed through the Teflon™ bailer, will be collected for the sampling blank. The ground water sampling blank will be of sufficient volume that it can be split into two samples. One sample part will be shipped to the COE-designated QA laboratory; the other will be prepared and shipped to the IT laboratory for analysis.

Split (Field) Samples

Well MW-02 is proposed to be used for field split sampling, provided that the well yields sufficient sample volume that it can be split into three samples. Water collected from this well will be sufficient to make three split samples. One of the two will be prepared and shipped to the COE-designated QA laboratory; the other two will be sent to the IT laboratory as field duplicates.

3.1.3 Soil Samples for Chemical Analysis

IT will collect discrete soil samples from 18 investigation site locations and from 1 background location within the former Plum Brook Ordnance Works. Soil samples will be obtained at each location from a depth of approximately 2 feet. Specific locations for soil sampling are addressed in Section 3.2 of this plan. All details of sampling will conform to this S/A-QA/QC Plan and applicable EPA requirements and guidelines. Refer to Section 4.0 for details of sample volumes, composition and size of containers, methods of preservation, identification and labeling, and packing, transportation, and shipment.

Field Control Samples - Soil

Field control soil samples will include split (field) samples, travel blanks, sampling (rinsate) blanks, and one background sample. These samples are discussed in the following paragraphs.

Split (Field) Samples

Two split (field) samples will be collected from locations (borehole) to be determined in the field. From each of the soil sampling points selected for split samples, sufficient soil will be collected and composited for three

sample sets. The soil from this location will be placed in a clean stainless steel pan, mixed thoroughly, and divided (using a stainless steel spoon) among three sets of sample containers. Each sample set will be preserved as required for analysis. Three samples for volatile organic analysis (VOA) will be collected at or near the bottom of the selected boring and will not be mixed. One sample set from each borehole will be sent to the COE-designated QA laboratory; the other two sample sets will be sent to the IT laboratory for analysis. Analytical requirements are listed in Tables 3-3 and 3-4.

Travel Blanks

Travel blanks for VOA will be sent from the IT laboratory with the sample containers, handled like a sample collected at the site, and shipped to the laboratory with the soil samples collected for VOA. One travel blank will be included for VOA samples sent to the COE-designated QA laboratory; the other will be sent with the corresponding shipment to the IT laboratory. A travel blank will be included in each cooler containing soil samples designated for VOA. No other travel blanks will be sent with soil samples. Travel blanks will not be opened at the site.

Sampling (Rinsate) Blanks

One rinsate blank will be collected and prepared during soil sampling activities. Reagent water, which is passed through the decontaminated split spoon sampler or hand auger sampler, will be collected for the sampling blank. The sampling blank will be of sufficient volume that it can be split into two samples. One blank will be sent to the COE-designated QA laboratory; the other will be sent to the IT laboratory.

Background Soil Samples

A background soil sample shall be collected upgradient from the investigated sites which represents uncontaminated soil similar to that secured in the field samples. Sufficient soil shall be collected so that the sample can be split into two samples. One sample will be sent to the QA laboratory. The additional background sample will be analyzed by the IT laboratory.

3.1.4 Surface Water Samples

A representative surface water sample will be collected from each of the four streams that drain the site.

Preparation

Sufficient sample containers will be on hand for surface water samples. Sample collection equipment will be decontaminated between sampling locations, or dedicated collection equipment for a single sample will be used.

Field Control Samples - Surface Water

Travel blanks

A travel blank will be included with the shipment to the COE-designated QA laboratory and the IT laboratory. This travel blank is included with each cooler containing volatile samples. The travel blank will not be opened at the site.

Sampling (Rinsate) Blanks

Dedicated sampling equipment will be used for each surface water sample; therefore, a rinsate sample will not be collected during surface water sampling.

Split (Field) Replicate Samples

The volume of surface water collected from one of the drainage streams will be enough for three samples. One sample will be submitted to the COE-designated QA laboratory. The other two will be separately identified and sent to IT's laboratory as field duplicates.

3.1.5 Summary - Types and Numbers of Samples

The types and numbers of ground water, surface water, and soil samples to be collected are summarized in Tables 3-1 and 3-2; analyses are specified in Tables 3-3 and 3-4.

3.2 SELECTION OF SAMPLING LOCATIONS

The approximate sampling locations (monitoring wells, boreholes, and surface water samples) for this project were selected after reviewing existing records concerning the site and after the visual site inspection. The proposed loca-

tions were refined by IT after a review of available site information and after a visit to the site. Sampling locations will be finalized in the field based on the judgment of the sampling team leader.

3.2.1 Soil Sampling Locations

Soil Samples for Geotechnical (Engineering Properties) Analyses

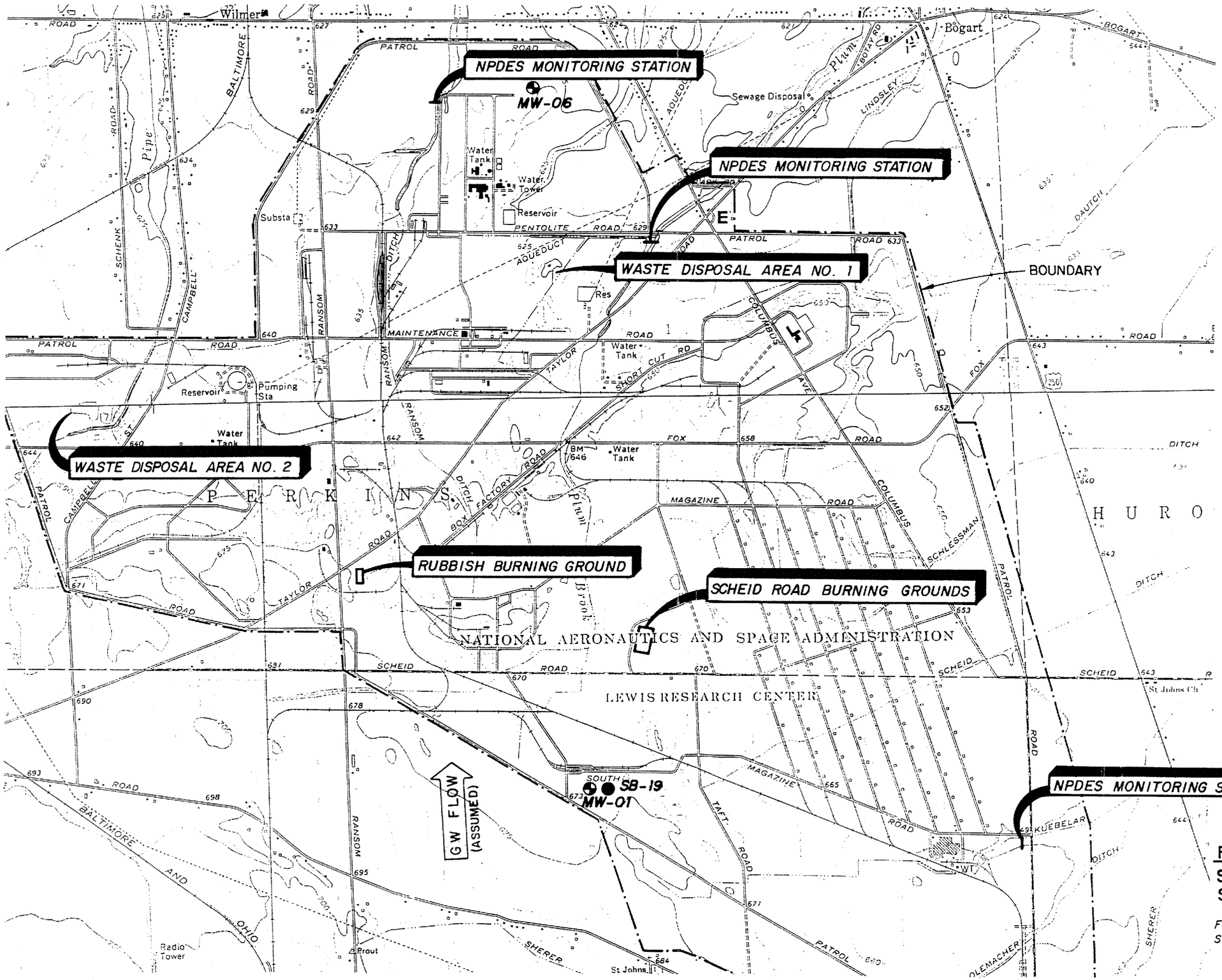
Soil samples will be collected for geotechnical testing during construction of the ground water monitoring wells. These locations are shown in Figure 3-1, are described in Section 3.2.2 of this plan, and are found in the Monitoring Well Installation Plan (MWIP), Appendix B to the Work Plan. Samples will be taken from each well boring, as described in Table 3-1, for analyses specified in Section 5.0 of this plan. Samples will be selected for testing following the Field Geologist's review of materials that have been logged. Samples for particle size analysis will be collected for the depth at which the well screen will be placed.

Soil Samples for Chemical Analyses

Nineteen shallow (4 feet) soil borings will be installed for sample collection for chemical analysis at various locations on the Plum Brook Ordnance Works site as shown in Figures 3-1, 3-2, 3-3, 3-4, and 3-5. One boring will be installed to assess background soil conditions (SB-19), and 18 borings (SB-01 through SB-18) will be installed to determine the presence or absence of soil contamination resulting from past activities at the four targeted areas on the site. Preliminary locations of the borings were selected based on historic data from the literature review.

Boring SB-19 will be located near the southern property boundary in an area that has not been affected by known or suspected potentially hazardous wastes or substances (Figure 3-1). Results from analyses of samples collected from this boring will be used as a standard against which results from other borings will be compared to determine the impact that each targeted site has had on local soil conditions.

Borings SB-01 and SB-02 will be located on opposite ends of the preexisting rubbish burning ground (Figure 3-2). Borings SB-03, -04, -05, and -06 will be



LEGEND

- MONITORING WELL
- SOIL BORING

SOURCE: USGS SANDUSKY QUADRANGLE OHIO 7.5 MINUTE SERIES (TOPOGRAPHIC) REVISED 1979

USGS KIMBALL QUADRANGLE OHIO 7.5 MINUTE SERIES (TOPOGRAPHIC) 1969

FIGURE 3-1

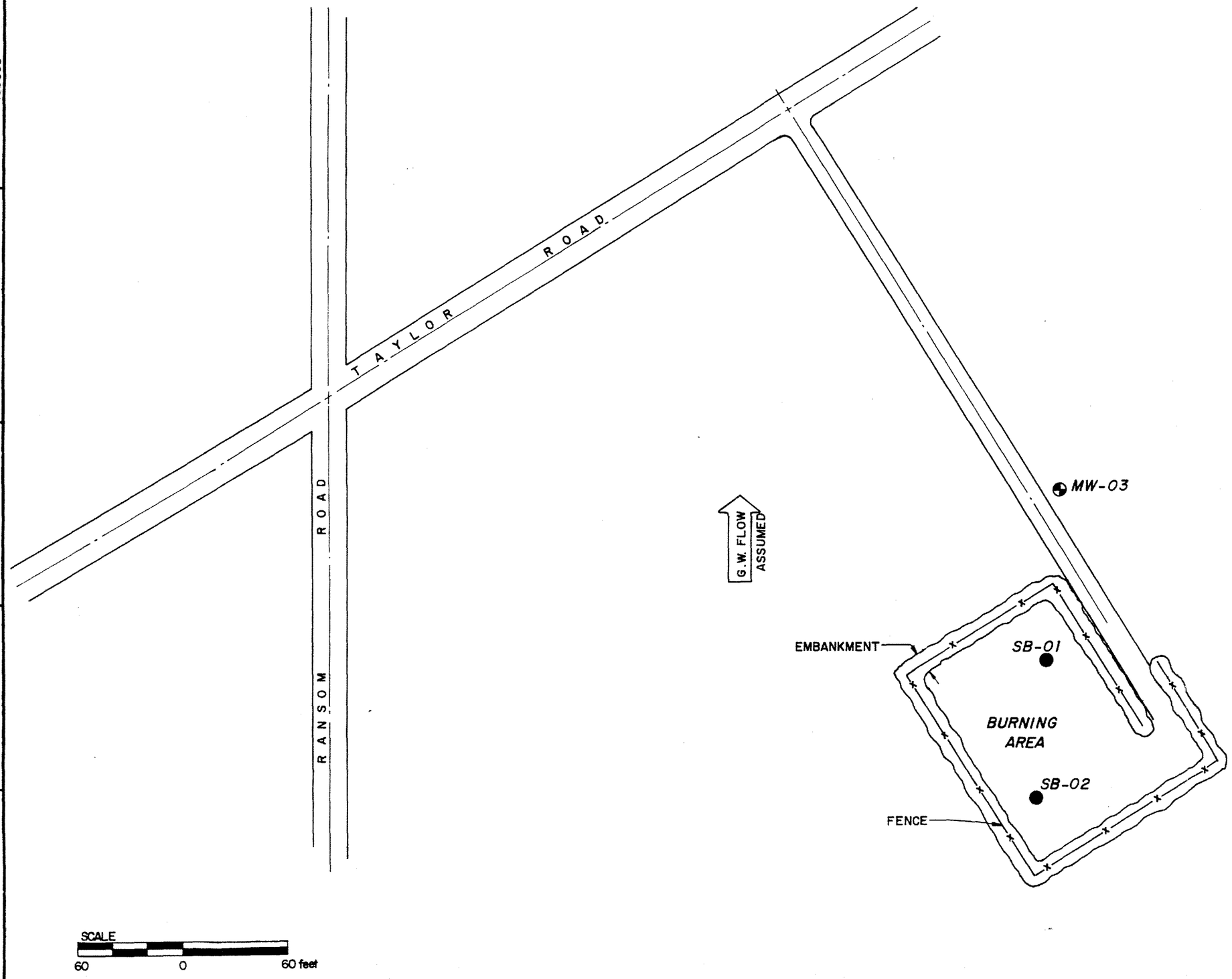
SITE PLAN AND SAMPLING LOCATIONS

FORMER PLUM BROOK ORDNANCE WORKS SANDUSKY, OHIO

INTERNATIONAL TECHNOLOGY CORPORATION

DRAWING NO.: 409658-B-MW01	INITIATOR: D. BURTON
PROJECT NO.: 409658	PROJ. MGR.: D. BURTON
DATE LAST REV.:	STARTING DATE: 4-26-89
DRAWN BY:	DRAWN BY: S. MOORE

BRUNING 72425



LEGEND

- MONITORING WELL
- SOIL BORING

FIGURE 3-2

RUBBISH BURNING GROUND AT TAYLOR AND RANSOM ROADS PROPOSED SAMPLING LOCATIONS

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 4-26-89	DATE LAST REV.:
DRAWN BY: S. MOORE	DRAWN BY:
INITIATOR: D. BURTON	DRAWING NO.: 409658-B-MW02
PROJ. MGR.: D. BURTON	PROJECT NO.: 409658

BRUNING 72425

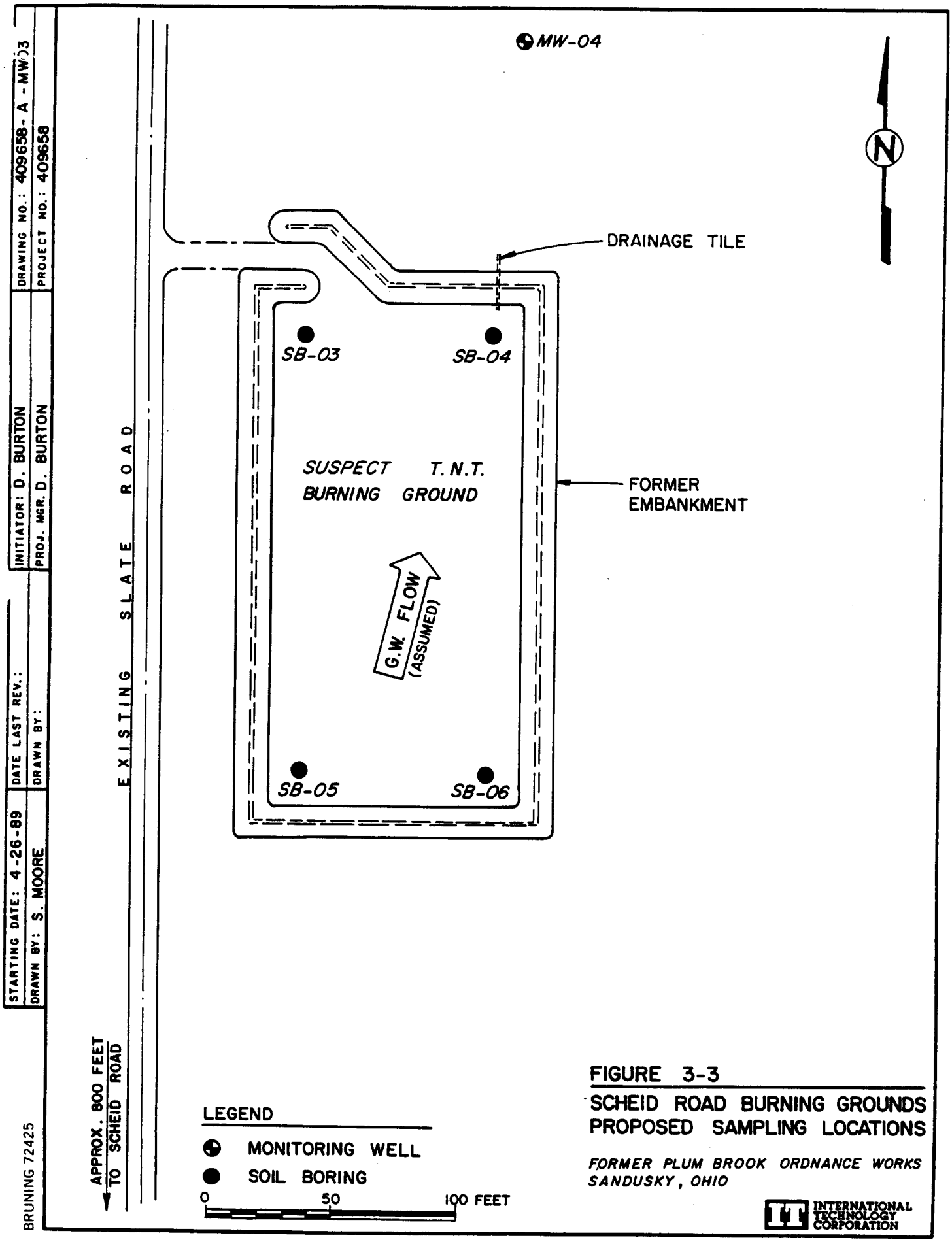
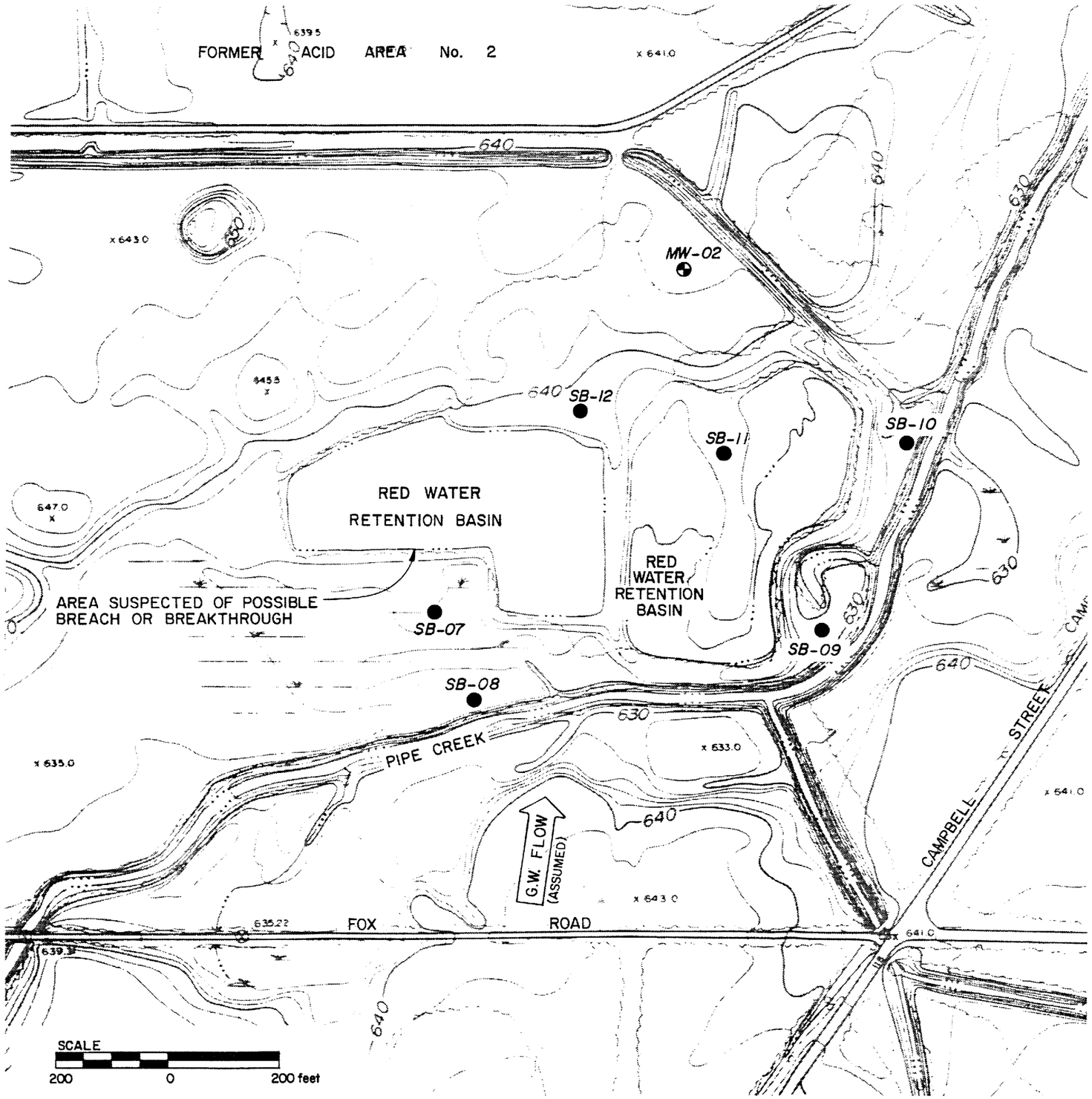


FIGURE 3-3

SCHEID ROAD BURNING GROUNDS
PROPOSED SAMPLING LOCATIONS

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO



LEGEND

- MONITORING WELL
- SOIL BORING
- SURFACE WATER

FIGURE 3-4

WASTE DISPOSAL AREA No. 2
PROPOSED SAMPLING LOCATIONS

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

INTERNATIONAL TECHNOLOGY CORPORATION

INITIATOR: D. BURTON	DRAWING NO.: 409658 - B - MW-04
PROJ. MGR.: D. BURTON	PROJECT NO.: 409658
STARTING DATE: 4-27-89	DATE LAST REV.:
DRAWN BY: S. MOORE	DRAWN BY:

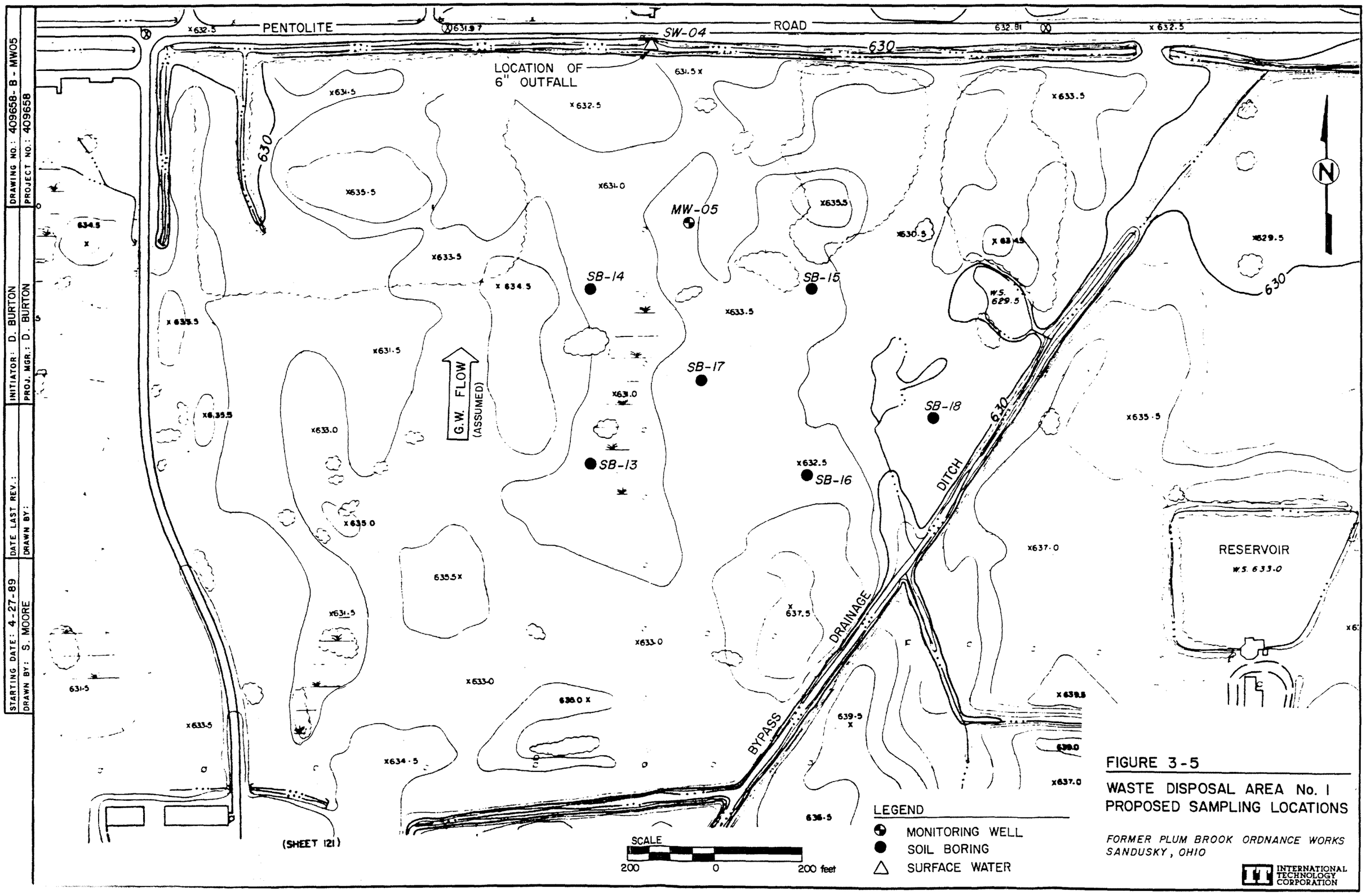


FIGURE 3-5

WASTE DISPOSAL AREA No. I
PROPOSED SAMPLING LOCATIONS

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

INTERNATIONAL TECHNOLOGY CORPORATION

located on a grid pattern in the approximate area of the preexisting TNT burning ground as determined during the records search (Figure 3-3). Borings SB-07, -08, -09, -10, -11, and -12 will be located in the immediate vicinity of Waste Disposal Area No. 2 (Figure 3-4). Borings will be located in topographically low areas and in areas where wastewater may have escaped confinement through breaches in the berm. Borings S-13, -14, -15, -16, -17, and -18 will be located in the immediate vicinity of Waste Disposal Area No. 1 (Figure 3-5). Preliminary locations of the borings were selected based on the approximate location of the red water retention basins at the site as determined by an examination of historic maps of the area. Boring SB-18 will be installed to the east of the approximate location of the preexisting water retention basin in the area suspected to have been affected by leakage or seepage detected in 1978.

3.2.2 Ground Water Sampling Locations

Six shallow ground water monitoring wells will be installed at the Plum Brook Ordnance Works site as specified by the SOW. The approximate sampling locations of monitoring wells for this project (Figure 3-1) were selected after reviewing existing records concerning the site and after visual site inspections. Five of the wells (MW-02 through MW-06) will be located downgradient from various sites at the facility to intercept possible contamination of ground water that may be polluted with residual chemicals or breakdown products emitting from point sources. Monitoring well MW-01 will be positioned upgradient of all known or suspected on-site contaminant sources and will be used to evaluate the quality of ground water as it enters the site.

Monitoring wells MW-05 and MW-02 will be located downgradient from the red water retention basins (Waste Disposal Area No. 1 and Waste Disposal Area No. 2, respectively). The wells are positioned so that potential ground water contamination resulting from wastewater from trinitrotoluene (TNT) production operations will be intercepted. Monitoring wells MW-03 and MW-04 will be located downgradient from the former rubbish burning pit and TNT burning grounds, respectively. The approximate locations of these disposal sites were established during the previously performed records search. Monitoring well MW-06 is to be located at the northern (downgradient) boundary of the site. The well is positioned so that the quality of ground water can be assessed as

it exits the site. This will allow detection of potential ground water contamination resulting from activities not specifically related to the six targeted sites. In particular, the likelihood of intercepting potential contamination from underground drain lines connecting ordnance manufacturing operations and waste disposal areas will be increased by the positioning of monitoring well MW-06.

3.2.3 Surface Water Sampling Locations

One surface water sample is to be collected from each of the four streams that drain the property.

3.3 SAMPLE COLLECTION METHODS

Sampling procedures follow EPA guidelines. Details of sampling procedures to be included in this plan will include types of information listed in the sampling section of Appendix A of ER 1110-1-263, Methods of Sampling (random, composite, grab, sampling grids, etc.). Sample handling procedures will be consistent with COE's Sample Handling Protocol 10/86 (or DERP Sample Handling Protocol 2/87 if applicable) or with requirements of EPA methods. QA samples will be handled in accordance with COE's Sample Handling Protocol for Low, Medium, and High Concentration Samples of Hazardous Waste, dated October 1986.

3.3.1 Soil Samples

Soil samples will be collected by a hollow stem auger and split spoon sampler or by a hand auger using the decontamination procedure described in the MWIP for monitoring well installation. All soil sampling and mixing equipment will be constructed of stainless steel. Sample collection methods will be in accordance with American Society for Testing and Materials (ASTM) D1586-84, "Penetration Test and Split-Barrel Sampling of Soils," or an equivalent method for hand augers.

Soil Samples for Geotechnical (Engineering Properties) Analyses

Monitoring well construction is described in the MWIP (Appendix B). Soil will be sampled in accordance with ASTM D1586-84. Sampling will be continuous for the first 10 feet and at 5-foot intervals thereafter. Samples will be stored

in airtight plastic or glass jars until they are needed for testing or until the project is completed.

After samples are logged and classified, six samples from each well will be selected by the Field Geologist for geotechnical testing. Information on sample selection will be recorded, and the sample will be identified by well number and depth. The selected samples will be packaged and shipped to IT's Pittsburgh, Pennsylvania laboratory for testing.

Soil Samples for Chemical Analyses

Soil samples (except for VOA) from the 19 boreholes (18 plus one background) will be individually composited as determined by the Field Geologist to provide the maximum evidence of soil contamination, based on color, odor, HNu reading, etc. Samples for VOA will be collected at the bottom of the boreholes in all cases, with precautions taken to minimize loss of volatile constituents that could be present.

3.3.2 Ground Water Samples

Before sampling each monitoring well, the water level will be measured and recorded (to the nearest 0.01 foot), and a minimum of five casing volumes of water will be removed from the well. The water in the well will be allowed to recover to 95 percent of its original level before samples are collected. If a well does not recharge fast enough to permit removal of five casing volumes, the well will be pumped/bailed dry and sampled as soon as sufficient recharge has occurred (up to 95 percent of original level).

Ground water samples will be collected using a Teflon bailer. Sample containers will be filled directly from the bailer; required preservatives will have been added to sample bottles before sample collection. Ground water samples for metals analyses will not be filtered in the field. Vials used for volatile organic compound (VOC) samples will be checked to ensure that no air bubbles are present. Sample containers and preservatives and/or preservation methods to be used for each sample are discussed in Section 4.0.

3.3.3 Surface Water Samples

Surface water samples will be collected with a Teflon, glass, or stainless

steel dipper or with other suitable devices. Samples will be collected near the surface at a location selected by the Field Geologist. Sediment will not be disturbed. Samples will not be filtered; sample handling will be as described for ground water samples.

3.4 PREVENTION OF CROSS CONTAMINATION

Before entering the site, the drill rig will have been steam cleaned to remove any surface oil, grease, or other material that has the potential for contaminating the site. Drilling equipment that will be in contact with the soil will be decontaminated before use and between each borehole. Monitoring well screen and casing in contact with ground water will be decontaminated before use. Sampling equipment will be decontaminated before use and between each sample. Each decontamination activity will be recorded in the Field Activity Daily Log form (Figure 3-6).

The decontamination procedures for all equipment used in the field are detailed in the following subsections; these procedures will be used by IT and its subcontractors. Documentation for all cleaning shall be recorded in the Field Activity Daily Log.

3.4.1 Nonsampling Equipment

All drilling equipment, well screen/casing, augers, and other nonsampling equipment shall be decontaminated with high-pressure steam and scrubbed with a laboratory-grade detergent rinsed and, if applicable, covered with plastic sheeting (protected from the elements).

3.4.2 Sampling Equipment

Ground Water Sampling Equipment

Personnel will wear Level D protective clothing while sampling ground water. Sampling will be done by means of a Teflon bailer and new, clean nylon rope. The rope will not be allowed to contact the ground or other objects before or during well bailing or sampling. Plastic sheeting will be placed on the ground around the well in the event that the rope or bailer is dropped. Personnel will not walk on the plastic or place potentially contaminated objects on it.

INTERNATIONAL TECHNOLOGY CORPORATION

Figure 3-6

FIELD ACTIVITY DAILY LOG

DAILY LOG				
	DATE			
	NO.			
	SHEET		OF	

PROJECT NAME	PROJECT NO.
FIELD ACTIVITY SUBJECT:	
DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:	
VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS:	IMPORTANT TELEPHONE CALLS:
IT PERSONNEL ON SITE:	
SUPERVISOR:	DATE:

327-7-86

After sampling, the bailer will be decontaminated for reuse. The following decontamination procedure will be used to decontaminate ground water sampling equipment:

- Detergent wash with water and a nonphosphatic detergent.
- Rinse with distilled water.
- Final rinse with isopropyl alcohol.
- Air dry.

[Note: Because the wells may never be sampled again, dedicated bailers will not be used for the initial round of sampling. If analytical results indicate a need for additional (periodic) sampling, dedicated bailers for each well may be employed beginning with the second round of sampling.]

Used rope, plastic sheeting, tyveks, etc. will be collected at each well and stored with the drill cuttings from that well location. Drill cuttings will be collected individually for each well in 55-gallon drums and stored at the well location. If results of ground water and soil sample analyses indicate that regulated concentrations of hazardous contaminants are present, IT will determine the optimum method for disposal and furnish an estimated cost of disposal to the Contracting Officer. If it is determined that the material is not a regulated waste, IT will dispose of the material at no additional cost to the COE.

Surface Water Sampling Equipment

Dedicated sample collection equipment will be used for collection of each surface water sample, or sampling equipment may be decontaminated and reused at the discretion of the Field Geologist. Decontamination procedures will be the same as for ground water sampling equipment.

3.5 FIELD DOCUMENTATION PROCEDURES

3.5.1 Photographs

Color photographs will be taken of each sampling site to show the surrounding area, drilling and sampling equipment, and sample activities. The picture number and roll number (if more than one roll of film is used) will be logged

on the Field Activity Daily Log form to identify which sampling site is depicted in the photograph. Each film roll will be identified by taking a photograph of an information sign on the first frame. The job and film roll numbers will be written on each sign to identify the pictures contained on the roll, for example:

Plum Brook Ordnance Works
Site Location
Roll Number 1
Frame Number 1 of 36
October 1, 1988 - (photographer's name).

Prints will be identified with the project number, date taken, and a brief description. If video recordings are made, the above information will be recorded at the beginning of each tape, or new location, either orally or written on a board and scanned by the video recorder.

3.5.2 Field Documentation

An integral part of the S/A-QA/QC for the field activities will be maintaining a Field Activity Daily Log form. Information identified on the Field Activity Daily Log will be obtained from site exploration and sampling activities and will be documented by the Field Geologist. Entries will be described at an appropriate level of detail so that the situation can be reconstructed without relying on memory. Field data collection activities will be recorded with indelible ink and bound numerically in a notebook. All log sheets will be kept in the project files in the central files at IT's Knoxville, Tennessee engineering office. Project files will be turned over to COE at the completion of the project contract.

Entries on the logs will contain a variety of information. At the beginning of each day, the date, start time, weather conditions for the past 48 hours, all field personnel present, level of personnel protection being used on site, and the signature of the person making the entry and other details as specified on the Field Activity Daily Log form will be entered. The names of visitors to the site and the purpose of their visit will be recorded. All

entries will be recorded in a bound prenumbered notebook and made in indelible/water-resistant ink; no erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single strike mark.

Measurements made and samples collected will be recorded. Equipment used to make measurements will be identified, along with the date of last calibration. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, and the volume and number of containers in which the sample was placed in the field. Results of any gas or vapor monitoring activities (in addition to those for sample screening) will be recorded. Sample numbers will be assigned in accordance with this plan. Major activities being performed or other items pertinent to the history of the investigation will also be noted.

Information to be recorded in each field log is as follows:

- Project identification
- Field activity subject
- General work activity
- Unusual events
- Visitors on site
- Subcontractor progress or problems
- Communication with the client or others
- Weather conditions
- IT personnel on site
- Sample number and time of day for each sample collected for analysis
- Listing by sample number of samples collected during the day, sorted by chain-of-custody record number (compiled at end of day)
- Record of telephone call to laboratory informing them of sample shipment

- Accomplishment of decontamination of drilling rig, construction materials, and sampling equipment[1]
- Accomplishment of required calibration checks[1]
- Accomplishment of well purging, with time and/or volume[1]
- Accomplishment of well development[1]
- Disposition of well development water, purging water, decontamination rinsing fluids, and drill cuttings[1]
- Well water levels and field measurements[1]
- Variances from project plans and procedures (details will be recorded in the site Variance Log)
- Accomplishment of tailgate safety meetings
- Review of project procedures with site personnel
- Organic vapor analyzer (OVA) readings for water samples
- Accomplishment of decontamination of water sampling equipment[1]
- Photographs taken and identification numbers.

Appropriate field-generated data forms will be prepared based on the requirements in the Work Plan. Data to be recorded will include such information as the monitored location (e.g., boring, well, depth, sampling station, elevation, and field coordinates) and applicable sample analysis to be conducted.

3.5.3 Variance Log

Minor variances in the Work Plan or field activities that do not affect the requirements of the SOW may be initiated either in the field or the office. Any variance must be approved by the COE and the Project Manager and recorded by the Field Geologist. Variances that would be beyond the SOW must be approved in advance by COE.

---

[1]If the description of these methods exists in writing elsewhere, the log entry can reference them. Otherwise, the log entry needs to describe the methods used.

Table 6-1c. Metals and Miscellaneous Parameter Detection Limits[a]

	Parameter	Estimated Detection Limit: Ground Water (µg/l)	Estimated Detection Limit: Soil/Sediment (mg/kg)
	Barium		0.2
	Cadmium		0.5
	Chromium		1
	Iron	10	1
	Lead		3
	Manganese	2	0.2
	Silver		0.5
	Sodium	200	20
	Arsenic		0.2[b]
	Selenium		0.2[b]
	Mercury		0.02[c]
Miscellaneous parameters			
	Sulfate	1000	10
	pH	NA[d]	NA
	Nitrates	10	0.4

[a]Specific detection limits are highly matrix dependent. The actual method detection limits are sample dependent and may vary as the sample matrix varies. The detection limits listed herein are provided for guidance and may not always be achievable.
[b]Based on 100 ml/1.0 gr.
[c]Based on 200 ml/2.0 gr.
[d]NA - Not applicable.

Table 6-1d. Estimated Detection Limits - Explosives[a]

Parameter	Estimated Detection Limit	
	Water-Direct Aqueous (µg/ml)	Soil Sediment[b] (mg/kg)
TNB	0.050	0.063
1,3 DNB	0.050	0.048
NB	0.050	0.051
TNT	0.050	0.074
2,6-DNT	0.054	0.082
2,4-DNT	0.040	0.053
NT	0.048	0.048

[a]Specific detection limits are highly matrix dependent. The actual method detection limits are sample dependent and may vary as the sample matrix varies. The detection limits listed herein are provided for guidance and may not always be achievable.
[b]Two milliliters of extraction volume/2 grams of soil.

Table 6-2. Sample Precision, Accuracy, and Completeness Objectives

Measurement Parameter	Sample Matrix	Precision Objective (% Average RPD)[a]	Accuracy Objective	Completeness Objective (%)	Reference Method
Volatile organics	Water	As per current CLP	As per current CLP	90	EPA CLP
Volatile organics	Solids	As per current CLP	As per current CLP	90	EPA CLP
Extractable organics	Water	As per current CLP	As per current CLP	90	EPA CLP
Extractable organics	Solids	As per current CLP	As per current CLP	90	EPA CLP
Metals	Water	<25	100±25% average Recovery	90	EPA CLP
Metals	Solids	<25	100±25% average Recovery	90	EPA CLP
pH	Water	<25	Not applicable	90	EPA 150.1
Explosives	Water	None listed	None listed	NA	THAMA 8G
Explosives	Solids	None listed	None listed	NA	THAMA 8H
Nitrate	Water	<25	75 - 125%	NA	EPA 353.3
Nitrate	Solids	<25	75 - 125%	NA	EPA 9200
Sulfate	Water	<25	75 - 125%	NA	EPA 375.3
Sulfate	Solids	<25	75 - 125%	NA	EPA 9035

[a]Applied to all samples of the same type from the same location.

Notes: CLP = Contract Laboratory Program.
EPA = U.S. Environmental Protection Agency.
NA = Not applicable.

Outputs are in graphic form (chromatograms), bar graph (spectra), and printed tabular form in the standard formats specified for each analysis. If incomplete or incorrect outputs are received, corrective actions are taken according to procedures established for each type of analysis, consistent with manufacturer recommendations.

In the data review process, the data are compared to information such as the sample history, sample preparation, and QC sample data to evaluate the validity of the results. Corrective action is minimized through the development and implementation of routine internal system controls. Analysts are provided with specific criteria that must be met for each procedure, operation, or measurement system.

Data validation includes dated and signed entries by analysts and group leaders on the worksheets and logbooks used for samples, the use of sample tracking and numbering systems to track the progress of samples through the laboratory, and the use of QC criteria to reject or accept specific data.

Steps and checks used to validate precision and accuracy of the measured parameters and to support the representativeness, comparability, and completeness include:

- Description of the calibration performed
- Description of routine instrument checks (noise levels, drift, linearity, etc.)
- Documentation of the traceability of instrument standards, samples, and data
- Documentation of analytical methodology and QC methodology
- Description of the controls taken to determine and minimize interference contaminants in analytical methods (use of reference blanks and check standards for method accuracy and precision)
- Description of routine maintenance performed
- Documentation of sample preservation and transport when shipped elsewhere.

6.3 DATA REPORTS

The format and content of a data report are dependent upon project needs, such as contract requirements, government agency reporting formats, and whether explanatory text is required. The IT Quality Assurance Program does not specify a report format; however, the following items are applicable to data presentation:

- The final data presentation shall be checked in accordance with data verification requirements and approved by the Laboratory Manager.
- Data are presented in a tabular format whenever possible.
- Data will be formatted as a Certificate of Analysis.
- Each page of data is identified with the project number and name; date of issue; and, if appropriate, client name.
- Data presentation includes:
  - Sample identification number used by the ITAS-Knoxville laboratory and/or the sample identification provided to the laboratory, if different than identification used in the laboratory
  - Dates of sample collection, receipt, and analysis report
  - Chemical parameters analyzed, reported values, and units of measurement
  - Detection limit of the analytical procedure if the reported value is less than the detection limit
  - Data for a chemical parameter are reported with consistent significant figures for samples
  - Results of QC sample analyses, if applicable
  - Achieved accuracy, precision, and completeness of data if appropriate
  - Footnotes referenced to specific data if required to explain reported values
  - Analytical methods specifically referenced on all laboratory reports (any method modification will be included in the case narrative), if applicable
  - Data for field QC samples reported in the same format as action samples (a CLP data package consisting of QA/QC summary data sheets will be provided for all internal laboratory quality control samples)

- Laboratory data stored so that complete CLP data packages can be subsequently assembled for EPA-designated review.

The Project Manager is responsible for the preparation of each technical report including the process of data validation.

6.4 ASSESSMENT OF DATA ACCURACY, PRECISION, AND COMPLETENESS

The following discussion describes the procedures that will be employed to evaluate the precision, accuracy, and completeness of the chemical test data generated during the investigation.

Accuracy will be assessed by splitting a sample into two portions, spiking, (i.e., adding a known quantity of the constituents of interest to one of the portions), and then analyzing both portions for these parameters. The difference in the concentration levels of the constituents of interest should be equal to the quantity of the spike added to one of the two portions. The actual percent recovery is calculated as follows:

$$\%R = \frac{O_i - O_s}{T_i} \times 100$$

where O_i is the observed spiked sample concentration, O_s is the sample concentration, and T_i is the true or actual concentration of the spike. One hundred percent recovery is equivalent to 100 percent accuracy. The coefficient of variation (C_v) of the percent recovery values is calculated as follows:

$$C_v = \frac{\text{Standard Deviation (SD)}}{\text{Mean (APR)}}$$

SD is the standard deviation of the percent recoveries for the various spiked constituents and APR is the average or mean percent recovery.

Precision will be assessed by conducting separate analyses of the duplicate samples or by analysis of matrix spike/matrix spike duplicate pairs according

to CLP protocol. A measure of the agreement in the reported values for the two portions is obtained by calculating the relative percent difference (RPD) in the concentration levels of each constituent, where

$$RPD_i = \frac{A_i - B_i}{\frac{A_i + B_i}{2}} \times 100$$

and A_i and B_i are the concentrations of the constituent.

The evaluation of the test data is based in part on criteria adopted by the Sample Management Office of EPA. These criteria provide a means of categorizing a data set as being quantitative, semiquantitative, or qualitative. They are as follows:

Organics		
Quantitative	APR	80% or greater
	Cv	20% or less
Semiquantitative	APR	60% or greater
	Cv	20 to 40%
Qualitative	APR	40% or greater
	Cv	70% or less
Inorganics		
Quantitative	APR	90 to 110%
	Cv	15% or less
Semiquantitative	APR	80% or greater
	Cv	15 to 30%
Qualitative	APR	80% or less
	Cv	30% or greater

In addition to evaluating each set of data for accuracy and precision, an assessment will also be made of the completeness of the data. This assessment will involve computing the fraction of the reported values that remain valid after the sampling procedures have been reviewed and the results have been assessed for precision and accuracy. The QA data objectives for the

investigation relative to precision, accuracy, and completeness were described in Section 6.1.

For those analyses conducted using EPA CLP protocol, current acceptance criteria established by EPA will be used. These include recoveries of surrogate compounds added to each sample and recoveries of Hazardous Substance List (HSL) compounds added to the matrix spike and matrix spike duplicate samples.

6.5 NONCONFORMANCES AND CORRECTIVE ACTION

Nonconforming equipment, items, activities, conditions, and unusual incidents that could affect compliance with project requirements will be identified, controlled, and reported in a timely manner. Nonconforming items and activities are those that do not meet the project requirements, procurement document criteria, approved work procedures, or accepted IT standard practice.

Each nonconformance affecting quality and compliance with project requirements will be documented by the personnel identifying or originating the nonconformance. A Nonconformance Memo form, as shown in Figure 6-1, is used to document malfunctions, failures, deficiencies, and deviations that fail to meet standard ITAS practices and procedures. Alternatively, any nonconformance can be reported on the Nonconformance Report form in Figure 6-2. The originator (any IT employee) of a Nonconformance Memo or Nonconformance Report will describe the finding, the corrective action or description of the variance granted, and the schedule for completing corrective action. Documentation will be made available to the Project Manager, Laboratory Manager, Quality Assurance Officer, and/or subcontractor management. Figure 6-1 is a Nonconformance Memo form used by Knoxville ITAS personnel. Each nonconformance will be reviewed and a disposition given for the item, activity, or condition. The disposition of a nonconformance will be documented and approved by the IT organization responsible for the issuance of the nonconformance. The Quality Assurance Officer will concur with the disposition of the nonconformance.

The laboratory QA/QC coordinator is responsible for assessment of QC sample information. If data fall outside accepted limits, the QA/QC Coordinator will immediately notify the Operations Manager and the responsible group leader. If the situation is not corrected and an out-of-control condition occurs or is

NONCONFORMANCE MEMO
ITAS - KNOXVILLE

SAMPLE RECEIVING

DATE _____
PROJECT CODE _____
FILED BY _____

SAMPLE NO.(s) _____
_____

NONCONFORMANCE: (Check applicable item(s)):

_____ (1) Not enough sample sent for proper analysis.
_____ (2) Sample bottle received broken and/or cap not intact.
_____ (3) Custody seal missing and/or broken.
_____ (4) Paperwork sent to one lab; sample sent to another.
_____ (5) Samples received without proper refrigeration, when it has been deemed necessary.
_____ (6) Illegible sample numbers or label missing from bottle.
_____ (7) Numbers on sample not the same as numbers on paperwork.
_____ (8) Incomplete instructions received with sample(s), i.e., no Request for Analysis, no Chain-of-Custody, incomplete billing instructions, no due dates, etc.
_____ (9) Samples received in improper container.
_____ (10) Physical characteristics different than those on sampling sheets, i.e., two phases.
_____ (11) Rush samples put on hold because of incomplete paperwork.
_____ (12) Standard operating procedure not adhered to (specify) _____
_____
_____ (13) Other (specify) _____
_____

CORRECTIVE ACTION TAKEN: (Check applicable item(s)):

_____ (1) Client informed verbally.
_____ (2) Client informed by memo/letter.
_____ (3) Sample processed "as is".
_____ (4) Resampling requested.
_____ (5) Samples "on hold" until further notice.
_____ (6) Other (specify) _____
_____

ROUTING

Title	Initials	Date	Check if Corrected
Coding Specialist	_____	_____	_____
QC Coordinator	_____	_____	_____
Assistant Lab Manager	_____	_____	_____

ITAS-K-QA007R1

FIGURE 6-1

NONCONFORMANCE MEMO
ITAS - KNOXVILLE

EXTRACTIONS

DATE _____
PROJECT CODE _____
FILED BY _____

SAMPLE NO.(s) _____

NONCONFORMANCE: (Check applicable item(s)):

_____ (1) Method development or modification, to include any extraction or cleanup sequence not currently used on a regular basis in the extractions lab. (Requires QA approval.) PLEASE SPECIFY _____

_____ (2) Sample matrix not as described on paperwork, i.e., supposed to be organic, but is actually aqueous, nonhomogeneity, etc. PLEASE SPECIFY _____

_____ (3) Reprep caused by: _____
(a) Error in spiking or surrogating
(b) Lost extract
(c) Lost sample
(d) Contamination
(e) Low recovery
(f) Other _____

_____ (4) Standard operating procedure not adhered to (SPECIFY) _____

_____ (5) Exceeded holding time by _____ (days).

_____ (6) Other (PLEASE SPECIFY) _____

CORRECTIVE ACTION TAKEN: (Check applicable item(s)):

_____ (1) Error corrected by analyst.
_____ (2) Situation noted on sample tracking sheet and appropriate lab personnel notified.
_____ (3) Sample processed "as is".
_____ (4) Reextraction or resampling requested/performed.
_____ (5) Sample put "on hold" until further notice.
_____ (6) Client informed verbally.
_____ (7) Client informed by memo/letter.
_____ (8) Other (specify) _____

ROUTING

Title	Initials	Date	Check if Corrected
Analyst			
Group Supervisor			
QC Coordinator			
Assistant Lab Manager			

ITAS-K-QA008R1

FIGURE 6-1

NONCONFORMANCE MEMO
ITAS-KNOXVILLE

DATA REVIEW - GC/MS

DATE _____
PROJECT CODE _____
FILED BY _____

SAMPLE NO.(s) _____

NONCONFORMANCE: (Check applicable item(s)):

_____ (1) Data missing
_____ (2) Data imoroperly filled out
_____ (3) Analysis incomplete or not meeting client request
_____ (4) Daily tune nonconformance
_____ (5) Initial calibration nonconformance
_____ (6) Continuing calibration nonconformance
_____ (7) Method blank nonconformance
_____ (8) Sample nonconformance
_____ (9) Additional QC nonconformance
_____ (10) Holding time exceeded by _____ (days).
_____ (11) Other (specify) _____

Explanation of Above (if needed): _____

CORRECTIVE ACTION TAKEN (Check applicable item(s)):

_____ (1) Project returned to analyst(s) for rework
_____ (2) Reanalysis requested
_____ (3) Reprep and reanalysis requested
_____ (4) Data accepted "as is"
_____ (5) Client informed verbally
_____ (6) Client informed by memo/letter
_____ (7) Project "on hold" until further notice
_____ (8) Other (specify) _____

ROUTING

Title	Initials	Date	Check if Corrected
Analyst			
Supervisor			
QC Coordinator (if necessary)			
EPA Project Manager (if necessary)			
Assistant Lab Manager (if necessary)			

ITAS-K-QA017R1

FIGURE 6-1

NONCONFORMANCE MEMO
ITAS-KNOXVILLE

GC/LC DATA REVIEW

DATE _____
PROJECT CODE _____
FILED BY _____

SAMPLE NO.(s) _____

NONCONFORMANCE: (Check applicable item(s)):

_____ (1) Method development or modification to include procedures not currently used on a regular basis (requires QA approval). (SPECIFY) _____

_____ (2) Three-point calibration: _____
(a) Curve not established prior to sample analysis.
(b) Curve not within ± 15% RSD for relative standards.
(c) Daily check standards deviate > ± 15% from mean.
(d) Other (SPECIFY): _____

_____ (3) Sample identification/dilution error. (SPECIFY) _____

_____ (4) Calculation/transcription error. (SPECIFY) _____
(a) Error discovered before report to client.
(b) Error discovered after report to client.

_____ (5) Matrix spike/duplicate: _____
(a) Not recoverable due to high concentration in original sample.
(b) Not determinable due to possible sample inhomogeneity.
(c) Not determinable due to matrix effects.
(d) % Recovery / % RPD outside prescribed limits.
(e) Other (SPECIFY): _____

_____ (6) Specified detection limit unobtainable due to: _____
(a) Matrix interferences.
(b) Limited sample volume.
(c) Blank criteria not met.
(d) Difficulty in quantitation due to pattern alteration and/or interference.
(e) Surrogate recovery not within suggested limits.
(f) Retention time of alternating standards or spiked components not within established retention time windows.
(g) Other (SPECIFY): _____

_____ (7) Standard operating procedure not adhered to. (SPECIFY) _____

_____ (8) Other (SPECIFY): _____

CORRECTIVE ACTION TAKEN (Check applicable item(s)):

_____ (1) Error corrected by analyst. (SPECIFY) _____

_____ (2) Error corrected/resolved by QC Coordinator. (SPECIFY) _____

_____ (3) Situation noted on sample tracking sheet and appropriate lab personnel notified. (SPECIFY) _____

_____ (4) Samples put "on hold" until further notice.

_____ (5) Spike/standard concentration verified. New solution made if necessary.

_____ (6) Samples reanalyzed.

_____ (7) Samples reprepped and reanalyzed.

_____ (8) Client informed verbally.

_____ (9) Client informed by memo/letter.

_____ (10) Other (SPECIFY): _____

ROUTING

Title	Initials	Date	Corrected
Analyst			
Group Supervisor			
QC Coordinator			
Assistant Lab Manager			

FIGURE 6-1

JANET M. JONES

Professional Qualifications

Ms. Jones is a chemist experienced in the collection and analysis of environmental samples. Her recent experience includes management of a laboratory in Florida with responsibilities ranging from sales and marketing through sample collection, analysis, report and invoice preparation. Instrumental experience includes atomic absorption spectrophotometry (flame and flameless techniques), inductively coupled argon plasma, gas chromatography and total organic carbon analysis. She has experience with wet chemical techniques and environmental microbiology. As Sales and Customer Services Representative, she acted as liaison between customers and laboratory personnel, as well as promoting new business through telephone inquiries from potential customers. She is experienced in laboratory Quality Assurance/Quality Control (QA/QC) procedures and data review. Her writing experience includes data reports, Standard Operating Procedures, proposals, and QA project plans.

Education

B.A. (with honors), Chemistry, University of Tennessee, Knoxville, Tennessee; 1980
Flameless Atomic Absorption Analysis, Instrumentation Laboratories, Atlanta, Georgia; 1981
1982 Winter Conference on Plasma Spectrochemistry, Orlando, Florida; January 1982
American Management Association course, "The Basics of Telephone Selling Techniques"; April 1986

Experience and Background

1987 - Present <u>Inorganic Analyses Coordinator, IT Corporation, Knoxville, Tennessee.</u> Responsible for the following:

- Supervising the AA/ICP laboratory.
- Providing technical support to the Water/Wastewater laboratory.
- Supervising and/or performing sample preparation, analysis, data reporting, and departmental QC review for the metals laboratory.
- Analysis techniques include atomic absorption, atomic emission, graphite furnace AA, cold vapor AA for mercury, and inductively coupled plasma.

1986 - 1987 <u>QA/QC Coordinator, IT Corporation, Knoxville, Tennessee.</u> Responsible for all quality assurance functions pertaining to laboratory operations. Specific job duties include: initiating and supervising on-going QA programs; entering intralaboratory and external QC samples into the sample stream; determining and maintaining accuracy and precision data; writing and reviewing QA/QC programs, project plans, proposals, reports

NONCONFORMANCE MEMO
ITAS-KNOXVILLE

AA/ICP DATA REVIEW

DATE
PROJECT CODE _____
FILED BY _____

SAMPLE NO.(s) _____

NONCONFORMANCE: (Check applicable item(s)):

_____ (1) Method development or modification to include procedures not currently used on a regular basis (requires QA approval). (SPECIFY) _____

_____ (2) Calibration failure: (SPECIFY) _____

_____ (3) Sample identification/dilution error: (SPECIFY) _____

_____ (4) Calculation/transcription error: (SPECIFY) _____

(a) Error discovered before report to client.
(b) Error discovered after report to client.

_____ (5) Matrix spike/duplicate: _____
(a) Not recoverable due to high concentration in original sample.
(b) Not determinable due to possible sample inhomogeneity.
(c) Not determinable due to matrix effects.
(d) % Recovery / % RPD outside prescribed limits.
(e) Other: (SPECIFY) _____

_____ (6) Specified detection limit unobtainable due to: _____
(a) Matrix interferences.
(b) Limited sample volume.
(c) Blank criteria not met.
(d) Other: (SPECIFY) _____

_____ (7) Standard operating procedure not adhered to. (SPECIFY) _____

_____ (8) Holding time exceeded by _____ (days).
_____ (9) Sample received unpreserved.
_____ (10) Other: (SPECIFY) _____

CORRECTIVE ACTION TAKEN (Check applicable item(s)):

_____ (1) Error corrected by analyst. (SPECIFY) _____

_____ (2) Error corrected/resolved by QC Coordinator. (SPECIFY) _____

_____ (3) Situation noted on sample tracking sheet and appropriate lab personnel notified. (SPECIFY) _____
_____ (4) Sample processed "as is".
_____ (5) Sample preserved with _____ and let sit _____ prior to processing.
_____ (6) Samples put "on hold" until further notice.
_____ (7) Spike/standard concentration verified. New solution made if necessary.
_____ (8) Samples reanalyzed.
_____ (9) Samples reprepped and reanalyzed.
_____ (10) Client informed verbally.
_____ (11) Client informed by memo/letter.
_____ (12) Other (SPECIFY): _____

ROUTING

Title	Initials	Date	Check if Corrected
Analyst			
Group Supervisor			
QC Coordinator (if necessary)			
Assistant Lab Manager (if necessary)			

ITAS-K-QA016R2

FIGURE 6-1

NONCONFORMANCE MEMO
ITAS-KNOXVILLE

WATER/WASTEWATER - DATA REVIEW

DATE _____
PROJECT CODE _____
FILED BY _____

SAMPLE NO.(s) _____

NONCONFORMANCE: (Check applicable item(s)):

_____ (1) Method development or modification, to include any procedures not current used on a regular basis in the Water/Wastewater lab. (Requires QA approval.) PLEASE SPECIFY: _____

_____ (2) Sample matrix not as described on paperwork, i.e., supposed to be aqueous, but is actually organic, nonhomogeneity, two phases, etc. PLEASE SPECIFY: _____

_____ (3) Error in data calculations.
_____ (4) Error on data summary sheet. SPECIFY: _____
_____ (5) Error discovered after data has been reported to client.
_____ (6) Sample paperwork omission or error. SPECIFY: _____

_____ (7) Recovery of spike compound from sample is not within limits set prior to analysis. SPECIFY: _____

_____ (8) % Recovery of spike duplicates outside of prescribed QC limits.
_____ (9) QC analysis performed too infrequently.
_____ (10) Method requested not applicable to sample matrix.
_____ (11) Standard operating procedure not adhered to (SPECIFY) _____

_____ (12) Exceeded holding time by _____ (days).
_____ (13) Sample received unpreserved.
_____ (14) Other (SPECIFY) _____

CORRECTIVE ACTION TAKEN (Check applicable item(s)):

_____ (1) Sample put "on hold" until further notice.
_____ (2) Situation noted on sample tracking sheet and appropriate lab personnel notified.
_____ (3) Error corrected by W/W analyst. SPECIFY: _____

_____ (4) Sample processed "as is".
_____ (5) Sample preserved with _____ and let sit _____ prior to processing.
_____ (6) Sample to be reanalyzed for corrective measures.
_____ (7) Error corrected or resolved by QC Coordinator. SPECIFY: _____

_____ (8) Client informed verbally.
_____ (9) Client informed by memo/letter.
_____ (10) Other (SPECIFY) _____

ROUTING

Title	Initials	Date	Check if Corrected
Analyst	_____	_____	_____
Group Supervisor	_____	_____	_____
QC Coordinator (if necessary)	_____	_____	_____
Assistant Lab Manager (if necessary)	_____	_____	_____

ITAS-K-QA009R4

FIGURE 6-1

INTERNATIONAL TECHNOLOGY CORPORATION

FIGURE 6-2

NONCONFORMANCE REPORT

PROJECT NO. _____ PAGE ___ OF ___

PROJECT NAME _____ DATE: _____

NONCONFORMANCE:

IDENTIFIED BY: _____ DATE: _____

CORRECTIVE ACTION REQUIRED:

TO BE PERFORMED BY: _____ DATE: _____

MUST CORRECTION BE VERIFIED? YES ___ NO ___

TO BE VERIFIED BY: _____ PREPARED BY: _____ DATE: _____

CORRECTIVE ACTION TAKEN:

PERFORMED BY: _____ DATE: _____

VERIFIED BY: _____ DATE: _____

CC:

Approved By: _____ Date: _____

_____ Date: _____

expected to occur, the QA/QC Coordinator will notify the Technical Director and the Laboratory Manager, who will in turn notify the project Quality Assurance Officer. The Operations Manager and group leaders are responsible for identifying the source of the nonconformance and initiating corrective action. Completion of corrective action should be evidenced by data returning to prescribed acceptable limits.

The modification, repair, rework, or replacement of nonconforming equipment, items, or activities will require the reverification of acceptability. In certain instances, as determined by the Project Manager, Program Manager, or Quality Assurance Officer, these actions may require that corrective action be completed and verified before site work continues.

The equipment, item, or activity which has the deficiency may be temporarily stopped while the nonconformance is being investigated. If, in the opinion of the Operations Manager and the Quality Assurance Officer, the nonconformance does not significantly affect the technical quality or use of the work, the work may continue pending resolution of the nonconformance. The basis for such decisions will be documented on the Nonconformance Report form and submitted to the Quality Assurance Officer for review and approval. The documentation will include the statement that the decision was made before continuing with the work. The records of nonconformance and their dispositions will be kept in the project central files.

In addition, the Project Manager will notify COE in writing within 2 working days of significant nonconformances that could impact the schedule or results of the work and will indicate the corrective action taken or planned.

Completion of corrective actions for nonconformances will be verified by QA personnel as part of future auditing activities.

Any recurring nonconformances will be evaluated by project, laboratory, and/or QA personnel to determine its cause and appropriate changes instituted in corporate or project requirements and procedures to prevent future recurrence. When such an evaluation is performed, the results shall be documented.

6.6 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Fundamental to the success of this S/A-QA/QC Plan is the active participation of management in the project. Management will be aware of project activities and will participate in development, review, and operation of the project. Management will be informed of QA activities through the receipt, review, and/or approval of:

- The S/A-QA/QC Plan
- Corrective action overdue notices
- Nonconformance reports
- Audit reports.

Periodic assessment of QA/QC activities and data accuracy, precision, and completeness will be conducted and reported.

The final report will include:

- QA management
- Measures of data quality from the project
- Significant quality problems, quality accomplishments, and status of corrective actions taken
- Results of quality assurance performance audits
- Results of quality assurance system audits
- Assessment of data quality in terms of precision, accuracy, completeness, representativeness, and comparability
- QA-related training conducted during the course of the project
- Status of this S/A-QA/QC Plan.

6.7 PROJECT-SPECIFIC REQUIREMENTS

The following are project-specific requirements contained in the project SOW.

IT's Pittsburgh Laboratory - Soil Geotechnical Testing

There are no project-specific requirements for soil geotechnical testing.

IT's Knoxville Laboratory - Chemical Analyses

The project-specific requirements are:

- Preparation and analyses of a matrix spike/matrix spike duplicate (MS/MSD) pair for ground water
- Preparation and analyses of a matrix spike/matrix spike duplicate (MS/MSD) pair sample for soil
- For significant instrumentation or QC problems or for chemical results that may have safety considerations, reports will be given verbally (telephoned) to the Contracting Officer and a written report will be sent to the Contracting Officer within 2 working days.

The Project Manager will forward the reports to the Quality Assurance Officer and the COE Contracting Officer, who will in turn forward them to the COE-designated QA laboratory. (Note: Submission of reports may be required more often than weekly, at the discretion of the COE Contracting Officer or the COE-designated QA laboratory). With respect to significant instrumentation or QC problems or a safety consideration, the determination of what is significant will be made by the IT Laboratory Manager.

The name, address, and telephone number of the COE Contracting Officer for the Plum Brook Ordnance Works contamination evaluation DERA Project No. G050H001800, are:

Mr. John Hall
COE Special Projects
US Army Corps of Engineers - Nashville District
P.O. Box 1070
Nashville, Tennessee 37202-1070
Telephone: (615) 736-5966.

7.0 PROGRAM CONTROLS

7.1 CALIBRATION PROCEDURES AND FREQUENCY

Laboratory and field measuring and testing equipment will be identified and calibrated in accordance with the requirements of Section 5.5 of IT's Engineering Services Quality Assurance Manual and IT's Knoxville Laboratory Specific Quality Assurance Manual and the use of approved calibration instructions. Measuring equipment, test equipment, and reference standards will be calibrated at prescribed intervals and/or before use. Calibration frequency will be based on the analytical methods employed, the type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, and experience. Laboratory instrument calibration frequency will be performed as dictated by each analytical method. A summary of typical field equipment calibration requirements and frequency of procedures is provided in Table 7-1. Table 7-2 identifies the laboratory equipment that will require calibration when used.

In some cases, particularly for field equipment, scheduled periodic calibration will not be performed because the equipment is not continuously in use. Such equipment will be calibrated if needed before use, and then at the required frequencies for as long as its use continues.

Calibrated equipment will be uniquely identified by using either the manufacturer's serial number or other means. Calibration records traceable to the equipment will be available.

7.1.1 Calibration Failures

Scheduled periodic calibration of testing equipment will not relieve field or laboratory personnel of the responsibility of employing properly functioning equipment. If an individual suspects an equipment malfunction, he should remove the device from service, tag it so it is not inadvertently used, and notify the Laboratory Coordinator or Field Geologist, as appropriate, so that recalibration can be performed or substitute equipment can be obtained.

Results of activities performed using equipment that has failed recalibration shall be evaluated by the involved QA personnel and the Laboratory Manager or

Table 7-1. Field Equipment Calibration Procedures

Equipment	Field Procedures	Units of Measure	Calibration Procedures
Photoionization portable gas analyzer	Air monitoring during field operations for presence of organic vapors. Soil vapor monitoring at selected sites.	Parts per million	Calibrated by manufacturer with known gas and concentration; zero adjusted in the field daily.
Explosimeter	Air monitoring during field operations for presence of combustible gases.	Percent of lower explosive limit	Calibrated by manufacturer with known gas and concentration; daily testing in known explosive environment (gas tank) and zero adjustment in clean environment.
pH	Water pH measurements during purging and sampling of monitoring wells and sampling of surface water.	Standard units	Calibrated by manufacturer and laboratory standard pH solutions; calibrated in the field daily by laboratory prepared standard solutions.
Specific conductivity meter	Water specific conductivity measurements during purging and sampling of monitoring wells and sampling of surface water.	Micro-mhos per centimeter	Calibrated by manufacturer and laboratory solutions; calibrated in the field daily by laboratory prepared known conductivity solutions.
Mercury thermometers	Water temperature measurements during purging and sampling of monitoring wells and sampling of surface water.	Degrees Celsius	Calibrated by manufacturer.

Table 7-1. (Continued)

Equipment	Field Procedures	Units of Measure	Calibration Procedures
Water level indicator	Ground water level measurements in monitoring wells.	±0.01 feet	Calibrated by manufacturer; checked monthly in the field with surveyor's tape.
Pipe and cable locator	Location of buried pipes and cables prior to soil boring and/or well drilling.	No specific units (needle deflection and sounder indicate presence of buried metallic objects)	Calibrated by manufacturer; checked daily in the field while over known metallic objects.
Magnetometer	Location of buried ferromagnetic objects (drums) at landfills.	Gammas	Calibrated by manufacturer; checked daily in the field at site-specific base station before and after surveys.
Pressure transducer	Ground water level measurements in aquifer test wells.	±0.1 feet	Calibrated by manufacturer; calibrated daily in the field by internal calibration procedures.

Table 7-2. Summary of Typical Calibration Requirements for IT Analytical Services Laboratory Operations

Instrument To Be Calibrated	Standard Reference	Calibration Technique	Acceptable Performance Specifications
Atomic absorption spectrophotometry	Three levels plus one blank, bracketing the sample concentrations; certified standards from chemical supply house are used	Direct reading using serial dilution of commercial standard	Standard curve must be linear or as per method
Analytical balances	Class "S" weight check	Annual or as needed using outside services to calibrate	At least every 3 months, Must meet 95% using Class "S" weight.
Gas chromatography/ mass spectrometry (GC/MS)	All in-house solutions. (DFTPP), (SPCC), and (CCC)	Reference standards, retention time, and additive percent recovery for surrogates	Per current CLP
Inductively coupled plasma spectro-photometer	Certified standards from chemical supply house	Serial dilutions of commercial standards; direct readouts	Standard must be within 10% of established calibration curve or per method
pH meter	Commercial buffers	Bracket technique	90% of slope
UV/VIS spectro-photometer	Three levels of in-house standards; photometric linearity	Standard curves	10 percent of original curve
Liquid chromatograph (HPLC)	Three levels bracketing the sample concentrations; certified standards from chemical supply house are used	Reference standards, scanning and purity indices using diode array	Standard curve must be linear (±15% RSD); daily standards must be within ±15 RPD of standard curve

Project Manager and the Project Quality Assurance Officer, as appropriate. If the activity results are adversely affected, the results of the evaluation shall be documented and the appropriate personnel notified.

Equipment that cannot be calibrated or becomes inoperable during use will be removed from service and either segregated to prevent inadvertent use or tagged to indicate that it is out of calibration. Such equipment will be repaired and recalibrated or replaced as appropriate. Any such action should be reported in the field activities daily log or appropriate laboratory log.

7.1.2 Calibration Records

Records will be prepared and maintained for each piece of calibrated measuring equipment, test equipment, and reference equipment to indicate that established calibration procedures have been followed. Records for equipment used will be kept in the equipment files.

Much of the measuring and test equipment used for field geophysical surveys is calibrated or checked as part of the operational use. For this equipment, records of the calibrations or checks will be kept in the files of projects for which the work was performed or as part of the responsible organization's calibration record system.

7.2 QUALITY CONTROL CHECKS

7.2.1 Field Quality Control Procedures

To check the quality of data from field sampling efforts, travel blank (water) and duplicate soil samples will be submitted to IT's analytical laboratory. The travel blanks will be prepared by the laboratory, shipped to the field, exposed to the sampling and packaging activities in the field, and shipped back to the laboratory with the ground water samples. Field QC samples are specified in Section 3.0 of this plan. Travel blanks will be analyzed to check for container contamination. Duplicate samples will be analyzed to check for sampling and analytical error causing data scatter. One duplicate will be prepared for every 10 samples collected and one blank prepared for every 10 samples (including duplicates) or one blank per sampling day, whichever is greater, shall be submitted for analysis.

Water used for the analysis of trace metals will be purified by reverse osmosis/deionization to not less than 1 MΩ cm. Water for organic determinations will be deionized and then further purified with activated carbon.

Standard ITAS sampling equipment and procedures will be used for blank and duplicate sampling as described in Section 3.0 of this plan. Blank (water) and duplicate samples will be treated as separate samples for identification, logging, and shipping.

7.2.2 Laboratory Quality Control Procedures

7.2.2.1 Volatile Organics

Samples for VOA will be analyzed according to current CLP protocol. An initial calibration curve will be prepared using a mixture of standards at five different concentrations and a mixture of three internal standards. Each GC/MS tune will be verified every 12 hours to ensure that its performance on bromofluorobenzene meets the applicable EPA criteria. The continuous calibration is also verified before sample analysis by reanalysis of the mid-range standard.

All standards, method blanks, and samples will be spiked before analysis with surrogate standards as specified in CLP protocol. Surrogate standards are defined as nonpriority pollutant compounds used to monitor the percent recovery efficiencies of the analytical procedures on a sample-by-sample basis. Samples exhibiting surrogate standard responses outside the established control limits will be evaluated to determine if the problem is due to sample matrix effects or if reanalysis is necessary. If the problem is not resolved by reanalysis (except matrix effects), the Project Manager will be notified to determine if resampling is required.

At least one method blank every 12 hours will be purged and analyzed for VOCs. VOA requires a method blank consisting of 5 millimeters of organic-

free water spiked with the appropriate surrogate standards. Results of the method blank analysis will be maintained with the corresponding sample analyses.

Matrix spike and matrix spike duplicate analyses will be performed as described in Section 7.2.2.3

7.2.2.2 Extractable Organics

Samples for extractable organics analysis will be analyzed according to current CLP protocol to the extent that the project SOW allows. An initial calibration curve will be prepared using a mixture of standards at five different concentrations and a mixture of six internal standards. Each GC/MS tune will be verified every 12 hours to ensure that its performance on decafluorotriphenylphoshine meets the applicable EPA criteria. The continuous calibration is also verified before sample analysis by reanalysis of the mid-range standard.

All standards, method blanks, and samples will be spiked before analysis with surrogate standards as specified in CLP protocol. Surrogate standards are defined as nonpriority pollutant compounds used to monitor the percent recovery efficiencies of the analytical procedures on a sample-by-sample basis. Samples exhibiting surrogate standard responses outside the established control limits will be evaluated to determine if reanalysis is necessary.

At least one method blank for every 20 samples would normally be extracted and analyzed for base/neutral and acid extractable compounds. For this project, a rinsate (sampling) blank will also be prepared and analyzed for the ground water samples only. Extractable organics analysis requires a method blank consisting of 1 liter of organic-free water spiked with the appropriate surrogate standards. Results of the method blank analysis will be maintained with the corresponding sample analyses.

Matrix spike and matrix spike duplicate analyses will be performed as described in Section 7.2.2.4.

7.2.2.3 Metals

QA for metals analyses by AA and inductively coupled plasma (ICP) will be performed in accordance with the ITAS Quality Assurance Manual and the TASK laboratory-specific attachment. The following QA measures are usually employed:

- The calibration blank is prepared at the same acid concentration as the calibration standards. Prepare a sufficient quantity to be used to flush the system between standards and samples.
- The instrument check standard is prepared by the analyst by combining compatible elements at a concentration equivalent to the midpoint of their respective calibration curves.
- With each batch of samples, the method blank is prepared and must contain all the reagents in the same volumes as used in the processing of the samples. The method blank must be carried through the complete procedure and contain the same acid concentration in the final solution as the sample solution used for analysis.
- The instrument is calibrated with SPEX standards. Initial calibration is verified with NBS standards; continuing calibration is verified with another SPEX standard solution. Standards must be ±10 percent of the true value of the standard.
- Analyze an appropriate instrument check standard containing the elements of interest at a frequency of 10 percent. This check standard is used to determine instrument drift.
- Analyze the calibration blank at a frequency of 10 percent.

7.2.2.4 Explosives

Samples for explosives will be analyzed in accordance with USATHAMA Methods 8G and 8H. An initial calibration curve will be prepared using a mixture of standards at three different concentrations. Daily linearity is verified by comparison with the three-point curve; if relative percent difference from the curve is greater than 15 percent, the standards must be graphed. A check standard is run every ten samples; it must meet the same criteria as the daily linearity standard.

A method blank is prepared with each set of samples and analyzed. The blank should be free from the analytes of interest. Results of the method blank analysis will be maintained with the corresponding sample analyses.

Matrix spike/matrix spike duplicate pairs are extracted and analyzed at a frequency of 1 pair/20 samples to assess accuracy and precision. The criteria for accuracy and precision are given in Table 6-2.

7.2.2.5 Miscellaneous Parameters

The samples will be analyzed for nitrate, sulfate, and pH by EPA-approved methods. For nitrate and sulfate analyses, an initial calibration curve will be prepared at three different concentrations. Daily linearity is verified by comparison with the three-point curve; the daily standard must be within 10 percent of the curve. A check standard and reference standard are analyzed with every group of samples analyzed. A method blank is also analyzed with each set of samples. Matrix spike/matrix spike duplicates are normally analyzed at a frequency of 1 pair/20 samples. The criteria for accuracy and precision of these samples are given in Table 6-2.

For pH, the instrument is calibrated with two buffer solutions that bracket the sample. Duplicate analyses are run to access precision.

7.2.2.6 Matrix Spike and Matrix Spike Duplicate Analyses

Matrix spike and matrix spike duplicate analyses are normally performed on one of every 20 samples per matrix type analyzed. For this project, they will be performed as specified in Section 3.0 of this plan, in accordance with the SOW. A separate aliquot of the sample will be spiked with the appropriate compounds before extracting, digesting, or analyzing the sample. The percent recoveries for the respective compounds will then be calculated. If the percent recovery values fall outside the appropriate QC limits, the other QC parameters will be evaluated to determine whether an error in spiking occurred or whether the entire set of samples required re-extraction or redigestion and analysis. Re-extraction or redigestion and analysis would not be performed if the problem is caused by matrix effects.

The relative percent error for each parameter will then be calculated from these matrix spike and matrix spike duplicate analyses. If the average relative percent error falls outside the appropriate QC limits, the other QC parameters will be evaluated to determine if the duplicate sample should be re-extracted or redigested and analyzed or whether the entire set of samples

should be re-extracted or redigested and analyzed. Re-extraction or redigestion and analysis would not be performed if the problem is caused by matrix effects.

7.2.2.7 General Chemistry Laboratory Controls

In addition to instrument calibration and the analysis of QC samples, the following controls will be implemented:

- Reagents and solvents will be of certified composition. Reagent storage environment and duration will meet EPA guidelines.
- Laboratory equipment such as balances will be regularly calibrated.
- Volumetric measurements will be made with certified glassware.
- Data reduction computations will be independently checked.
- Qualified personnel will be used for laboratory analyses.
- Holding times and sample storage provisions will conform to EPA guidelines.

The IT-Knoxville Laboratory QA/QC Coordinator is responsible for preparing QC standards and for sending QC samples into the laboratory for analysis. Statistical analyses will then be performed utilizing the results of QC sample analyses.

QA/QC samples will be collected to provide independent laboratory verification of results and will be shipped via Federal Express to a QA laboratory to be designated by COE.

7.3 SYSTEM AUDITS

Because of the limited scope of this site investigation, a field audit is not planned. The records of field and laboratory operations will be available for review to verify that laboratory and field-related activities were performed in accordance with appropriate approved procedures. Items reviewed will include, but would not be limited to, the calibration records of equipment, daily field activity logs, chain-of-custody documentation, and data resulting from field and laboratory operations.

Records of audits will be maintained in the project files. Audit files will include, as a minimum, an Audit Report, the reply to the audit, and any supporting documents. It is the responsibility of the Project Manager to conform to the established procedures, particularly as to timely replies to audit reports and implementation of such corrective action as may be indicated.

7.4 PREVENTIVE MAINTENANCE

Periodic preventive maintenance is required for all sensitive equipment and will be in accordance with the manufacturers recommendations. Instrument manuals will be kept on file for reference purposes if equipment needs repair. The troubleshooting section of factory manuals may be used in assisting personnel in performing maintenance tasks. The frequency of preventive maintenance for field equipment will be in accordance with the operating instruction manual, when appropriate. Records of preventative maintenance and repairs are maintained and will be available for inspection by the Contracting Officer on request.

Laboratory equipment requiring routine maintenance will have a control system indicating the date of required maintenance, person maintaining the equipment, and the next maintenance date. Information pertaining to life histories of equipment maintenance will be kept in individual logs for each instrument.

Major instruments in the laboratories are normally serviced by an in-house maintenance person or by annual service contracts with manufacturers. Maintenance will be documented and maintained in permanent records by the individual responsible for each instrument.

A listing will be maintained of the critical spare parts that should be on hand to minimize equipment downtime.

Specific laboratory equipment preventive maintenance practices and frequency are described in Table 7-3.

Table 7-3. Preventive Maintenance - Knoxville Laboratory Operations

Instrument	Items Checked/Services	Frequency
Atomic absorption spectrophotometer	Three-point calibration performed	Daily
	Burner head checked	Daily
	Nebulizer checked	Monthly
	Tygon tubing checked	Semiannually
Analytical balance	Internal weight, train, gears, electronics	Annual service
Inductively couples plasma spectrophotometer	Sample introduction system checked	Daily
	Check pumps	Weekly
pH meters	Gel filled maintenance free	Daily check with calibration standards
GC/MS	GC/MS maintenance is the same as GC with the following additions:	
	(1) For model 4000 and 4500	
	DP oil	Biweekly
	Mech. oil	Quarterly
	Power Con. Air Filter	Biweekly
	EM filter	Biweekly
	Water bay filter	Biweekly
	2010 Interface box	Biweekly
	Vacuum chaff filter	Monthly
	(2) For OWAs	
	Water filter (if applicable)	Observe and change as needed
	Computer air filter	Bimonthly
	Card gage air filter	Monthly
UV/VIS Spectrophotometer	Lamp	As needed
	Wavelength checked	During calibration steps
	Serviced	As needed

CEE21857C
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7.5 EXTERNAL CERTIFICATION

The following is a listing of certifications and accreditations currently held by the ITAS laboratory in Knoxville, Tennessee:

National Approvals/Accreditations

American Industrial Hygiene Association
American Association for Laboratory Accreditation
National Institute for Occupational Safety and Health

State Certifications

California Department of Health Services
Florida Department of Health and Rehabilitative Services
South Carolina Department of Health and Environmental Control
New York State Department of Health
North Carolina Department of Public Health
Tennessee Department of Public Health
Utah Department of Health

Qualified by/Suitability Status By

New Jersey Superfund Program
New York State Superfund Program
U.S. Environmental Protection Agency Contract Laboratory Program (Organics,
Inorganics, Dioxins)
Minnesota Superfund Program
Virginia Superfund Program
Tennessee Superfund Program
National Bureau of Standards
U.S. Army Corps of Engineers, Waterways Experiment Station
U.S. Army Corps of Engineers, Missouri River Division
Tennessee Valley Authority

Memberships

American Council of Independent Laboratories
American Society for Testing and Materials.

8.0 RESUMES OF KEY FIELD AND LABORATORY PERSONNEL

CLIFFORD E. VAUGHAN

Professional Qualifications

Mr. Vaughan is a professional engineer with more than 19 years of experience in the construction/mining and environmental remediation field. He is experienced in problem assessment and implementation of construction and mining projects, including developing permit applications and dealing with regulatory affairs relating to industry. His background in the development and administration of environmental regulations from both a government and industry perspective is extensive. Mr. Vaughan has negotiated out-of-court settlements (including site mitigation measures) for both the mining industry and the federal government regarding violations of environmental regulations. His experience includes overall project management as well as detailed day-to-day operations. He has a strong background in problem solving and management of multidisciplined staff with both physical science and biological science members, and has directed remedial investigation/feasibility studies (RI/FSs) on large National Priority List (NPL) sites. He serves as a senior consultant to provide guidance and consultation to industries involved in NPL site investigation and remediation.

Education

B.S., Civil Engineering, Virginia Polytechnic Institute, Blacksburg, Virginia; 1969

Experience and Background

1988 - Present

General Manager, Environmental Assessment and Remedial Design (EARD), IT Corporation, Knoxville, Tennessee. Responsible for profit center management, including technical, operating, and business considerations. Administers company policies and procedures relative to the QA program, performs administrative functions, and oversees overall project performance. Works with clients to identify appropriate project/program functions and client preferences for services to be provided. Provides direction to the managers of the various operating groups within EARD for completion of projects. Other responsibilities include:

- Directs RI/FS studies on major NPL sites at Air Force bases in the western United States through the Hazardous Waste Remedial Actions Program (HAZWRAP) in Oak Ridge, Tennessee.
- Directs development of an underground storage tank program to provide client services in investigation and remediation from IT-Knoxville.
- Directs a program of complete environmental services for a large national defense contractor for nationwide services provided by IT.
- Directs completion of RI/FS studies for multiple commercial clients in the southeastern United States.

1984 - 1988 Manager, Civil and Environmental Engineering, IT Corporation, Knoxville, Tennessee. Was responsible for management of the civil and environmental engineering group that includes engineers, geologists, and hydrogeologists. Was the Manager-in-Charge of multiple major projects done simultaneously by IT Corporation in the Southeast, such as RCRA Part B permits and RI/FS studies at NPL sites. Was responsible for assigning project managers to coordinate the assignment of personnel working on multiple projects. Served as a senior consultant to provide staff and industry with guidance and consultation on the necessary activities for waste site assessment and remediation. Experience includes:

- Managed RI/FS oversight project for the Environmental Quality Board (EQB) of Puerto Rico.
- Directed an RI/FS for a state Superfund site in Florida.
- Managed a geochemical evaluation and study of the environmental impacts of ash disposal at a large coal-fired power plant in the southeastern United States.
- Directed preparation of a RCRA Part B permit for a large DOE facility at Oak Ridge, Tennessee.
- Directed multiple underground storage tank leak investigations and remediation projects.
- Directed RI/FS studies on several large NPL sites in the southeastern United States.
- Was the Program Manager for developing Remedial Action Plans (RAPs) or RI/FSs on multiple sites at Air Force bases in the western United States.

1983 - 1984 Project Manager/Senior Civil Engineer, IT Corporation, Knoxville, Tennessee. Was responsible for directing the design of hazardous waste landfills, site mitigation, and complex environmental studies. Hazardous waste facility designs conformed to requirements of RCRA regulations for permitting. Provided service to the mining industry on special problems, such as complex ground water contamination, "lands unsuitable for mining" petitions, and reclamation. Managed complex environmental assessments for the coal mining industry relative to petitions filed under P.L. 95-87 to have areas determined as unsuitable for coal mining. Experience includes:

- Designed a state-of-the-art landfill to store dioxin-contaminated soil.

- Completed an environmental study on a large stream and watershed to determine the validity of a petition to have the watershed declared unsuitable for coal mining under P.L. 95-87.

- Investigated sites in British Columbia to select a site suitable for a commercial hazardous waste landfill.

- Performed extent-of-contamination surveys involving organics, solvents, dioxins, heavy metals, PCBs, and wood treatment chemicals.

- Investigated leaking underground storage tanks and designed remediation procedures.

1982 - 1983 Senior Environmental Engineer, Sierra Coal Company, Prestonsburg, Kentucky. Was the director of the company's environmental regulation compliance efforts. Coordinated technical support supplied by corporate environmental staff. Directed engineering consultants in developing mining permit applications. Directed company technical staff in the preparation of permit applications. Evaluated capabilities of engineering consulting firms and selected consultants for projects. Inspected mining and construction projects and determined appropriate action to be taken. Served as liaison between the company and various state and federal regulatory agencies. Recommended company policies to ensure cost-effective compliance with federal and state regulations.

1979 - 1982 Civil Engineer, Office of Surface Mining, Department of the Interior, Knoxville, Tennessee. Had regional authority on civil and environmental engineering problems. Reviewed and evaluated experimental mining practices. Served as national expert on excess spoil disposal for a rewrite of the excess spoil regulations. Investigated abandoned mined land emergency projects and developed specifications for construction. Conducted training seminars and workshops on federal regulations requirements for government employees and industry representatives.

1977- 1979 Civil Engineer, Department of Agriculture, Soil Conservation Service, Richmond, Virginia. Was the chairman of a Citizens Advisory and Technical Committee to develop a Best Management Practice Handbook for Virginia. Handbook identified cost-effective land treatment methods for control of diverse sources of water pollution. Developed a procedure to assess diverse-source water pollution problems in Virginia and set priorities, by watershed, where diverse-source control would be most critical.

1973 - 1977 Civil Engineer, Soil Conservation Service, Department of Agriculture, Franklin, Virginia. Directed and checked design and field layouts done by engineering technicians. Served as project engineer on construction contracts. Designed dams, reservoirs, drainage

systems, waste disposal systems, and storm water retention and erosion control structures. Obtained permits for construction from state and federal agencies.

1972 - 1973 Civil Engineer, Soil Conservation Service, Department of Agriculture, Chase City, Virginia. Was the assistant engineer responsible for construction work in south central Virginia, which included design and layout for construction. Served as the project engineer on earth-fill flood control structures.

1970 - 1972 Construction Engineer, U.S. Army. Was the platoon leader for an earth-moving construction platoon. Was in charge of design and construction of roads, dams, culverts, and other assorted earth-moving projects.

1969 - 1970 Civil Engineer, Soil Conservation Service, Department of Agriculture, Richmond, Virginia. Designed earth-fill flood control structures and reinforced concrete appurtenances. Coordinated with regional design group on methods of design and changes in designs. Developed stage storage and other hydrologic data for reservoirs.

Registration/Certification

Registered Professional Engineer: Virginia, Kentucky, West Virginia, Tennessee, Missouri, Florida, New Jersey, Alabama, South Carolina, and the Commonwealth of Puerto Rico

Publications

Vaughan, Clifford E., 1979, "Best Management Practice Handbook," report prepared for the Virginia State Water Control Board, Richmond, Virginia.

Vaughan, Clifford E., James L. Chisholm, and Thomas N. Crebbs, 1984, "An Evaluation of Expected Impacts on the Environment of Frozen Head State Natural Area if Mining Is Conducted in Flat Fork Watershed," IT Corporation, Knoxville, Tennessee.

DON C. BURTON

Professional Qualifications

Mr. Burton has 9 years of civil and mining engineering experience with 3 years of experience in environmental management. His diversified experience includes project management performing hydrogeologic/remedial investigations at hazardous waste sites, process engineering design of support systems for hazardous waste incineration systems, and engineering support for remediation projects.

His project management experience includes managing site investigations, performing Resource Conservation and Recovery Act (RCRA) tank assessment reviews, conducting site assessments, and preparing proposals for fixed price projects. His project engineering experience includes process development, conceptual and detail design, contract and fabrication management, commissioning and testing, and development of cost-effective alternatives for engineered applications. He has extensive experience in coal processing, materials handling, construction, and mining applications.

Education

B.S., Civil Engineering, University of Kentucky, Lexington, Kentucky; 1980
B.S., Mining Engineering, University of Kentucky, Lexington, Kentucky; 1979

Experience and Background

1986 - Present

Project Manager/Senior Project Engineer, IT Corporation, Knoxville, Tennessee. Responsible for managing and directing hydrogeologic remedial investigations at suspected hazardous waste sites. Responsible for managing the process design, equipment specification, procurement, fabrication, testing, delivery, and implementation of support facilities associated with the modification of new and existing waste incineration systems.

Project Manager - Develops work plans and performs remedial investigations of suspected hazardous wastes sites at the California Air National Guard Fresno Air Terminal for Martin Marietta Energy Systems, Inc.

Project Manager - Develops work plans and performs limited site investigations of suspected hazardous waste sites at previously owned U.S. Department of Defense (DOD) properties for the U.S. Army Corps of Engineers, Nashville District. The contamination evaluations consisted of five different properties in three states and included records review and evaluations, geophysical surveys, ordnance detection surveys, drilling soil borings, installing ground water monitoring wells, sampling, aquifer permeability testing, and evaluating analytical results.

Project Manager - Manages an independent assessment of the tank design for six new mixed waste or hazardous waste tank systems for the Consolidated Incineration Facility at the Savannah River Plant. The review included an evaluation of the structural integrity corrositivity and compatibility of the tank and support systems.

Project Engineer - Provides home office engineering support to field personnel for remediation projects at the Cornhusker Army Ammunition Plant and the Louisiana Army Ammunition Plant. Responsible for planning, designing, and coordinating on-site modifications and for implementing equipment modifications in addition to general system maintenance.

Project Engineer - Coordinated the requisite design for preparing Toxic Substance Control Act (TSCA) and RCRA permits for a fixed incineration facility. Was responsible for facility arrangement, site design, planning, budgetary control, and process design for the proposed incineration facility including its support facilities.

Project Engineer - Was a core member of design team for process conceptualization, design, specification, and fabrication of the utility system for the Hybrid Thermal Treatment System® (HTTS®). Responsibilities included: preparation of process flow diagrams (PFDs), equipment and instrument specifications, complete piping and instrumentation diagrams (PIDs), process descriptions, preparation and evaluation of bid proposals, and management of fabrication for transportable utility skids. Was responsible for coordinating the engineering from conception to design and fabrication of all interconnecting piping and electrical modules and hose assemblies for the total HTTS facility.

1981 - 1986 Project/Senior Preparation Engineer, Sierra Coal Company, Subsidiary of Utah International, Inc., Prestonburg, Kentucky. Was responsible for process development, evaluation, design, and construction of coal preparation and support facilities. Major responsibilities included developing potential mining projects, designing, and sizing coal washing circuits including process balance; providing technical support for existing problems at plant; predicting product quality for various cleaning methods; developing and implementing testing programs for equipment performance evaluations; and evaluating and developing modifications for engineered projects (e.g., slurry impoundments, sediment ponds, pumping and hydraulic applications). Other duties included developing cost comparisons of engineered alternatives, preparing and evaluating construction contracts (earthworks and mechanical), assisting in preparing permits, evaluating existing operations for potential acquisitions, and developing computer programs for various applications.

1983 Mine Engineer (Temporary Assignment), Utah International, Inc., Navajo Mine, Fruitland, New Mexico. Was responsible for assisting in the Apparent Completeness Review for the submitted mine permit

application. Duties included proposed ash and ash sludge disposal plans, final reclamation plans, and final surface hydrological plans for the total mine, which was actively producing 8 million tons per year. Was responsible for the 1983 proposed development drilling program. Coordinated and assisted with the design of a new mine area including spoil diagrams, reserve calculations, etc. for relocation of dragline. Acted as Reclamation Engineer for total mine.

1980 - 1981 Associate Fuel Engineer, Texas Utilities Generating Company, MOSES Fuel, Winfield, Texas. Was responsible for coordinating engineering projects; assisting in mining plans, design of support facilities, preparation of capital and operating budgets; design and construction management of hydrology structures. Was responsible for duties of maintenance foreman when the Maintenance Engineer was absent. Supervision of employees varied with size of crew, usually 15 men.

Summer 1979 Student Engineer, U.S. Steel Corporation, Lynch, Kentucky. Surveyor with responsibilities of party chief and assisting the Reclamation Department.

1974 - 1977 Laborer, U.S. Steel Corporation, Corbin Coal Preparation Plant, Corbin, Kentucky. Duties consisted of plant panel operator (coarse coal operator), car dropper, shake-out operator, sampler, heavy equipment operator (payloader, Mack Pac), load-out operator, switchman, and maintenance work.

1974 - 1977 Owner/Partner, Burton's Flowers, Inc., Corbin, Kentucky. Partner in two retail florist businesses and one wholesale business. Owner of single retail florist business after dissolution of partnership with full responsibilities of management.

Registration/Certifications

Engineer-in-Training Certificate, Kentucky; 1983
Land Surveyor-in-Training Certificate, Kentucky; 1979

Publications

Aident, M. L., D. C. Burton, and R. J. Lovell, 1988, "Cornhusker Army Ammunition Plant Remediation Project Case History," publication presented at International Conference on Incineration of Hazardous Radioactive Wastes, San Francisco, California.

KRISTEN K. BAKSA

Professional Qualifications

Mrs. Baksa is responsible for marketing and delivering educational and industrial hygiene services to external groups and organizations. She is a certified industrial hygienist with 8 years of experience in recognizing, evaluating, and controlling hazardous chemical and physical agents in a wide variety of manufacturing facilities. Her background includes experience with a national research laboratory as well as consultation and enforcement activities with a state Occupational Safety and Health Administration plan.

Education

M.P.H., Occupational and Environmental Health and Safety, University of Tennessee, Knoxville, Tennessee; 1981
B.S., Medical Technology, Michigan State University, East Lansing, Michigan; 1977

Experience and Background

1988 - Present — Special Projects Manager, Occupational Health and Safety Services, IT Corporation, Knoxville, Tennessee. Responsible for providing industrial hygiene and training services to clients and IT personnel. Specific activities include:

- Develops and delivers health and safety training for numerous industrial and government clients
- Provides a variety of industrial hygiene services for private industries and government agencies
- Develops site-specific health and safety plans for IT hazardous waste site projects
- Provides on-site and off-site industrial hygiene support services for IT personnel working on hazardous waste sites
- Coordinates the activities of a large industrial hygiene services contract.

1986 - 1988 — Health and Safety Coordinator, IT Corporation, Knoxville, Tennessee. Was responsible for developing and delivering hazardous materials training to clients and IT personnel. Provided industrial hygiene services to clients in the form of health hazard evaluations, exposure monitoring, and abatement recommendations. Duties also included providing health and safety support services for IT projects. Experience included:

- Participated in developing and delivering numerous 3- and 5-day "Hazardous Waste Operations and Emergency Response" courses for industrial and government clients.

- Participated in developing and delivering several 3-day presentations of "Hazard Appraisal and Recognition Planning" for the California Department of Health Services.

- Participated in developing and delivering "Air Surveillance for Hazardous Materials", a 4-day course conducted for the California Specialized Training Institute.

- Developed asbestos removal specifications for government and private industrial facilities.

- Monitored and evaluated employee exposures to a variety of hazardous materials in numerous industries.

- Provided on-site health and safety support services for IT personnel during hazardous waste site activities and asbestos cleanup operations.

1984 - 1986 Industrial Hygienist, Consultation Resources, Tennessee Occupational Safety and Health Administration, Knoxville, Tennessee. Conducted surveys in area industries to evaluate employee exposures to chemical and physical hazards. Made recommendations for hazard abatement. Assisted industries in developing safety and health programs. Conducted employee training overviews for local business organizations. Assisted in implementing internal industrial hygiene training programs.

1983 - 1984 Industrial Hygienist, Oak Ridge National Laboratory, Oak Ridge, Tennessee. Was responsible for health hazard evaluation and control in many areas of the laboratory, including research and fabrication facilities. Was responsible for reproductive hazard evaluation program. Assisted with employee training programs on a variety of topics related to occupational health.

1981 - 1983 Industrial Hygienist, Tennessee Occupational Safety and Health Administration, Knoxville, Tennessee. Conducted inspections of area industries to evaluate employee exposures to occupational health hazards and to ensure compliance with TOSHA regulations.

1978 - 1980 Medical Technologist, East Tennessee Baptist Hospital, Knoxville, Tennessee. Was responsible for tests performed in all areas of a clinical hospital laboratory. Position required operating and troubleshooting sophisticated laboratory equipment.

Certifications

Certified in the Comprehensive Practice of Industrial Hygiene by the American Board of Industrial Hygiene, Certificate No. 3236
Certified as an Environmental Trainer in Health and Safety by the National Environmental Training Association.
Certified as a Hazardous Materials Manager by the Institute of Hazardous Materials Management.

Professional Affiliations

American Academy of Industrial Hygiene
American Industrial Hygiene Association - National and Tennessee Valley Section
American Society of Safety Engineers
National Environmental Training Association

JONATHAN SHIREMAN

Professional Qualifications

Mr. Shireman is a hydrogeologist with experience in modeling solute transport in complex geological terrains. He is a registered Professional Geologist, with his education concentrated in structural geology, geochemistry, and mineralogy. Mr. Shireman's experience includes evaluation of proposed remedial action plans, modeling of aquifer restoration strategies, and evaluation of the impact of hazardous waste disposal sites on human health.

Education

Ph.D. Candidate, Geology, University of Tennessee, Knoxville Tennessee; Thesis nearing completion
M.S., Geology, University of South Carolina, Columbia, South Carolina; 1983
B.S., Geology, Humboldt State University, Arcata, California; 1981

Experience and Background

1988 - Present

Project Hydrogeologist, IT Corporation, Knoxville, Tennessee. Responsible for supervising a wide range of tasks in support of remedial investigations for both industrial and governmental clients. Has performed the following duties:

- Investigating hydrogeologist on a remedial investigation for Yellow Freight Inc. at their Nashville Terminal. In the first phase, Mr. Shireman conducted a long-term aquifer test to establish aquifer characteristics. These parameters were incorporated into a numerical transport model to determine the migration path and residence time for fuel hydrocarbon contaminants present in the soil. During the second phase, Mr. Shireman was involved in the design and implementation of an extensive geotechnical and analytical investigation which established the location of the contamination plume and fracture systems in the bedrock. During the third phase of the project, Mr. Shireman supervised installation of ground water monitoring wells and conducted injection tests to determine the immediate aquifer response to proposed remediation designs.

- Project geologist on a remedial investigation at a Superfund hazardous waste site in Columbia, South Carolina. Mr. Shireman supervised installation of ground water monitoring wells and provided technical expertise on well development and sampling methods.

- Technical assistance on cost proposals for tasks at Yellow Freight, Inc.

- Scores hazardous materials sites and potentially contaminated chemical waste sites using the hazard ranking system.

- Developed quality assurance procedures for the Knoxville Engineering operations office (KE QAP) for a wide spectrum of technical tasks. These procedures were designed to ensure that hydrogeological investigations are in compliance with requirements of HAZWRAP project quality plans.

1987 - 1988 Hydrogeologist, Oak Ridge National Laboratory, Oak Ridge, Tennessee
Was a consultant to the Office of Risk Analysis, acting in the capacity of senior scientist. Experience included:

- Principal investigator for ground water solute transport modeling and risk evaluation at the S-3 disposal ponds under the Y-12 Closure and Post Closure Analysis project. The first phase of the project required the calibration of hydraulic parameters governing ground water flow and contaminant transport in anisotropic, deformed, and heterogeneous aquifers. The second phase involved determining the site-specific factors governing the transport characteristics of several representative contaminants (i.e., adsorption, cation exchange, and decay reactions). The third phase required predictive studies of aquifer response to restoration activities, analysis of the associated risk levels, redesign of the proposed recovery network, and preparation of a final report.

- Developed methodology and guidance for identifying and evaluating possible health hazards because of water transport of contaminants from waste management units.

- Provided risk assessment of hazardous waste management units.

1983 - 1987 Laboratory Instructor and Lecture Assistant, University of Tennessee, Knoxville, Tennessee. Was responsible for developing laboratory exercises in geochemistry and petrology and administering and grading lecture examinations.

- Prepared lectures for Physical Geochemistry, Optical Mineralogy, and Metamorphic Petrology. Designed Geochemistry problem sets, exams, and served as a substitute lecturer.

- Developed a geochemical software code to solve for thermodynamic equilibrium conditions in terms of pressure, temperature, and/or fluid composition from mineral composition data for a variety of calibrated mineral assemblages.

- Assistant instructor to geologic Field Methods course. Course required 6 weeks of field study in the Appalachian Foreland Thrust belt near Dayton, Tennessee. Was responsible for instructing groups of up to eight students during daily field exercises.

1981 - 1983 Laboratory Instructor for Petrology and Mineralogy, University of South Carolina, Columbia, South Carolina. Was responsible for developing laboratory exercises in petrology and administering and grading lecture examinations.

1982 Petrographic Consultant to Amselco Mineral Exploration, Camden, South Carolina. Worked as a private consultant managing the manufacture of petrographic thin sections and making petrographic examinations of the specimens.

- Provided ore mineralogy of each specimen and an analysis of the paragenetic sequence. Where possible, each generation of ore mineralization was related to structural or metamorphic events observable in the thin section. A report for each section was provided and a final report for each borehole summarized the findings for the study.

1981 Assistant Instructor, Los Angeles State College, Los Angeles, California. Geologic field methods course, 6-week field study in crystalline basement. Was responsible for instructing groups of up to six students during daily field exercises.

1977 - 1981 Petrographic Assistant, Humboldt State University, Arcata, California. Manufactured petrographic thin sections for mineral exploration and faculty research. Also assisted professors in teaching laboratories in Geologic Field Methods, Petrology, Petrography, and Optical Mineralogy.

Registration/Certifications

Professional Geologist: Tennessee (No. TN0171)

Professional Affiliations

National Water Well Association

Publications:

Brumback, V. J. and J. Shireman, Draft Health Assessment for the Vineland Chemical Company Site, Vineland, New Jersey, Agency for Toxic Substances and Disease Registry (ATSDR) Health Assessment, Atlanta, Georgia.

Shireman, J., 1981, Igneous and Metamorphic Petrology of Phaneritic Melange Blocks Near Trinidad, North Wester California, (Manuscript) Senior Thesis, Humboldt State University, Arcata, California.

Shireman, J., 1983, Petrology and Deformational History of the Clouds Creek Igneous Complex, Central South Carolina Piedmont, (Manuscript) Thesis, University of South Carolina, Columbia, South Carolina.

Shireman, J., 1983, "Petrographic Variations of Peraluminous Granitic Rocks and Associated Quartz Gabbros of the Clouds Creek Igneous Complex, South Carolina Piedmont," Geological Society of America, abstracts with programs, V. 15, No. 2, p. 64.

Shireman, J., T. Labotka, and S. Knapp, 1985, "Metamorphic History of a Portion of the North Carolina Blue Ridge", Geological Society of America, abstracts with programs, V. 17, No. 2, p. 134.

Shireman, J. and V. J. Brumback, 1988, Health Assessment, Midway Landfill NPL Site, I-87-158, Seattle, Washington, (in review), Agency for Toxic Substances and Disease Registry (ATSDR) Health Assessment, Atlanta, Georgia.

Travis, C. C., R. K. White, J. Shireman, F. R. O'Donald, and G. R. Southworth, 1988, Analysis of Proposed Post Closure Alternatives at the S-3 Ponds, Oak Ridge National Laboratory (ORNL) (in review), Oak Ridge, Tennessee.

SCOTT A. McKINNEY

Professional Qualifications

Mr. McKinney is a recent graduate of the University of Tennessee. He received a Bachelor's of Science in Civil Engineering with a primary in solid and hazardous waste management and a secondary in water resources. While at UT, he was employed by two separate consulting companies which dealt primarily with surveying and site work. He also has an Associate of Science degree from State Technical Institute in Construction Engineering Technology.

Education

B.S., Civil Engineering, University of Tennessee, Knoxville, Tennessee; 1988

A.S., Construction Engineering Technology, State Technical Institute, Knoxville, Tennessee; 1984

Experience and Background

1988 Engineer Scientist, IT Corporation, Knoxville, Tennessee. Provides technical assistance for the development of work plans and job specifications. Develops detailed job analyses for use in project bids and submittals. Assists in field activities under the project administrator.

1987 - 1988 Junior Engineer, Adams Craft Herz Walker, Architects Engineers Surveyors Planners, Oak Ridge, Tennessee. Managed cut/fill volumes for new roadway construction and some parking lot designing. Was responsible for blueprint assembly and cover sheet designs.

1984 - 1985 Draftsman/Survey Crew, Hinds Surveying Company, Knoxville, Tennessee. Transferred land surveys from field notes to velum for mortgage companies and banking institutions. Field experience included associate crew chief and notekeeper.

Registrations/Certifications

Engineer in Training: Tennessee

Professional Affiliations

American Society of Civil Engineers

E09/15/88

JACK R. HALL

Professional Qualifications

Mr. Hall is a professional chemist with 23 years of experience in the collection and chemical analysis of environmental samples. His experience ranges from analysis of air, water, and milk for radiological constituents to analysis of a wide variety of chemical wastes, including experience in coordinating the analytical analyses and monitoring needs for the startup of coal liquification and chemical pilot plants. Currently, he has responsibility for the four IT analytical laboratories in the South. Mr. Hall has worked in a personnel supervisory and project management capacity for more than 16 years. The current projects and laboratories he is actively involved with are: method development for organic pollutants; compliance testing for specific CLP organics; testing of vents for treatment equipment design; analysis of hazardous pollutants in waste materials and environmental media for EPA and several industrial clients; testing of specific emissions from test burns for a variety of wastes; and Resource Conservation and Recovery Act analysis. Mr. Hall has been involved in the design of IT's Special Analysis, Mixed Waste, and Austin Environmental laboratories and is currently locating and designing a laboratory in Florida.

Education

B.S., Chemistry, Pennsylvania State University, University Park, Pennsylvania; 1962

Experience and Background

1984 - Present — Director, Southern Analytical Operations, IT Corporation, Knoxville Tennessee. Responsible for four analytical services laboratories that:

- Provide consulting and analytical services to industrial and governmental clients.
- Have full-service capabilities for analyzing environmental media and hazardous materials for inorganic and organic constituents at the parts-per-trillion through percent levels.
- Responsible for negotiating and managing large analytical services contracts, introduction of new technologies into the laboratories, budgeting, and quality assurance of the laboratories.

1982 - 1984 — Manager, Proposal Administration, IT Corporation, Knoxville, Tennessee. Was responsible for the evaluation of requests for proposals and managing the preparation of proposals for analytical, engineering, and technical services. Managed special analytical chemistry projects (EPA Interlaboratory Study for Priority Pollutants).

1980 - 1982 Vice-President and Manager of Analytical and Technical Services, IT Enviroscience, Division of IT Corporation, Knoxville, Tennessee. Managed the IT Enviroscience analytical laboratory and oversaw conceptual design through construction of a state-of-the art, limited-access analytical laboratory for analyzing extremely hazardous materials as an addition to the Knoxville laboratory and a 40-foot mobile laboratory with similar capabilities.

1975 - 1980 Manager, Analytical Services Department, Hydroscience, Inc., Knoxville, Tennessee. Was responsible for maintaining the analytical technology of Hydroscience at a high level of the state of the art. Utilizing extensive experience in chromatograpy, managed the Knoxville Laboratory Analytical Services Group, which specializes in the analysis of trace organic compounds in environmental matrices.

1968 - 1975 Senior Analytical Chemist, Michigan Division Analytical Laboratories, Dow Chemical Company, Midland, Michigan. Was responsible for the analysis of environmental samples in the Michigan Division Analytical Laboratory. Functions included development of procedures for in-plant monitoring of all discharges. Plants thoroughly studied included chlorinated benzene, 2-4 dichlorophenoxy acetic acid, 0,0 dimethyl-o(3,5,6-trichloro-2-pridyl phosphate), salicylic acid, glycol ethers, and polyethylene glycols.

Senior Analytical Chemist, Analytical Laboratories. Was responsible for research and method development for specific compound analysis of environmental samples (air, water, and solid wastes). Coordinated air- and water-sampling programs in production processes of phenol, alkyl phenols, chlorinated phenolics, chlorinated benzenes, and herbicides.

Analytical Chemist, Waste Control Department. Was responsible for analysis of samples from waste control research projects and waste water treatment plants. Involved in implementation of new analytical instrumentation in laboratory and on-stream at WWTP.

1964- 1968 Supervisor, Radiological Health Analytical Section, Pennsylvania Department of Health, Harrisburg, Pennsylvania. Primary function of group was the analysis of air, water, and milk for radiological constituents.

Supervisor, Public Waters Analysis Section, Division of Sanitary Engineering. Section was responsible for sampling and analysis of all public and drinking waters of Pennsylvania for compliance with federal and state regulations.

Chemist, Division of Sanitary Engineering, Industrial Wastewater Section. Was responsible for sampling and analysis of industrial wastewaters of Pennsylvania for compliance with state and federal discharge permits. Worked with other regulatory agencies on analytical method development and training programs. Experience included reviewing process chemistry of chemical, pharmaceutical, and formulating plants and requesting discharge permits. Evaluated potential of air and water discharges.

Publications

Hall, J. R., D. Stagg, and S. Clark, 1987, "Guidelines and Precautions in Collecting and Analyzing for Mixed Wastes," presented at the 1987 Winter Meeting of the American Nuclear Society.

Hall, J. R., 1983, "Quality Assurance in Environmental Trace Analysis," Liquid Chromatography in Environmental Analysis, edited by James F. Lawrence, Humana Press.

Hall, J. R., J. R. Florance, and D. L. Strother, 1981a, EPA Method Study, Method 604-Phenols, Contract No. 68-03-2625, submitted to Quality Assurance Branch, EMSL, EPA - Cincinnati, Ohio, for publication.

Hall, J. R., J. R. Florance, and D. L. Strother, 1981b, EPA Method Study 22, Method 612-Chlorinated Hydrocarbons, Contract No. 68-03-2625, submitted to Quality Assurance Branch, EMSL, EPA - Cincinnati, Ohio, for publication.

Hall, J. R., J. R. Florance, 1980, "Implementation of a Quality Assurance Program for the Determination of Trace Organics in Environmental Samples," presented at the 1980 Pittsburgh Conference.

Hall, J. R., C. W. Stuewe, R. C. Wilmolth, and J. L. Kennedy, 1979, Removal of Trace Elements from Acid Mine Drainage, EPA-600/7-79-101.

Hall, J. R., M. N. Wass, and R. A. Solomon, 1978, "Problems Encountered with the EPA Protocol Procedures for Screening of Industrial Waste Effluents for Priority Pollutants," presented at the 176th National Meeting, ACS.

Hall, J. R., 1977a, "Effect of New Effluent Guidelines on the Industrial Waste Treatment Laboratory," presented at Mid-Atlantic Industrial Waste Conference.

Hall, J. R., 1977b, "The Effect of Recent Legislation on the Industrial Wastewater Laboratory", presented at the New York Water Pollution Control Federation Meeting.

Hall, J. R., J. R. Florance, and R. D. Fox, 1976, "Role of New Techniques in Wastewater Analysis," presented at the 31st Purdue Industrial Waste Conference.

Hall, J. R., 1970, "Determination of Select Phthalates in Wastewater," presented at the 166th National Meeting ACS.

Hall, J. R., R. T. Richards, and D. T. Donovan, 1967, "A Preliminary Report on the Use of Silver Metal Membrane Filters in Sampling for Coal Tar Pitch Volatiles," Amer. Ind. Hyg. Assoc. J.,.

BARRY A. STEPHENSON

Professional Qualifications

Barry Stephenson is a professional chemist with 18 years of experience in the collection and chemical analysis of environmental samples and 5 years of experience teaching in the physical sciences area. He has worked in supervision of analytical laboratory personnel and laboratory administration for more than 15 years, including laboratory management, project design, sales and customer service and contract administration, as well as hands-on experience in field collection and laboratory analysis. Project experience includes direction of sampling and analysis for hazardous waste incinerator trial burns, Occupational Safety and Health Administration (OSHA) and industrial hygiene field surveys, polychlorinated biphenyl (PCB) cleanups, National Pollutant Discharge System (NPDES) monitoring programs, surface and ground water assessments, waste characterization, and hazardous waste site assessments. Currently he has responsibility for IT's Field Analytical and Sampling Group. This group has been structured to provide coordination of activities between IT Operations and IT Analtyical Services. The Field Analytical Group is responsible for assuring that projects which involve analytical testing are appropriately designed for establishing field sampling and data management guidelines and for providing quality assurance/quality control direction to field collection projects.

Education

M.S., Science Education, University of Tennessee, Knoxville, Tennessee; 1970
B.S., Chemistry, Biology, and Physics, University of Tennessee at Martin, Martin, Tennessee; 1965
OEO Fellowship in Physical Sciences, University of Tennessee, Knoxville, Tennessee; Summer 1979
NSF Fellowship in HPP Physics, Oak Ridge Associated Universities, Oak Ridge, Tennessee; Summer 1968
NSF Fellowship in PSSC Physics, Auburn University, Auburn, Alabama; Summer 1967
"Recognition of Occupational Health Hazards," National Institute for Occupational Safety and Health and American Industrial Hygiene Association, New Orleans, Louisiana; (40 hour course) February 1976

Professional Affiliations

American Chemical Society
American Industrial Hygiene Association
American Society for Testing and Materials

Experience and Background

1984 - Present: Manager, Field Analytical and Sampling, IT Corporation, Knoxville Tennessee. Responsible for management of Eastern and Western Division offices of FAS Group provides coordination of field sampling and field analytical support for combined IT Operations/IT Analytical Services Projects.

- o General management of administrative and support functions of FAS.
- o Technical input as analytical chemist to project design for field sampling projects.

1983 - 1984 General Manager, IT Analytical Services, Stewart Laboratories, which was acquired by IT Corporation in July 1981, Knoxville, Tennessee. Responsible for operations of analytical service laboratory engaged in analysis of environmental samples and hazardous materials for inorganic and organic constituents. Supervised day-to-day activities.

1981 - 1983 Manager of Customer Service, Sales and Marketing, IT Analytical Services, Stewart Laboratories Division, Knoxville, Tennessee. Responsible for coordination of sales and marketing for analytical testing laboratory. Duties included contract administration, client contact, project design, proposal and report writing, and supervision of field collection projects.

1974 - 1981 Assistant Vice-President, Manager of Administrative Services, Stewart Laboratories, Knoxville, Tennessee. Served as member of management group for independent analytical testing laboratory with primary responsibility for marketing. Duties included contract administration, client contact, project design, proposal and report writing, and supervision of some field collection projects.

1973 - 1974 Manager of Administrative Services, Stewart Laboratories, Knoxville, Tennessee. Supervisor for sales, marketing, purchasing, proposals, and special reports. Also served as member of field services work pool.

1970 - 1973 Director of Analytical Services, Stewart Laboratories, Knoxville, Tennessee. Supervisor of chemists and technicians in independent analytical testing laboratory. Primary business of the laboratory was analysis of trace metals and classical parameters in environmental samples.

1969 - 1970 Physics Instructor, Oak Ridge Associated Universities, Oak Ridge Tennessee. Taught laboratory course in Harvard Project Physics to junior college instructors. During this time, also completed work on Master's Degree in OEO Fellowship program.

1968 - 1970 Analyst, Stewart Laboratories, Knoxville, Tennessee. Performed general laboratory duties in sample preparation analysis of water and wastewater samples, and operated atomic absorption spectrometer. Part-time employment.

1965 - 1969 Chemistry and Physics Instructor, Roane County Schools, Kingston, Tennessee. Taught chemistry and physics to high school juniors and seniors. Wrote and taught advanced science course in introductory biochemistry.

Publications

Stephenson, B. A., 1979, "Screening Techniques for Toxic Pollutants," presented at General Electric Environmental Seminar, Orlando, Florida.

Stephenson, B. A., 1970, "An Investigation of the Composition -- Lattic Parameter -- Oxygen Potential of the U-Eu-O System," Master's Thesis, University of Tennessee, Knoxville, Tennessee.

ALYCE R. MOORE

Professional Qualifications

Ms. Moore has fourteen years of experience in analytical operations, supervision and management, and extensive experience in all aspects of sample preparation and analysis of environmental samples for metals, anions, classical parameters and organic analysis, as well as experience in microbiology, biological and aquatic samples and EP Toxicity extraction techniques for waste disposal. She has extensive experience in laboratory scheduling, writing and evaluating reports. In addition, she possesses background in screening applicants and handling personnel problems.

Education

Gas Chromatography Course, Southern Analytical, Knoxville, Tennessee; January 1978

Perkin-Elmer One Day Seminar, Infrared, Knoxville, Tennessee; April 1976

"Instrumentation and Application of Liquid and Gas Chromatography", Perkin-Elmer Seminar, Knoxville, Tennessee; 1975

"Atomic Absorption Seminar", Varian Instrument Division, Knoxville, Tennessee; 1973

"Techniques of Solid Waste Management", Knoxville, Tennessee; January 1972

"Microbiological Analysis of Water and Wastewater", Millipore Workshop, Chattanooga, Tennessee; September 1972

"Society for Applied Spectroscopy", Eleventh National Meeting, Dallas, Texas; September 1972

Experience and Background

1971 - Present <u>Laboratory Manager, IT Corporation, Knoxville, Tennessee</u>. Former Lab Manager at Stewart Laboratories, Inc., which was acquired by IT Corporation in July 1981. Responsible for supervision of all analytical groups, covering a two-shift operation and involving:

- Scheduling projects, shifting laboratory personnel to meet changes in work loads, evaluating data and writing reports, expansion and changes in laboratory facilities, instructing new employees and coordinating all day-to-day operations.
- Handles client calls dealing with technical questions and sales and customer service.
- Works closely with quality control coordinator to assure continued excellent quality of laboratory operations.
- Assists IT Field operations where possible and as needed.

- Provides support to field operations, evaluates data and compiles reports.
- Assists analytical groups by actual "hands on" analytical testing. Trains new personnel and assists in interviewing and hiring of personnel.
- Schedules and coordinates large government projects.

1961 - 1968 Assistant Manager and Bookkeeper, Cashier, Robert Hall Clothes, Knoxville, Tennessee. Handled all bookkeeping duties and managed store operations in manager's absence.

ROBYN M. WAGNER

Professional Qualifications

Robyn Wagner has eight years of experience in laboratory operations management, analytical laboratory supervision, project design, project management, analytical chemistry, and biology/chemistry research. She is experienced in the supervision of analytical, mobile, and biological/toxicological laboratories and competent in the use of gas chromatography, high performance liquid chromatography, DC argon plasma emission spectroscopy, infrared spectroscopy, classical wet methods, and programming in BASIC.

Education

B.S., Biology, Rutgers University, New Brunswick, New Jersey; 1981

ACS Short Courses:
Capillary Gas Chromatography: Techniques and Problem Solving; 1983
Effective Management Techniques; 1984
Effective Management Techniques for Chemical Analysis Laboratories; 1985

Experience and Background

1986 - Present <u>Operations Manager, IT Corporation, Knoxville, Tennessee.</u> Responsible for management of daily laboratory operations; review all analytical data and report to Laboratory Manager for approval; handle client calls dealing with technical questions, sales, and customer service; supervise quality control activities performed as part of routine analytical operations; schedule projects and set priorities; responsible for supervision of group supervisors.

1985 - 1986 <u>(On special assignment), IT Corporation, Knoxville, Tennessee.</u> Assigned to the Knoxville analytical laboratories to expand technical expertise and develop working knowledge of all laboratory areas including laboratory information and data management, water and wastewater analyses, metals analyses, organic preparation, GC/LC, GC/MS and dioxin/furan analyses.

1981 - 1985 <u>Laboratory Supervisor, IT Corporation, Edison, New Jersey.</u> Supervised a group of seven chemists and two technicians to provide analytical support to the USEPA under EERU Contract No. 68-03-3069. Established work plans, budgets and manpower forecasts for both R+D and emergency response activities, and was responsible for sampling and analytical expenditures of $1,000,000. covering more than 100 different EERU projects. Directed research projects to evaluate equipment and develop rapid methodology for use onboard EPA's mobile laboratory. Supervised and performed analysis of hazardous materials in complex environmental

matrices using standard, as well as, non-standard methodology, and a variety of analytical techniques (GC/MS, GC, HPLC, IR, TOC, DCP emission spectroscopy). Designed and directed extent of contamination studies. Responsible for the development and implementation of internal quality control procedures to ensure reliable and statistically sound data generation. Designed and managed an external quality assurance program to assure the validity of environmental measurements made during the testing of EPA prototypical hardware, including the mobile incinerator and the carbon regenerator. Responsible for the daily operation of EPA's central and mobile laboratories.

1980 - 1981 Laboratory Technician, USEPA-OHMSB, Edison, New Jersey. Performed methods development research and environmental sample analyses. Preparation of rapid analytical methods for publication. Performed sample analyses onboard mobile laboratories during emergency response activations. Experience in repair and maintenance of analytical instruments.

1979 - 1980 Laboratory Technician, USEPA-Region II, Edison, New Jersey. Performed acute and chronic aquatic toxicology tests in support of the National Pollution Discharge Elimination Program. Assisted in the design of a flow-through aquatic bioassay system for the Surveillance and Analysis Division, Biology/Toxicology Laboratory. Maintained and cultured bioassay test organisms. Responsible for the daily operation of the laboratory. Conducted independent research of the life cycle of *Daphnia magna*.

1979 US Forest Service, Camptonville, California. Participated in the biology intern program.

Professional Affiliations

Member of the American Chemical Society
Member of the ACS Environmental Chemistry Division
Member of the American Institute of Chemists

Publications

Wagner, R., et. al., March 1984, "A Comprehensive Strategy for On-Site Analysis of Hazardous Waste," presented at the 1984 Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Atlantic City, New Jersey.

Wagner, R., D. Remeta, and M. Gruenfeld, March 1985, "Rapid On-Site Methods of Chemical Analysis," CONTAMINATED LAND: Reclamation and Treatment, R. E. Montgomery ed., Plenum Publishing Corp., New York, pp. 257-310.

THOMAS W. WILSON

Professional Qualifications

Thomas Wilson has been a gas chromatography/mass spectrometry (GC/MS) chemist since 1978. He worked in GC/MS pollutant analysis for nine years, and has recently served as Group Leader for major effluent guidelines isotope dilution contract, and now is the GC/MS Group Supervisor. Chemistry, electronics, and computer programming background qualify him for problem solving associated with interpretation and evaluation of raw analytical data and development of programs specifically designed to perform those functions. He has extensive experience in electronics and computer programming, having programmed in machine, assembly, and higher languages for several minicomputers, such as TI 980, PNP, and NOVA series. He was listed in Journal of Analytical Chemistry at the University of Tennessee in 1972 as its outstanding undergraduate analytical chemistry student.

Education

A.B.D., Chemistry, University of Tennessee, Knoxville, Tennessee; 1976
B.A., Biology, Vanderbilt University, Nashville, Tennessee; 1968

Experience and Background

1986 - Present GC/MS Group Supervisor, IT Corporation, Knoxville, Tennessee. Responsible for:

- Coordinating and prioritizing projects.
- Reviewing and overseeing QC on all analyses.
- Training personnel.
- Purchasing for GC/MS needs.
- Expediting and improving procedures in GC/MS group as a whole.
- Commercial and CLP analyses, including special projects, to cover all phases of GC/MS work.

1978 - 1986 Group Leader for Special EPA Projects, IT Corporation, Knoxville, Tennessee. Responsible for effluent guidelines work, and for GC/MS extractables analyses for hazardous waste contracts and all phases of GC/MS priority pollutant analysis, including development and optimization of procedures. Also responsible for Finnigan 4000 operation; GC/MS analysis including priority pollutant VOA's, base neutrals, and acid extractables, as assigned; application of GC/MS and GC techniques to wastewater analysis.

1972 - 1976 Department of Chemistry, University of Tennessee, Knoxville, Tennessee. Conducted recitation classes and laboratories for various freshman courses, administered and proctored tests and exams, graded tests and laboratory papers.

1972 - 1976 Research Worker, University of Tennessee, Department of Chemistry, Knoxville, Tennessee. Conducted research under Dr. W. A. Van Hook. Involved osmotic pressure-free energy relationships between heavy and "natural" waters. Also did work for Dr. J. W. Larsen on research and development analysis of protein in hamburger meat.

DANIEL R. LONGNECKER

Professional Qualifications

With extensive experience as a chemist, Mr. Longnecker is experienced in the preparation of city water, industrial discharge, and various environmental type samples, including water, sediment, oil, sludge, wood, filters, plants, fish, and wipe samples, especially for gas chromatography (GC) and gas chromatography/mass spectrometry (GC/MS) priority pollutant analysis, and some inorganic work. He is also experienced in determining biochemical oxygen demand (BOD) and total organic carbon (TOC) amounts in water and in trihalomethane (THM) analysis; is proficient in the routine standard operating procedures associated with the gas chromatography group, involving autosampling for polychlorinated biphenyls (PCB's), pesticides, and herbicide residue analysis; and has done some work in National Institute for Occupational Safety and Health (NIOSH) air sample analysis. He has extensive experience in the analysis of samples, interpretation of chromatograms and the preparation of forms involved with the EPA Contract Laboratory Program (CLP), and has supervised the GC personnel involved with CLP projects for about 1½ years, presently supervising the GC Department as a whole.

Education

B.A., Biology, Spring Arbor College, Spring Arbor, Michigan; 1975

Experience and Background

1988 - present <u>Group Supervisor - GC, IT Corporation, Knoxville, Tennessee</u>. Responsible for the following:

- Overall scheduling of projects and instrumentation
- People management
- Ability to understand and QC all the various methods, analyses, and calculations that are performed by gas chromatography
- Working with upper management on behalf of the department
- Dealing with vendors, instrument service people, and various IT facilities for project information

1987 - 1988 <u>Chemist, IT Corporation, Knoxville, Tennessee</u>. Responsible, as Team Leader, for the following duties in connection with Contract Laboratory Program work: scheduling of project analysis; monitoring productivity; supervision of GC personnel involved directly with CLP work.

1977 - 1987 <u>Chemist, IT Corporation, Knoxville, Tennessee</u>. Responsible for the following: involvement with autosampling in PCB, pesticide, and herbicide residue analysis; preparation of stock and working standards, sample extract cleanups, and GC maintenance; involved in many different aspects and methods of sample preparations and extractions for GC and

GC/MS analysis of priority pollutants; involved in BOD and TOC analysis, and in preparing filters for analysis of air particulate contaminants; extractions and colorimetric readings of phenols and surfactants, and the determination of oil and grease residues in water samples; extensive experience with gas chromatography (analysis of priority pollutant pesticides, herbicides, and PCB's); and analyzing sample extracts by CLP protocol.

and Standard Operating Procedures; initiating, establishing, and maintaining preventive maintenance programs, corrective actions, method R&D, new employee QC training programs, and sample receipt and preservation protocols; handling matters pertaining to ITAS accreditations, certifications, and outside QA audits and inspections; and supervising inventory and quality control of reagents, calibration standards, and Standard Reference Materials.

1984 - 1986 Sales and Customer Services Representative, IT Corporation, Knoxville, Tennessee. Responsible for normal telephone inquiries from potential clients, including intercompany requests, quoting prices and answering client requests on sample status. Works with sales and marketing on proposals.

1983 - 1984 Laboratory Manager, Envirolab, Briley, Wild & Associates, Ormond Beach, Florida. Responsible for marketing and client relations, sample collection, sample analysis, report and invoice preparation. Analytical departments included atomic absorption, gas chromatography, total organic carbon, wet chemistry, and microbiology.

1980 - 1983 Group Leader, Atomic Absorption, IT Corporation, Knoxville, Tennessee. Responsible for scheduling technicians, sample preparation and all analyses by atomic absorption (flame and flameless) and inductively coupled argon plasma.

1979- 1980 Accounting Clerk, Plasma Alliance, Production Statistics, Knoxville, Tennessee. Responsible for plasma inventory control. Also prepared expense reports and cash reports.

1977 - 1979 Office Assistant, University of Tennessee, Knoxville, Tennessee. Responsible for general office duties including typing, filing and reception for two U.T. departments - math and athletics.

1976 - 1977 Assistant Bookkeeper, Frank Wylie Realty, Knoxville, Tennessee. Responsible for maintaining and balancing the books for all departments including rental properties. Also worked as backup receptionist.

Professional Affiliations

American Chemical Society
Florida Society for Environmental Analysts