Garage and Maintenance Area
NASA Plum Brook Station
Sandusky, Ohio

Closure Work Plan

September 1995

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GARAGE AND MAINTENANCE AREA
NASA PLUM BROOK STATION
SANDUSKY, OHIO

CLOSURE WORK PLAN
TASK ORDER 7059-004

SEPTEMBER 1995

PREPARED FOR:

NASA LEWIS RESEARCH CENTER
21000 BROOKPARK ROAD
CLEVELAND, OHIO 44135

PREPARED BY:

URS CONSULTANTS
23355 MERCANTILE ROAD
CLEVELAND, OHIO 44122

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ABBREVIATIONS AND ACRONYMS

ABS	Dermal Absorption Factor
ASTM	American Society for Testing and Materials
B	Morrison Knudsen Boring
BUSTR	Bureau of Underground Storage Tank Regulations
CAA	Clean Air Act
DNAPL	Dense Non-Aqueous Phase Liquid
DOT	Department Of Transportation
DSHWM	Division of Solid and Hazardous Waste Management
EIS	Environmental Impact Statement
EPC	Exposure Point Concentration
ERD	Environmental Resources Document
GC	Gas Chromatography
GMA	Garage and Maintenance Area
HDPE	High Density Polyethylene
HEAST	Health Effects Summary Table
HI	Hazard Index
HIF	Human Intake Factor
HQ	Hazard Quotient
ID	Inside Diameter
IRIS	Integrated Risk Information System
LCS	Lab Control Sample
LeRC	Lewis Research Center
LNAPL	Light Non-Aqueous Phase Liquid
LIMS	Laboratory Information Management Systems
MK	Morrison Knudsen Corporation
MSL	Mean Sea Level
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MDL	Method Detection Limit
µg/kg	Micrograms per Kilogram (ppb)
µg/L	Micrograms per Liter (ppb)
mg/kg	Milligram per Kilogram (ppm)
MW	Monitoring Well
MSL	Mean Sea Level
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
OAC	Ohio Administrative Code
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
OVA	Organic Vapor Analyzer
PA	Preliminary Assessment
PC	Permeability Constant
PID	Photoionization Detector
ppb	Parts Per Billion
ppm	Parts Per Million
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability

ABBREVIATIONS AND ACRONYMS-Continued

PCB	Polychlorinated Biphenyl
PPE	Personal Protection Equipment
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
RA	Reactor Area
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study
ROE	Risk Of Exposure
RPD	Relative Percent Difference
SF	Slope Factor
SIF	Sample Intensity Factor
SOP	Standard Operating Procedures
SWL	Static Water Level
TAL	Target Analyte List
TCL	Target Compound List
TPH	Total Petroleum Hydrocarbons
UST	Underground Storage Tank
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 INTRODUCTION

Under the direction of the National Aeronautics and Space Administration (NASA), URS Consultants has prepared this site Closure Work Plan for the Garage and Maintenance Area (GMA), located at the NASA Plum Brook Station (PBS) facility near Sandusky, Ohio. The purpose of this Work Plan is to establish specific site procedures that will be used by NASA to determine the presence and extent of contamination and the associated risks of a waste management unit that was comprised of two underground storage tank (UST) areas located adjacent to Buildings 7121 and 7131 at the GMA.

In 1989, nine USTs were removed from three areas at the GMA. Four USTs, in the vicinity of Building 7132, contained petroleum products and were closed in accordance with the Bureau of Underground Storage Tank Regulation (BUSTR) rules. Three USTs adjacent to Building 7121 were product USTs that formerly contained acetone, trichloroethane, and trichloroethene. The two remaining USTs (one north of Building 7131 and one east of Building 7121) contained waste oil and solvents. Post removal sampling at the GMA detected volatile organic compounds in the soil and in the groundwater.

This Closure Work Plan will address the following activities:

- Identification and complete delineation of the full horizontal and vertical extent of soil and groundwater contamination at the GMA as a result of waste management operations;
- Preparation of a risk assessment;
- Development of remediation standards for contaminants in soil and groundwater if recommended risk levels are exceeded;
- Development of a remediation methodology to eliminate the identified contaminant source in the soil and prevent contaminant migration through groundwater.

This document was prepared in response to an Ohio Environmental Protection Agency (OEPA) request that NASA submit a Work Plan demonstrating how it intends to fully characterize and remediate contamination at the GMA as a result of waste storage operations at the site. Figures and tables referenced in this report are located at the end of the section in which they are cited.

This Work Plan has been prepared in accordance with the closure performance standards and associated requirements as promulgated in the Ohio Administrative Code (OAC) Chapters 3745-52-34(A)(1), and applicable sections of 3745-66. The Work Plan also follows the guidance presented in Closure Plan Review Guidance, September 1993, issued as an interim final document by the OEPA, Division of Solid and Hazardous Waste Management (DSHWM) (OEPA, 1993).

2.0 NASA PLUM BROOK FACILITY DESCRIPTION

2.1 FACILITY DESCRIPTION AND HISTORY

Plum Brook Station is 50 miles west of the NASA Lewis Research Center (LeRC) in Cleveland, Ohio, and is approximately 4 miles south of the Lake Erie port of Sandusky, Ohio, in an area that is primarily agricultural and rural. The area surrounding Plum Brook Station is mostly used for crop production. Plum Brook Station is generally undisturbed forested land and is located in Perkins and Oxford townships. There are small portions of the site along the eastern boundary that extend into Huron and Milan townships. Plum Brook Station is located on what was originally a flat lake bottom from glacial melt waters. The facility derives its name from Plum Brook, the major stream that flows through its boundary.

Plum Brook Station is approximately 6,400 acres. The northernmost boundary of Plum Brook Station occurs at latitude 41°23'39" and extends as far south as latitude 41°20'04". The westernmost longitude occurs at 82°43'12" and extends as far east as 82°38'39". NASA's LeRC controls the land associated with Plum Brook Station through the following: ownership of title; use of easements, leases, and permits; and ownership of development rights. NASA LeRC management has responsibility for both the Cleveland Center and Plum Brook Station.

Figure 2-1 is a facility map of Plum Brook Station and identifies the area of concern, the GMA, in the north central portion of the facility. There are approximately 149 permanent buildings and structures on the Plum Brook Station site and 99 munitions bunkers, which were constructed when the facility was an ordnance plant. The munitions bunkers are currently used for the storage of supplies, equipment, and records. The buildings and structures include offices, test facilities, mechanical or process equipment, shipping and receiving areas, substations, sanitary wastewater treatment facilities, and cooling towers. All the test facilities located at the site are remotely located from each other, as original use dictated hazard-exclusion distances.

Electric power is provided to the facility by Ohio Edison Company. Potable water is supplied by the City of Sandusky. Raw water, used for cooling, testing, and fire protection, is provided by two Plum Brook Station-owned intake in Lake Erie (Big Island and Rye Beach Pump Stations). Plum Brook Station has three sanitary waste treatment systems; one is operated continuously and the other two are operated intermittently.

An 8-foot-high security fence surrounds 5,400 acres of Plum Brook Station. Unauthorized site access is prohibited. Access to the site is gained through the security guard house located on Columbus Avenue. The guard house is manned by armed guards 24 hours a day. During each eight-hour shift, a security guard patrols the inside perimeter road (Patrol Road) of the facility. Persons gain access to the station by showing the guard a badge that authorizes entry into the station.

In addition to NASA activities currently conducted at PBS, the Department of Agriculture, Department of the Interior, Department of Labor, the Immigration and Naturalization Services, and the Federal Bureau of Investigation have offices located at PBS for non-aerospace activity.

2.2 FACILITY REGULATORY HISTORY

This section of the report contains information on environmental permits, known hazardous material releases, and previous and current remediation activities.

2.2.1 Facility Environmental Permits and Other Regulatory Activities

Environmental permits currently held by NASA PBS and on-going regulatory activities include;

- Open Burning Permit
- National Pollutant Discharge Elimination System (NPDES) Permit
- Air Permits
- National Environmental Policy Act (NEPA) Documentation
- Resource Conservation and Recovery Act (RCRA) Activities

The Northwest District Office of the OEPA in Bowling Green, Ohio is responsible for the administration and enforcement of PBS's permits.

2.2.1.1 Open Burning Permit - The PBS Open Burning Permit is a written authorization obtained on a yearly basis from the OEPA. PBS requests it yearly to allow the burning of open fields each spring. The field burning is conducted in order to eradicate noxious weeds and to propagate the growth of field grasses that the site wildlife feed upon. A burn campaign, lasting approximately three months, is conducted each year, alternating burns between the northern and southern halves of the facility, terminating prior to the nesting of PBS wildlife.

2.2.1.2 NPDES Permit - NASA PBS has a NPDES permit (Application No. OH000-1392) for seven outfalls. The United States Environmental Protection Agency (USEPA) has transferred primary authority for the NPDES permit program for federal facilities in Ohio to OEPA. Three of the seven permitted outfalls are process/stormwater discharges at Kuebelar Ditch (outfall 001), Ransom Brook (outfall 002), and Plum Brook at Pentolite Road (outfall 003). Two outfalls (005 and 006) are for effluent from PBS sewage treatment plants, which discharge to Kuebelar Ditch and Plum Brook. Outfall 008 is for effluent from the B Control Building sewage package plant, which ultimately discharges to the Box Factory Road Ditch. Outfall 009 is for non-contact cooling water from K Site that is discharged onto the ground a distance of 100 feet from the building.

The most recent NPDES permit issued by the OEPA (OEPA Permit No. 21000002*ED) has an effective date of April 1, 1995.

2.2.1.3 Air Permits - In order to comply with the Federal Clean Air Act (CAA), the State of Ohio through its CAA State Implementation Program requires Permits to Install (PTI) New Sources of Pollution for sources installed since 1974 and Permits to Operate (PTO) for all air pollution sources. Small emissions sources (typically less than 10

tons/year) often receive "Registration Status" or "T Status" on the OEPA records. In response to a 1972 request from the Ohio Board of Health, PBS pre-registered potential air pollution sources with the Ohio Air Pollution Control Board for information purposes only. PBS currently holds five OEPA air permits and has 28 sources on registration status. Many of the test facilities remain inactive today; therefore, many potential air emission sources are not operating at this time. Potential sources include rocket testing activities, gas/liquid storage, degreasers, cooling towers, boilers, a paint-spray booth, an incinerator, and construction activities.

PBS conducted an air pollution source inventory during the fall of 1993. If a significant portion of PBS was reactivated or a new source was installed, emissions would be evaluated to determine which, if any, required permitting. Air permits for boilers have been issued.

2.2.1.4 National Environmental Policy Act Documentation - NASA prepared an Environmental Impact Statement (EIS) in 1971 for both the LeRC and PBS facilities in accordance with the requirements of the National Environmental Policy Act. The 1971 EIS was superseded by a 1978 EIS which NASA submitted to the OEPA. Environmental Resources Documents (ERDs) were prepared to supplement the 1978 EIS. The current ERD was prepared in August 1990 and addresses management of hazardous substances and hazardous wastes at LeRC and PBS.

2.2.1.5 Resource Conservation and Recovery Act - PBS has registered with the OEPA as a generator of Resource Conservation and Recovery Act (RCRA) hazardous waste and has received an EPA identification number - OH3800015379. Wastes generated from routine operations are managed in Building 9206 under the limitations of the 90-day storage requirements. No RCRA hazardous wastes are treated or disposed of onsite. Although NASA PBS is a hazardous waste generator under RCRA, no operations have required the submission of Part A or Part B permit applications.

2.2.2 Facility Environmental Remediation History

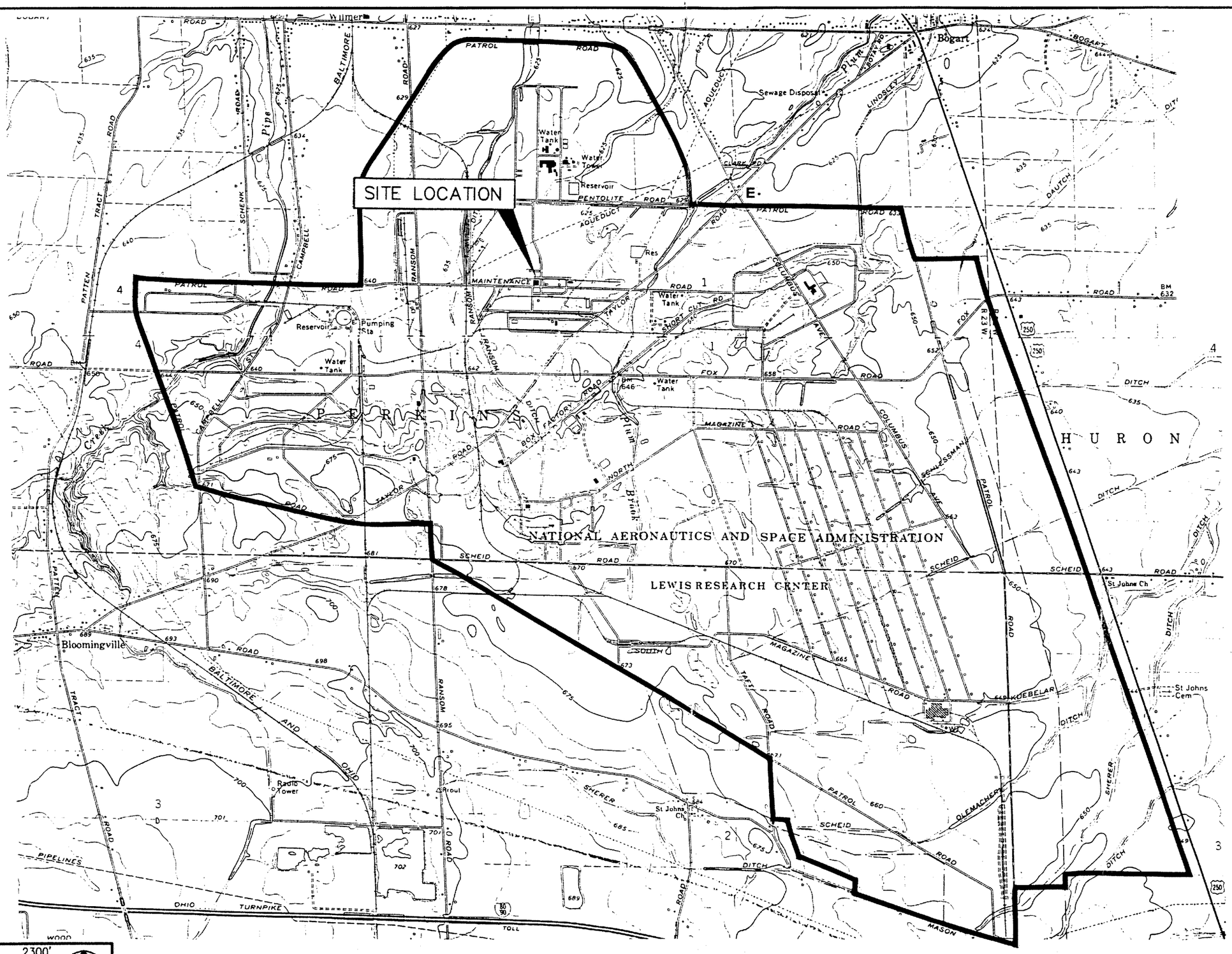
The OEPA conducted a Preliminary Assessment (PA) of PBS in 1983. The areas of interest were the red water ponds, a byproduct of the US Army's production of explosives in the 1940s, and a 1981 spill of approximately 170 gallons of polychlorinated biphenyls (PCBs) at Building 9206. An onsite inspection of these areas was conducted by the OEPA Division of Solid and Hazardous Waste Management (DSHWM) to determine the potential for groundwater and surface water contaminant migration from these areas. In 1990, after site remediation, post remediation groundwater monitoring, and discussion with the USEPA, groundwater monitoring was discontinued at the site of the PCB spill because no contamination was detected.

Following a 1989 assessment by EBASCO Environmental (EBASCO), 19 USTs used during various PBS operations were identified and earmarked for removal. The following list summarizes the removal of these USTs.

- 9 USTs at the Garage/Maintenance Area (Building 7121, 7131 and 7132);
- 1 UST at the Pump Station (Building 8133);

- 2 USTs at the Space Power Facility (Building 1411);
- 3 USTs at the Plum Brook Reactor Facility (Building 1131);
- 2 USTs at the "B" Site Boiler Building (Building 5231); and
- 2 USTs at the Fuel Storage Tank (Building 8951).

Four of the USTs removed contained waste oil mixed with solvents. Nine USTs contained water prior to their removal, but at some point during their operating lifetime contained solvents, fuel oil, gasoline, or diesel fuel. Six of the removed USTs contained either fuel oil (4), gasoline (1) or diesel fuel (1). All of the USTs showed evidence of leaking or spillage while in the ground with the exception of the USTs located at the Fuel Storage Tank. All excavations exhibited some amount of visible contamination. Visibly contaminated soil was removed from the excavations and replaced with clean sand. In April, 1993, Morrison Knudsen Corporation (MK) performed a Site Assessment of the UST areas and a Site Investigation of the entire PBS was performed in June/July, 1993.



SOURCE: USGS 7.5 MIN SERIES QUADRANGLE(S):
SANDUSKY, OHIO 1969(PHOTO REVISED 1979)
KIMBALL, OHIO 1969

NASA Lewis Research Center
Plum Brook Station
Garage and Maintenance Area

Figure 2-1
Facility Location
Map

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M:\B705900\C E\FIG2-1

3.0 GARAGE AND MAINTENANCE AREA

3.1 SITE-SPECIFIC CONDITIONS

As mentioned previously in this report, the Plum Brook Facility is very extensive in size, approximately 6,400 acres. Physical conditions change considerably across the facility. The following is a site-specific description of the north central area of Plum Brook Station which includes the GMA. Figure 3-1 shows the GMA and the locations of the former UST pits adjacent to the north side of Building 7131 and to the east of Building 7121.

3.1.1 Topography

The GMA is located on relatively flat terrain characterized by topography that slopes gently north towards Lake Erie. The ground surface has an average slope of less than six percent. The surficial deposits and landforms were produced by glacial processes. The approximate elevation at the GMA is 640 feet mean sea level (MSL).

3.1.2 Surficial Geology/Soil Conditions

Numerous soil borings in the vicinity of the GMA have identified the surface soil to be predominantly a moist gray sandy silt with a trace of clay. Saturated soils occur at approximately five to ten feet in a grayish brown sand with traces of clay and silt. A generalized stratigraphic section of the GMA is found in Appendix B-3. Borings were not advanced below a depth of 29 feet, and a bedrock unit has been identified as the Ohio Shale. The soil is consistent with that identified in mapping by the Ohio Department of Natural Resources (ODNR) as the Arkport-Galen association which occurs in the northern and western portions of PBS.

3.1.3 Bedrock Geology

As mentioned, borings have not been advanced deeper than 29 feet and bedrock has been encountered. Shale bedrock was encountered in two borings on site at depths of 27 and 29 feet. Below 29 feet the shale appears massive in nature. The shale appears consistent in nature to that described as the Ohio Shale, which is common to portions of PBS.

According to a groundwater zone map developed by the ODNR the underlying shale bedrock can supply domestic wells. Limited groundwater flow (<3gpm) may be obtained from thin, discontinuous sand and gravel deposits interbedded in fine sandy clay seams.

3.1.4 Surficial Groundwater

The overburden lying above the shale has been described as a poor water bearing material. The high clay/silt content of the soil makes it a poor source of groundwater. The wells installed at the GMA location were slow to recharge during well development and did not produce sufficient water to complete the purging operation. Figure 3-2 shows the regional surficial groundwater elevation contours developed from the May 1991 groundwater level measurements. Appendix B-3 (Figures 3-13 and 3-14) contains detailed maps of groundwater elevation contours developed

for the GMA for January 1991 and May 1991. The groundwater flow direction is toward the northwest at a low gradient.

Considering the maximum theoretical hydraulic conductivity for the various silt and clay units observed at this site, the maximum horizontal groundwater flow velocity associated with the May 1991 measurements was calculated to be about 3.9 feet per year. It must be emphasized that this estimate is based on the theoretical performance of a homogeneous water-bearing layer consisting entirely of the most transmissive soil type. The theoretical horizontal groundwater velocities calculated would suggest that horizontal migration of the UST contaminants in the overburden aquifer would be relatively slow and not significant relative to preferential migration along buried lines or structures.

3.2 PAST WASTE MANAGEMENT ACTIVITIES

There were two separate waste management units at the GMA. The two areas of concern are the former UST located east of Building 7121 and the former UST to the north of Building 7131. Figures 3-3 and 3-4 show the GMA and these two former waste management sites. Wastes generated through operations at Building 7121 were managed in a UST across the Garage Road east of Building 7121. Wastes generated through maintenance operations at Building 7131 were temporarily stored in a UST north of the building. The sites were operated independently and NASA intends to close the waste management units as separate sites. In the following sections, the two units will be described separately as Building 7121 and Building 7131. The sites will be investigated and characterized separately, and eventually closed as separate units.

Three product USTs were located adjacent to Building 7121. These product USTs contained trichloroethane, trichloroethene, and acetone. Although the USTs were removed during the same excavation as the waste UST, these three USTs are not considered part of the waste management unit.

Four additional USTs were located in a third area near former Building 7132. These four USTs, used to store gasoline and diesel fuel, were removed and closed under BUSTR regulations in 1989. Since these USTs were never regulated as a waste management unit by RCRA and not known to ever have contained any waste oils, waste solvents, or other RCRA waste, they are not part of the RCRA closure of the GMA and are not discussed further.

3.2.1 Building 7121

This building is titled the Maintenance Shop in PBS records, but it is also known as the Combined Shop. Built in 1942 and covering 23,896 square feet, it has historically been used as a machine shop with a portion of the building used as a Clean Room.

Four USTs were removed in September of 1989. UST #28 (7121-1), located across the road about 50 feet east of Building 7121, was a 3,000-gallon steel UST used to store waste oil and spent solvents. This UST was installed in 1942 and was in operation until the time of its removal. Three 700-gallon steel USTs, #29 (7121-2), #30 (7121-3), and #31 (7121-4), were installed in 1964 immediately adjacent to the building. These USTs were used to store product

(trichloroethane, trichloroethene, acetone) and were taken out of service in 1973. They held water as ballast at the time of their removal.

None of the USTs had secondary containment or a release detection system. When the USTs were removed, it was not known whether the USTs had been leaking. The intention was to close the site according to the Ohio State Fire Marshall BUSTR Regulations. There were no formally established target cleanup levels other than those presented in BUSTR guidance. During and after UST removal a photoionization detector (PID) was used to locate and sample soil which exhibited the highest levels of contamination, based on PID readings. Soil samples were collected and analyzed for VOCs and total petroleum hydrocarbons (TPH) during the removal action. The samples were analyzed by SW-846 Method 8240 for volatile organic compounds and EPA Method 418.1 for TPH.

Figure 3-3 shows the extent of waste management operations at Building 7121. Also identified as part of the waste management unit are the approximate former locations of excavated soil adjacent to the UST excavations. Of the four USTs formerly located at Building 7121, UST #28 presents the most concern due to its use in the management of potentially hazardous waste. The three other USTs were used to store pure solvents for use at the facility.

Records listing the identities and quantities of waste solvents stored in UST #28 could not be found, but discussions with facility personnel provided the following information: acetone, methylene chloride, methyl ethyl ketone, 1,1,1-trichloroethane, and trichloroethene were known to have been used and are likely to have been placed in the UST. Waste oil and solvents were allowed to accumulate in the UST until it was approximately full. There are no manifests which document routine disposal of the UST contents. Maximum inventory of waste in UST #28 is estimated at 2,500 gallons. UST #28 was in service for 47 years, and the throughput of the UST is estimated at approximately 117,500 gallons. The quantities of solvents stored in the product USTs is unknown.

Table 3-1 is a list of chemical solvents known to have been managed at UST #28. The list was generated through discussion with facility personnel. Table 3-2 is a list of additional chemicals that were found at the site during past investigations and are potentially associated with the Building 7121 waste management area as either chemicals that were used or degradation products thereof. The combination of Tables 3-1 and 3-2 constitutes the list of potential chemicals of concern for this site closure.

3.2.2 Building 7131

This building is titled the Garage in PBS records. It comprises three sections. The easternmost section is used as a vehicle maintenance location, the center portion is a wash/spray-paint booth, and the west section is used for storage and some maintenance activities.

UST #32 (7131-1) was located about 20 feet north of the northeast corner of Building 7131. This UST was installed in 1942 and removed in 1989. The steel UST had a 1,500 gallon capacity and was used for the storage of waste oil and spent solvents generated through vehicle maintenance. The UST had no secondary containment or release detection system. When the UST was removed, it was not known whether it had been leaking. The intention was to close

the site according to the Ohio State Fire Marshall BUSTR Regulations. There were no formally established target cleanup levels other than those presented in BUSTR guidance. During and after UST removal a photoionization detector (PID) was used to locate and sample soil that exhibited the highest levels of contamination based on PID readings. Soil samples were collected and analyzed for VOCs and total petroleum hydrocarbons (TPH) during the removal action. The samples were analyzed by SW-846 Method 08240 for volatile organic compounds and EPA Method 418.1 for TPH.

Figure 3-4 shows the extent of waste management operations of Building 7131 at the GMA. Also identified as part of the waste management unit is the approximate location of excavated soil adjacent to the UST excavation.

Records listing the identities and quantities of waste oil and spent solvents stored in UST #32 could not be found, but discussions with facility personnel indicated that methylene chloride, carbon tetrachloride, and 1,1,1-trichloroethane were known to have been used as part of cleaning and degreasing activity at Building 7131 and are likely to have been placed in the UST. Waste oil and spent solvents were allowed to accumulate in the UST until it was approximately full, and the contents of the UST were disposed of about once a year. There are no manifests that document the routine disposal of UST contents. Maximum inventory of waste in UST #32 is estimated at about 1,000 gallons. UST #32 was in service for 47 years and the throughput of the UST is estimated at approximately 47,000 gallons.

Table 3-3 is a list of chemical solvents known to have been stored in UST #32. The list was generated through discussion with facility personnel. Table 3-4 is a list of additional chemicals that were found at the site during past investigations and are potentially associated with UST #32 as either chemicals that were used or degradation products thereof. The combination of Tables 3-3 and 3-4 constitutes the list of potential chemicals of concern for this site closure.

3.3 PREVIOUS SITE INVESTIGATIONS

During the past six years there have been a number of environmental investigations at Plum Brook Station that provide site-specific background information for the GMA. These investigations are summarized in the following sections. Sampling locations from previous investigations are shown on Figure 3-5.

3.3.1 Underground Storage Tank Removals

On September 18th and 19th, 1989, the permanent closure-by-removal of USTs #28, #29, #30, and #31 at Building 7121 and the removal of UST #32 at Building 7131 were performed at the GMA. EMPACO Incorporated and Independence Excavating were retained as subcontractors to Turner Construction to remove the USTs. No as-built or engineering drawings were available for the USTs. Wastes generated as a result of UST removal included the following:

- A total of 9500 gallons of liquid/sludge were removed during the removal activities. Copies of the manifests are provided in Appendix C. These wastes were transported by Chem Freight and disposed at the Hukill Chemical Corp., Bedford Heights, Ohio.

- From February 28 through March 8, 1990, soil generated through the removal of the USTs was transported by Myers Chemical Transport and disposed at the Envirosafe landfill in Oregon, Ohio. Uniform Hazardous Waste Manifests which document soil disposal are also included in Appendix C. A total of 158.35 tons of soil was disposed at the landfill. Discussions with facility personnel indicate that only enough soil was removed from around the USTs to allow for their removal and sample collection. The excavations were free of visual contamination when soil samples were collected.

- Site personnel have stated that the USTs were cut open and rendered useless prior to removal from the site and disposed of as scrap steel. There is no available documentation as to the final disposition of the USTs or their ancillary piping.

- All excavations were backfilled with sand brought in to the GMA from a borrow pit within PBS.

In regard to health and safety during the 1989 UST removal, NASA required a site-specific health and safety plan from each contractor that performed work on site. The health and safety plan was reviewed by NASA Health and Safety personnel. During this removal, all work was performed in accordance with OSHA 29CFR 1910.120. These regulations include site worker 40-hour training, environmental monitoring for organic vapors and explosive environment, and personal protection with respect to clothing and decontamination.

3.3.2 UST Closure Assessment, EBASCO Environmental, 1989

As part of the BUSTR UST removal, a closure assessment was undertaken in September 1989 that included soil sampling and laboratory analyses. A copy of this report, including data summaries, logs, etc. is included in Appendix B-1.

A total of fourteen soil samples were collected: two from the base of the UST #29, #30, #31 excavation, three from the base of the UST #28 excavation, three from the base of the UST #32 excavation; and two from each of the three excavated soil areas created adjacent to each excavation. Samples were collected to determine if a release of UST contents had occurred during the active life of the USTs. The laboratory results indicated that varying degrees of contamination were present. The soil samples were analyzed using SW-846 Method 8240 for VOCs, TPH by EPA Method 418.1, EP Toxicity Lead, and ignitability.

3.3.2.1 Building 7121 - Table 3-5 summarizes the chemicals identified in the soil at the Building 7121 waste management unit (UST #28). The chemical contaminants are listed with their highest detected concentrations and the associated soil sample. Samples SS8 and SS9 were taken from the excavated soil; samples SS5-SS7 were taken from the excavated pit bottom. There were also detectable levels of TPH in the area of both excavations. Eight samples were analyzed for TPH and concentrations ranged from undetectable levels (<33 ppm) to a high of 287 ppm.

Lead leachate concentrations were below the detection limits in all of the samples and a flashpoint >200 F was measured in each of the samples indicating the soils are not considered hazardous by virtue of their toxicity characteristics or ignitability.

3.3.2.2 Building 7131 - Table 3-6 summarizes the chemicals identified in the soil at the Building 7131 waste management unit. The chemical contaminants are listed with their highest detected concentrations. Five samples were analyzed for TPH; results ranged from undetectable levels (<38 ppm) to 244 ppm.

3.3.3 Soil Gas Survey, EBASCO Environmental, 1991

In October of 1989, a soil gas survey was conducted at the GMA. Results and a map of sample points are included in Appendix B-2.

A total of 87 sample points were collected and analyzed. The sample points targeted the three excavations, the building foundations, buried utility lines, and an extensive area to the north and west of Building 7121 and Building 7131. A portable gas chromatograph was used and calibrated to quantify dichloroethene, benzene, trichloroethene, toluene, tetrachloroethene, and xylene.

3.3.3.1 Building 7121 - About 20 of the soil gas sample points in the vicinity of Building 7121 reported detectable levels of contamination. The majority of these soil gas samples indicated the presence of contamination from fuel products. Trichloroethene was detected throughout the areas surrounding the former UST cavities, around the building foundation and beneath the parking lot north of Building 7121. Chemicals detected near Building 7121 are listed below at their highest level of detection.

Chemical	Highest Concentration (ppb)
benzene	39,000
1,1-dichloroethene	170
trichloroethene	4,200
toluene	730
xylene	290

3.3.3.2 Building 7131 - Soil gas samples were collected at twelve sample points in the vicinity of Building 7131. Two samples detected volatile organic compounds in the soil. Benzene was detected along the north side of Building 7131. Trichloroethene, toluene, and xylene were detected approximately 50 feet southeast of the site. Chemicals detected near Building 7131 are listed below at the highest level of detection.

Chemical	Highest Concentration (ppb)
benzene	28
trichloroethene	11
toluene	16
xylene	58

3.3.4 Soil and Groundwater Sampling and Analyses, EBASCO Environmental, 1991

EBASCO Environmental performed a site assessment utilizing directed soil sampling and monitoring well installation from November, 1990 to May, 1991 in order to further characterize the Building 7121 and Building 7131 waste management units at the GMA. Appendix B-3 contains a map that shows the sample and monitoring well locations and the laboratory analytical results for data collected as part of this investigation.

Seven borings, six completed as monitoring wells, were installed to help characterize the extent of potential contaminant migration. Composite soil samples were collected over the total depth of the borings and analyzed for SVOCs, metals/cyanide, and pesticides/PCBs. Soil samples were collected in the saturated zone at depths ranging from 4 to 12 feet and analyzed for VOCs. Two of the installed monitoring wells were sampled. Groundwater was sampled for volatile organic compounds, semivolatile organic compounds, and total metals. Contaminants were detected in both the well assumed to represent background (GM-2) and the well presumed to be most likely to be contaminated (GM-6). Results of these analyses are summarized in Table 3-7.

The analytical method for VOC analysis was SW-846 Method 8240. Analytical methods for other parameters are not known, although they are believed to have been consistent with SW-846 methodology.

3.3.4.1 Building 7121 - The sample locations which were used to characterize the waste management unit at Building 7121 include boring locations PBS-GM-SB-05, PBS-GM-SB-06, and PBS-GM-SB-07. Table 3-8 summarizes the maximum concentrations of chemicals detected in soil samples at these locations.

3.3.4.2 Building 7131 - The sample locations which were used to characterize the waste management unit at Building 7131 include boring locations PBS-GM-SB-02, PBS-GM-SB-03, and PBS-GM-SB-04. Table 3-9 summarizes maximum chemical concentrations detected in soil at these locations.

3.3.5 Soil and Groundwater Sampling and Analysis, Morrison Knudsen Corporation, 1993

Soil sampling, the installation of four groundwater monitoring wells, and groundwater sampling were completed at the GMA in April of 1993 by MK. Analytical results for this sampling are included in Appendix B-4.

Six borings were advanced to depths of approximately 15 feet and soil samples were collected. Four borings were completed as monitoring wells. Soil samples were collected at various depth intervals of 0-2 feet, 2-4 feet, 6-8 feet, and 10-12 feet. Soil samples were analyzed by SW-846 methods as follows: VOCs (8240), PNAs (8100), TPH (9071), and BTEX (8020). Four new monitoring wells and the six existing monitoring wells (GM-01 through GM-06) were sampled. As part of this investigation, the existing monitoring wells were renamed EB-1 through EB-6. Although these additional identifiers are included in Figure 3-5, the monitoring wells will be referred to by their original well numbers (i.e., GM-01 through GM-06).

3.3.5.1 Building 7121 - The sample locations used to characterize the waste management unit at Building 7121 include boring/monitoring well locations B-1/MW-1, B-6, B-31, B-32, and B-33. Table 3-10 summarizes maximum chemical concentrations detected in soil and groundwater samples during this round of sampling.

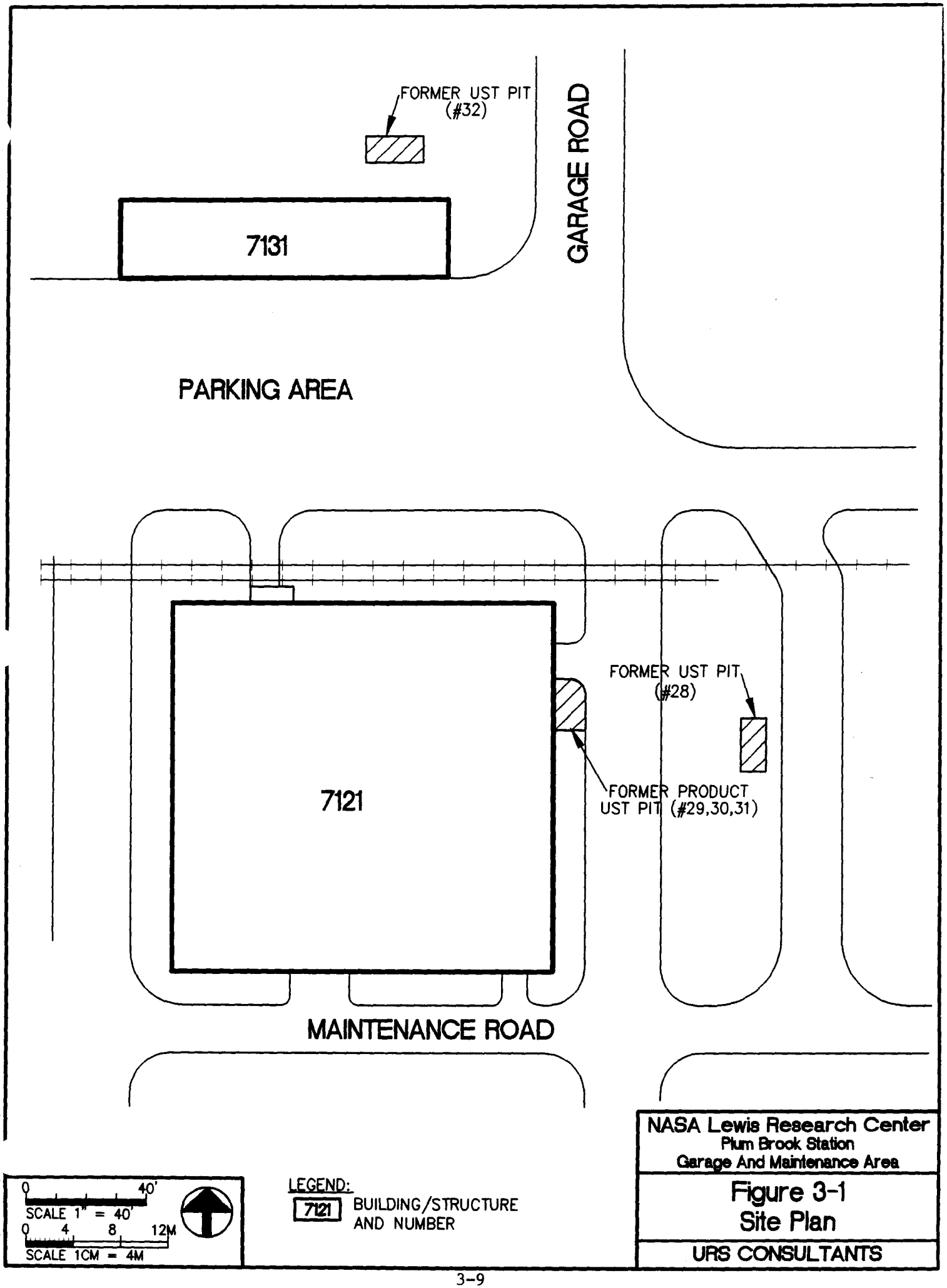
3.3.5.2 Building 7131 - The sample locations used to characterize the waste management unit at Building 7131 include boring/monitoring well locations B-2/MW-2, B-3/MW-3, B-4/MW-4, and B-5. Table 3-11 summarizes maximum chemical concentrations detected in soil and groundwater samples during this round of sampling.

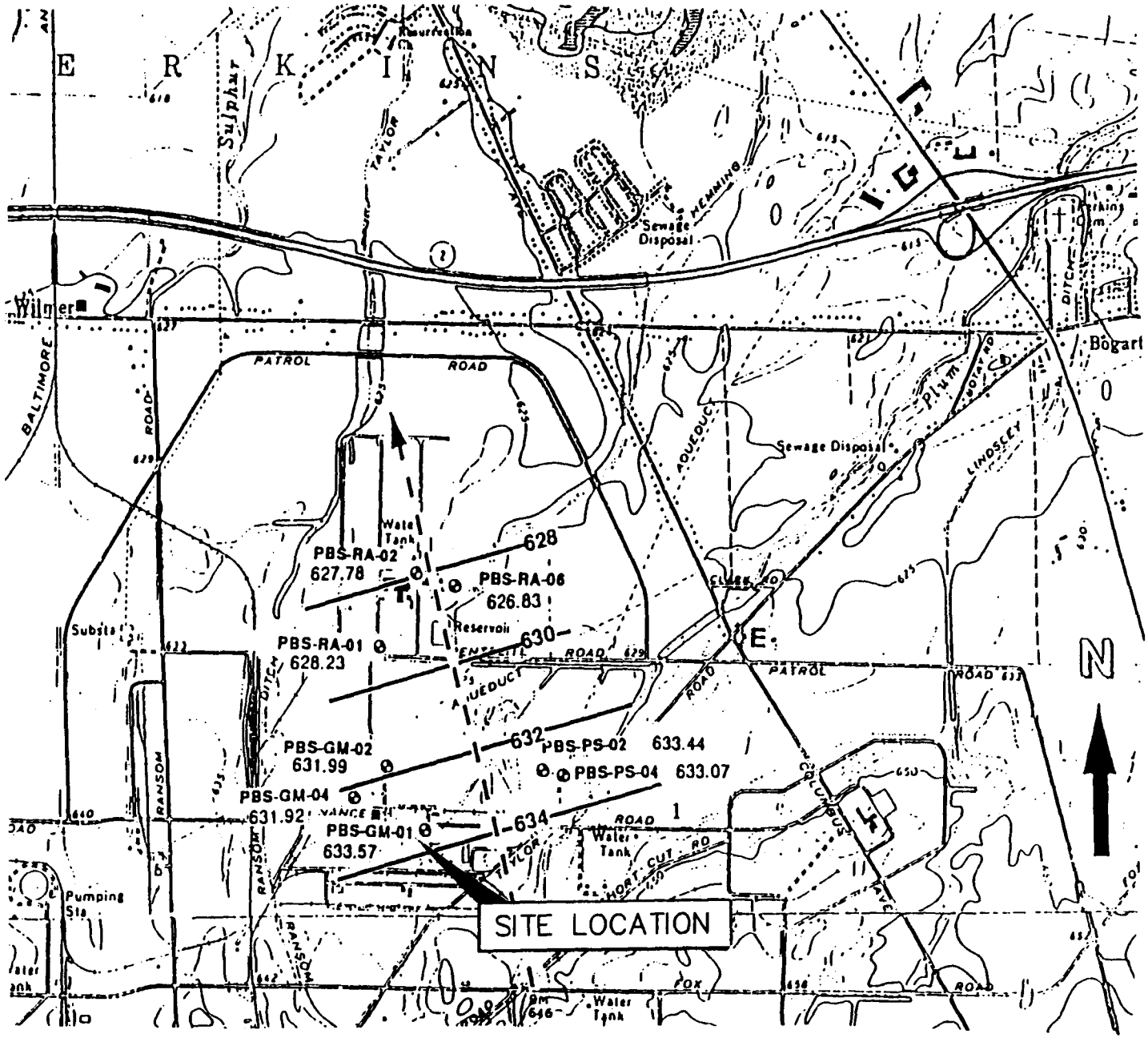
3.3.6 Summary of Previous Site Investigations at the Garage and Maintenance Area

Based on soil and groundwater sample analyses of the previous site investigations, it is apparent that soil contamination and groundwater contamination exist as a result of waste management operations at both of the GMA waste management units. Thirty-five chemicals have been identified (or are considered likely to be present) in the soil and groundwater in the vicinity of Building 7121. Twenty-two chemicals have been detected (or are considered likely to be present) in the soil and groundwater in the vicinity of Building 7131.

Ohio EPA has commented on the above mentioned investigations used in a previous submittal (Closure Work Plan, Garage/Maintenance Area, May, 1994). After review and discussion with OEPA, NASA agrees that the GMA sites have not been adequately characterized for extent and that much of the analytical data used to support risk assessments may not have the required validation.

NASA intends to define the full vertical and horizontal extent of soil and groundwater contamination at both waste management units at the Garage and Maintenance Area. The following section presents a sampling and analysis plan that details how NASA intends to fully determine the extent of contamination. The results of the previous investigations will be used as qualitative information to direct a more efficient site characterization.


FORMER UST PIT
(#32)
GARAGE ROAD
7131
PARKING AREA
FORMER UST PIT
(#28)
7121
FORMER PRODUCT
UST PIT (#29,30,31)
MAINTENANCE ROAD
0 40'
SCALE 1" = 40'
0 4 8 12M
SCALE 1CM = 4M
LEGEND:
7121 BUILDING/STRUCTURE
AND NUMBER
NASA Lewis Research Center
Plum Brook Station
Garage And Maintenance Area
Figure 3-1
Site Plan
URS CONSULTANTS
M:\B705900\C
GE\FIG3-1



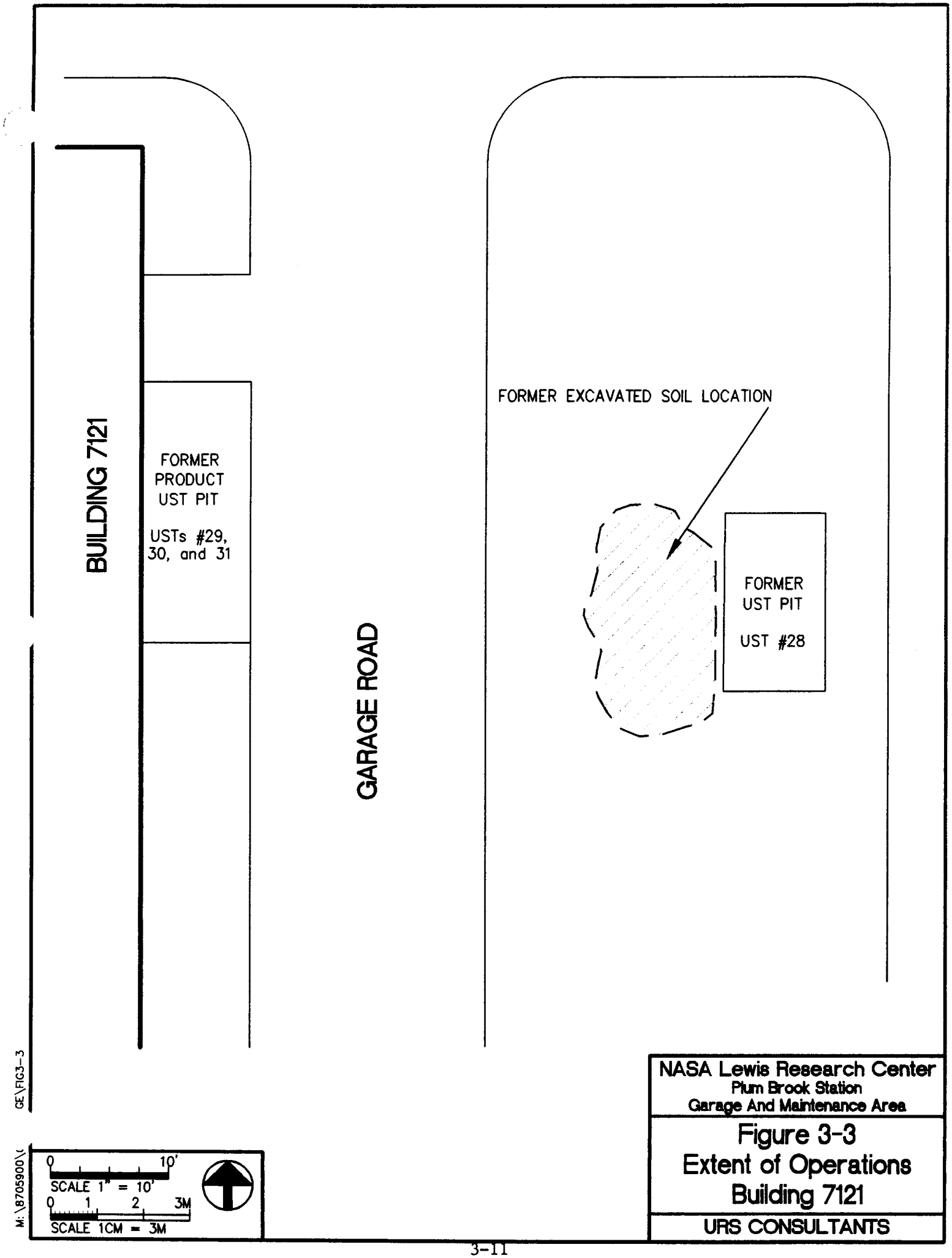
LEGEND

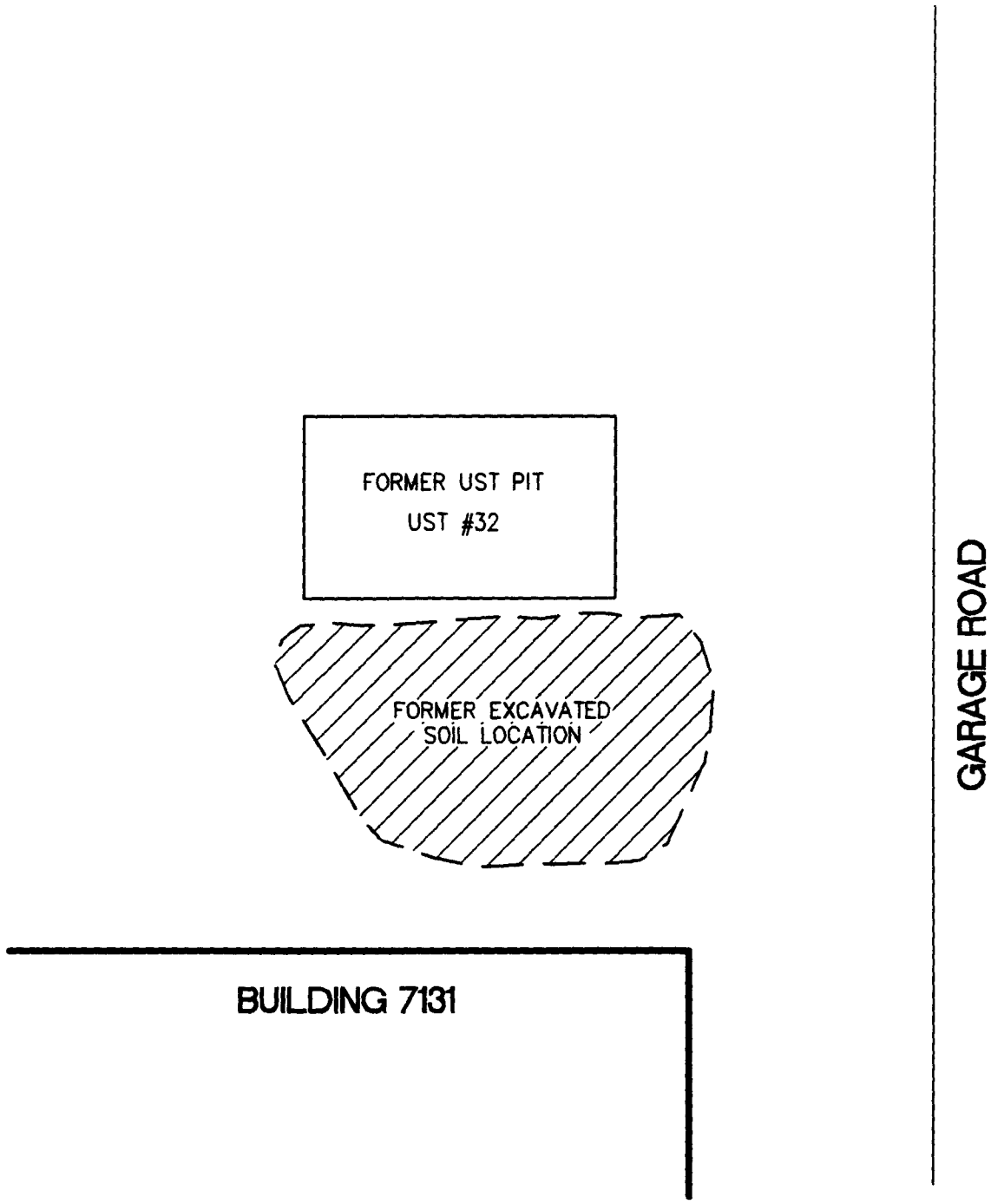
PBS-GM-01 633.57	Ground Water Monitoring Well Ground Water Elevation
634.0	Ground Water Elevation Contour
	Direction of Ground Water Flow

NASA Lewis Research Center
Plum Brook Station
Garage Maintenance Area

Figure 3-2
Groundwater Elevation Contours - May 1991

URS CONSULTANTS


BUILDING 7121
FORMER PRODUCT UST PIT
USTs #29, 30, and 31
GARAGE ROAD
FORMER EXCAVATED SOIL LOCATION
FORMER UST PIT
UST #28
GE\FIG3-3
M:\8705900\
0 10'
SCALE 1" = 10'
0 1 2 3M
SCALE 1CM = 3M
NASA Lewis Research Center
Plum Brook Station
Garage And Maintenance Area
Figure 3-3
Extent of Operations
Building 7121
URS CONSULTANTS

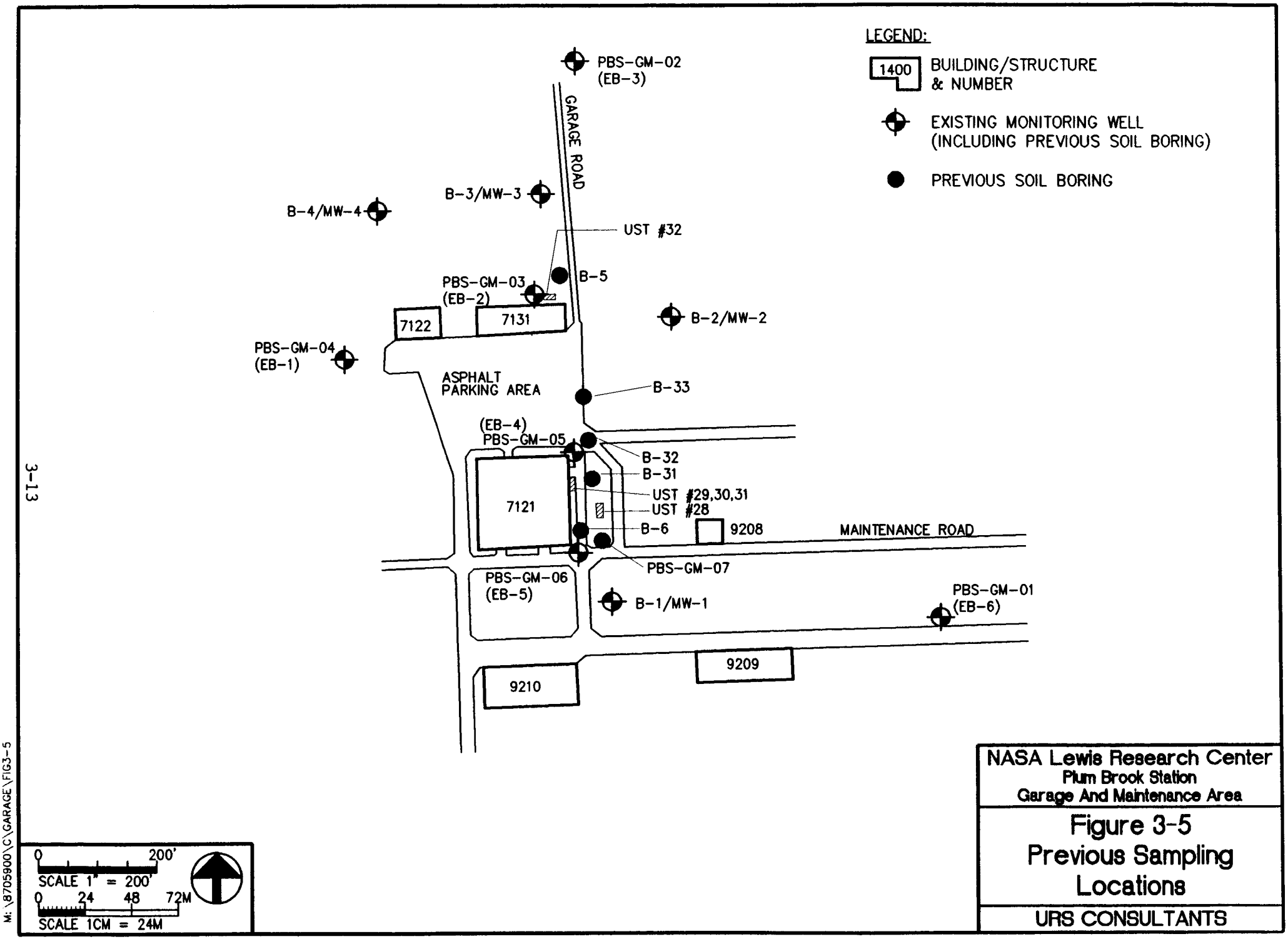


NASA Lewis Research Center
Plum Brook Station
Garage And Maintenance Area

Figure 3-4
Extent of Operations
Building 7131

URS CONSULTANTS

0 10'
SCALE 1" = 10'
0 1 2 3M
SCALE 1CM = 3M



NASA Lewis Research Center
Plum Brook Station
Garage And Maintenance Area

Figure 3-5
Previous Sampling Locations

URS CONSULTANTS

M:\8705900\C\GARAGE\FIG3-5

Table 3-1

Chemicals Known to Have Been Managed
Building 7121, Garage and Maintenance Area, Plum Brook Station

Chemical	Hazardous Waste Code
acetone	F003
methylene chloride	F001
methyl ethyl ketone (2-butanone)	F005
toluene	F005
1,1,1-trichloroethane	F001
trichloroethene	F001

Table 3-2

Chemicals Potentially Managed
Building 7121, Garage Maintenance Area, Plum Brook Station

Chemical
bromodichloromethane
carbon disulfide
carbon tetrachloride
chlorobenzene
chloroethane
chloroform
1,1-dichloroethane
1,2-dichloroethane
1,1-dichloroethene
trans-1,2-dichloroethene
cis-1,2-dichloroethene
2-hexanone
isopropylbenzene
p-isopropyltoluene
naphthalene

Table 3-2, continued

Chemical
sec-butylbenzene
tert-butylbenzene
1,1,1,2-tetrachloroethane
1,1,2,2-tetrachloroethane
tetrachloroethene
propylbenzene
toluene
1,2,3-trichlorobenzene
1,2,4-trichlorobenzene
1,1,2-trichloroethane
trichlorofluoromethane
1,2,4-trimethylbenzene
1,3,5-trimethylbenzene
vinyl chloride
xylene

Table 3-3

Chemicals Known to Have Been Managed
Building 7131, Garage and Maintenance Area, Plum Brook Station

Chemical	Hazardous Waste Code
methylene chloride	F001
carbon tetrachloride	F001
1,1,1-trichloroethane	F001

Table 3-4

Chemicals Potentially Managed
Building 7131, Garage and Maintenance Area, Plum Brook Station

Chemical
acetone
2-butanone
bromodichloromethane
carbon disulfide
1,1-dichloroethane
1,2-dichloroethane
1,1-dichloroethene
hexachlorobutadiene
naphthalene
1,1,2,2-tetrachloroethane
tetrachloroethene
toluene
1,2,3-trichlorobenzene
1,2,4-trichlorobenzene
trichloroethene
trichlorofluoromethane
1,2,4-trimethylbenzene
1,3,5-trimethylbenzene
xylene

Table 3-5

Soil Analytical Results, UST Closure Assessment EBASCO Environmental, 1989
Building 7121, Garage and Maintenance Area, Plum Brook Station

Chemical	Maximum Concentration (ug/kg)	Sample Number
trichloroethene	21,142	SS9
1,1,1-trichloroethane	7,770	SS9
chloroform	1	SS9
1,2-dichloroethane	96	SS9
trans-1,2-dichloroethene	2	SS8
ethylbenzene	411	SS9
isopropylbenzene	10	SS9
methylene chloride	249	SS7
naphthalene	268	SS9
p-isopropyltoluene	22	SS9
carbon tetrachloride	431	SS8
tetrachloroethene	10,048	SS9
sec-butylbenzene	8	SS9
tert-butylbenzene	40	SS9
1,1-dichloroethene	141	SS9
1,1-dichloroethane	1214	SS9
cis-1,2-dichloroethene	152	SS9
toluene	1101	SS9
xylenes	532	SS9
1,3,5-trimethylbenzene	442	SS9
1,2,4-trimethylbenzene	479	SS9
acetone	6	SS5

Table 3-6

Soil Analytical Results, UST Closure Assessment EBASCO Environmental, 1989
Building 7131, Garage and Maintenance Area, Plum Brook Station

Chemical	Maximum Concentration (ug/kg)	Sample Number
carbon tetrachloride	2	SS4
1,2-dichloroethane	370	SS5
hexachlorobutadiene	14	SS1
methylene chloride	70	SS5
trichlorethene	606	SS3
trichlorofluoromethane	17	SS5
1,2,3-trichlorobenzene	18	SS1
1,3,5-trimethylbenzene	366	SS5
1,2,4-trimethylbenzene	349	SS5
naphthalene	159	SS5

Table 3-7

Groundwater Analytical Results EBASCO Environmental, 1991
Garage and Maintenance Area, Plum Brook Station

Chemical	GM-02, Maximum Concentration (ug/L)	GM-06, Maximum Concentration (ug/L)
1,1-dichloroethane	ND*	24
1,1-dichloroethene	ND	20
trichloroethene	7	ND
1,1,1-trichloroethane	ND	120
di-n-octyl phthalate	14	ND
bis(2-ethylhexyl)phthalate	ND	7
butylbenylphthalate	ND	6
beta-BHC	0.056	0.190
endosulfan sulfate	0.210	1.0

* ND, Not detected

Table 3-8

Soil Analytical Results EBASCO Environmental, 1991
Building 7121, Garage and Maintenance Area, Plum Brook Station

Chemical	Maximum Concentration (ug/kg)	Sample Number
acetone	38	SB06
bis(2-ethylhexyl)phthalate	1,500	SB05
carbon tetrachloride	260	SB05
1,1 dichloroethane	50	SB05
1,1 dichloroethene	61	SB05
tetrachloroethene	24	SB05
trichloroethene	55	SB05
1,1,1-trichloroethane	2,000	SB05
1,1,2,2-tetrachloroethane	18	SB05
methylene chloride	113	SB07
carbon disulfide	75	SB06

Table 3-9

Soil Analytical Results EBASCO Environmental, 1991
Building 7131, Garage and Maintenance Area, Plum Brook Station

Chemical	Maximum Concentration (ug/kg)	Sample Number
acetone	110	SB01
methylene chloride	120	SB01
carbon disulfide	14	SB03
1,1,2,2-tetrachloroethane	35	SB02
ethylbenzene	21	SB02
bromodichloromethane	6	SB02

Table 3-10

Soil and Groundwater Analytical Results Morrison Knudsen Corporation, 1993 Building 7121, Garage and Maintenance Area, Plum Brook Station

Chemical	Maximum Soil Concentration (ug/kg)	Sample Number
acetone	106	B-06
methylene chloride	12.2	B-32
1,1,1-trichloroethane	82.2	B-32
toluene	10.2	B-33
Chemical	**Maximum Groundwater Concentration (ug/L)**	**Sample Number**
chloroethane	4.13	GM-05
cis-1,2-dichloroethene	2.93	GM-05
1,1-dichloroethane	112	GM-06
1,1-dichloroethene	52.9	GM-06
tetrachloroethene	5.72	GM-05
1,1,1-trichloroethane	1,130	GM-06
1,1,2-trichloroethane	2.13	GM-05
trichloroethene	13.4	GM-05

Table 3-11

Soil and Groundwater Analytical Results Morrison Knudsen Corporation, 1993
Building 7131, Garage and Maintenance Area, Plum Brook Station

Chemical	Maximum Soil Concentration (ug/kg)	Sample Number
1,1-dichloroethane	19.4	B-4
1,1,1-trichloroethane	16.8	B-4
tetrahydrofuran	287	B-3
Chemical	**Maximum Groundwater Concentration (ug/L)**	**Sample Number**
1,1,1-trichloroethane	9.88	GM-03
1,1-dichloroethane	18.0	MW-04
1,1-dichloroethene	1.74	MW-04

4.0 SAMPLING AND ANALYSIS PLAN

This section of the Closure Work Plan details the methods that will be employed during field investigation and data collection activities in support of site closure at both Building 7121 and Building 7131. The objective of the sampling program is to determine the extent and concentration of contamination in the soil and groundwater at the GMA and to collect enough data to conduct a risk assessment. Field operations that will be conducted individually at Building 7121 and Building 7131 at the GMA will include:

- collection of twelve soil samples to be used to establish background conditions for inorganics in the soil;
- collection of site soil samples that will determine the extent and concentration of potential contamination in the soil;
- installation of upgradient and downgradient groundwater monitoring wells;
- sampling of some existing and all proposed monitoring wells to determine extent, concentration and source of potential contaminants in the groundwater.

NASA intends to sample and characterize the soil adjacent to the former tank excavations and the soil below the former excavated soil. NASA also intends to sample away from the former tank excavations and the former excavated soil locations, circumscribing the waste management unit until the full extent of soil contamination has been identified.

Appendix A contains a generic Hazardous Waste Operations Health and Safety Plan. The contractor will provide their own site-specific health and safety plan, which will be reviewed and approved by NASA Health and Safety personnel prior to initiation of field work.

4.1 SOIL SAMPLING

Soil samples will be collected at GMA for two distinct purposes: 1) Background soil samples to establish background concentration of inorganics in soil, and 2) Site soil samples to determine the extent and concentrations of contaminants in soil for comparison to remediation standards.

4.1.1 Background Soil Samples

Figure 4-1 shows the tentative location of 12 sample points that will be used to establish background conditions for naturally occurring compounds in the soil at the GMA. Considering the proximity of Building 7121 and Building 7131, background for both buildings will be established using the same sample points. Soil conditions at the GMA are similar to those at the Reactor Area Complex; therefore the same points will be utilized for both areas. A soils map of Plum Brook Station was used to determine the location of sample points where the:

- background soil horizon is similar to GMA
- background soil samples have not been affected by the GMA waste management unit or any other waste management operation

- sample locations are representative of the matrix of interest

Final locations will be selected during the field effort to avoid ditches, railroad tracks, roadways or other waste management units. The background soil samples will be used to determine whether inorganic chemicals should be included as chemicals of potential concern.

4.1.2 Site Soil Samples

Site samples will be used to determine the extent and concentration of chemical contamination at the GMA. Laboratory analyses of site samples that show non-detect will be used to define the horizontal and vertical extent of contamination. Site samples will be used to select chemicals of concern for risk assessment purposes and to compare against remediation standards developed to support site closure.

Soil sample locations will be selected in an effort to determine the full horizontal and vertical extent of all potential contaminants in the soil including those previously specified in Tables 3-1 and 3-2 for Building 7121 and in Tables 3-3 and 3-4 for Building 7131. Sampling will proceed until full extent is adequately determined. Rectangular grid sampling will be conducted in the horizontal (x - y) plane utilizing the algorithm presented in Section 3.13 of the OEPA Closure Plan Review Guidance. Sample grid intervals have been developed for both Building 7121 and Building 7131. The grid interval for soil sampling in a "Hot Spot" contamination scenario has been utilized for both buildings as follows:

4.1.2.1 Building 7121

Step 1: Determine the Potency of Carcinogens

Chemical	Potency Slope Factor$(mg/kg\text{-}d)^{-1}$	Score
bromodichloromethane	6.2E-02	1
carbon tetrachloride	1.3E-01	2
chloroform	6.1E-03	1
1,2 dichloroethane	9.1E-02	2
1,1-dichloroethene	6.0E-01	2
methylene chloride	7.5E-03	1
1,1,2-trichloroethane	5.7E-02	1
1,1,1,2-tetrachloroethane	2.6E-02	1
1,1,2,2-tetrachloroethane	2.0E-01	2
tetrachloroethene	5.2E-02	1
trichloroethene	1.1E-02	1
vinyl chloride	1.9E-00	3
12 chemical constituents	Total Score	18
Average Score = Total Score/Chemical Constituents = 18/12=1.50		

Step 2: Determine the Potency of Systemic Toxicants

Chemical	Potency RfD(mg/kg-d)	Score
acetone	1.0E-01	1
bromodichloromethane	2.0E-02	2
carbon disulfide	1.0E-01	1
carbon tetrachloride	7.0E-04	3
chlorobenzene	2.0E-02	2
chloroform	1.0E-02	2
cis-1,2-dichloroethane	1.0E-02	2
trans-1,2-dichloroethane	2.0E-02	2
1,1-dichloroethene	9.0E-03	2
1,1 dichloroethane	1.0E-01	1
isopropylbenzene	4.0E-02	2
methylene chloride	6.0E-02	1
2-butanone	6.0E-01	1
naphthalene	4.0E-02	2
1,1,1,2-tetrachloroethane	3.0E-02	2
tetrachloroethene	1.0E-02	2
toluene	2.0E-01	1
1,1,1-trichloroethane	9.0E-02	1
1,1,2-trichloroethane	4.0E-03	2
trichloroethylene	6.0E-03	2
1,2,4-trichlorobenzene	1.0E-02	2
trichlorofluoromethane	3.0E-01	1
xylene	2.0E+00	1
23 chemicals with RfDs	Total Score	38
Average= Total Score/Chemical constituents = 38/23 = 1.65		

Step 3: Determine the Average Risk of Exposure (ROE)

Risk of Exposure (ROE)	Score
Facility has 24-hour guard and limited access.	1
Depth to groundwater is approximately three -five feet.	3
Soil Permeability is 10^{-7} cm/sec.	2
Unit design had no secondary containment and is considered outdated.	3
Adjacent land use is a mixture of residential and agricultural	3
Presence of contaminants has been confirmed.	3
Contaminant K_{oc} is > 2 mg/l.	1
Average ROE = Total Score/Exposures = 16/7 = 2.29	Total Score = 16

Step 4: Determine the Soil Sampling Intensity Matrix

Soil Sampling Intensity Matrix	
Criterion	Sample Intensity Factor (SIF)
Potency of Carcinogens	1.50
Potency of Systemic Toxicants	1.65
Average ROE	2.29
Composite SIF = (1.50 + 1.65 + 2.29) =	5.44

Step 5: Determine the Grid Interval for Soil Sampling

Grid Interval for Soil Sampling	
Composite SIF	Grid Interval
< 4	24 Feet
4 - 6	16 Feet
> 6	11 Feet

By utilizing the above algorithm, a composite SIF of 5.44 has been computed. A composite SIF of 5.44 will require a 16-foot sampling grid to be used as a guide in defining the extent of soil contamination for Building 7121 at the GMA. The grid will be laid out over the area of concern and a discrete sample will be collected at each grid intersection.

4.1.2.2 Building 7131

Step 1: Determine the Potency of Carcinogens

Chemical	Potency Slope Factor(mg/kg-d)$^{-1}$	Score
bromodichloromethane	6.2E-02	1
carbon tetrachloride	1.3E-01	2
1,2 dichloroethane	9.1E-02	2
1,1-dichloroethene	6.0E-01	2
hexachlorabutadiene	7.8E-02	1
methylene chloride	7.5E-03	1
tetrachloroethene	5.2E-02	1
1,1,2,2-tetrachloroethane	2.0E-01	2
trichloroethene	1.1E-02	1
9 chemical constituents	Total Score	13
Average Score = Total Score/Chemical Constituents = 13/9=1.44		

Step 2: Determine the Potency of Systemic Toxicants

Chemical	Potency RfD(mg/kg-d)	Score
acetone	1.0E-01	1
bromodichloromethane	2.0E-02	1
2-butanone	6.0E-01	1
carbon disulfide	1.0E-01	1
carbon tetrachloride	7.0E-04	3
1,1-dichloroethene	9.0E-03	2
1,1-dichloroethane	1.0E-01	1
cis-1,2-dichloroethene	1.0E-02	1
trans-1,2-dichloroethene	2.0E-02	1
hexachlorobutadiene	2.0E-04	3
methylene chloride	6.0E-02	1
naphthalene	4.0E-02	2
tetrachloroethene	1.0E-02	2

Step 2, continued

Chemical	Potency RfD(mg/kg-d)	Score
trichloroethene	6.0E-03	2
1,2,4-trichlorobenzene	1.0E-02	2
toluene	2.0E-01	1
1,1,1-trichloroethane	9.0E-02	1
trichlorofluoromethane	3.0E-01	1
xylene	2.0E+00	1
19 chemicals with RfDs	Total Score	28
Average= Total Score/Chemical constituents = 28/19 = 1.47		

Step 3: Determine the Average Risk of Exposure (ROE)

Risk of Exposure (ROE)	Score
Facility has 24-hour guard and limited access.	1
Depth to groundwater is approximately three -five feet.	3
Soil Permeability is 10^{-7} cm/sec.	2
Unit design had no secondary containment and is considered outdated.	3
Adjacent land use is a mixture of residential and agricultural	3
Presence of contaminants has been confirmed.	3
Contaminant K_{OC} is > 2 mg/l.	1
Average ROE = Total Score/Exposures = 16/7 = 2.29	Total Score = 16

Step 4: Determine the Soil Sampling Intensity Matrix

Soil Sampling Intensity Matrix	
Criterion	**Sample Intensity Factor (SIF)**
Potency of Carcinogens	1.44
Potency of Systemic Toxicants	1.47
Average ROE	2.29
Composite SIF = (1.44 + 1.47 + 2.29) =	5.20

Step 5: Determine the Grid Interval for Soil Sampling

Grid Interval for Soil Sampling	
Composite SIF	Grid Interval
< 4	24 Feet
4 - 6	16 Feet
> 6	11 Feet

By utilizing the above algorithm, a composite SIF of 5.20 has been computed. A composite SIF of 5.20 will require a 16-foot sampling grid to be used as a guide in defining the extent of soil contamination for Building 7131 at the GMA. The grid will be laid out over the area of concern and a discrete sample will be collected at each grid intersection.

Soil samples at each grid intersection will be collected at intervals of 0-1 foot at excavated soil locations, from 6-8 feet and from 10-12 feet at all locations at both Building 7121 and Building 7131. Soil samples will not be composited. Intervals for soil sampling are based on the following criteria:

- The waste management units at the GMA were USTs. Surficial or shallow samples generally would not be taken to characterize an UST site because the waste is stored at a depth below the surface. Any release of waste would be detected at depth, especially considering the fact that most of the chemicals suspected of being stored in the USTs are heavier than water. Any surface spillage would have been removed during the UST removals. However, when the USTs were removed in 1989, the soil surrounding the former USTs was excavated and placed on the ground surface adjacent to the tank excavation. Although the excavated soil has been removed, it will be necessary to sample the soil directly below and adjacent to the former excavated soil to determine if any chemicals remain at the site or if any chemicals have leached to the shallow soil. Shallow soil samples (0-1 foot) will be collected to examine the soil directly below the former excavated soil and to define the extent of potential soil contamination resulting from the placement of the excavated soil.

- Samples will be collected at a depth interval of 6-8 feet, at the approximate elevation of the base of the former USTs, to characterize and define the vertical extent of potential waste solvents released from the USTs.

- Samples will be collected at a further depth interval of 10-12 feet to further delineate the vertical extent of any contamination.

The sample locations shown on Figure 4-2 are the minimum number of locations on the grid that will be sampled at Building 7121. The sample locations shown on Figure 4-3 are the minimum number of locations that will be sampled at Building 7131. The grid will be expanded outward and additional samples will be collected at grid intersections at both sites until the full extent of contamination has been determined. Laboratory analysis demonstrating non-detect in a soil sample will identify a horizontal and vertical extent of contamination. If shallow soil samples detect contamination, it will be necessary to sample the 1-2 foot interval for signs of contamination. If soil samples detect contamination at the 10-12 feet interval, it will be necessary to sample the underlying soil to

determine the vertical extent of contamination. NASA will continue sampling in the horizontal and vertical directions until the full extent of contamination is determined.

4.2 GROUNDWATER MONITORING SYSTEM

4.2.1 Monitoring Well Location

The current ground water monitoring network at the GMA identifies groundwater moving to the northwest following the general topography of the area. It is estimated that approximately 27 to 29 feet of overburden material at the GMA overlies a grey shale bedrock. The overburden material is generally composed of brown clayey silt, and, based on previous well development and sampling activity, has a very low permeability and is considered a poor water bearing unit. In general, the static water elevation is approximately five feet below the ground surface. The bases of the USTs were set at about eight feet below the ground surface in the saturated zone. There are ten existing monitoring wells located at the GMA. Figure 4-4 shows the well locations for both Building 7121 and Building 7131. Monitoring wells PBS-GM-01, PBS-GM-04, PBS-GM-05, PBS-GM-06, and B-1/MW-1 are associated with Building 7121. Monitoring wells PBS-GM-02, PBS-GM-03, B-2/MW-2, B-3/MW-3, and B-4/MW-4 are associated with Building 7131.

4.2.1.1 Building 7121 - Monitoring well PBS-GM-01 is located about 600 feet to the east and upgradient from the UST sites. Monitoring well B-1/MW-1 is located about 100 feet south and upgradient from the former UST pit. Previous groundwater sampling detected no signs of contamination in either well. Monitoring well B-1/MW-1 will serve as an upgradient well for the former UST pit since it is at the same hydrostatic position as the downgradient wells. Monitoring well PBS-GM-04 is located about 400 feet to the northwest and downgradient from the waste management unit. Previous groundwater sampling detected no signs of contamination in this well. The monitoring well is located quite a distance from the site but it is still useful in identifying the extent of groundwater contamination at Building 7121. Monitoring well PBS-GM-06 is located at the southeast corner of Building 7121. Monitoring well PBS-GM-05 is located at the northeast corner of Building 7121. Previous well sampling detected evidence of groundwater contamination in both monitoring wells. Soil samples collected at depths of four to eight feet (in the saturated zone) from borings B-31, B-32, and B-33 all showed chemical contamination.

Four monitoring wells will be installed to identify the extent of groundwater contamination at Building 7121. Monitoring well MW-05 will be installed to the east of the former UST pit in order to help define flow direction and determine if leakage from UST #28 has impacted groundwater. Monitoring well MW-06 will be placed about 50 feet downgradient, northwest of Building 7121. The well will be located between PBS-GM-05 (contaminated) and PBS-GM-04 (clean) to identify the extent of contamination to the northwest of the site. Contamination has been identified in the saturated zone 150 feet north of the site at boring B-33. A monitoring well, MW-07, will be located north of boring B-33 and south of Building 7131 in an effort to define the northern extent of groundwater contamination.

Due to the known contamination in the area, this phase of groundwater monitoring will determine the vertical extent of contamination by drilling into the bedrock between the contaminated wells GM-05 and GM-06 and downgradient of the UST to determine if the bedrock has been compromised. This well will be referred to as MW-13. Drilling methods

will utilize the double casing method to assure there will be no introduction of contaminants into the bedrock (Section 4.4.2).

Groundwater samples will be collected from each of the four proposed wells at Building 7121 (MW-05, MW-06, MW-07, and MW-13) and from the existing monitoring wells (B-1/MW-1, GM-PBS-GM-04, PBS-GM-05, and PBS-GM-06). If contamination is detected in the newly installed monitoring wells, the extent of contamination will be investigated further. If the sampling and analysis of the proposed and existing monitoring wells fail to identify the extent of groundwater contamination, additional wells will be installed. Locations of additional wells will be based on mapping and identifying contaminant plume(s) and the contaminant concentrations. Monitoring wells will also be installed to the north and west of Building 7131 to determine extent of contamination from the waste management unit at Building 7131. The wells placed as part of the Building 7131 investigation may be used to further identify the extent of groundwater contamination from Building 7121. If contamination in the groundwater from Building 7121 extends to the north of Building 7131, it will be necessary to determine whether all groundwater contamination is a result of storage operations at Building 7121 or if contamination in the groundwater is a combined result of both waste management units.

4.2.1.2 Building 7131 - Monitoring well PBS-GM-03 is located west and adjacent to the former UST #32 excavation. Chemical contaminants were detected in groundwater samples previously collected from this well. A boring to the east and adjacent to the excavated UST detected no signs of contamination in previous soil sampling. Monitoring well B-2/MW-2 is located about 200 feet east of Building 7131 and will act as an upgradient well. Previous sampling detected no chemical contaminants in the well. Monitoring wells B-3/MW-3 and PBS-GM-02 are located about 170 feet and 400 feet, respectively, to the north of Building 7131. Monitoring well PBS-GM-02 is located too far from the waste management unit to be useful in characterizing the site, but monitoring well B-3/MW-3 does begin to establish extent of contamination to the north of Building 7121. Monitoring well B-4/MW-4 is located about 300 feet northwest of UST #32 and previous sampling did indicate groundwater contamination. Whether the contamination is a result of storage operations at Building 7121 or Building 7131 has yet to be determined.

Five monitoring wells will be installed to identify the extent of groundwater contamination at Building 7131. Monitoring well MW-08 will be installed to the northwest of the former excavation. Monitoring well MW-09 will be placed to the northwest of the former UST site between PBS-GM-03 (contaminated) and B-4/MW-4 (contaminated) to determine whether groundwater contamination is present between the two wells. The information would aid in determining whether contamination at B-4/MW-4 is a result of operations at Building 7121 or from Building 7131. The well may also aid in defining extent of contamination north of monitoring well MW-06 and determine whether contaminants from Building 7121 have migrated north of Building 7131. Monitoring well MW-10 will be located between PBS-GM-04 (clean) and monitoring well B-4/MW-4 (contaminated) to further define the limit of the extent of contamination to the northwest of both waste management units. Monitoring well MW-11 will be placed between and slightly west of monitoring wells PBS-GM-03 (contaminated) and B-3/MW-3 to further define extent of groundwater contamination to the north of Building 7121. Monitoring well MW-12 will be located northwest of B-4/MW-4 (contaminated) to further aid in defining extent to the northwest.

Groundwater samples will be collected from the five proposed wells (MW-08 through 12) and from the existing wells PBS-GM-03, B-2/MW-2, B-3/MW-3, and B-4/MW-4. If the sampling and analysis of the proposed and existing monitoring wells fail to identify the extent of groundwater contamination, additional wells will be installed. Locations of additional wells will be based on mapping and identifying contaminant plume(s) and the contaminant concentrations.

4.2.2 Slug Tests

Slug tests will be performed at this site to determine the hydraulic conductivity of the unit. The test will utilize the following seven wells: GM-03, GM-05, GM-06, MW-1, MW-4, MW-08, and MW-13 (deep). Slug test procedures are outlined in Section 4.4.7.

4.3 ANALYTICAL PARAMETERS

The potential chemicals of concern have been identified for the waste management unit at Building 7121 in Tables 3-1 and 3-2 and for the waste management unit at Building 7131 in Table 3-3 and 3-4. Soil and groundwater samples collected to define the extent and concentration of contamination and data used in support of site closure will be analyzed in the laboratory for all the potential chemicals of concern and their potential degradation products. Table 4-1 is a summary of samples which will be collected under this closure plan, the parameters for which they will be analyzed, and the analytical methods to be used. Section 4.7 of this report further identifies potential contaminants that will be analyzed and their method detection limits.

4.4 FIELD PROCEDURES

4.4.1 Soil Sampling

A stainless steel hand auger will be used to collect soil samples used in the determination of background levels for inorganics. Prior to initial sample collection and between all samples, the auger will be decontaminated as described in Section 4.5. At each background sample location, all organic debris (leaves, grass) will be removed from the upper one inch of soil. The hand auger will be rotated with downward pressure to retrieve the soil sample. Soil will be collected from the full length of the 0-1 foot boring and placed in a decontaminated stainless steel mixing bowl. The soil in the bowl will be homogenized and the required quantity placed in the proper laboratory supplied container. The sample will be labeled and placed in a cooler with ice prior to shipment to the lab.

The use of a hollow-stem auger drilling rig will be employed in the collection of all soil samples. The use of a hollow-stem auger is a standard method of subsurface drilling that enables the recovery of an undisturbed representative subsurface samples for soil description and laboratory testing. The borings will be advanced by rotating the augers the desired depth into the subsurface. Discrete soil samples will be collected with a stainless steel split-spoon sampler in accordance with American Society for Testing and Materials (ASTM) D-1586 procedure. The following procedures will be followed for split-spoon sampling:

- For the 0-1 foot sample interval, the split-spoon sampler will be attached to the drill rod and placed on the ground surface on the sample grid intersection. The drive head sub and hammer will rest on the drill rod.

- Two six-inch intervals will be marked on the rod stem to a reference point on the drill rig. The sampler will be driven into the ground with the 140 lb. hammer falling freely from 30 inches until the sampler has penetrated 12 inches. The number of blows per every six inches will be recorded. Fifty blows per six-inch interval will indicate spoon refusal.

- The split-spoon will be pulled from the ground and opened to retrieve the soil sample. The portion of the sample to be used for VOC analysis will be immediately placed into the sample container. The remaining sample will be described and the percent recovery noted. Soil for the other sample parameters will be placed into their respective sample containers. If additional sample volume is required, another split-spoon will be advanced from 0-1 feet, using the same methodology, adjacent to the previous sample.

- The center plug will be attached to the drill stem, and the auger will be advanced to a depth of six (or ten) feet. The plug will be removed, and the split-spoon will be attached to the drill stem and lowered to the bottom of the auger column. Four six-inch intervals will be marked on the rod stem to a reference point on the drill rig. The sampler will be driven into the ground with the 140 lb. hammer falling freely from 30 inches until the sampler has penetrated 24 inches. The number of blows per every six inches will be recorded. Fifty blows per six-inch interval will indicate spoon refusal.

- The split-spoon will be pulled from the ground and opened to retrieve the soil sample. The portion of the sample to be used for VOC analysis will be collected first and immediately placed into the sample container. The remaining sample will be described and the percent recovery noted. Soil for the other sample parameters will be placed into their respective sample containers in the following order, SVOCs, metals and pH.

- The sample containers will be labeled and placed in a chilled cooler until onsite work has been completed, at which time the samples will be prepared for transport to the analytical laboratory.

- The split-spoon sampler will be decontaminated between sample retrievals.

The drilling rig will be set up and operated in accordance with standard drilling practices and in a manner that will ensure the safe and efficient operation of the equipment. The drilling contractor will eliminate or prevent hydraulic system leaks, as well as lubricant and fuel leaks on the drill rig. All equipment used in the drilling operations will be steam-cleaned upon arrival at the site. All equipment and tools that come in contact with soil during drilling will be decontaminated before resampling, moving to the next drilling location, or leaving the project site. Decontamination procedures are outlined in Section 4.5. Once sampling is complete, boreholes will be sealed with sodium bentonite chips to the ground surface elevation. The lithologic descriptions for the unconsolidated materials collected during sampling will be recorded in the field log book as follows:

- Names of unconsolidated materials shall follow the name of the predominant particle size (e.g., clay, silt, sand).

- Dimensions of the predominant and secondary sizes shall be recorded using the metric system.

- The grain size and name of the deposit shall be accompanied by the predominant mineral content, accessory minerals, color, moisture, density, plasticity, odor, particle angularity, and other characteristics.

- Symbols of the Unified Soil Classification System and ASTM lithologic symbols will be included with the description.

The Field Team members will document all drilling and sampling activities and observations in the field log book. Information will be recorded with indelible ink in a permanently bound notebook with sequentially numbered pages.

Information recorded will include:

- Location
- Date and Time
- Identity of people and subcontractor performing activities
- Weather conditions
- Boring identification
- Location of borings in relation to easily identifiable landmark, determined using a tape and compass
- Sampling intervals
- Blow counts
- Sample lithologic descriptions
- Collection time of samples
- Identity and calibration of field instruments
- Depth at which saturated conditions were encountered
- Termination depths of borings
- Field instrument readings, background, borehole, and samples
- Drilling method
- Size of downhole equipment
- Drilling rates

Field operations for sample labelling, handling, etc. are outlined in Section 4.7.5.1.

4.4.2 Monitoring Well Installation

The existing groundwater monitoring network is sufficient to detect any light non-aqueous phase liquids (LNAPLs) in the groundwater and to identify any contaminants in the top of the uppermost saturated zone. No LNAPLs were detected in the groundwater during previous site investigations; therefore, further site investigation will determine the extent of groundwater contamination, including dense non-aqueous phase liquids (DNAPLs), and characterize groundwater contamination in the lower portion of the uppermost saturated zone and in the bedrock.

A drill rig utilizing a hollow stem auger will be employed, using 4.25 inch inside diameter (ID) auger flights, which will result in an approximate 8-inch diameter borehole. The borehole will be four inches larger than the well casing and screen allowing adequate space for the sand pack filter. The wells will be constructed using two-inch (ID) stainless steel screen and riser. Ten-foot well screens will be used. Screen and riser will be threaded flush joints. All well material will be steam-cleaned prior to installation in the borehole. The screen slots will be sized to retain 90% of

the sandpack material. The aquifer at the GMA is known to be very fine grained, and a 10-mm slot size will be used.

At Building 7121, monitoring wells MW-05, MW-06, and MW-07 will be screened to intercept the saturated zone above the bedrock. The top of the screens will be placed ten feet above the shale bedrock. If the shale bedrock is saturated, the screen for MW-13(deep) will be placed 10 feet into the top of the bedrock. If it is not saturated, drilling will continue until the next saturated zone is encountered or sufficient depth is achieved to allow determination that the bedrock acts as an aquitard.

At Building 7131, monitoring wells MW-08, MW-09, MW-10, MW-11, and MW-12 will be screened to intercept the saturated zone above the bedrock. The top of the screens will be placed ten feet above bedrock.

The monitoring well boreholes will be advanced one foot into the shale bedrock. The auger plug will be removed, the augers will be raised incrementally, and No. 5 or 6 silica sand pack will be added. The incremental lifting of the augers and the emplacement of the sand pack will continue until the sand pack extends just above the shale/soil interface. At this point the well screen and riser pipe will be lowered into the auger flights to rest on the sand pack. The incremental lifting of the augers and emplacement of the sand pack will continue until the sand pack extends one foot above the screen. Periodic sounding with a decontaminated weighted tape will ensure a continuous sand pack.

After the sand pack has been emplaced and measurements ensure its proper vertical location, two feet of bentonite pellets will be placed as a seal on top of the sand pack. The bentonite seal will be hydrated with potable water. A cement and bentonite grout will be paced on top of the bentonite seal and will extend to two feet from ground surface. The cement and bentonite mixture will consist of 94 lbs. of Type I or II portland cement and five pounds pure bentonite per 6.5 gallons of potable water.

For the drilling of the deep bedrock well, MW-13, it is important that the potential for cross-contamination between the groundwater horizons be considered. Adequate drilling precautions must be taken to prevent cross-contamination. The upper water-bearing zone will be drilled, cased, and grouted separately. A smaller diameter borehole then will be completed through the grouted casing into the underlying zone. The bedrock monitoring well shall be double cased to seal off the contamination from the overburden to sample the bedrock aquifer. Special well construction standards will be as follows:

- The well will be double cased, with the outside casing running the total depth of the overburden.

- The casing must be steel. The casing should be joined by three passes of weld which has been slagged after each weld.

- The annular space of 1.5 inches on both sides (3.0 inches total) will be pressure grouted to land surface through a tremie pipe using bentonite slurry. Alternately, an annular space of 1.0 inch on both sides will be grouted to the land surface using the casing method of grouting, in which the slurry is forced down the casing and into the annular space. (If the casing method is used, a slow setting bentonite slurry will be used).

- The inner diameter will be drilled and screened 10 feet into the bedrock.

- The viscosity of the bentonite will be 90% or higher and the mud weight will be 9.5 lbs/gallon or greater.

- The static water levels (SWLs) for both aquifers must be recorded on the well logs. The SWL will be used as an indicator that the upper aquifer is cased off properly.

For all new wells, a protective surface casing capable of being locked to prevent unauthorized entry will be installed within 48 hours of well installation. A concrete pad with a minimum diameter of two feet will be built around the casing and will be sloped away from the monitoring well to ensure proper drainage.

All monitoring wells will be surveyed by an Ohio licensed surveyor to establish horizontal and vertical location. Vertical elevations will be determined for the ground elevation adjacent to the monitoring well and for the top of the inner well casing. The elevation of the riser pipes will also be taken at the highest point on the riser, and the riser will be notched at the point where the elevation is taken.

4.4.3. Monitoring Well Development

Following completion of drilling and no sooner than 24 hours after well installation, each monitoring well will be developed by pumping or bailing until the discharged water is relatively sediment free and the indicator parameters (pH, temperature, and specific conductance) have reached steady state. Developing the well not only removes any sediment but also may improve the hydraulic properties of the sand pack. All drilling fluids, if any, used during well construction will be removed during development.

Development procedures are as follows:

Wells will be developed using surge blocks, bailers and/or pumps. All items used in well development will be decontaminated prior to use. Well development will proceed by repeated removal of water from the well until turbidity measures less than 5 NTUs and stabilization criteria are met or until a maximum of 10 well volumes have been removed. Stabilization is achieved when variation in temperature, pH and electrical conductivity is within ± 10 percent for a minimum of three sequential samples. All measurements, including the volume of water removed, the discharge water color and physical criteria will be recorded in the field log book.

4.4.4. Groundwater Measurement

Groundwater measurements will be taken after all the wells have been installed, developed, and the water level allowed to recover to a static level. All groundwater measurements will be taken within a 24-hour period. Any condition that may affect the water levels will be recorded in the field log book. Water level measurements will be taken with a decontaminated electronic water level recorder. Groundwater levels will be measured to the nearest 0.01 foot. Static water level will be measured each time a well is sampled. The presence and thickness of any LNAPL or dense non-aqueous phase liquid (DNAPL) will be measured with an electronic interface probe.

4.4.5 Groundwater Samples

In order for representative groundwater samples to be collected, groundwater wells must be adequately purged prior to sampling no sooner than 24 hours after development. Purging will require the removal of three to five volumes standing water in rapidly recharging wells, and at least one volume from wells with slow recharge rates.

Samples will be collected after the water level has recovered to 80 percent of its static level or between 16 and 24 hours after completion of purging, whichever occurs first. The upgradient monitoring well will be sampled first. Monitoring wells with highest levels of known contamination or suspected contamination will be sampled last.

Sampling procedures are as follows:

The well cover will be unlocked and carefully removed in a manner that prevents any foreign material from entering the well. The interior of the riser pipe and the breathing zone will be monitored for organic vapors using an organic vapor analyzer (OVA). If a reading of greater than 5 ppm is recorded, the well will be vented until levels are below 5 ppm before purging begins.

The water level below the top of the riser pipe or inner casing will be measured using an electronic water level indicator. All measurements will be recorded in the field log book. The total depth of the well and the depth to water will allow calculation of the volume of water in the well. The water level detector will be washed with detergent and water and rinsed with deionized water between wells.

A suction-lift, hydrolift pump, or bailer will be used to remove three to five times the well volume, measured into a calibrated pail. Dedicated new polyethylene discharge and intake tubing (3/8" I.D. low-density polyethylene) will be used for each well when a pump is used.

The well volume will be defined as the volume of water standing inside the casing measured prior to evacuation. The well volume in gallons will be calculated as follows:

$$V = 7.48 * \pi\left(\frac{D}{24}\right)^2 * (A-B)$$

Where D = inner diameter of the casing in inches; A = total length of the well in feet; B = water level below the top of casing in feet; and 7.48 is the conversion factor from cubic feet to gallons.

During this evacuation of the well, the intake opening of the pump tubing will be positioned just below the surface of the well water. If the water level drops, then the tubing will be lowered as needed to maintain flow. Pumping from the top of the water column will ensure proper flushing of the well. Pumping will continue until the required volumes are removed.

If the well purges to dryness and recharges rapidly (within 15 minutes), water will continue to be removed as it recharges until the required volumes are removed. If the well purges to dryness and

collected in 55-gallon drums or temporary storage tanks. Storage containers will be labeled with monitoring well identification and date. The disposal method of the water will be determined based on the results of the laboratory analysis. The handling and disposition of wastewater is discussed in Section 4.6.3.

Measurements for pH, turbidity, temperature, and conductivity will be taken and recorded initially and after each ½ well volume has been purged. The stability of these measurements with time will be used to guide the decision to discontinue purging. If the parameters have not stabilized after 6 well volumes have been removed, purging will be discontinued.

After well purging is completed and the well has recharged sufficiently, a sample will be collected with a disposable teflon bailer and placed into the appropriate laboratory supplied containers and preserved, if required. The bailer will be attached to a clean, dedicated ¼-inch nylon line. The bailer will be lowered slowly and retrieved gently to minimize splashing or jarring. Sample containers will be filled slowly using a bottom emptying device.

Samples will be collected in the following order of volatilization sensitivity: VOCs, SVOCs, metals, and pH.

VOC vials will be carefully filled until there is a convex meniscus over the top. After the cap is replaced, the vial will be inverted and gently tapped to verify that no air bubbles are entrapped in the sample. If air bubbles are present the vial will be discarded and a new sample will be collected into a new vial.

Duplicate samples will be collected using the same sampling equipment.

All sample bottles will be labeled using waterproof ink with date, time of collection, sample designation, and analysis to be performed. The samples will be placed in a cooler with ice.

The following information will be recorded in the field log book each time a well is purged and sampled:

- Depth to water before and after purging
- Well bore volume calculation
- Sounded total depth of the monitoring well
- The thickness of any phase separated hydrocarbons
- Field parameters, such as pH, temperature, specific conductance, and turbidity, including the date and time of each set of reading
- Total purged volume
- Date and time of sample collection and parameters sampled for.

4.4.6 Sample Handling

Completed chain-of-custody forms placed inside self-sealing bags will be taped to the underside of the cooler lids. The front and back of cooler lids will be custody sealed and taped closed. All sealing, labeling, and chain-of-custody procedures will conform to SW-846, 3rd Edition, 1986. Samples will be shipped on a daily basis to the analytical laboratory by an overnight courier. Shipments will be labeled and documented in accordance with applicable Ohio EPA and Department of Transportation (DOT) Regulations. The individual leading the sampling effort will contact the laboratory daily to verify receipt of samples. Upon completion of analyses, copies of fully-executed chain-of-custody forms will be returned to the contractor performing the sampling.

All sampling and analysis will be conducted in accordance with rigorous quality assurance/quality control procedures (QA/QC). Field QA/QC will include field blanks, field duplicates, equipment rinse samples, and trip blanks. Laboratory QA/QC will include duplicates and spikes. Further detail on field and laboratory QA/QC can be found in Section 4.7.

4.4.7 Slug Tests

Slug tests are performed in groundwater monitoring wells to determine the in-situ hydraulic conductivity of the hydrostratigraphic unit. A slug test involves the instantaneous displacement of a known volume of water in a well and measuring changes in water level over time as the well returns to static conditions. Slug tests can be either rising head (removing a slug) or falling head (adding a slug). Data will be collected electronically using an In-Situ Company, Inc. Hermit Data Logger. Hydraulic conductivities will be calculated using the Hvorslev Method, or the Bouwer and Rice Method for unconfined aquifers.

Prior to conducting a slug test the following items must be accomplished:

- Ensure data logging equipment is fully charged and operating properly. Be sure that the pressure transducer is functioning.
- Complete slug test information sheet log.
- Decontaminate all equipment that will come into contact with the groundwater.
- Calculate the volume of standing water in the well and calibrate the transducer according to the manufacturer's specifications.

To conduct a slug test:

- Determine if the screened interval of the well is fully saturated and indicate on the log form if a falling-head or rising-head slug test will be conducted.
- Connect the transducer to the data logger.
- Measure a length of transducer cable sufficient to lower the transducer to a depth of approximately 1 foot above the measured bottom of the well. Securely attach the cable with duct tape to the outside of the protective well casing.

- Consult operators manual and enter the required information into the data logger.

- Attach a dedicated rope to the slug. Measure and mark a length of rope sufficient to lower the top of the slug below the measured depth to water.

- Mark a point on the rope corresponding to where the bottom of the slug will be suspended slightly above the measured water level. Lower the slug into the well so that it is suspended above the water level.

For a falling-head slug test:

- Begin recording data with the data logger. Quickly lower the slug completely into the water column (upper marked point on the rope) which will raise the level of water in the well.

- Continue recording depth-time measurements until the water level returns to approximately 90 to 95 percent of static conditions, or a sufficient number of readings have been recorded to plot the data showing recovery versus the logarithm of time.

For a rising-head slug test:

- Completely submerge the slug into the well and let the water level return to 90 to 95 percent of static water level. Begin recording data with the data logger. Quickly remove the slug from the water until it is at the point where its bottom is above the measured water level (lower marked point on the rope). Do not pull the slug so quickly that a suction force is created.

- Continue recording depth-time measurements until the water level returns to 90 to 95 percent of static water conditions, or until a sufficient number of readings have been recorded to plot the data showing recovery versus the logarithm of time.

At completion of slug test:

- Stop data logger and remove all equipment from the well.

- Download data from the slug test onto floppy disk as soon as possible.

- Analyze slug test results using appropriate software or graphical solution methodology.

4.5 DECONTAMINATION PROCEDURES

To ensure that cross-contamination or outside contamination will not be introduced into the sample, all equipment used during the field investigation will be decontaminated. All decontamination will be performed in a specified area on a water-tight decontamination pad established during mobilization. All decontamination water will be collected and containerized. The following cleaning protocols will be applied.

4.5.1 Decontamination Facility (Decon Pad)

A decontamination facility for large and small sampling equipment will be constructed in the paved parking area south of Building 7121 during site mobilization. A scaled drawing of the decontamination facility is presented in Figure 4-5. The facility will be delineated with orange fencing and appropriate signage as part of the contamination reduction zone. The equipment decontamination facility will be constructed on a sound base capable of supporting a drill rig. The base of the facility will be constructed of a 20 mil high density polyethylene (HDPE) liner draped over straw bales and sloped to a sump. Rinse water will flow into the sump and will be pumped into 55 gallon drums for temporary storage. The drums will be labeled for contents and dated pending analytical results prior to disposal. A single sheet of HDPE will be used to cover the entire base of the decontamination facility. The sheeting will be weighted down on the hay bales by decontamination facility sand bags or other devices to secure the plastic in place at all times including periods of high winds. The liner will be visually inspected prior to use on a daily basis to detect possible failures of the liner material. This liner will be inspected for:

- evidence of tears and holes;
- evidence of seepage;
- that the sheeting is adequately fastened to the side walls;
- that the liner adequately covers the straw bales at the end sections and is secured by sandbags; and
- that expected quantities of generated liquids can be contained until collected for disposal.

If any damage is detected, the decontamination facility will be repaired or replaced before further use. Records will be maintained specifying decontamination facility construction materials and methods, disposition of liquids, and any repairs and/or breaches of liner integrity.

At the completion of all field activity and after all equipment has received its final decontamination, the decontamination facility will be decontaminated with a high pressure or steam cleaning. All materials used in construction (hay bales, sand bags, lumber) that did not come into contact with potentially contaminated rinsate may be reused. Prior to leaving the site, the liner will be cut into manageable pieces and disposed along with the personal protection equipment that will be disposed with the soil cuttings. When the decontamination facility is dismantled, the underlying soil will be visually inspected for signs of contamination (seepage). Evidence of a potential release will require the same sampling and analyses as describe in the closure work plan to ensure that no spread of contamination has occurred through decontamination activities.

4.5.2 Decontamination of Large Equipment

The drill rig and drilling equipment will be steam cleaned upon arrival at the site, between boreholes, and prior to leaving the site. The following will be used to decontaminate the rig, augers, pipe, and rods:

- Clean external surfaces of equipment with a steam cleaner or high-pressure hot water and Alconox, or equivalent laboratory grade detergent. If necessary, scrub until all visible signs

of contamination (primarily soil) have been removed. Inside surfaces of augers and pipes will also be cleaned.

- Rinse with potable water.
- Allow equipment to air dry.

4.5.3 Decontamination of Sampling Equipment

The following procedure will be used to decontaminate split-spoon samplers, bailers, and other tools:

- Scrub the equipment with a solution of potable water and Alconox, or equivalent laboratory-grade detergent.
- Rinse with potable water.
- Rinse with ASTM Type II Reagent Water (deionized water).
- Allow equipment to air dry on a clean surface or on a rack elevated at least two feet above the ground.
- If equipment will not be used immediately, wrap in aluminum foil.

4.6 PROCEDURES FOR HANDLING AND DISPOSITION OF WASTE GENERATED THROUGH CLOSURE PLAN ACTIVITY

Three types of waste will be generated during closure activity: 1) Contaminated soil generated as soil cuttings during soil sample collection; 2) Potentially contaminated rinsate water generated through decontamination procedures and water generated through development/purging of monitoring wells; and 3) Personal protection equipment and other waste such as plastic from decontamination activity. The procedures for handling and disposing of each type of waste are described in the following sections. All waste containers will be labeled, dated, manifested, placarded, and transported in accordance with all applicable Ohio EPA and DOT regulations. Copies of executed manifests and certificates of treatment and/or disposal, as appropriate, will be obtained by NASA and will be submitted with the closure documentation.

4.6.1 Contaminated Soil

All soil generated in the course of closure activity will be placed in DOT 17H containers for off-site disposal. The drums will be identified as to the contents, the boring from which the waste was generated, and dated. The soil will be sampled and analyzed for soil disposal parameters identified in Table 4-1. The soil may be considered hazardous by characteristic or by listed hazardous constituent. All hazardous waste will be managed in accordance with Land Disposal Restrictions. If the soil is nonhazardous, it will be transported offsite and disposed as solid waste. Hazardous waste will be transported offsite and disposed. It is anticipated that ten, 55-gallon drums of soil will be generated during closure activity. Appropriate offsite facilities able to accept, treat, and dispose of contaminated soil are identified in Section 4.6.4.

4.6.2 Personal Protection Equipment and Decontamination Material

Equipment such as tyvek, gloves, plastic sheeting, disposable booties, bailers, etc. will require disposal at the completion of work activity. These discarded materials will be placed in plastic bags and disposed along with the soil from the borings with which they were generated, as long as they are consistent with that waste stream.

4.6.3 Rinsate Water and Monitoring Well Development/Purge Water

Rinsate water will be generated during decontamination procedures, which should eliminate the potential of cross-contamination during sampling activity. The bulk of the decontamination fluid will be generated during decontamination of the drill rig and auger flights. Fluids will be kept to a minimum through the use of a steam cleaner or sprayer which utilizes a high pressure/low volume wash.

It is expected that approximately 200 gallons of rinsate will be generated through decontamination. The rinsate will be pumped and poured into temporary storage containers which will be labeled for contents and date of generation. At completion of the work activities, the containers will be sampled and analyzed for the disposal parameters identified on Table 4-1. If analytical results indicate the water is within acceptable limits for disposal into sanitary sewers, permission will be sought to discharge the rinsate to the PBS sanitary sewer system. If permission is denied or contaminants are above discharge limits, the waste water will be transported off site to a properly permitted disposal facility capable of handling the wastes.

The new monitoring wells installed to support closure will require development, and all wells to be sampled will require purging. As mentioned previously in this report, the uppermost aquifer that will be sampled is a poor water bearing unit and monitoring wells are slow to recharge. Development and purge water from each newly installed well will be temporarily stored in 55-gallon drums. The drums will be labeled to identify from which monitoring well the water was generated and the date which it was generated. Based on previous well development activity at the GMA, it is anticipated that less than one drum will be generated from each well. All purge water from the existing wells will be contained in the same temporary storage container. Disposal will be based on laboratory results and will be handled in a similar method as rinsate water.

4.6.4 Identification of Off-Site Waste Management Facilities

All the wastes generated during closure activities could be contaminated with organic compounds and may require treatment to ensure that land disposal restriction requirements are met for all constituents. For contaminated soils, the following facilities have the appropriate permits and treatment technologies to handle the anticipated waste types and contaminants:

Laidlaw Environmental Services: incineration, stabilization, and land disposal.
1-800-251-1227

Trade Waste Incineration: incineration, land disposal.
1-618-271-2804

If aqueous waste cannot be discharged to the PBS sanitary sewer system, the following facility can be used for waste treatment and/or disposal:

Chemtron Corporation
1-216-871-8048

Solid (nonliquid) wastes that meet the land disposal restriction requirements may be sent for pretreatment prior to disposal at:

Envirosafe Services of Ohio, Inc.
1-419-255-5100

4.7 INTERNAL QUALITY CONTROL CHECKS FOR FIELD AND LABORATORY OPERATIONS

4.7.1 Field Quality Control

QC samples to be collected include equipment blanks (or field blanks), field duplicates/replicates, and trip blanks. Definitions for these samples are listed below.

4.7.1.1 Equipment Blanks - An equipment blank is Type II, reagent-grade water (preferably supplied by the laboratory) that is poured into or pumped through the sampling device after decontamination has been performed, transferred to the appropriate sample container(s), and transported to the laboratory for analysis. All parameters performed on the associated field samples are required to be performed on the equipment blank. One equipment blank shall be collected for every ten environmental samples.

4.7.1.2 Field Duplicate Samples - A field duplicate sample is a second sample collected independently at the same location as the original sample during a single act of sampling. Duplicate sample results are used to assess precision, including variability associated with both the laboratory analysis and the sample collection process. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. Ten percent of all water samples shall be field duplicates. Both duplicates shall be analyzed for the same parameters in the laboratory.

4.7.1.3 Field Replicate Samples - A field replicate sample is a single sample divided into two equal parts for analysis. Replicate sample results are used to assess precision, including variability associated with both the laboratory analysis and the sample collection process. Replicate samples are treated in an identical manner during storage, transportation, and analysis. Ten percent of all soil samples shall be field replicates. Both replicates shall be analyzed for the same parameters in the laboratory.

4.7.1.4 Trip Blanks - A trip blank is a volatile sample vial filled in the laboratory with organic-free water (Type II, reagent grade water), transported to the site, handled like a sample, and returned to the laboratory for analysis. Trip blanks are prepared only for volatile samples and are subjected to the same handling as other samples. Trip blanks shall not be opened in the field. Trip blanks serve to identify contamination from sample containers or transportation and storage procedures. For every cooler containing soil or water samples collected for VOC analysis, one trip blank will be added to the cooler and analyzed for the presence of VOCs.

4.7.2 Laboratory Quality Control

The principal criteria for verification of data quality is the continuous monitoring of analytical accuracy, precision, and overall method performance through systematic analysis of quality control samples. Each analytical method used in the laboratory utilizes specific quality control procedures to continually monitor acceptable analytical method accuracy and precision. These method quality control procedures involve the mandatory systematic insertion of quality control samples into 10% of all laboratory analysis, in addition to strict adherence to instrument performance and calibration specifications. These procedures are thoroughly detailed in the laboratory Standard Operating Procedures (SOPs) and are based upon USEPA methods guidance.

The following subsections identify the types of laboratory QC terminology and QC samples and how they are evaluated.

4.7.2.1 Analytical Batch - An analytical batch consists of samples (not to exceed 20) that are similar in composition (matrix), extracted or digested at the same time and with the same lot of reagents. For each preparation batch, one method blank and an Laboratory Control Sample (LCS) must be included. When required, each sample must be spiked with the method-specified surrogates. The identity of each preparation batch shall be unambiguously reported with the analytical data so that the reviewer can identify the QC samples and the associated environmental samples.

4.7.2.2 Calibration Standards - Initial calibration is performed as required for each analytical method, usually using a range of calibration standards with the low standard at or near the PQL for that analyte. These standards are used to determine the quantitation range for each instrument. Initial and continuing calibration standards must include all target analytes.

4.7.2.3 Method Blanks - A method blank is defined as laboratory-demonstrated analyte-free water that is carried through the entire analytical procedure. A method blank is prepared and analyzed for each batch of samples for all applicable parameters. The method blank is used to determine the level of laboratory background contamination. Unfavorable method blank performance renders associated data suspect and requires corrective action and/or data qualification.

4.7.2.4 Matrix Spike/Matrix Spike Duplicate Samples - An aliquot of a matrix (water or soil) is fortified (spiked) with a known concentration of the compounds of interest or (for organic analyses) a representative subset of the target analytes. The matrix spike and matrix spike duplicate (MS/MSD) are subjected to the entire analytical procedure in order to indicate both accuracy and precision of the method for the matrix by measuring the percent recovery and the Relative Percent Difference (RPD) of the two spiked samples. These samples are used to assess matrix interference effects on the method, as well as to evaluate instrument performance. The MS/MSDs do not control the analytical process. Matrix spike/matrix spike duplicates are analyzed for each matrix for every 20 environmental samples in order to maintain continuous surveillance of acceptable method performance.

4.7.2.5 Duplicate Samples - A second aliquot of the sample is subjected to the same analytical procedure as the original sample in order to determine the precision of the method by measuring the RPD of the two results.

4.7.2.6 Laboratory Control Samples (LCS) - An aliquot of a contaminant free matrix is fortified (spiked) with known concentration of all compounds of interest or a representative subset. The laboratory prepares and analyzes a LCS for each batch of samples for all applicable parameters. The LCS is subjected to the entire analytical procedures in order to continuously evaluate method performance. Percent recovery determination from these check samples are monitored to provide a continuous measure of each method's accuracy. Laboratory quality control charts are constructed from this data in order to monitor and compare actual check sample data with established laboratory method performance criteria. When an analyte in an LCS exceeds the control limits, corrective action must be performed. If corrective action is not performed the appropriate validation flag shall be applied to all affected results.

4.7.2.7 Surrogate Spike - A surrogate spike consisting of an organic compound that is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but not normally found in environmental samples, is added to GC/MS analyses, GC volatile analyses, and GC pesticide and herbicide analyses to evaluate acceptable method performance. Surrogate spike recoveries must compare favorably to the laboratory performance limits in order for an analysis to be acceptable. Unfavorable surrogate spike recoveries render associated data suspect and require corrective action.

4.7.3 Quality Assurance Objectives for Chemical Measurements Data

The overall QA objective for this project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results which are legally defensible in a court of law.

Chemical measurements data are evaluated in terms of its precision, accuracy, representativeness, completeness, and comparability (PARCC). In addition, the sensitivity required for each analysis will be established and appropriate analytical methods selected prior to the initiation of analytical work.

4.7.3.1 Definitions - General definitions and methods for evaluating data in terms of the PARCC parameters and requirements for data sensitivity are given below. All data quality requirements and methods for evaluating data quality and accepting or rejecting data will be in accordance with USEPA guidelines.

4.7.3.2 Precision - The laboratory objective for precision is to equal or exceed the precision demonstrated for the applied analytical methods on samples of similar matrix. For this investigation, precision is evaluated using analyses of laboratory duplicates and/or matrix spike/matrix spike duplicates, which not only exhibit sampling and analytical precision, but also the reproducibility of the analytical results. Relative Percent Difference (%RPD) criteria are used to evaluate precision. In general, a matrix spike/matrix spike duplicate or duplicate sample will be prepared for analysis at a frequency based upon:

- each batch of field samples, or
- each 20 field samples in a batch, or
- each group of samples of a similar concentration level (soils only), or
- each 14 calendar day period during which samples in a batch were received (said period beginning with the receipt of the first sample in that batch), <u>whichever is more frequent</u>

Requirements for the %RPD for each analysis will be as set by the laboratory data quality requirements and chosen methodologies. The formula for calculating the %RPD is provided below.

$$\%RPD = \frac{(X1 - X2)}{(X1 + X2)/2} \times 100$$

Where: X1 = the initial sample result
X2 = the duplicate result

Requirements for the %RPD for each analysis will be as set by the laboratory data quality requirements and chosen methodologies.

4.7.3.3 Accuracy - Percent recovery criteria determined from laboratory performance data are used to estimate accuracy based on recovery of the LCSs, surrogates, matrix spike, and matrix spike duplicate samples. The laboratory objective for accuracy is to equal or exceed the accuracy demonstrated for the applied analytical methods on samples of similar matrix. For volatile, semivolatile, and pesticide/PCB analyses, accuracy is also determined by the addition of surrogate standards to all environmental samples, blanks, and QC. The surrogates, spike, and spike duplicate will give an indication of matrix effects that may be affecting the target compounds, and are also a good gauge of the method efficiency. An LCS is performed with each batch of samples and must demonstrate that the process is in control. A matrix spike/matrix spike duplicate will be prepared for analysis at a frequency based upon:

- each batch of field samples, or
- each 20 field samples in a batch, or
- each group of samples of a similar concentration level (soils only), or
- each 14 calendar day period during which samples in a batch were received (said period beginning with the receipt of the first sample in that batch), <u>whichever is more frequent</u>

Requirements for the %Recovery for each analysis will be as set by the laboratory data quality requirements and chosen methodologies. The formula for calculating the %Recovery is provided below.

$$\%Recovery = \frac{(X - B)}{Z} \times 100$$

Where: X = the total amount of the spiked compound found (for MS; spike plus sample concentration)
B = the unspiked sample result (0 for LCS)
Z = the true amount of compound spiked into the sample

4.7.3.4 Representativeness - Representativeness expresses the degree to which data accurately and precisely represent the environmental condition, characteristics of a population, parameter variation at a sampling point, or a process condition. The representativeness of the data from the sampling sites depends in part on the sampling procedures. The sampling procedures have been designed with the goal of obtaining representative samples for each of the different matrices.

procedures. The sampling procedures have been designed with the goal of obtaining representative samples for each of the different matrices.

Representativeness of the analytical data is also a function of the procedures used in processing the samples. Representativeness may be determined for this objective by a comparison of the quality control data for these samples other against other data for similar samples analyzed at the same time.

4.7.3.5 Comparability - Analytical results are comparable to results of other laboratories because of the following procedures and programs: instrument standards traceable to National Institute of Standards and Technology (NIST) or reputable sources; the use of standard methodology; reporting results from similar matrices in consistent units; applying appropriate levels of quality control within the context of the laboratory quality assurance program; and participation in interlaboratory studies to document laboratory performance. By using traceable standards and standard methods, the analytical results may be compared to other laboratories operating similarly. The QA Program documents internal performance. Periodic laboratory proficiency studies are instituted as a means of monitoring interlaboratory performance.

4.7.3.6 Completeness - The completeness of the sample set is defined as the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. The percent valid data will be expressed for each method analyte in each sample matrix. If a method provides results for multiple analytes (e.g., VOAs, SVOAs, metals, etc.), the percent Valid data for each analyte will be expressed. For completeness requirements, valid results are all results not qualified with an "R" flag. The formula for calculating percent Valid Data is provided below.

$$\text{Completeness} = \frac{A}{B} \times 100$$

Where: A = the number of valid results
B = the total number of possible results

4.7.3.7 Goals - Equipment blanks, trip blanks, method blanks, duplicates, LCSs, and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

The general level of the QC effort will be one field duplicate and one equipment blank for every 10 or fewer investigative samples. One VOC analysis trip blank consisting of Type II, reagent grade water will be included along with each shipment of samples analyzed for VOCs. The frequency of field QC samples to be collected are listed in Tables 4-2a and 4-2b for Building 7121 and 7131, respectively.

The goals for completeness are 90% for soil samples and 95% for aqueous samples. For completeness requirements, valid results are all results not qualified with an "R" flag. If there are any instances of samples that could not be analyzed for any reason (holding time violations in which resampling and analysis were not possible, samples spilled or broken,

etc.), the numerator of this calculation would become the number of valid results minus the number of possible results not reported.

4.7.4 Analytical Procedures

4.7.4.1 Identification of Methods - Table 4-1 lists all analytical methods to be used for this project with the source for each method referenced.

4.7.4.2 Practical Quantitation Limits -

4.7.4.2.1 Terminology

Method Detection Limits (MDL) - 40 CFR 136, Appendix B defines the MDL as the "minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte."

Practical Quantitation Limits (PQL) - The PQL as defined in Chapter 1 of Test Methods for Evaluation of Solid Waste (SW846): "The lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions." PQLs must be supported by a MDL study, in which the determined MDL must be equal to or below the PQL.

4.7.4.2.2 Procedures - The laboratory shall establish MDLs for each target analyte. The laboratory must demonstrate the MDLs for each method of analysis using the instructions defined in 40 CFR 136, Appendix B. The laboratories must verify the existing MDLs on an annual basis. The laboratory must also verify that the PQLs are routinely reported and reliably achieved by including a standard at or below the PQL as the lowest point on the calibration curve.

4.7.4.2.3 Reported Values - Tables 4-3 through 4-6 lists the method MDLs, PQLs, and reporting units for all methods to be used for this investigation. Laboratory-derived MDLs will be included once the contract laboratory has been selected. The laboratory is required to report concentrations down to the MDL. Any positive value that is between the MDL and the PQL must be qualified by the laboratory as estimated. Tables 4-7 and 4-8 are treatment standards and regulatory levels. PQLs for these analytes must be equal to or below those values.

4.7.4.3 Method Calibration - Analytical instruments shall be calibrated in accordance with the specified methods. The multipoint calibration curve must include a standard at a concentration at or near the PQLs listed in Tables 4-3 through 4-6. The initial and the continuing calibrations must include all target analytes reported (including multi-response analytes) for each method listed in Table 4-1. The initial calibrations must be checked at the frequency specified by the method and by a second source standard. These calibrations must meet the acceptance criteria of the specified method. Records of standards preparation and instrument calibration must be maintained in such a manner to unambiguously trace the preparation of standards, their use in calibration, and the quantitation of sample results. Inorganic calibration standards must be traceable to available NIST materials when available. Calibration standards for organic analytes must be traceable to materials certified by

Cooperative Research and Development Agreement, NIST, Contract Laboratory Program-Standard Reference Material, or the American Association for Laboratory Accreditation when available.

4.7.4.4 Sample Container, Preservation, and Holding Time Requirements - The selection of sample containers is based on both the media being sampled and the analysis of interest. Table 4-9 summarizes the sample container requirements for various media and analytical parameters. In addition this table details the preservation requirements and holding times which will be followed to ensure integrity of all environmental samples.

4.7.5 Sample Custody

A sample is physical evidence collected from a site or from the environment. As such, each sample must be documented in a manner that makes it legally defensible and which provides all information necessary for proper analysis.

Custody is one of several factors which is necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. A sample or evidence file is "Under Custody" if:

1. It is in actual possession of a person, or
2. It is in the view of the person, after being in actual possession, or
3. It was in actual possession but is locked up to prevent tampering, or
4. It is in a designated and identified secure area.

Procedures to ensure the custody and integrity of samples are initiated at the time of sample collection and continue through sample transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples must be maintained in field and laboratory documentation. The following sections discuss operations for sample handling and custody.

4.7.5.1 Field Operations - At the time of the sampling, the Field Team member will record the sample information in a logbook and on a chain-of-custody form, noting on each any difficulties encountered in sampling. All label, logbook, and chain-of-custody form entries shall be made in waterproof ink. The sample information recorded in the logbooks should be at least as detailed as that recorded on labels, and should indicate the type of sample (e.g., groundwater, soil, waste, etc.), preservation technique, and sampling location, in sufficient detail as to allow resampling at the same location.

Affixed to each sample container will be a non-removable (when wet) label. The following information will be written with permanent marker:

- Site name
- Sample identification
- Project number
- Date/time
- Sampler's initials
- Sample preservation
- Analysis required

After samples are collected, the Field Team member will place the filled containers in coolers. The storage containers must be labelled with a genral description of the contents (e.g., cutting, PPE) and accumulation start date once they are full and while awaiting the receipt of analytical results.

The field technician will maintain custody of all samples until they are shipped to the laboratory. Samples submitted to the laboratory are accompanied by the chain-of-custody to ensure adequate documentation. These forms are completed and sealed within the cooler to be opened and examined by the Laboratory Sample Custodian. Information to be included on the chain-of-custody is as follows:

- Client
- Project or Sampling Location
- Sample Identification Number or Designation
- Sample Description
- Sample Container Numbers and Volumes
- Cooler Identification Number
- Analysis Required
- Preservatives (if applicable)
- Signatures of Persons Involved in Chain-of-Custody
- Date and Time of Possession

All entries on the chain-of-custody form must correspond to the field log book and sample labels.

Custody seals are provided with the sample containers and are used to detect unauthorized tampering with samples prior to laboratory acceptance. Custody seals are affixed to the cooler in a manner that requires seal breakage in order to open the cooler. Unauthorized seal breakage indicates possible tampering and will render a sample suspect.

4.7.5.2 Laboratory Operations - The following information describes the laboratory operations for sample handling, identification, and sample custody records.

4.7.5.2.1 Sample Handling - Upon receipt in the laboratory, the integrity of the shipping container is checked by verifying that the custody seal on the cooler is not broken. Custody seals are used to detect unauthorized tampering of samples prior to laboratory acceptance. The custody seals are affixed to the sample transport container in a manner that requires seal breakage in order to open the container. Unauthorized seal breakage indicates possible tampering and will render samples suspect. Samples are to be maintained at 2°C to 6°C. When, in the judgement of the laboratory, the temperature of the samples upon receipt may have affected the stability of the analytes of interest, the problem must be discussed with the URS Project Manager. The samples are checked for breakage, leakage, damage, and the contents of the shipping container are verified against the chain-of-custody documentation. Custody seal integrity, temperature, and sample preservation must be documented. Any problems are documented on the chain-of-custody and/or in a format traceable to the sample(s) and the Project Manager is notified immediately. If the samples and documentation are acceptable, each sample is assigned a unique laboratory identification number from the Laboratory Information Management System (LIMS) database. If the samples, documenta-

tion, or coolers are not acceptable, the Project Manager is notified. All corrective actions must be clearly documented.

The following sample information, at a minimum, is required and stored on LIMS:

- Date of sample collection
- Date of sample receipt
- Sample laboratory number
- Number of samples
- Source of samples
- Analytical test(s) requested
- Final disposition of the sample

When LIMS log-in has been completed, the samples are transferred to the appropriate storage areas with restricted access. Separate refrigerators are used for samples receiving analysis for volatile compounds. The sample refrigerators are maintained at 2°C to 6°C and their temperatures are recorded daily with thermometers calibrated against NIST thermometers.

Samples are retained for a minimum of thirty days after a laboratory report has been generated and mailed to the client. The samples are then transferred to a sample disposal area where they are then prepared for proper disposal. Final transfer from the sample control area to disposal must be documented in LIMS and/or in the final evidence files. Samples may be stored to meet specific project requirements if prior arrangements have been made with the laboratory.

4.7.5.2.2 Sample Identification - As discussed above, once samples have been received by the laboratory and the samples and corresponding documentation are determined to be acceptable, each sample is assigned a unique laboratory identification number. Samples are tracked through the laboratory with this number.

Sample analysis is performed by preparation batches or lots. Analyses which do not include a preparatory step are batched in the same manner at time of analysis. Analyses which require a preparatory step must be batched at time of sample preparation. Laboratory QC samples (e.g., blanks, LCS, MS/MSDs) must be included in the preparation batch with the environmental samples. A batch is a group of samples (not to exceed 20) that are similar in matrix and that are extracted or digested at the same time and with the same lots of reagents. The identification of each batch shall be unambiguously reported with the analyses so that the reviewer can clearly identify the QC samples with the associated environmental samples. The type of QC samples and the frequency of these samples were discussed in section 4.7.1 of this plan.

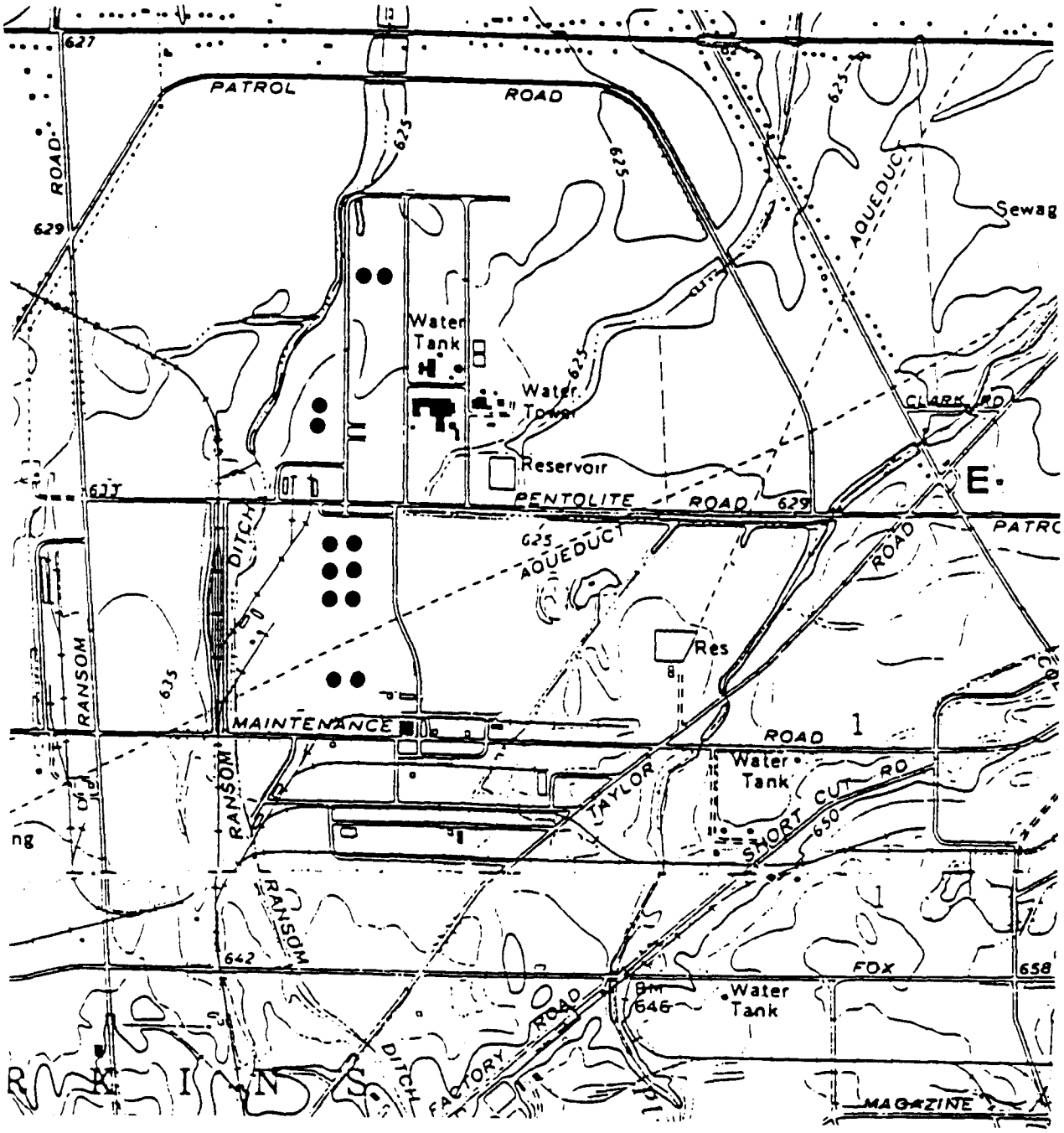
4.7.5.2.3 Sample Custody Records - All entries on the Laboratory chain-of-custody form must correspond to the Laboratory Sample Labels. The Laboratory is to maintain complete laboratory documentation measures to ensure the integrity and legal validity of all sample analytical results. These documentation measures encompass all analytical activities to create a traceable, legal history of each sample's subsequent analysis. These records are retained in accordance to the Laboratory retention policy meeting state and regulatory requirements.

4.8 REVIEW OF LABORATORY DATA

All laboratory data generated are reviewed for accuracy and completeness by the laboratory prior to reporting. The analyst who generates the analytical data has the prime responsibility for the correctness and completeness of the data.

The review of laboratory data received from the laboratory shall focus on the following items:

- Chain-of-custody forms.
- Holding times. (If exceeded, evidence of resampling and analysis or written variances shall be noted.)
- Method calibration limits. (Reviewed to assure conformance to acceptance criteria and completeness of records.)
- Method blanks.
- Laboratory verification of quantitation limits.
- Preparatory batch control records.
- Corrective actions. (Samples with out-of-control QC data shall be identified in the Technical Report and an assessment of the usability of the data shall be recorded.)
- Formulas used for analyte quantitation. (Formulas used and sample calculations shall be provided.)
- Examples of analyte quantitation. (Quantitation reports shall be reviewed to assure correctness and completeness of calculated results.)
- Completeness of data.
- Use of current control limits. Exceedances are identified.
- Field duplicate results.
- Field and laboratory blank results.
- Sample matrix effects.



LEGEND:

● SOIL SAMPLING LOCATION
SAMPLE INTERVAL 0-1'

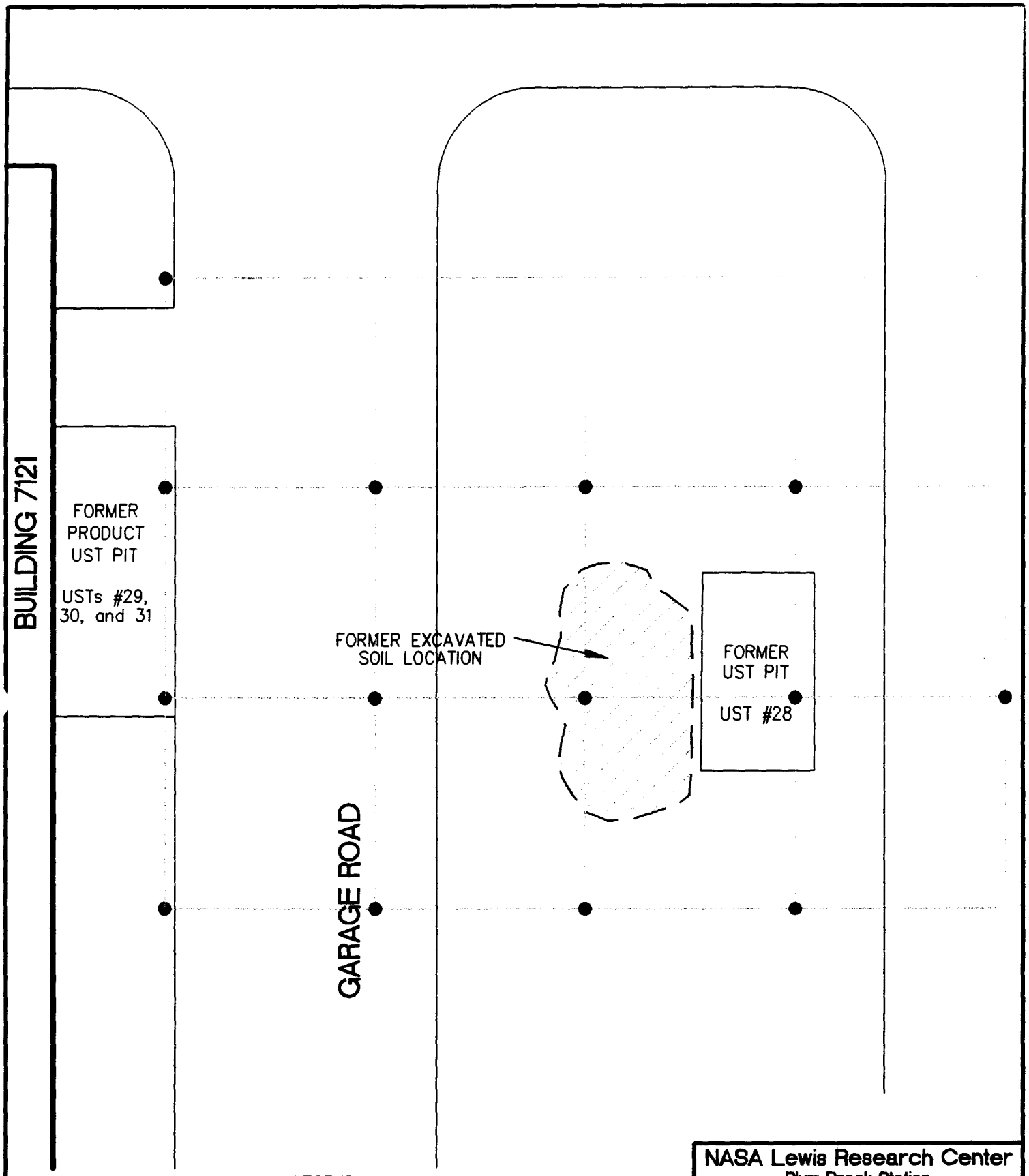
0 2000'
SCALE 1" = 2000'
0 240 480 720M
SCALE 1CM = 240M

NASA Lewis Research Center
Plum Brook Station
Garage And Maintenance Area

Figure 4-1
Background Soil
Sample Locations

URS CONSULTANTS

M:\8705900\C .GE\FIG4-1



LEGEND:

● SOIL SAMPLING LOCATION
SAMPLE COLLECTION INTERVALS 6–8' AND 10–12'.
INTERVAL AT FORMER EXCAVATED SOIL LOCATION ALSO AT 0–1'.

16' GRID

0 10'
SCALE 1" = 10'
0 1 2 3M
SCALE 1CM = 3M

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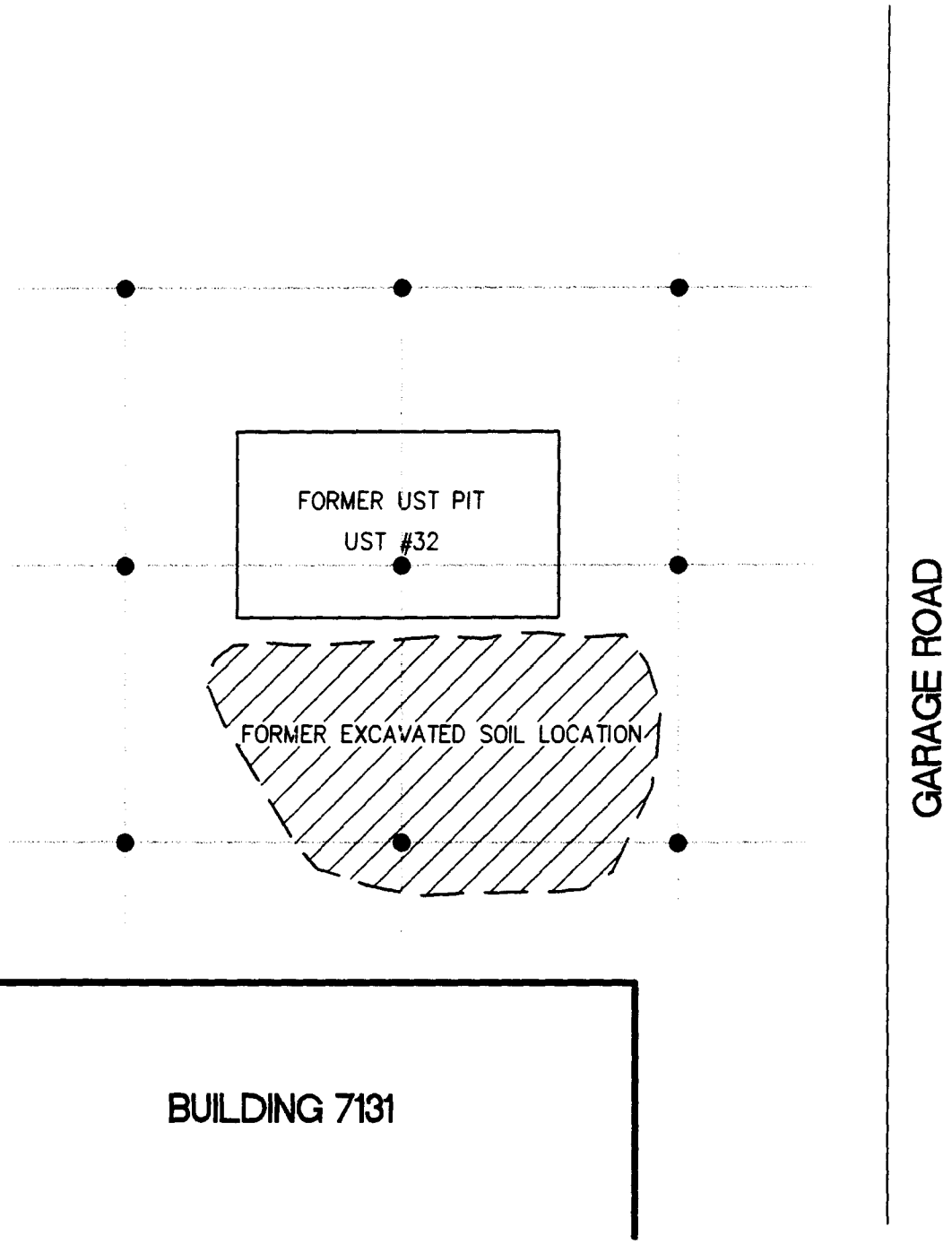
Plum Brook Station
Garage And Maintenance Area

Figure 4-2
Site Soil
Sampling Locations
Building 7121

URS CONSULTANTS

M:\8705900\C:\ GE\FIG4-2



LEGEND:

● SOIL SAMPLING LOCATION
SAMPLE COLLECTION INTERVALS
6-8' AND 10-12'.
INTERVAL AT FORMER EXCAVATED
SOIL LOCATION ALSO AT 0-1'.

16' GRID

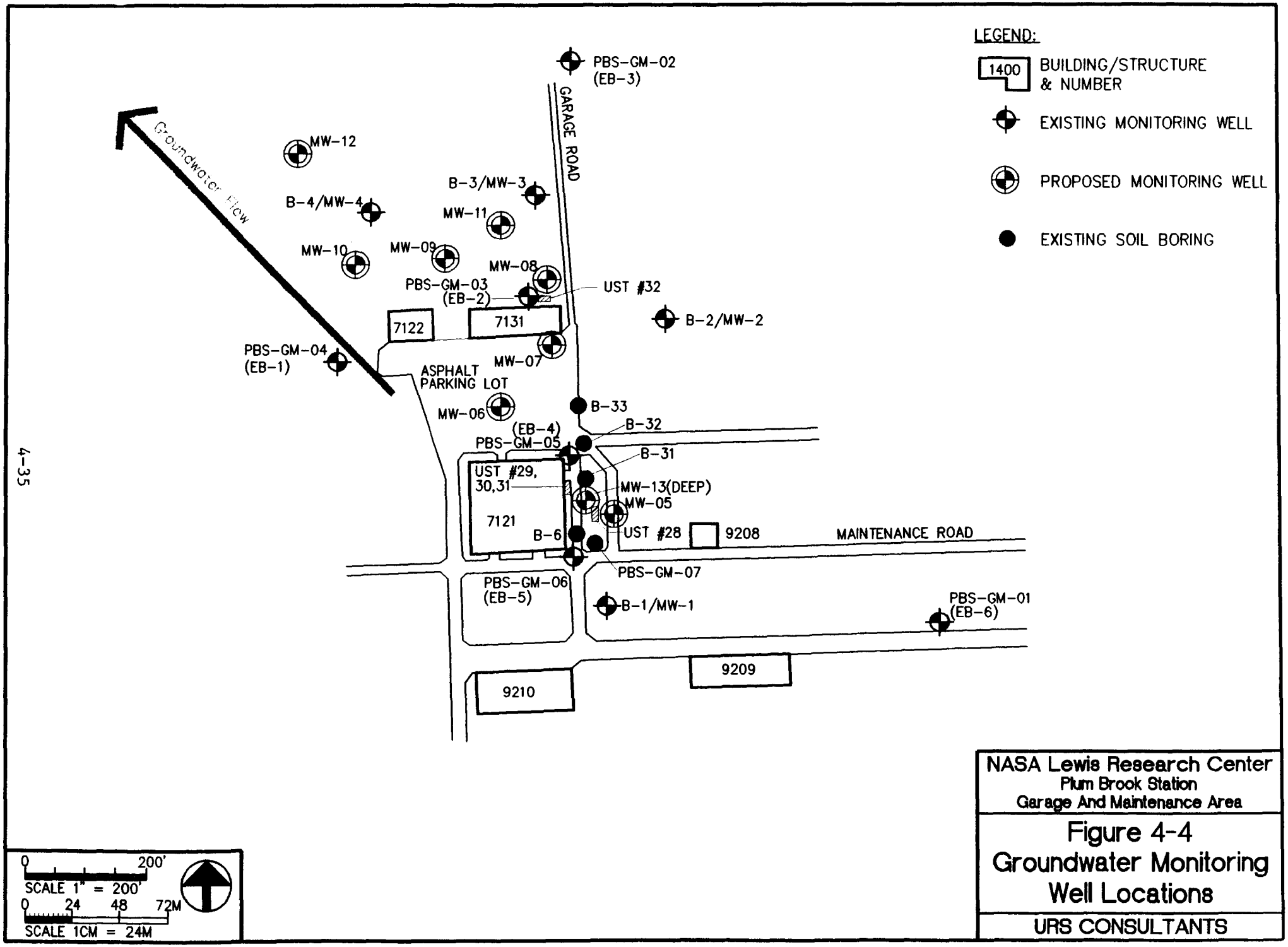
0 10'
SCALE 1" = 10'
0 1 2 3M
SCALE 1CM = 3M

NASA Lewis Research Center
Plum Brook Station
Garage And Maintenance Area

Figure 4-3
Site Soil
Sampling Locations
Building 7131

URS CONSULTANTS

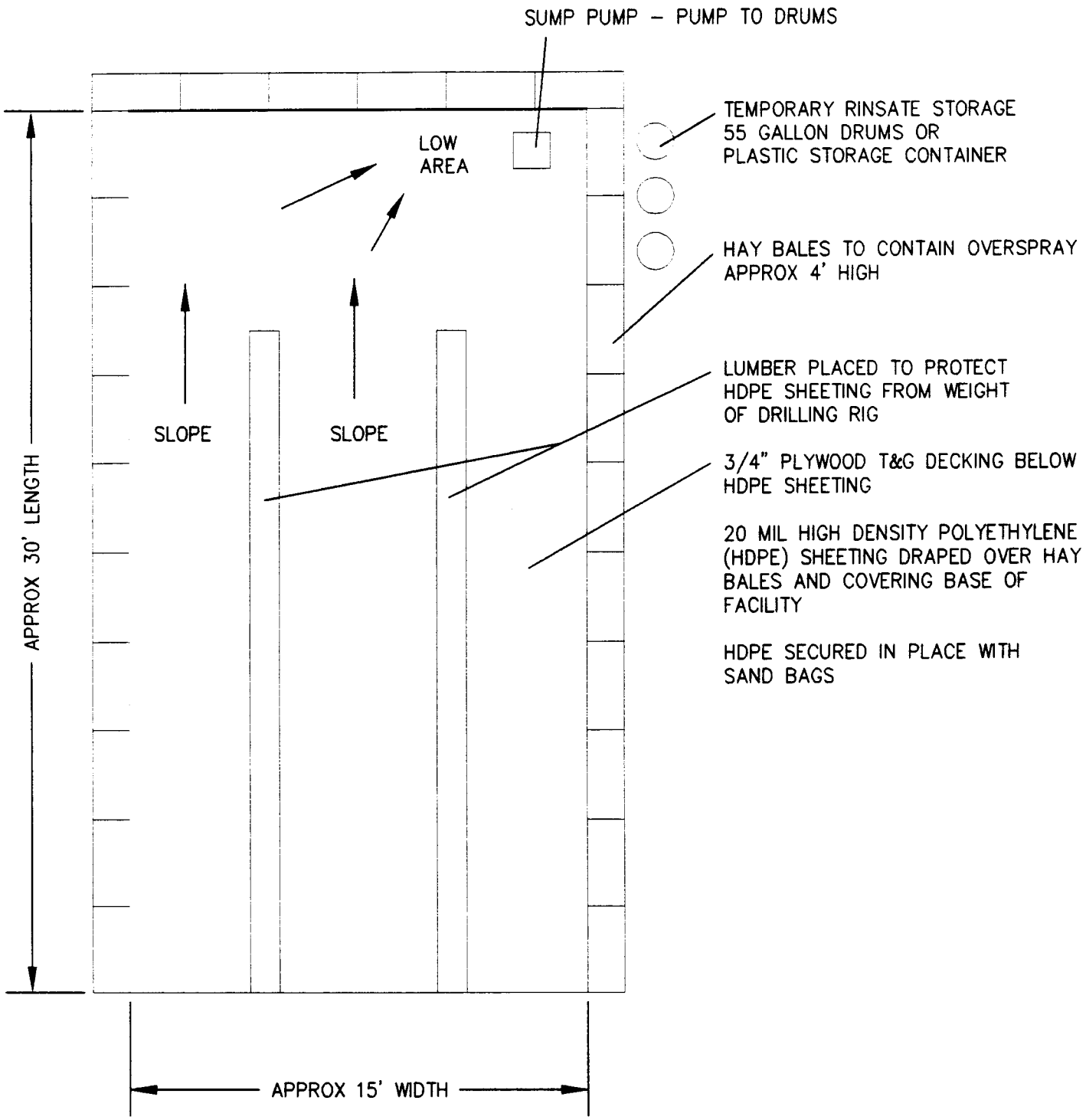
M:\8705900\C .GE\FIG4-3



NASA Lewis Research Center
Plum Brook Station
Garage And Maintenance Area

Figure 4-4
Groundwater Monitoring Well Locations

URS CONSULTANTS



FACILITY WILL BE CONSTRUCTED IN PARKING LOT SOUTH OF BUILDING 7121.

0 5'
SCALE 1" = 5'
0 .6 1.2 1.8M
SCALE 1CM = .6M

NASA Lewis Research Center
Plum Brook Station
Garage And Maintenance Area

Figure 4-5
Decontamination Facility

URS CONSULTANTS

M:\B705900\C\GE\FIG4-5

Table 4-1

Summary of Laboratory Analysis
Garage and Maintenance Area, Plum Brook Station

MEDIA TYPE	SAMPLE PARAMETER	SAMPLE METHOD[1,2]
Background Soil Samples	**RCRA Metals**	**RCRA Metals**
	arsenic lead	SW7060 SW6010
	barium mercury	SW6010 SW7471
	cadmium selenium	SW6010 SW7740
	chromium silver	SW6010 SW6010
Site Soil Samples	Volatile Organic Compounds	SW8260
	Semi-Volatile Organic Compounds	SW3510B/3550/8270
	RCRA Metals, total iron[3]	methods as above
	pH	SW9045
	Total Kjeldahl Nitrogen[3]	EPA351.3
	Total Phosphorus[3]	EPA365.2
	Alkalinity (soluble)[3]	EPA310.1
	Particle Size Analysis[3]	ASTMD1140-92/D422-63
	Total organic carbon[3]	SW9060/Walkley Black
Site Groundwater Samples	Volatile Organic Compounds	SW8260
	Semi-Volatile Organic Compounds	SW3510/3550/8270
	RCRA Metals	methods as above
	pH	SW9040
Soil Disposal Samples (as required by disposal facility)	F001-F005 Scan	SW8260/8270/8015
	TCLP Volatiles	SW1311/8260
	TCLP Semivolatiles	SW1311/8270
	TCLP Pesticides	SW1311/8080
	TCLP Herbicides	SW1311/8150
	TCLP Metals	SW1311/6010/7470
	Ignitability	SW1010
	Corrosivity	SW9045
	Reactivity (Cyanide and Sulfide)	SW Sections 7.3.3.2/7.4.3.1
	Paint Filter	SW9095
Water Disposal Samples (as required by disposal facility)	Volatile Organic Compounds	SW8260
	Semi-Volatile Organic Compounds	SW8270
	RCRA Metals	SW6010/7470
	Ignitability	SW1010
	Corrosivity	SW9040
	Oil & Grease	EPA 413.2

(1) *SW846 Test Methods for Evaluating Solid Waste*, USEPA, November 1986, SW-846 Third Edition, and Update I, July 1992; Update II, September 1994; Update IIB, January 1995

(2) *Methods for Chemical Analysis of Water and Waste*, Revised March 1983, EPA-600/4-79-020

(3) Four selected soil samples to be analyzed for this parameter. See Section 6.1.2.2.

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Table 4-2a

Summary of QA/QC Samples for Background and Site Samples
Building 7121, Garage and Maintenance Area, Plum Brook Station

Matrix	Analysis	No. of Env. Samples[1]	Equip. Blanks[2]	Field Rep/Dup[3]	Trip Blanks[4]	MS/MSD[5]	Total No. of Env. and QC Samples[6]
Water	Volatiles	8	1	1	1	2	13
	Semivolatiles	8	1	1	0	2	12
	Metals (8 RCRA)	8	1	1	0	2	12
	pH	8	0	1	0	0	9
Soil	Volatiles	32	4	4	3	4	47
	Semivolatiles	32	4	4	0	4	44
	Metals (8 RCRA)	48	5	5	0	6	64
	pH	48	0	5	0	0	53

1. Number of Environmental Samples - Environmental samples include background samples.
2. Equipment Blanks - One equipment blank shall be collected for every ten environmental samples per matrix.
3. Field Replicates/Duplicates - One field replicate or duplicate will be collected for every ten environmental samples per matrix (replicates for soil, duplicates for water). Analysis to include all parameters requested from the associated ten samples.
4. Trip Blanks - For every cooler containing environmental samples collected for VOC analysis, one trip blank will be added to the cooler and analyzed for the presence of VOCs only.
5. Matrix Spike/Matrix Spike Duplicate (MS/MSD) - One MS/MSD sample pair (2 samples) shall be analyzed for every 20 environmental samples per matrix type. Analysis to include all parameters requires for the associated 20 samples.
6. Total number of environmental and QA/QC samples.

NOTE: This table reflects the minimum number of samples that will be collected to support site closure. NASA intends to fully define the vertical and horizontal extent of contamination at the site. Additional environmental and QA/QC samples may be required to define extent.

Table 4-2b

Summary of QA/QC Samples for Site Samples
Building 7131, Garage and Maintenance Area, Plum Brook Station

Matrix	Analysis	No. of Env. Samples[1]	Equip. Blanks[2]	Field Rep/Dup[3]	Trip Blanks[4]	MS/MSD[5]	Total No. of Env. and QC Samples[6]
Water	Volatiles	9	1	1	1	2	14
	Semivolatiles	9	1	1	0	2	13
	Metals (8 RCRA)	9	1	1	0	2	13
	pH	9	0	1	0	0	10
Soil	Volatiles	18	2	2	2	2	26
	Semivolatiles	18	2	2	0	2	24
	Metals (8 RCRA)	18	2	2	0	2	24
	pH	18	0	2	0	0	20

1. Number of Environmental Samples - Environmental samples include background samples.
2. Equipment Blanks - One equipment blank shall be collected for every ten environmental samples per matrix.
3. Field Replicates/Duplicates - One field replicate or duplicate will be collected for every ten environmental samples per matrix (replicates for soil, duplicates for water). Analysis to include all parameters requested from the associated ten samples.
4. Trip Blanks - For every cooler containing environmental samples collected for VOC analysis, one trip blank will be added to the cooler and analyzed for the presence of VOCs only.
5. Matrix Spike/Matrix Spike Duplicate (MS/MSD) - One MS/MSD sample pair (2 samples) shall be analyzed for every 20 environmental samples per matrix type. Analysis to include all parameters requires for the associated 20 samples.
6. Total number of environmental and QA/QC samples.

NOTE: This table reflects the minimum number of samples that will be collected to support site closure. NASA intends to fully define the vertical and horizontal extent of contamination at the site. Additional environmental and QA/QC samples may be required to define extent.

Table 4-3

Method Detection Limits (MDL)/Practical Quantitation Limits (PQL)
Volatiles by GC/MS
Garage and Maintenance Area, Plum Brook Station

Target Analyte	CAS Number	Method Detection Limits (MDLs)[1]		Practical Quantitation Limits (PQLs)[2]	
GC/MS Volatiles (by SW8260A):		Water (μg/L)	Low Soil (μg/Kg)	Water (μg/L)	Low Soil (μg/Kg)
Chloromethane	74-87-3	0.13	0.65	2	10
Bromomethane	74-83-9	0.11	0.55	2	10
Butylbenzene, Total	---	0.27	1.35	2	10
Vinyl chloride	75-01-4	0.13	0.65	2	10
Chloroethane	75-00-3	0.10	0.50	1	5
2-Chlorotoluene	95-49-8	0.04	0.20	1	5
Methylene Chloride	75-09-2	0.03	0.15	1	5
Acetone	67-64-1	NA	NA	20	100
Carbon Disulfide	75-15-0	NA	NA	20	100
1,1-Dichloroethene	75-35-4	0.12	0.60	1	5
1,1-Dichloroethane	75-34-3	0.04	0.20	2	10
1,2-Dichloroethene (total)	540-59-0	0.12	0.60	2	10
Chloroform	67-66-3	0.03	0.15	1	5
1,2-Dichloroethane	107-06-2	0.06	0.30	1	5
2-Butanone	78-93-3	NA	NA	20	100
Isopropylbenzene	98-82-8	0.15	0.75	2	10
Isopropyltoluene	99-87-6	0.12	0.60	2	10
Propylbenzene	103-65-1	0.04	0.20	1	5
1,1,1-Trichloroethane	71-55-6	0.08	0.40	1	5
Carbon Tetrachloride	56-23-5	0.21	1.05	2	10
Bromodichloromethane	75-27-4	0.08	0.40	1	5
Dichlorodifluoromethane	75-71-8	0.10	0.50	1	5

Table 4-3 (Continued)

Target Analyte	CAS Number	Method Detection Limits (MDLs)[1]		Practical Quantitation Limits (PQLs)[2]	
GC/MS Volatiles (by SW8260A):		Water (µg/L)	Low Soil (µg/Kg)	Water (µg/L)	Low Soil (µg/Kg)
1,2-Dichloropropane	78-87-5	0.04	0.20	1	5
cis-1,3-Dichloropropene	10061-01-5	NA	NA	1	5
Trichloroethene	79-01-6	0.19	0.95	2	10
Dibromochloromethane	124-48-1	0.05	0.25	1	5
1,1,2-Trichloroethane	79-00-5	0.10	0.50	1	5
Benzene	71-43-2	0.04	0.20	1	5
trans-1,3-Dichloropropene	10061-02-6	NA	NA	1	5
Bromoform	75-25-2	0.12	0.6	1	5
4-Methyl-2-pentanone	108-10-1	NA	NA	5	50
2-Hexanone	591-78-6	NA	NA	5	50
Tetrachloroethene	127-18-4	0.14	0.70	2	10
1,2,4-Trimethylbenzene	95-63-6	0.13	0.65	2	10
1,3,5-Trimethylbenzene	108-67-8	0.05	0.25	1	5
Trichlorofluoromethane	75-69-4	0.08	0.40	1	5
Toluene	108-88-3	0.11	0.55	1	5
1,1,1,2-Tetrachloroethane	630-20-6	0.05	0.25	1	5
1,1,2,2-Tetrachloroethane	79-34-5	0.04	0.2	1	5
1,2,3-Trichloropropane	96-18-4	0.32	1.6	1	5
Chlorobenzene	108-90-7	0.04	0.20	1	5
Ethyl Benzene	100-41-4	0.06	0.30	1	5
Styrene	100-42-5	0.04	0.20	1	5
Xylenes (Total)	1330-20-7	0.29	1.45	1	5

NA = Not available

Table 4-3 (Continued)

NOTE: Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment calculated on a dry weight basis will be higher.

Footnotes:

1. MDLs are estimated from the cited method. Soil MDLs were determined from the water MDLs based on a 5 g. sample aliquot and a 5 mL purge. This table is to be revised with MDLs supplied by the selected laboratory. Data are required to be reported down to the laboratory MDLs for background and site samples only.

2. PQLs for water are approximately 10x the method detection limits in the cited method and are based on a 25 mL purge. Soil PQLs are 5x the water PQLs based on a 5 g. sample aliquot and a 5 mL purge. PQLs are the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. PQLs may be nominally chosen within these guidelines to simplify data reporting. For many analytes the PQL is selected from the lowest non-zero standard in the calibration curve. PQLs are highly matrix-dependent and may not always be achievable.

Reference: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, Method 8260A, Revision 1, September 1994.

Table 4-4

Method Detection Limits (MDL)/Practical Quantitation Limits (PQL)
Semivolatiles by GC/MS
Garage and Maintenance Area, Plum Brook Station

Target Analyte	CAS Number	Method Detection Limits (MDLs)[1]		Practical Quantitation Limits (PQLs)[2]	
Semivolatiles (by SW8270B):		Water (µg/L)	Low Soil (µg/Kg)	Water (µg/L)	Low Soil (µg/Kg)
Phenol	108-95-2	1.5	100	10	660
bis(2-Chloroethyl)ether	111-44-4	5.7	380	10	660
2-Chlorophenol	95-57-8	3.3	220	10	660
1,3-Dichlorobenzene	541-73-1	1.9	130	10	660
1,4-Dichlorobenzene	106-46-7	4.4	290	10	660
1,2-Dichlorobenzene	95-50-1	1.9	130	10	660
2-Methylphenol	95-48-7	NA	NA	10	660
2,2'-oxybis (1-Chloropropane)#	108-60-1	NA	NA	10	660
4-Methylphenol	106-44-5	NA	NA	10	660
N-Nitroso-di-n-propylamine	621-64-7	NA	NA	10	660
Hexachloroethane	67-72-1	1.6	100	10	660
Nitrobenzene	98-95-3	1.9	130	10	660
Isophorone	78-59-1	2.2	140	10	660
2-Nitrophenol	88-75-5	3.6	240	10	660
2,4-Dimethylphenol	105-67-9	2.7	180	10	660
bis(2-Chloroethoxy) methane	111-91-1	5.3	350	10	660
2,4-Dichlorophenol	120-83-2	2.7	180	10	660
1,2,4-Trichlorobenzene	120-82-1	1.9	130	10	660
Naphthalene	91-20-3	1.6	100	10	660
4-Chloroaniline	106-47-8	NA	NA	20	1300
Hexachlorobutadiene	87-68-3	0.9	60	10	660
4-Chloro-3-methylphenol	59-50-7	NA	NA	20	1300
2-Methylnaphthalene	91-57-6	NA	NA	10	660

Table 4-4 (Continued)

Target Analyte	CAS Number	Method Detection Limits (MDLs)[1]		Practical Quantitation Limits (PQLs)[2]	
Semivolatiles (by SW8270B):		Water (µg/L)	Low Soil (µg/Kg)	Water (µg/L)	Low Soil (µg/Kg)
Hexachlorocyclopentadiene	77-47-4	NA	NA	10	660
2,4,6-Trichlorophenol	88-06-2	2.7	180	10	660
2,4,5-Trichlorophenol	95-95-4	NA	NA	10	660
2-Chloronaphthalene	91-58-7	1.9	130	10	660
2-Nitroaniline	88-74-4	NA	NA	50	3300
Dimethylphthalate	131-11-3	1.6	100	10	660
Acenaphthylene	208-96-8	3.5	230	10	660
2,6-Dinitrotoluene	606-20-2	1.9	130	10	660
3-Nitroaniline	99-09-2	NA	NA	50	3300
Acenaphthene	83-32-9	1.9	130	10	660
2,4-Dinitrophenol	51-28-5	42	2800	50	3300
4-Nitrophenol	100-02-7	2.4	160	50	3300
Dibenzofuran	132-64-9	NA	NA	10	660
2,4-Dinitrotoluene	121-14-2	5.7	380	10	660
Diethylphthalate	84-66-2	1.9	130	10	660
4-Chlorophenyl-phenyl ether	7005-72-3	4.2	280	10	660
Fluorene	86-73-7	1.9	130	10	660
4-Nitroaniline	100-01-6	NA	NA	20	1300
4,6-Dinitro-2-methylphenol	534-52-1	24	1600	50	3300
N-nitrosodiphenylamine	86-30-6	NA	NA	10	660
4-Bromophenyl-phenylether	101-55-3	1.9	130	10	660
Hexachlorobenzene	118-74-1	1.9	130	10	660
Pentachlorophenol	87-86-5	17.5	1200	50	3300
Phenanthrene	85-01-8	5.4	360	10	660
Anthracene	120-12-7	1.9	130	10	660
Carbazole	86-74-8	NA	NA	10	660

Table 4-4 (Continued)

Target Analyte	CAS Number	Method Detection Limits (MDLs)[1]		Practical Quantitation Limits (PQLs)[2]	
Semivolatiles (by SW8270B):		Water (µg/L)	Low Soil (µg/Kg)	Water (µg/L)	Low Soil (µg/Kg)
Di-n-butylphthalate	84-74-2	2.5	170	10	660
Fluoranthene	206-44-0	2.2	150	10	660
Pyrene	129-00-0	1.9	120	10	660
Butylbenzylphthalate	85-68-7	2.5	170	10	660
3,3'-Dichlorobenzidine	91-94-1	16.5	1100	20	1300
Benzo(a)anthracene	56-55-3	7.8	510	10	660
Chrysene	218-01-9	2.5	170	10	660
bis(2-Ethylhexyl)phthalate	117-81-7	2.5	170	10	660
Di-n-octylphthalate	117-84-0	2.5	170	10	660
Benzo(b)fluoranthene	205-99-2	4.8	320	10	660
Benzo(k)fluoranthene	207-08-9	2.5	170	10	660
Benzo(a)pyrene	50-32-8	2.5	170	10	660
Indeno(1,2,3-cd)pyrene	193-39-5	3.7	240	10	660
Dibenz(a,h)anthracene	53-70-3	2.5	170	10	660
Benzo(g,h,i)perylene	191-24-2	4.1	270	10	660

NA = Not Available

NOTES: Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment calculated on a dry weight basis will be higher.

#Previously known by the name bis(2-Chloroisopropyl)ether.

Footnotes: 1. MDLs are estimated from EPA Method 625. The soil MDLs were determined from the water MDLs by multipling by a factor derived from a sample aliquot and final volumes typically used in the analysis. This table must be revised with MDLs supplied by the selected laboratory. Data are required to be reported down to the laboratory MDLs for background and site samples only.

2. PQLs are from the cited method. PQLs are the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. PQLs may be nominally chosen within these guidelines to simplify data reporting. For many analytes the PQL is selected from the lowest non-zero standard in the calibration curve. PQLs are highly matrix-dependent and may not always be achievable.

References: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846 Method 8270B, Revision 2, September 1994

EPA 600 Series Methods - 40 CFR, Part 136, July 1, 1988, Method 625

Table 4-5

Method Detection Limits (MDL)/Practical Quantitation Limits (PQL)
Total Metals by ICP/AA
Garage and Maintenance Area, Plum Brook Station

Target Analyte	Determinative Method	Method Detection Limits (MDLs)[1]		Practical Quantitation Limits (PQLs)[2]	
Metals (by SW-6010A/7000A)		Water (μg/L)	Soil (mg/Kg)	Water (μg/L)	Soil (mg/Kg)
Arsenic	SW 7060A	1	0.2	10	2.0
Barium	SW 6010A	2	0.4	200	40
Cadmium	SW 6010A	4	0.8	5	1.0
Chromium	SW 6010A	7	1.4	10	2.0
Iron	SW 6010A	7	1.4	10	2.0
Lead	SW 7420/7421	1	0.2	3	0.6
Mercury	SW 7470A/ 7471A	0.2	0.4	0.2	0.1
Selenium	SW 7740	2	0.4	5	1.0
Silver	SW 6010A	7	1.4	10	2.0

NOTE: Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment calculated on a dry weight basis will be higher.

Footnotes:

1. MDLs listed above are from the cited methods. Soil MDLs are multiplied by a factor derived from the sample aliquot and final volume typically used in the analytical procedure. This table is to be revised with MDLs supplied by the selected laboratory. Data are required to be reported down to the laboratory MDL for background and site samples only.

2. Soil PQLs are based on the U.S. EPA Contract Laboratory Program (CLP) for inorganic analyses (ILM03.0). PQLs are the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. PQLs may be nominally chosen within these guidelines to simplify data reporting. For many elements, the PQL is selected from the lowest non-zero standard in the calibration curve. PQLs are highly matrix-dependent and may not alway be achievable.

Reference: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, Methods 6010A and 7000A, Revision 1, July 1992 and Revision 2, September 1994.

USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Multi-Media Multi-Concentration, Document Number ILM03.0

Table 4-6

Practical Quantitation Limits (PQL)
Miscellaneous Analytical Parameters
Garage and Maintenance Area, Plum Brook Station

Target Analyte	Determinative Method	Practical Quantitation Limits (PQLs)[1]	
		Water (mg/L)	Soil (mg/Kg)
Reactive Cyanide	SW846 Section 7.3.3.2	200	200
Reactive Sulfide	SW846 Section 7.4.3.1	200	200
Oil & Grease	EPA 413.2	1.0	10
Total Kjeldahl Nitrogen	EPA 351.3	--	0.2
Alkalinity (Soluble)	EPA 310.1	--	10
Total Phosphorus	EPA 365.2	--	0.2
Total Organic Carbon	SW9060/Walkley Black	--	10

NOTE: Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment calculated on a dry weight basis will be higher.

1. Data are required to be reported down to the MDL for background and site samples only. Disposal samples are reported down to the specified PQL. The PQLs listed above are maximum values to meet regulatory requirements. Lower PQLs are acceptable.

References:

(1) *SW846 Test Methods for Evaluating Solid Waste*, USEPA, November 1986, SW-846 Third Edition, and Update I, July 1992; Update II, September 1994; Update IIB, January 1995

(2) *Methods for Chemical Analysis of Water and Waste*, Revised March 1983, EPA-600/4-79-020

Table 4-7

F001-F005 Spent Solvents
Treatment Standards
Garage and Maintenance Area, Plum Brook Station

Target Analyte	CAS Number	Treatment Standard
F001-F005 Spent Solvents		Soil (mg/Kg)
Acetone	67-64-1	160
Benzene	71-43-2	10
n-Butyl alcohol	71-36-3	2.6
Carbon tetrachloride	56-23-5	6.0
Chlorobenzene	108-90-7	6.0
o-cresol	95-48-7	5.6
m-cresol	108-39-4	5.6
p-cresol	106-44-5	5.6
Cresols (total)	---	11.2
p-Dichlorobenzene	95-50-1	6.0
Ethyl acetate	141-7-6	33
Ethyl benzene	100-41-4	10
Ethyl ether	60-29-7	160
Isobutyl alcohol	78-83-1	170
Methylene chloride	75-9-2	30
Methyl ethyl ketone	78-93-3	36
Methyl isobutyl ketone	108-10-1	33
Nitrobenzene	98-95-3	14
Pyridine	110-86-1	16
Tetrachloroethylene	127-18-4	6.0
Toluene	108-88-3	10
1,1,1-Trichloroethane	71-55-6	6.0

Table 4-7 (Continued)

Target Analyte	CAS Number	Treatment Standard
1,1,2-Trichloroethane	79-00-5	6.0
Trichloroethylene	79-01-6	6.0
1,1,2-Trichloro-1,2,2-trifluoromethane	76-13-1	30
Trichloromono-fluoromethane	75-69-4	30
Xylenes (total)	---	30
Carbon disulfide	75-15-0	96
Cyclohexanone	108-94-1	15
Methanol	67-56-1	15

1. *Environmental Reporter, ER-Federal Regulations*, 161:3678 - 161:3679, [Sec. 268.40(f)], The Bureau of National Affairs, Inc., 3/3/95

Table 4-8

Maximum Concentration of Contaminants for the Toxicity Characteristic (TCLP) Garage and Maintenance Area, Plum Brook Station

EPA HW No.[1]	Target Analyte	CAS Number[2]	Regulatory Level (mg/L)
D004	Arsenic	7440-38-2	5.0
D005	Barium	7440-39-3	100.0
D018	Benzene	71-43-2	0.5
D006	Cadmium	7440-43-9	1.0
D019	Carbon tetrachloride	56-23-5	0.5
D020	Chlordane	57-74-9	0.03
D021	Chlorobenzene	108-90-7	100.0
D022	Chloroform	67-66-3	6.0
D007	Chromium	7440-47-3	5.0
D023	*o*-Cresol	95-48-7	200.0[4]
D024	*m*-Cresol	108-39-4	200.0[4]
D025	*p*-Cresol	106-44-5	200.0[4]
D026	Cresol, total	---	200.0[4]
D016	2,4-D	94-75-7	10.0
D027	1,4-Dichlorobenzene	106-46-7	7.5
D028	1,2-Dichloroethane	107-06-2	0.5
D029	1,1-Dichloroethylene	75-35-4	0.7
D030	2,4-Dinitrotoluene	121-14-2	0.13[3]
D012	Endrin	72-20-8	0.02
D031	Heptachlor (and its epoxide)	76-44-8	0.008
D032	Hexachlorobenzene	118-74-1	0.13[3]
D033	Hexachlorobutadiene	87-68-3	0.5
D034	Hexachloroethane	67-72-1	3.0
D008	Lead	7439-92-1	5.0
D013	Lindane	58-89-9	0.4

Table 4-8 (Continued)

EPA HW No.[1]	Target Analyte	CAS Number[2]	Regulatory Level (mg/L)
D009	Mercury	7439-97-6	0.2
D014	Methoxychlor	72-43-5	10.0
D035	Methyl ethyl ketone	78-93-3	200.0
D036	Nitrobenzene	98-95-3	2.0
D037	Pentachlorophenol	87-86-5	100.0
D038	Pyridine	110-86-1	5.0[3]
D010	Selenium	7782-49-2	1.0
D011	Silver	7440-22-4	5.0
D039	Tetrachloroethylene	127-18-4	0.7
D015	Toxaphene	8001-35-2	0.5
D040	Trichloroethylene	79-01-6	0.5
D041	2,4,5-Trichlorophenol	95-95-4	400.0
D042	2,4,6-Trichlorophenol	88-06-2	2.0
D017	2,4,5-TP (Silvex)	93-72-1	1.0
D043	Vinyl chloride	75-01-4	0.2

Footnotes:

1. Hazardous Waste Number
2. Chemical Abstracts Service number
3. Quantitation limit may be greater than the calculated regulatory number. The quantitation limit therefore becomes the regulatory level.
4. If *o*-, *m*-, and *p*-Cresol concentrations cannot be differentiated, the toal cresol (D026) concentration is used. The regulatory level of total cresol is 200 mg/L

Reference: 40 CFR Ch. I, Part 261.24, Table 1

Table 4-9

Sample Bottle Requirements
Preservation and Holding Times
Garage and Maintenance Area, Plum Brook Station

Container/Volume Requirements		# of Containers		Preservative		Holding Time*	
Soil	Water	Soil	Water	Soil	Water	Soil	Water
Hydrogen ion (pH, SW846 9040/9045)							
Glass or polyethylene \ 50 g	Glass or poly-ethylene \ 100 mL	1	1	None required	None required	Analyze immediately	Analyze immediately
Volatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS, SW846 8240, 8260)							
Glass with teflon-lined lid (120 wide-mouth)/50 g	40 mL glass with teflon-lined septa	2	2	Cool - 4°C	Cool - 4°C HCl to pH <2	14 days	14 days
Semi-Volatile Organics by Gas Chromotography/Mass Spectometry (GC/MS, SW846 8270)							
Glass with teflon-lined lid \ 100 g	Amber glass with teflon-lined Lid \1000 mL	1	2	Cool - 4°C	Cool - 4°C	Extract within 14 days, analyze within 40 days following extrac-tion	Extract within 7 days, analyze within 40 days following extrac-tion

Table 4-9 (Continued)

Container/Volume Requirements		# of Containers		Preservative		Holding Time*	
Soil	Water	Soil	Water	Soil	Water	Soil	Water
Metals (except Mercury, SW846 6010/7000)							
Glass or polyethylene \ 50 g	Glass or poly-ethylene \ 1000 mL	1	1	Cool - 4°C	Cool - 4°C HNO_3 to pH <2 (dissolved metals filtered prior to pres-ervation)	180 days	180 days
Metals (Mercury, SW846 7470/7471)							
Glass or polyethylene \ 50 g	Glass or poly-ethylene \ 1000 mL	1	1	Cool - 4°C	Cool - 4°C HNO_3 to pH <2 (dissolved metals filtered prior to pres-ervation)	28 days	28 days
TCLP Volatiles (SW846 1311/8260)							
Glass with teflon-lined lid \ 50 g	40 mL glass with teflon-lined septa	2	4	Cool - 4°C	Cool - 4°C	14 days to TCLP extraction; 14 days from extrac-tion to analysis	14 days

Table 4-9 (Continued)

Container/Volume Requirements		# of Containers		Preservative		Holding Time*	
Soil	Water	Soil	Water	Soil	Water	Soil	Water
TCLP Semivolatiles, Pesticides, and Herbicides (SW846 1311/8270/8080/8150)							
Glass with teflon-lined lid \200 g	Amber glass with teflon-lined lid \1000 mL	1	2	Cool - 4°C	Cool - 4°C	14 days to TCLP extraction; 7 days from TCLP extraction to prep. extraction; 40 days from prep. to analysis	14 days to TCLP extraction; 7 days from TCLP extraction to prep. extraction; 40 days from prep. to analysis
TCLP Metals, except Mercury (SW846 1311/6010/7000)							
Glass or polyethylene \ 200 g	Glass or polyethylene \ 1000 mL	1	1	Cool - 4°C	Cool - 4°C	180 days to TCLP extraction; 180 days from extraction to analysis	180 days to TCLP extraction; 180 days from extraction to analysis
TCLP Mercury (SW 846 1311/7470)							
Glass or polyethylene \ 200 g	Glass or polyethylene \ 1000 mL	1	1	Cool - 4°C	Cool - 4°C	28 days to TCLP extraction; 28 days from extraction to analysis	28 days to TCLP extraction; 28 days from extraction to analysis
Reactive Cyanide (SW846 Section 7.3.3.2)							
Glass or polyethylene \50 g	Glass or polyethylene \500 mL	1	1	Cool - 4°C	Cool - 4°C, NaOH to pH >12	14 days	14 days

Table 4-9 (Continued)

Container/Volume Requirements		# of Containers		Preservative		Holding Time*	
Soil	Water	Soil	Water	Soil	Water	Soil	Water
Reactive Sulfide (SW846 Section 7.4.3.1)							
Glass or polyethylene \50 g	Glass or polyethylene \500 mL	1	1	Cool - 4°C	Cool - 4°C, NaOH to pH >12, plus 2 mL zinc acetate	7 days	7 days
Paint Filter (SW846 9095)							
Glass or polyethylene \100 g	Glass or polyethylene \100 mL	1	1	None required	None required	N/A	N/A
Oil and Grease (EPA 413.2)							
Glass only \50 g	Glass only \1 liter	1	1	Cool - 4°C	Cool - 4°C, HCl to pH<2	28 days	28 days

* Holding time begins from time of sample collection

5.0 DATA ASSESSMENT

This section of the work plan describes how the data collected will be used to determine the nature and extent of contamination, the quantification of risks associated with these contaminants, and, if necessary, the development of remediation standards. Preliminary risk analysis based on previous sampling suggests that both these sites exceed OEPA-recommended risk levels. If the proposed sampling confirms the need for remediation, an amended Closure Work Plan will be developed and submitted to OEPA. The amended plan will contain remediation standards based on either method detection limits or a risk assessment and will provide additional information regarding proposed remediation.

5.1 NATURE AND EXTENT OF CONTAMINATION

The environmental data collected in the proposed sampling effort will be used to determine the nature and extent of contamination. Positive results will be presented in tabular format in the closure report along with descriptions of contaminant levels found either in soil or groundwater. Interpretation of this information will be based on two criteria:

- Any organic compound positively detected will be considered evidence of contamination and will be assessed as to its relevance to the RCRA waste management unit.

- Any inorganic chemical present above background will be considered evidence of contamination.

Background action levels will be calculated from the results of the background sample analyses according to the OEPA guidance (OEPA, 1993). The action level for each constituent will be the mean of the background population plus two standard deviations. The data from both the background and site samples will be tested for normality using probability plots and either the Shapiro-Wilk test or the Kolmogorov-Smirnov test with Lilliefors critical values. If the data are not normally distributed, it will be transformed to make it approximately normal (i.e., a lognormal distribution will be assumed).

The information developed in the characterization of the nature and extent of contamination will then form the basis for the quantification of risks.

5.2 RISK ASSESSMENT METHODOLOGY

The framework that will be used to characterize risks based on the results of the proposed sampling is described in the following sections. The results of the risk assessment will be 1) compared to OEPA Agency recommended risk limits to determine if cleanup is needed and 2) used to establish health-based remediation standards for cleanup if those risk levels are exceeded.

Risk assessment in general is a four-step process involving data evaluation, the assessment of exposure potential, the determination of toxicity and the calculation of risk estimates. The following subsections discuss the methodologies that will be followed in each step.

The methodologies presented in this work plan conform to the requirements contained in the OEPA's Closure Plan Review Guidance for RCRA Facilities (OEPA, 1993). The information in this

guidance has been supplemented, where necessary, with details provided in similar U.S. Environmental Protection Agency Guidance documents.

5.2.1 Selection of Chemicals of Concern

The first step in the risk assessment process is the determination of the useability of the sampling data for risk characterization and the selection of the chemicals for risk quantification. Only the reviewed data results from the sampling effort described in this plan will be used in risk quantification. Any result rejected by the data review process, will be eliminated from the data set used in the risk assessment. Any otherwise qualified data will be utilized.

All chemicals detected in this sampling effort will be included in risk quantification with the following exceptions.

Exclusions Not Related to the Sites: The risk assessment will include all organic chemicals which NASA has determined could reasonably have been managed in the waste UST at each site plus those chemicals which OEPA personnel indicated, during a meeting June 28, 1995, that they believe potentially could have been managed in each waste UST. As agreed upon between OEPA and NASA, benzene and ethylbenzene will not be considered chemicals of concern. Therefore, the risk assessment will include all chemicals listed in Section 5.0 tables if they are detected in the planned site sampling. Any other organic compounds detected in planned site samples that could have been managed in the waste UST will also be included in the risk assessment.

Blank Contamination: If sampling results are qualified to indicate possible field or laboratory blank contamination, that chemical will be evaluated for possible exclusion from risk quantification. The procedure for exclusion will be based on the comparison of concentrations in the sample with concentrations in the associated blank. For common laboratory contaminants (e.g. acetone, methylene chloride, 2-butanone, phthalate esters), the sample results will be considered positive only if the concentrations in the sample exceed ten times the maximum amount detected in the blank. For all other chemicals, the sample results will be considered positive only if the concentrations in the sample exceed five times the concentrations reported in the blank (USEPA, 1989).

Comparison to Background: The sampling results obtained from the background samples will be compared to results from site samples. A criterion for elimination will be established as the mean plus two standard deviations of the background population (OEPA, 1993), as described previously. If no site sample exceeds the background criterion, that chemical will be eliminated from the risk assessment. Chemicals detected above the criterion will be included in risk calculations.

5.2.2 Assessment of Exposure

The OEPA requires the assumption of an unrestricted future land use in establishing a risk-based cleanup. Therefore the appropriate exposure scenario to be utilized is residential, including both adult and child (ages 1 through 6) populations. These two populations are assumed to live on site and to be exposed to site contaminants via a number of exposure pathways. These include:

- Ingestion of and dermal contact with soil
- Inhalation of volatiles or particulates released from soil

- Ingestion of groundwater, dermal contact while bathing and inhalation of volatiles released from groundwater during showering

Standard exposure factors recommended by OEPA (1993) will be used for each of the pathways quantified.

At these sites there does not appear to be a potential for particulate releases for two reasons. The very small area contains nonerodible elements (vegetation, gravel, stones, etc.) thus reducing and even preventing the ability of particulates to become windborne. Furthermore, the majority of contaminants are volatile organic compounds. These chemical compounds are more likely to volatilize into the ambient air rather than be associated with windborne particulate material. These conditions would not change under any future residential land use of the site. Therefore, only the release of volatiles from the soil will be quantified.

Exposure is generally quantified by calculating an average daily intake for each chemical evaluated. The general equation for this is:

$$DI = \frac{C \times IR \times EF \times ED}{BW \times AT}$$

Where:

DI = Average daily intake, mg/kg/day
C = Chemical concentration in the medium of concern, mg/kg soil, mg/L water, mg/m^3 air.
IR = Intake rate, units depending on medium
EF = Exposure frequency, days or events
ED = Exposure duration, years
BW = Body weight, kg
AT = Averaging time, days. Equal to the exposure duration for noncarcinogens and 70 years for carcinogens

Exposure potential is quantified in two steps: the calculation of exposure point concentrations (EPCs) in each medium of concern and the assumption of values for the remaining terms of the equation, the exposure factors, for each population of concern.

5.2.2.1 Calculation of Exposure Point Concentrations - An EPC is the arithmetic mean concentration of a chemical in a medium, averaged over the area over which exposure is expected to occur. Because of the uncertainty in estimating the true mean from a limited number of samples, the upper 95th percent confidence limit (95UCL) will be used as the EPC. The 95UCL will be calculated according to Gilbert (1987), assuming that the environmental concentration data set is lognormally distributed. In the event that the 95UCL exceeds the maximum detected value, the maximum detected value will be utilized as the EPC.

There are two adjustments to the data that will be necessary in calculating the EPC. Field duplicates will be averaged before including them in the EPC calculation; sample results that

are reported by the laboratory as nondetects will be included in the calculation at one-half the sample quantitation limit.

Since it is assumed that the site's future use would be a residence, all soil sampling locations across the site will be used in calculating an EPC. It is possible that the future use could include excavation for a residence thus bringing deeper, more contaminated soils to the surface. Therefore, soil samples taken at depth will also be included in the exposure point concentration calculation.

In order to calculate an air concentration of volatiles released from the soil a volatile emission model and a dispersion model will be used. The concentration of VOCs in air that result from releases from soil is a complex function of soil, chemical and meteorological parameters. Estimation of the concentration values can be approached in two steps: first, the emission rate of each volatile from soil is calculated, and then the resultant concentration in air is calculated.

Hwang (1986) developed a mathematical model for estimating the average emission rate of a chemical from soil that considers the physical-chemical properties of the chemical and the characteristics of the soil. The model assumes that the concentrations decrease over time, therefore the emission rate also decreases as a function of time. The basic equation is:

$$Q = Cs \times \frac{2 \times E \times De \times H'}{(\pi \times a \times t)^{0.5} K_d}$$

Where:

Q = The average emission rate (g/cm^2 sec.) of a chemical emitted from soil over the exposure time period.

Cs = The concentration of the chemical in soil (g/g).

E = The soil porosity. A default value of 0.35 is assumed, indicative of soils found at this site (USEPA, 1991).

De = The effective diffusivity (cm^2/sec.) of each chemical, calculated from the chemical-specific molecular diffusivity constant (D) and the soil porosity by the following equation:

$$De = D*E^{1/3}$$

H′ = The nondimensional Henry's law constant (atm-m^2/mol) calculated from the chemical-specific Henry's law as follows:

$$H' = H/RT$$

where: R = Gas Constant (8.2E-05 atm-m^3/mol-K)

T = Temperature (K), 20°C

a = The term that describes several soil- and chemical-specific parameters, as follows:

$$a = \frac{De \times E}{E + P_s (1 - E)(K_d/H')}$$

The values of De, E and H′ have been discussed. The term P_s is the average moist bulk density of the soil, assumed to be 2.65 g/cm^3 (USEPA, 1991). The value of K_d is described below.

K_d = The soil-water partition coefficient (cm^3/g). It is a soil- and chemical-specific term calculated as follows:

$$K_d = K_{oc} \times f_{oc}$$

where:

K_{oc} = Organic carbon binding constant (cm^3/g)

f_{oc} = Soil organic carbon fraction. A default of 2% is assumed (USEPA, 1991).

t = The time (seconds) over which the emission rate is averaged. Since the exposure assessment includes exposure durations of 6 and 30 years, emission rates will be calculated for these two time periods.

The concentrations of volatile chemicals in air that result from soil emissions will be estimated using a box model approach (Hanna et al., 1982). The basic equation is:

$$C = \frac{Q \times X}{(H/2) \times U}$$

Where:

C = concentration in air (mg/m^3)

Q = emission rate from the Hwang model (in units of mg/m^2-sec.)

X = crosswind width of the box (m)

H = the mixing height of the box (m)

U = the average windspeed across the box (m/sec)

The distance from the upwind to downwind edge of the box (assumed to be square) is the approximate size of the site.

The mixing height is a function of distance from the source and turbulence of the air which, in turn, is a function of the roughness of the terrain. The value of H at the upwind edge of the site is zero. At the downwind edge, the value of H is calculated as follows:
A roughness height (Z_0) of 0.1m based on the terrain at the site is assumed.

$$X - 6.25Z_0[(H/Z_0) \times \ln(H/Z_0) - 1.58(H/Z_0) + 1.58]$$

The average windspeed for Plum Brook, obtained from the on-site meteorological station, will be used.

Chemical-specific values required in this modeling include: Henry's Law Constant (H), the soil-water partition coefficient (K_{oc}), and the molecular diffusivity constant (D). These values will be obtained from the open literature for each chemical. Only chemicals detected in the soils that have a Henry's Law Constant greater than or equal to 1E-05 atm-m^3/mol and a molecular weight less than 200 g/mol will be modeled (USEPA, 1991). Tables 5-1 and 5-2 summarize these values for potential chemicals of concern identified for this site.

For groundwater, the EPC will be calculated utilizing the most heavily contaminated portion of any plume detected. The indoor air concentration of chemicals volatilizing from groundwater during showering is a complex function of water temperature, shower flow rate, bathroom size and the physical/chemical properties of each contaminant. Since site-specific data are not available to support a detailed calculation of indoor air during showering, an air/water concentration ratio of 0.5 will be assumed (USEPA, 1991).

5.2.2.2 Estimation of Exposure Factors - The remaining terms of the exposure equation (collectively referred to as the Human Intake Factor or HIF) describe the human activity patterns and the physiological variables necessary for quantifying the magnitude of exposure. Since there is no site-specific information available to describe these terms, the exposure factors that will be used in the risk assessment are those recommended values in OEPA (1993), Appendix E, Tables 1 through 4. These values are summarized in Table 5-3.
Two additional, chemical-specific parameters are required to evaluate dermal pathways. These are the absorption factor (ABS), which accounts for the desorption of a chemical from soil and its absorption across the skin and the dermal permeability constant (PC) which accounts for the movement of the chemical from water across the skin. The USEPA's Dermal Guidance will be used as the source for the PC values (USEPA 1992). Published literature values will be used to estimate the ABS term. In the absence of published ABS terms, the following default assumptions will be utilized: 25% for volatile organic compounds, 10% for semivolatile organic compounds, and 1% for inorganic compounds (OEPA,1993). These values for potential chemicals of concern at these sites are summarized in Tables 5-4 and 5-5.

5.2.3 Toxicity Assessment

The toxic effects of a chemical depend not only upon its inherent toxicity and the level of exposure, but also on the route (oral, inhalation, dermal) and the duration of exposure (subchronic, chronic, lifetime). Numeric values that are used to quantify the toxicity and carcinogenicity of a chemical have been derived by the USEPA. For noncancer health effects these values are termed Reference Doses (RfDs) and for cancer the value is termed a Slope Factor (SF). The RfD is route- and duration-specific and estimates the average daily intake that could occur without appreciable risk of any adverse effect. The SF is route-specific and is derived by extrapolating from observed data at high dose levels of chemicals in their pure form. In addition, USEPA assigns a cancer weight-of-

high dose levels of chemicals in their pure form. In addition, USEPA assigns a cancer weight-of-evidence category to each chemical ("A" through "E") that reflects the overall confidence that a chemical is likely to cause cancer in humans.

The RfD and SF values are available from USEPA in its Integrated Risk Information System (IRIS) data base and on Health Effects Assessment Summary Tables (HEAST) (USEPA, 1995 & 1994). These two sources will be utilized in determining the appropriate toxicity values for use in this risk assessment. Tables 5-6 and 5-7 provide the currently available toxicity values and weight-of-evidence classification for those chemicals preliminarily identified as chemicals of concern at these sites.

For some chemicals, there are no toxicity values available on IRIS or HEAST. This can occur for several reasons-- either there is insufficient toxicological information on a particular chemical, or the available information is being reviewed for possible changes. Any values obtained from sources other than IRIS or HEAST are footnoted on the table. In general, further investigation beyond USEPA sources (including the USEPA Technical Support Office) will not be done to obtain a toxicity value.

The USEPA has not established dermal toxicity values. These can be obtained by extrapolating from the oral values. This will be done by multiplying the oral RfD values by the chemical's oral absorption fraction and dividing the oral slope factor by the oral absorption fraction (USEPA, 1989). If an oral absorption factor (AF_0) is not available for a particular organic compound, then the value assumed will be 1.0 (i.e., 100% oral absorption). Tables 5-4 and 5-5 include these values for potential chemicals of concern identified for this site.

Tables 5-6 and 5-7 indicate that a number of chemicals that are expected to be included in this risk assessment are classified as "C" carcinogens (i.e., possible human carcinogen). Chemicals classified as "A" (known human carcinogen) and "B" (probable human carcinogen) will be included in the carcinogenic risk quantification (OEPA, 1993). Chemicals that are classified as "C" carcinogens but have no RfD values also will be included in the risk characterization.

5.2.4 Risk Characterization

Risk characterization integrates the results of the exposure and toxicity assessments into a quantitative description of potential cancer risks and noncancer effects. The risk of cancer from exposure to a chemical is described in terms of the probability that an individual exposed for his or her entire lifetime will develop cancer by age 70. This value is calculated from the daily intake averaged over a lifetime (DI_L) and the SF for each chemical (classified as an A or B carcinogen), as follows:

$$\text{Cancer Risk} = \text{DI(lifetime)} \times \text{SF}$$

Cancer risks are summed for each chemical and each pathway relevant to a particular population. The OEPA recommends a risk limit of 1E-06 (OEPA, 1993). Results from the site risk estimation will be compared to this value to conclude whether risks are within the recommended limit thus indicating remedial action is not warranted.

For noncarcinogens, toxicity is evaluated based on the threshold principle -- that a range of exposures from zero to some finite level can be tolerated without an adverse effect expressed. The RfD identifies the upper bound of this range. Thus, the potential for noncancer effects from exposure

to a chemical is evaluated by comparing the estimated intake of the chemical over a specified time period with the RfD for that chemical derived for a similar exposure period. Two exposure durations will be evaluated in this risk assessment: 1) six years for children, and 2) 30 years for resident adults. Thus daily intakes for children will be compared to subchronic RfDs. The longer exposure for adults will be compared to chronic RfD values. The comparisons result in a noncancer hazard quotient (HQ), as follows:

$$HQ = DI/RfD$$

Since exposure occurs simultaneously to more than one chemical, HQ values are summed to develop a Hazard Index (HI). Additionally, exposure occurs by more than one pathway therefore, HI values are further summed for each pathway that contributes to the exposure of an individual in a given population. The OEPA recommends that the population HI not exceed the value of 1.0 (OEPA, 1993). Summing HQ values across all chemicals and HI values across all pathways assumes that all noncancer effects are additive. Since this is not usually true, when a population total HI exceeds one it may be appropriate to re-examine the noncancer effects and segregate them by effect (USEPA, 1989). The results of hazard estimates for this site will be compared to the OEPA-recommended value, segregated where appropriate, to determine the need for remedial action.

There are a number of factors that will introduce uncertainty into any exposure and risk estimate. The key ones that affect this site will be identified as part of the risk characterization process.

5.2.5 Remediation Standards

The results of the risk characterization, when compared to OEPA recommended risk guidelines will indicate whether remediation standards are required. If either the risk level exceeds 1E-06 for a given population, or a population HI exceeds one, then remediation standards will be selected based on either method detection limits or the risk assessment. If risk-based remediation standards are selected, the exposure and risk equations will be re-arranged to solve for the chemical concentrations that would result in meeting OEPA's recommended limits.

In general, the equation for carcinogens is as follows:

$$RS = \frac{TR}{HIF \times SF}$$

where:

RS	=	Risk-Based Remediation Standard
TR	=	Target Risk Level, 1E-06
HIF	=	Human Intake Factor-lifetime. This is the term in each pathway intake equation which accounts for all the terms <u>except</u> the concentration term.
SF	=	Slope factor, the route-specific toxicity value.

This equation will be expanded to account for all relevant pathways for the particular population under evaluation.

The general equation for noncarcinogens is as follows:

$$RS - \left(\frac{HIF}{RfD}\right)^{-1}$$

where:

RS	=	Risk-Based Remediation Standard
HIF	=	Human Intake Factor (chronic or subchronic), as defined in the previous equation.
RfD	=	Reference Dose (chronic or subchronic), the route-specific toxicity value which estimates acceptable exposures to noncarcinogenic chemicals.

This equation will be expanded to account for all relevant pathways for the particular population under evaluation.

If there is a concern for the contribution of soil contamination to the groundwater, the proposed soil remediation standards will be used to predict leachate levels based on solubility and partitioning constants. These will be compared to a risk-based remediation standard calculated for groundwater to ensure that proposed chemical concentrations in the soil would be protective of groundwater. If the calculation indicates that they are not, then the soil remediation standard will be modified accordingly.

TABLE 5-1

Summary of Constants for Potential Chemicals of Concern
Bldg 7121, Garage and Maintenance Area, Plum Brook Station

Chemical	CAS Number	Henry's Law Constant (a)	Koc (a)	Molecular Diffusivity Constant (b)
Acetone	67-64-1	2.06E-05	2.20E+00	1.22E-01
Bromodichloromethane	75-27-4	2.10E-03	--	--
2-Butanone	78-93-3	2.74E-05	4.50E+00	1.06E-01
sec-Butylbenzene	135-98-8	1.14E-02	--	--
tert-Butylbenzene	98-06-6	1.17E-02	--	--
Carbon disulfide	75-15-0	1.23E-02	5.40E+01	1.16E-01
Carbon tetrachloride	56-23-5	2.41E-02	4.39E+02	9.45E-02
Chlorobenzene	1-8-90-7	3.93E-03	3.30E+02	8.50E-02
Chloroethane	75-00-3	8.48E-03	3.30E+01	1.23E-01
Chloroform	67-66-3	2.87E-03	3.10E+01	1.05E-01
1,1-Dichloroethane	75-34-3	4.31E-03	3.00E+01	1.08E-01
1,2-Dichloroethane	107-06-2	9.79E-04	1.40E+01	1.08E-01
1,1-Dichloroethene	75-35-4	3.40E-02	6.50E+01	9.38E-02
cis-1,2-Dichloroethene	156-59-2	7.58E-03	4.90E+01	9.38E-02
trans-1,2-Dichloroethene	156-60-5	6.56E-03	5.90E+01	9.38E-02
2-Hexanone	591-78-6	1.75E-03	--	--
Isopropylbenzene	98-82-8	1.46E-02	--	--
p-Isopropyltoluene	99-87-6	--	--	--
Methylene chloride	75-09-2	2.03E-03	8.80E+00	1.16E-01
Naphthalene	91-20-3	4.83E-04	9.40E+01	1.20E-01
Propylbenzene	103-65-1	1.02E-02	--	--
1,1,1,2-Tetrachloroethane	630-20-6	3.81E-04	5.40E+01	8.64E-02
1,1,2,2-Tetrachloroethane	79-34-5	3.81E-04	1.18E+02	8.64E-02
Tetrachloroethene	127-18-4	2.59E-02	3.64E+02	8.78E-02
Toluene	108-88-3	6.37E-03	3.00E+02	9.28E-02
1,2,4-Trichlorobenzene	120-82-1	1.40E-03	9.20E+03	7.40E-01
1,2,3-Trichlorobenzene	87-61-6	8.90E-03	--	7.40E-01
1,1,1-Trichloroethane	71-55-6	1.44E-02	1.52E+02	9.45E-02
1,1,2-Trichloroethane	79-00-5	1.17E-03	5.60E+01	9.45E-02
Trichloroethene	79-01-6	9.10E-03	1.26E+02	9.63E-02
Trichlorofluoromethane	75-69-4	9.70E-02	1.59E+02	9.31E-02
Trimethylbenzenes	25551-13-7	--	--	--
Vinyl chloride	75-01-4	8.19E-02	5.70E+01	1.27E-01
Xylenes, mixture	1330-20-7	7.04E-03	2.40E+02	8.50E-02

(a) Sources: provided by OEPA or from other literature sources
(b) Source: Superfund Exposure Assessment Manual
(c) -- Not available

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TABLE 5-2

Summary of Constants for Potential Chemicals of Concern
Bldg 7131, Garage and Maintenance Area, Plum Brook Station

Chemical	CAS Number	Henry's Law Constant (a)	Koc (a)	Molecular Diffusivity Constant (b)
Acetone	67-64-1	2.06E-05	2.20E+00	1.22E-01
Bromodichloromethane	75-27-4	2.10E-03	--	--
2-Butanone	78-93-3	2.74E-05	4.50E+00	1.06E-01
Carbon disulfide	75-15-0	1.23E-02	5.40E+01	1.16E-01
Carbon tetrachloride	56-23-5	2.41E-02	4.39E+02	9.45E-02
1,1-Dichloroethane	75-34-3	4.31E-03	3.00E+01	1.08E-01
1,2-Dichloroethane	107-06-2	9.79E-04	1.40E+01	1.08E-01
1,1-Dichloroethene	75-35-4	3.40E-02	6.50E+01	9.38E-02
cis-1,2-Dichloroethene	156-59-2	7.58E-03	4.90E+01	9.38E-02
trans-1,2-Dichloroethene	156-60-5	6.56E-03	5.90E+01	9.38E-02
Hexachlorobutadiene	87-68-3	--	2.90E+04	--
Methylene chloride	75-09-2	2.03E-03	8.80E+00	1.16E-01
Naphthalene	91-20-3	4.83E-04	9.40E+01	1.20E-01
1,1,2,2-Tetrachloroethane	79-34-5	3.81E-04	1.18E+02	8.64E-02
Tetrachloroethene	127-18-4	2.59E-02	3.64E+02	8.78E-02
Toluene	108-88-3	6.37E-03	3.00E+02	9.28E-02
1,2,3-Trichlorobenzene	87-61-6	8.90E-03	--	7.40E-01
1,2,4-Trichlorobenzene	120-82-1	1.40E-03	9.20E+03	7.40E-01
1,1,1-Trichloroethane	71-55-6	1.44E-02	1.52E+02	9.45E-02
Trichloroethene	79-01-6	9.10E-03	1.26E+02	9.63E-02
Trichlorofluoromethane	75-69-4	9.70E-02	1.59E+02	9.31E-02
Trimethylbenzenes	25551-13-7	--	--	--
Xylenes, mixture	1330-20-7	7.04E-03	2.40E+02	8.50E-02

(a) Sources: provided by OEPA or from other literature sources
(b) Source: Superfund Exposure Assessment Manual
(c) -- Not available

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Table 5-3

Summary of Assumed Exposure Factors

Exposure Parameter	Assumed Value, Adult	Assumed Value, Child
Body Weight, kg	70	15
Exposure Frequency, days/yr	350	350
Exposure Duration, yr	30	6
Exposure Time-indoor/outdoor	24	24
Exposure Time-showering hr/day	0.2	0.2
Averaging Time (cancer), days	25,550	25,550
Averaging Time (noncancer), days	10,950	2,190
Soil Intake, mg/day	100	200
Fraction from contaminated area	1	1
Inhalation Rate, m^3/hr	0.83	0.83
Inhalation Rate-Showering, m^3/hr	0.6	0.6
Drinking Water Intake, L/day	2	2
Skin Surface Area, soil, cm^2	5,000	2,000
Skin Surface Area, showering, cm^2	20,000	7,000
Soil to Skin Adherence Factor, mg/cm^2	1.0	1.0

TABLE 5-4

Summary of Dermal Values for Potential Chemicals of Concern
Bldg 7121, Garage and Maintenance Area, Plum Brook Station

Chemical	CAS Number	ABS	AFo (a)	PC (b)
Acetone	67-64-1	0.25	1.00E+00	5.69E-04
Bromodichloromethane	75-27-4	0.25	1.00E+00	5.81E-03
2-Butanone	78-93-3	0.25	1.00E+00	4.50E-03
sec-Butylbenzene	135-98-8	0.25	1.00E+00	--
tert-Butylbenzene	98-06-6	0.25	1.00E+00	--
Carbon disulfide	75-15-0	0.25	5.00E-01	5.00E-01
Carbon tetrachloride	56-23-5	0.25	5.00E-01	2.24E-02
Chlorobenzene	1-8-90-7	0.25	3.00E-01	4.07E-02
Chloroethane	75-00-3	0.25	5.00E-01	7.97E-03
Chloroform	67-66-3	0.25	1.00E+00	8.92E-03
1,1-Dichloroethane	75-34-3	0.25	1.00E+00	8.86E-03
1,2-Dichloroethane	107-06-2	0.25	1.00E+00	5.34E-03
1,1-Dichloroethene	75-35-4	0.25	5.00E-01	1.59E-02
cis-1,2-Dichloroethene	156-59-2	0.25	9.00E-01	1.02E-02
trans-1,2-Dichloroethene	156-60-5	0.25	9.00E-01	1.49E-02
2-Hexanone	591-78-6	0.25	1.00E+00	4.45E-03
Isopropylbenzene	98-82-8	0.25	1.00E+00	--
p-Isopropyltoluene	99-87-6	0.25	1.00E+00	--
Methylene chloride	75-09-2	0.25	8.00E-01	4.46E-03
Naphthalene	91-20-3	0.1	1.00E+00	6.94E-02
Propylbenzene	103-65-1	0.25	1.00E+00	--
1,1,1,2-Tetrachloroethane	630-20-6	0.25	1.00E+00	2.60E-02
1,1,2,2-Tetrachloroethane	79-34-5	0.25	1.00E+00	8.96E-03
Tetrachloroethene	127-18-4	0.25	1.00E+00	4.00E-01
Toluene	108-88-3	0.25	1.00E+00	1.00E+00
1,2,4-Trichlorobenzene	120-82-1	0.1	1.00E+00	9.98E-02
1,2,3-Trichlorobenzene	87-61-6	0.1	1.00E+00	--
1,1,1-Trichloroethane	71-55-6	0.25	1.00E+00	1.71E-02
1,1,2-Trichloroethane	79-00-5	0.25	1.00E+00	8.35E-03
Trichloroethene	79-01-6	0.25	5.00E-01	2.00E-01
Trichlorofluoromethane	75-69-4	0.25	5.00E-01	1.73E-02
Trimethylbenzenes	25551-13-7	0.1	1.00E+00	--
Vinyl chloride	75-01-4	0.25	5.00E-01	7.32E-03
Xylenes, mixture	1330-20-7	0.25	1.00E+00	7.04E-02

(a) Sources: OEPA provided. Value of 1.0 assumed in absence of data.
(b) Source: USEPA Dermal Guidance.

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TABLE 5-5

Summary of Dermal Values for Potential Chemicals of Concern
Bldg 7131, Garage and Maintenance Area, Plum Brook Station

Chemical	CAS Number	ABS	AFo (a)	PC (b)
Acetone	67-64-1	0.25	1.00E+00	5.69E-04
Bromodichloromethane	75-27-4	0.25	1.00E+00	5.81E-03
2-Butanone	78-93-3	0.25	1.00E+00	4.50E-03
Carbon disulfide	75-15-0	0.25	5.00E-01	5.00E-01
Carbon tetrachloride	56-23-5	0.25	5.00E-01	2.24E-02
1,1-Dichloroethane	75-34-3	0.25	1.00E+00	8.86E-03
1,2-Dichloroethane	107-06-2	0.25	1.00E+00	5.34E-03
1,1-Dichloroethene	75-35-4	0.25	5.00E-01	1.59E-02
cis-1,2-Dichloroethene	156-59-2	0.25	9.00E-01	1.02E-02
trans-1,2-Dichloroethene	156-60-5	0.25	9.00E-01	1.49E-02
Hexachlorobutadiene	87-68-3	0.1	1.00E+00	1.21E-01
Methylene chloride	75-09-2	0.25	8.00E-01	4.46E-03
Naphthalene	91-20-3	0.1	1.00E+00	6.94E-02
1,1,2,2-Tetrachloroethane	79-34-5	0.25	1.00E+00	8.96E-03
Tetrachloroethene	127-18-4	0.25	1.00E+00	4.00E-01
Toluene	108-88-3	0.25	1.00E+00	1.00E+00
1,2,3-Trichlorobenzene	87-61-6	0.1	1.00E+00	--
1,2,4-Trichlorobenzene	120-82-1	0.1	1.00E+00	9.98E-02
1,1,1-Trichloroethane	71-55-6	0.25	1.00E+00	1.71E-02
Trichloroethene	79-01-6	0.25	5.00E-01	2.00E-01
Trichlorofluoromethane	75-69-4	0.25	5.00E-01	1.73E-02
Trimethylbenzenes	25551-13-7	0.1	1.00E+00	--
Xylenes, mixture	1330-20-7	0.25	1.00E+00	7.04E-02

(a) Sources: OEPA provided. Value of 1.0 assumed in absence of data.
(b) Source: USEPA Dermal Guidance.

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Table 5-6

Summary of Toxicity Values for Potential Chemicals of Concern
Bldg 7121, Garage and Maintenance Area, Plum Brook Station

Chemical	CAS Number	Oral RfD mg/kg/day		Inhalation RfD mg/kg/day (a)		Weight of Evidence	Oral SF $(mg/kg/day)^{-1}$	Inhal SF (b) $(mg/kg/day)^{-1}$
		Chronic	Subchronic	Chronic	Subchronic			
Acetone	67-64-1	1.00E-01	1.00E+00	--	--	--	--	--
Bromodichloromethane	75-27-4	2.00E-02	2.00E-02	--	--	B2	6.20E-02	--
2-Butanone	78-93-3	6.00E-01	2.00E+00	2.90E-01	2.90E-01	D	--	--
sec-Butylbenzene	135-98-8	--	--	--	--	--	--	--
tert-Butylbenzene	98-06-6	--	--	--	--	--	--	--
Carbon disulfide	75-15-0	1.00E-01	1.00E-01	2.90E-03	2.90E-03	C	--	--
Carbon tetrachloride	56-23-5	7.00E-04	7.00E-03(c)	--	--	B2	1.30E-01	5.30E-02
Chlorobenzene	108-90-7	2.00E-02	2.00E-01	5.70E-03	5.70E-02	--	--	--
Chloroethane	75-00-3	--	--	--	--	--	--	--
Chloroform	67-66-3	1.00E-02	1.00E-02	2.90E+00	--	B2	6.10E-03	8.10E-02
1,1-Dichloroethane	75-34-3	1.00E-01	1.00E+00	1.40E-01	1.40E+00	C	--	--
1,2-Dichloroethane	107-06-2	--	--	--	--	B2	9.10E-02	9.10E-02
1,1-Dichloroethene	75-35-4	9.00E-03	9.00E-03	--	--	C	6.00E-01	1.80E-01
cis-1,2-Dichloroethene	156-59-2	1.00E-02	1.00E-01	--	--	D	--	--
trans-1,2-Dichloroethene	156-60-5	2.00E-02	2.00E-01	--	--	--	--	--
2-Hexanone	591-76-8	Data inadequate for quantitative risk assessment.						
Isopropylbenzene	98-82-8	4.00E-02	4.00E-01	2.60E-03		--	--	--
p-Isopropyltoluene	99-87-6	--	--	--	--	--	--	--
Methylene chloride	75-09-2	6.00E-02	6.00E-02	3.00E+00	3.00E+00	B2	7.50E-03	1.60E-03
Naphthalene	91-20-3	4.0E-02(d)	4.0E-02(d)	--	--	D	--	--
Propylbenzene	103-65-1	--	--	--	--	--	--	--
1,1,1,2-Tetrachloroethane	630-20-6	3.00E-02	3.00E-02	--	--	C	2.60E-02	2.60E-02
1,1,2,2-Tetrachloroethane	79-34-5	--	--	--	--	C	2.00E-01	2.00E-01
trachloroethene	127-18-4	1.00E-02	1.00E-01	--	--	B2/C	5.20E-02(d)	2.00E-04(d)
oluene	108-88-3	2.00E-01	2.00E+00	1.10E-01	--	D	--	--
1,2,4-Trichlorobenzene	120-82-1	1.00E-02	1.00E-02	5.70E-02	5.70E-01	D	--	--
1,2,3-Trichlorobenzene	87-61-6	--	--	--	--	--	--	--
1,1,1-Trichloroethane	71-55-6	9.00E-02(c)	9.00E-01(c)	--	--	D	--	--
1,1,2-Trichloroethane	79-00-5	4.00E-03	4.00E-02	--	--	C	5.70E-02	5.70E-02
Trichloroethene	79-01-6	6.0E-03(d)	--	--	--	B2/C	1.10E-02(c)	6.00E-03(c)
Trichlorofluoromethane	75-69-4	3.00E-01	7.00E-01	2.00E-01	2.00E+00	--	--	--
Trimethylbenzenes	25551-13-7	Data inadequate for quantitative risk assessment.						
Vinyl chloride	75-01-4	--	--	--	--	A	1.90E+00(e)	3.00E-01(e)
Xylenes, mixture	1330-20-7	2.00E+00	4.00E+00(c)	--	--	D	--	--

Source: All values from IRIS(1995) or HEAST (USEPA 1994) unless otherwise referenced.
(a) Inhalation RfD values calculated from Reference Concentration values using formula in OEPA (1993).
(b) Inhalation SF values calculated from inhalation unit risk values using formula in OEPA(1993).
(c) Value obtained from USEPA's Technical Support Center.
(d) Provisional value provided by USEPA's Technical Support Center.
(e) Value under review by USEPA.

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Table 5-7

Summary of Toxicity Values for Potential Chemicals of Concern
Bldg 7131, Garage and Maintenance Area, Plum Brook Station

Chemical	CAS Number	Oral RfD mg/kg/day		Inhalation RfD mg/kg/day (a)		Weight of Evidence	Oral SF $(mg/kg/day)^{-1}$	Inhal SF (b) $(mg/kg/day)^{-1}$
		Chronic	Subchronic	Chronic	Subchronic			
Acetone	67-64-1	1.00E-01	1.00E+00	--	--	--	--	--
Bromodichloromethane	75-27-4	2.00E-02	2.00E-02	--	--	B2	6.20E-02	--
2-Butanone	78-93-3	6.00E-01	2.00E+00	2.90E-01	2.90E-01	D	--	--
Carbon disulfide	75-15-0	1.00E-01	1.00E-01	2.90E-03	2.90E-03	C	--	--
Carbon tetrachloride	56-23-5	7.00E-04	7.00E-03(c)	--	--	B2	1.30E-01	5.30E-02
1,1-Dichloroethane	75-34-3	1.00E-01	1.00E+00	1.40E-01	1.40E+00	C	--	--
1,2-Dichloroethane	107-06-2	--	--	--	--	B2	9.10E-02	9.10E-02
1,1-Dichloroethene	75-35-4	9.00E-03	9.00E-03	--	--	C	6.00E-01	1.80E-01
cis -1,2-Dichloroethene	156-59-2	1.00E-02	1.00E-01	--	--	D	--	--
trans-1,2-Dichloroethene	156-60-5	2.00E-02	2.00E-01	--	--	--	--	--
Hexachlorobutadiene	87-68-3	2.00E-04	2.00E-03(c)	--	--	C	7.80E-02	7.80E-02
Methylene chloride	75-09-2	6.00E-02	6.00E-02	3.00E+00	3.00E+00	B2	7.50E-03	1.60E-03
Naphthalene	91-20-3	4.0E-02(d)	4.0E-02(d)	--	--	D	--	--
1,1,2,2-Tetrachloroethane	79-34-5	--	--	--	--	C	2.00E-01	2.00E-01
Tetrachloroethene	127-18-4	1.00E-02	1.00E-01	--	--	B2/C	5.20E-02(d)	2.00E-04(d)
Toluene	108-88-3	2.00E-01	2.00E+00	1.10E-01	--	D	--	--
1,2,3-Trichlorobenzene	87-61-6	--	--	--	--	--	--	--
1,2,4-Trichlorobenze	120-82-1	1.00E-02	1.00E-02	5.70E-02	5.70E-01	D	--	--
1,1,1-Trichloroethane	71-55-6	9.00E-02(c)	9.00E-01(c)	--	--	D	--	--
Trichloroethene	79-01-6	6.0E-03(d)	--	--	--	B2/C	1.10E-02(c)	6.00E-03(c)
Trichlorofluoromethane	75-69-4	3.00E-01	7.00E-01	2.00E-01	2.00E+00	--	--	--
Trimethylbenzenes	25551-13-7	Data inadequate for quantitative risk assessment.						
Xylenes, mixture	1330-20-7	2.00E+00	4.00E+00(c)	--	--	D	--	--

Source: All values from IRIS(1995) or HEAST (USEPA 1994) unless otherwise referenced.
(a) Inhalation RfD values calculated from Reference Concentration values using formula in OEPA (1993).
(b) Inhalation SF values calculated from inhalation unit risk values using formula in OEPA(1993).
(c) Value obtained from USEPA's Technical Support Center.
(d) Provisional value provided by USEPA's Technical Support Center.
(e) Value under review by USEPA.

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6.0 REMEDIATION OPTIONS

In the event that soil and/or groundwater remediation is necessary at these sites, remediation options will be evaluated in detail based on information gathered during the sampling and analysis program described in this Closure Work Plan. Remediation options discussed below are the most promising based on what is currently known about the sites. Other remedial techniques may be considered after additional information is gathered.

6.1 SOIL REMEDIATION

6.1.1 Introduction

If soil remediation is necessary at either site, the most likely scenario is the excavation of the most contaminated areas (the "hot spots"), treatment or disposal of the soil off-site, and in-situ treatment of the remaining contaminated areas. If the results of this Closure Work Plan indicate this option is infeasible, other remediation options will be investigated in detail.

6.1.2 Options

6.1.2.1 Excavation and Treatment

Jackhammers will be used to break up any concrete or asphalt paved areas. Demolished concrete and asphalt will be collected directly by front-end loaders and placed into lined roll-off boxes. Drums may be used if volumes are small. Soil will be excavated in lifts until the excavation depth, based on the vertical extent of contamination, is reached. The thickness of the lifts will be selected based upon the vertical disttribution of contaminants. Based upon the current information, it appears that 12-inch lifts are likely to be selected. The excavation process will be guided by the use of a photoionization detector (PID) to screen for Volatile Organic Compounds (VOCs). When the screening process indicates that the limits of the contamination have been reached, soil at the bottom and sides of the excavation will be sampled and analyzed to verify removal of soils with contamination exceeding the desired concentrations. If contamination above the desired concentrations is still present, additional excavation will be evaluated with regards to nearby buildings or structures and other limitations.

An excavation of sufficient size will be maintained to allow workers ample room to complete the work, but also to protect the workers from sliding or cave-ins. Sheeting, bracing, or shoring will be installed in the absence of adequate trench side slopes because of space restrictions or stability of material excavated. The sides and slopes of the excavations will be maintained in a safe condition until backfilling is completed. Safety in and around the excavations will conform, at a minimum, to the requirements of the Occupational Safety and Health Administration (OSHA) 29 CFR 1926 and the 29 CFR 1910.120. Sheeting, bracing, or shoring, if used, shall be maintained in the excavation regardless of the time period the excavations will be open. Sheeting, bracing, or shoring will be extended as the excavation progresses.

All excavations will be conducted using backhoes, front end loaders, or shovels as appropriate to the depth and volume of material to be removed. The volume of excavated

feed system separates and shreds larger particles if necessary and conveys the media to the primary combustion chamber. The most common types of combustion chambers are the rotary kiln and the fluidized bed. In the primary combustion chamber the contaminants and the media are combusted and/or volatilized. The secondary combustion chamber completely destroys the remaining volatilized organics. The air pollution control unit consists of scrubbers to remove any particulates or acids from the exhaust gas. The residual ash often requires landfilling. All soil handling will be conducted in a manner that minimizes generation of dust and prevents spillage.

Incineration can be used to treat virtually any organic constituents and is especially suited to high concentration levels. Metals in the contaminated media will be concentrated in the ash which may be classified as hazardous. All types of soils can be treated by incineration. Larger particles may require shredding prior to treatment.

6.1.2.2 Soil Vapor Extraction/Bioventing

After excavation of the most contaminated areas, the remaining areas of contamination can be treated with a soil vapor extraction/bioventing system. Soil vapor extraction utilizes the volatility of a compound to remove it from the subsurface soil. A blower produces a vacuum through a series of horizontal trenches or vertical wells, which aids in the volatilization and the transportation of the compounds to the surface.

Bioventing refers to the process of biodegradation enhanced during soil vapor extraction due to the increase in the oxygen supply. Biodegradation can also be stimulated by supplying sufficient nutrients and moisture to the subsurface. One possible technique to accomplish this is using a sprinkler system. The resulting end products are biomass and harmless byproducts of microbial metabolism such as carbon dioxide and water. The addition of nutrients will be done in a manner that prevents runoff.

In general, volatilization and bioremediation will occur simultaneously, resulting in some hydrocarbons in the extracted air. Treatment may be required to remove remaining organic compounds from the extracted air prior to exhausting to the atmosphere. To minimize volatilization and maximize biodegradation (thereby reducing emission treatment) the extraction flowrate can be decreased. The extracted air will be sampled to determine if treatment is necessary. The treated air will be sampled to confirm that the effluent meets applicable discharge standards.

There are various techniques that can be used to optimize the system. Passive or active air injection to the subsurface can be used. An impermeable surface seal can prevent short-circuiting. The groundwater table may be depressed by pumping to prevent upwelling and expose more unsaturated zone to the soil vapor extraction system. The extracted groundwater can be treated and disposed as presented in the Pump and Treat discussion.

This process is most applicable to VOCs but can also be effective on less volatile compounds if they can be aerobically biodegraded in a reasonable time frame. Because an evenly distributed air flow is important for the success of this technology, highly permeable soils are best. Current data indicate that the site soils may be sufficiently permeable.

to design a full-scale system. Monitoring wells will be evaluated as to their applicability as an air sparging well for the pilot study. Monitoring points may need to be installed.

6.2.2.2 Pump and Treat

Pump and treat technologies involve the removal of groundwater from the subsurface through pumping from recovery wells or trenches and the treatment of the water prior to disposal or re-injection. Slug tests will be done in order to determine the feasibility of this remediation option.

Organic compounds are typically removed using either air stripping or carbon adsorption. There are many configurations possible for air stripping but the basic principle is the mass transfer of volatile organic compounds from the water matrix to the air matrix that comes in contact with it. Carbon adsorption is a treatment process where the organic compound is transferred from the water to the carbon surface. This is applicable for organic compounds with low solubilities and high adsorptive properties.

Inorganic compounds are usually removed by precipitation. Chemicals are added depending on the solubility of inorganic compounds at a specific pH. The precipitated compounds are then removed and disposed of as appropriate.

6.2.3 Conclusions

Existing groundwater data are not current and are only being used qualitatively. Slug tests have not been performed to date. Therefore a remediation technique cannot be chosen at this time. If remediation is necessary the slug test data will be evaluated and an air sparging pilot study may be performed.

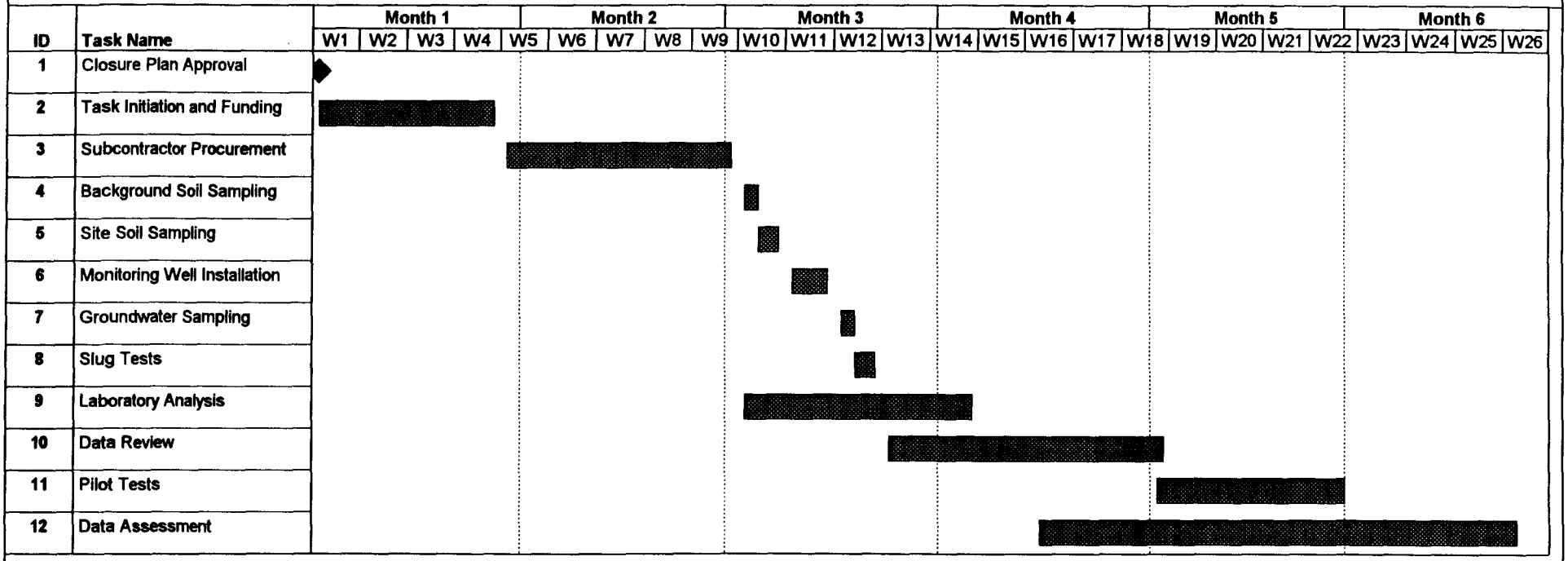
7.0 CLOSURE SCHEDULE

Implementation of this Work Plan for the Closure of Building 7121 and Building 7131 at the GMA waste management units is expected to commence upon OEPA approval of this Closure Work Plan. NASA will notify Ohio EPA Director 30 days prior to the initiation of closure activities.

Implementation will only begin after receiving Ohio EPA concurrence on this Closure Work Plan and NASA obtaining a contractor to perform the work. Figure 7-1 shows the proposed schedule for work plan activities.

NASA PBS will contact the Ohio EPA District Inspector at least five business days in advance of critical closure activities for their observation, if desired. Critical activities would include: soil sampling; groundwater well installation, development and sampling; and waste disposal.

Figure 7-1
Closure Schedule
Garage and Maintenance Area, Plum Brook Station



Project: Plum Brook Station
Date: 9/5/95

Task Progress Milestone

h:\1244jeb\n[illegible]\gm1.mpp

URS C[illegible]ultants

8.0 AMENDMENT OF WORK PLAN

NASA fully expects to implement this Closure Work Plan as described in Section 4.0 and in accordance with the schedule in Section 7.0. A number of issues may arise during the implementation of the plan. Most will be resolved during the normal course of operations and work will continue as outlined. There may be, however, some problems that arise which would require additional sampling/testing, equipment modification, or supplemental investigations of existing conditions. This closure plan may be amended if any of the following events occur:

- Inclement weather or other unexpected event during closure;
- The horizontal and vertical extent of soil and/or groundwater contamination is more extensive than known conditions indicate and additional sampling is required;
- The additional sampling reveals site conditions are significantly different than expected.

NASA will verbally notify the OEPA District inspector prior to significant modifications being made to the work plan included in the approved closure plan.

9.0 CLOSURE CERTIFICATION DOCUMENTATION

The completed closure of the waste management units at the GMA shall be certified according to the requirements of OAC 3745-50-42 and will include the exact wording found in OAC 3745-50-42(D).

At a minimum, the certification document shall include the following information:

- The certificate statement;
- The approved Closure Work Plan or reference to the approved plan;
- The volume of waste removed or closed in place;
- All correspondence regarding closure activity after OEPA approval;
- Details of sampling and analysis methods;
- Laboratory records;
- A narrative describing all activities during closure;
- Details including as-built drawings, for landfill closures;
- Post-closure cleanup documentation;
- The signature of the owner/operator and of a qualified, independent, registered, professional engineer;
- A qualified, independent, registered professional engineer shall submit the closure certification; and
- The qualified professional engineer or his representative will be present for all critical activities such as geoprobe sampling, treatment system installation and system startup.

9.1 WAIVERS OR EXEMPTIONS

No waivers or exemptions are anticipated to be requested or required for generator closure of this facility. Activities will be conducted in accordance with requirements described in this document.

9.2 STATUS OF FACILITY AFTER CLOSURE

The Garage and Maintenance Area will not be utilized in the future for storage of hazardous waste. Two USTs remain in the GMA for gasoline and diesel fuel, and waste oils are generated by vehicle maintenance activities. Waste solvents are stored in satellite drums that, when full, are sent to Building 9206 to await disposal. Waste oil is segregated and handled separately as nonhazardous. Plum Brook Station will remain a generator of hazardous waste and will continue to accumulate hazardous wastes in containers for less than 90-day periods in Building 9206.

10.0 REFERENCES

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APPENDIX A

Health and Safety Plan

APPENDIX A

HEALTH AND SAFETY PLAN

PLUM BROOK STATION

TASK ORDER 7059-004

_____

Employee Signature Date

has read and understands this Health and Safety Plan.

This form must be signed and returned to the Site Safety Officer prior to working on site.

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EMERGENCY CONTACTS

Emergency Phone Contacts:

Chemtrec		(800) 424-9300
TSCA Hotline		(800) 424-9065
		(202) 544-1404
ATSDR	Days	(404) 329-2888
	Night	(404) 566-7777
AT&F (Explosives)		(800) 424-9555
National Response Center		(800) 424-8802
Pesticide Information Service		(800) 845-7633
EPA Emergency Response Team		(201) 321-6660
RCRA Hotline		(800) 424-9346
CMA Chemical Referral Center		(800) 262-8200
National Poison Control Center		(800) 942-5969
U.S. DOT	Days Only	(202) 366-0656

NASA Representative:	**Renee Palyo**	(216) 433-6460
NASA COTR:	**Les Main**	(216) 433-6345

1.0 INTRODUCTION

The purpose of this Health and Safety Plan (HASP) is to set forth, in an orderly and logical fashion, appropriate health and safety procedures to be followed during on site investigative activities at the NASA Plum Brook Station project location. Activities for the project will consist of the sampling of potentially contaminated soil samples, installation of monitoring wells, and sampling of groundwater. This document will serve not only to explain the chemical and physical hazards associated with working on the Project, but will also outline approved measures for dealing with such hazards.

In order to be easily accessible, a list of emergency contacts are attached at the front of this HASP.

The procedures presented in this plan comply with the following regulatory or guidance documents:

- OSHA Occupational Safety and Health Regulations, 29 CFR 1910/1926, U.S. Department of Labor, Occupational Safety and Health Administration, OSHA, March 6, 1990.
- OSHA Occupational Safety and Health Standards, 29CFR 1926.62.
- OSHA Occupational Safety and Health Standards, 29 CFR 1910.120.
- USEPA Order 1440.2, Health and Safety Requirements for Employees Engaged in Field Activities, July 12, 1981.
- NIOSH/OSHA/USCG/USEPA, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, October 1985.
- Standard Operating Safety Guides, United States Environmental Protection Agency, Office of Emergency and Remedial Response, November 1984.
- URS Health and Safety Manual, February 1994.

All personnel involved in onsite activities under this Health and Safety Plan will be required to follow the HASP protocols, as directed by the Site Health and Safety Officer (HSO).

All personnel who will be involved in these activities onsite have completed the appropriate waste site worker training as required by OSHA 1910.120(e)(2), 1910.120(e)(3), and 1910.120-(e)(8), as applicable, and the required medical surveillance as required by OSHA 1910.120(f). Copies of training certificates and medical surveillance certification for all URS field personnel will be maintained onsite.

2.0 RESPONSIBILITIES

A qualified individual and a backup will be designated for each key position. The following is a summary of the health and safety responsibilities of various project personnel.

2.1 PROJECT MANAGER

The Project Manager (PM) is responsible for implementing and ensuring compliance with this Health and Safety Plan. However, the PM may delegate authority, as necessary, to expedite and facilitate the implementation of any of the elements described herein.

2.2 PROJECT HEALTH AND SAFETY OFFICER

The responsibilities of the Project Health and Safety Officer (HSO) are to develop and coordinate the Site Health and Safety Program and provide necessary direction and supervision to the Site HSO and Project Manager. He will review and confirm changes in personal protection requirements when site conditions are found to be different than those originally anticipated.

The Project Health and Safety Officer will be involved, as necessary, in all discussions on health and safety matters with NASA personnel, Occupational Safety and Health Administration (OSHA), local health authorities, or other governmental or labor representatives. In addition, this individual will provide the Site Health and Safety Officer with details concerning the task-specific health and safety considerations. The Project HSO may also perform at least one unannounced onsite health and safety audit. The Project HSO reports directly to the Project Manager. URS will designate a qualified backup for the Project Health and Safety Officer prior to the initiation of onsite activities.

2.3 SITE HEALTH AND SAFETY OFFICER

The responsibilities of the Site Health and Safety Officer (HSO) are as follows:

- Implement this HASP onsite
- Contact the local health department, hospital, police, and fire departments prior to the initiation of work onsite
- Conduct the initial site-specific training session (Onsite Health and Safety Briefing)
- Enforce day-to-day health and safety protocols in effect onsite
- Require that all workers who will be involved in the sampling activities on the site have had appropriate waste site worker training and medical examinations, and review and maintain training and medical certifications onsite
- Require that all personnel entering the site understand the provisions of this HASP
- Conduct periodic training sessions in proper use and maintenance of personal protective equipment and safety practices

- Conduct periodic emergency response drills
- Conduct daily health and safety meetings each morning
- Direct and advise onsite URS personnel, visitors, and subcontractor(s) HSO(s) on all aspects, especially changes, related to health and safety requirements at the site
- Conduct necessary health and safety monitoring
- Administer air monitoring program
- Monitor site conditions and determine all necessary changes in levels of personal protection and, if warranted, execute work stoppages
- Report changes in site conditions and changes in personal protection requirements to the Project HSO
- Prepare accident/incident reports

The Site HSO reports directly to the Project HSO. The site contractor will designate a qualified backup for the Site Health and Safety Officer prior to the initiation of onsite activities.

2.4 FIELD TEAM PERSONNEL

Field team personnel will be responsible for understanding and complying with site health and safety requirements. One member of the project field team will be assigned the responsibility of cleaning and maintaining the personal protective equipment and the decontamination equipment. Field team personnel who will be involved in sampling activities will have completed the required waste site worker training to comply with 29 CFR, Part 1910.120.

3.0 TRAINING REQUIREMENTS

All personnel conducting field activities onsite are required to be certified in health and safety practices for hazardous waste operations as specified in the Federal OSHA Regulations (29 CFR 1910.120) (revised March 6, 1990). Paragraph (e) (2) of the above-referenced regulations requires that each employee, at the time of job assignment, receive a minimum of 40 hours of initial instruction off the site, and a minimum of three days of supervised field experience.

Paragraph (e) (3) of the above referenced regulations requires that all onsite management and supervisory personnel directly responsible for, or who supervise employees engaged in hazardous waste operations, must initially receive eight hours of additional specialized training. Management and supervisory training must emphasize health and safety practices related to managing hazardous waste work. Paragraph (e)(8) of the above referenced regulations requires that workers and supervisors must receive eight hours of refresher training annually on the items specified in Paragraph (e)(1) and/or (e)(3). Additionally, all personnel must receive adequate site-specific training, in the form of an Onsite Health and Safety Briefing given by the Site HSO prior to participating in onsite field work, which will involve a review of this Health and Safety Plan with emphasis on the following:

- Protection of the adjacent community from hazardous vapors which may be released during intrusive activities,
- Attention to health effects and hazards of substances known to be present onsite,
- Hazards and protection against heat/cold,
- The need for vigilance in personal protection, and the importance of attention to proper use, fit, and care of personal protective equipment,
- The effectiveness and limitations of personal protective equipment,
- Prescribed decontamination procedures,
- Site control, including work zones, access, and security,
- The proper observance of daily health and safety practices, such as the entry and exit of work zones and site, proper hygiene during lunch, break, etc.,
- Recognition in oneself or in others of physical conditions requiring immediate medical attention, and application of simple first aid measures, and
- Emergency procedures to be followed (with rehearsals) in cases of fire, explosion, or sudden release of hazardous gases.

Health and Safety Meetings will be conducted daily by the Site Health and Safety Officer and will cover protective clothing and other equipment to be used that day, potential chemical and physical hazards, emergency procedures, and conditions and activities from the previous day. All visitors entering potentially contaminated areas will be required to receive the necessary site-

specific training from the Site HSO, must be equipped with the proper personal protective equipment, and if not equipped with fit test certification, will be required to pass an irritant smoke respirator fit test.

4.0 MEDICAL SURVEILLANCE REQUIREMENTS

All personnel who engage in onsite activities for 30 days or more per year participate in the Medical Surveillance Program. This examination must take place annually and must be conducted by a physician who is board-certified in occupational medicine. The physician will have been made familiar with the job-related duties of each worker examined.

Components of the Medical Surveillance Program are consistent with OSHA regulations as defined in 29CFR 1910.120. The physician must certify whether the individual is fit to conduct work on hazardous waste sites using personal protection, or whether he or she must work within certain restrictions. Personnel may be excluded from this site for medical reasons. Copies of medical examination reports are given to each employee. Employees are encouraged to forward copies to their personal physician. Any person exposed to high levels of hazardous substances will be required to undergo a repeat medical exam at or before the conclusion of the project to determine possible health impacts. Any person suffering a lost-time injury or illness must have medical approval prior to returning to work onsite. When employment is terminated for any reason, the employee must receive an exit medical examination. All medical records will be held by the employer for the period of employment plus at least 30 years, in accordance with OSHA regulations on confidentiality and any other applicable regulations and will be made available to OSHA upon request.

5.0 SITE HAZARD EVALUATION

5.1 CHEMICAL HAZARDS

Contact with chemically contaminated materials will generally be of short duration. URS will ensure worker exposures do not exceed allowable limits by developing and adhering to conservative procedures for sampling activities. Exposures will be minimized by engineering controls, limiting exposure times, proper selection and use of PPE, and a field monitoring program. Exposures involved with the planned sampling activities will be highly transient with potential brief peak exposures. Threshold limit values (TLV) will be the most important control levels to be monitored. Selection of PPE and control measures are based upon the degree to which the TLV is measured in the worker breathing zone. Sampling activities could result in worker exposure to a variety of organic chemicals.

The historic usage of the site and the information generated from previous studies indicate that chlorinated solvents may be encountered in the subsurface soils. Possible exposure may be through ingestion, dermal contact, or inhalation depending on the type and concentration of compounds encountered during field activities.

5.2 PHYSICAL HAZARDS

Physical hazards range from the dangers of tripping and falling on uneven ground to those associated with moving vehicles. The following are physical hazards which may be encountered during the sampling activities.

5.2.1 Trauma

The use of excavation equipment carries with it the risk of being struck by, caught between or under, or pinched by various moving components. Limiting access to areas where equipment is operating, physical guarding, and the use of substantial work gloves will be employed as a means of minimizing this exposure.

5.2.2 Tripping Hazards

Any debris or wet surface at the site may add to this difficulty as do holes, deep crevices, steep grades, and loosely packed fill. Work boots with substantial soles and the elimination of debris will reduce this hazard.

5.2.3 Noise Hazards

Drilling equipment, large trucks, and other local noise sources such as vehicular traffic and rocket testing may result in noise levels which require the use of hearing protection. Hearing protection will be worn when conditions warrant. NASA PBS policy requires hearing protection when noise levels exceed 85dBA. Noise exposure is generally not constant and difficult to control. Controls such as increasing the distance of workers to the noise source and limiting exposure time will be implemented. When hearing protection is necessary, ear muffs and inserts/plugs are acceptable devices to reduce noise level exposure.

5.2.4 Cuts and Lacerations

Field activities that involve sampling could result contact with various types of equipment or from flying or falling objects. Hard hats and safety glasses with side shields will be worn to prevent these types of injuries. At least one person onsite must be currently American Red Cross certified in first aid and CPR. Personnel trained and certified in first aid should be prepared to take care of cuts and bruises as well as other minor injuries. A first aid kit approved by the American Red Cross will be present and available during all field activities.

5.2.5 Animal Bites

Animals and some insects may bite and thereby pose a health hazard in the form of irritation, illness, or poisoning. Anyone bitten should be given immediate first aid as necessary, and shall be transported to the nearest medical facility. Members of the field investigation team will be properly briefed regarding the potential for encountering insects and animals.

5.2.6 Lifting Hazards

Improper lifting by workers is one of the leading causes of industrial injuries. Sampling personnel may be required to move heavy objects including the lifting of the hand auger and soil accumulated on the auger. Therefore, all members of the field crew will be trained in the proper methods of lifting heavy objects. All workers will be cautioned against lifting objects too heavy for one person.

5.2.7 Heat Stress

The combination of high ambient temperature, high humidity, physical exertion, and personal protective apparel which limits the dissipation of body heat and moisture can cause heat stress. The Site HSO will be responsible for monitoring heat stress in the field team personnel.

Personnel will be trained to recognize the symptoms of heat stress and apply the appropriate treatment. Means of prevention include:

- Provide plenty of liquids
- Provide cooling devices
- Adjustment of the work schedule

When ambient temperatures exceed 75 degrees Fahrenheit, breaks should be taken at regular intervals of two (2) hours, or more frequently, if necessary. Decrease the work by 30 minutes for every 5 degree increase in temperature above 75 degrees Fahrenheit.

5.2.8 Cold Stress

Personnel can be susceptible to cold stress while conducting field work during cold weather months. To guard against cold stress and to prevent cold injuries, appropriate warm clothing should be worn, warm shelter must be previously identified and readily available, rest periods should be adjusted as needed, and the physical conditions of onsite field personnel should be closely

monitored. All personnel working onsite must be able to recognize the signs and symptoms of cold stress and apply first aid as needed. The Site HSO is responsible for monitoring the signs and symptoms of cold stress among field personnel.

5.3 SITE COMMUNICATIONS

Successful communication between members of the field team is essential. Since verbal communications may be limited due to the wearing of air-purifying respirators or high noise levels, the following hand signals will be utilized to convey emergency information:

- Hand gripping throat - Can't breathe.
- Grip partner's wrist, or place both hands around wrist - Leave area immediately, no debate!
- Hands on top of head - Need assistance.
- Thumbs up - I am all right, OK, I understand.
- Thumbs down - No, negative.

6.0 SITE CONTROL

6.1 GENERAL

In order to prevent the potential spread of contaminants from the work site, the site will be divided into three controlled zones: the exclusion zone, the contamination reduction zone, and the support zone.

- The exclusion zone is the general work area where soil contamination has been identified, and where excavation activity will take place. The outer boundary of the exclusion zone, the hotline, will be identified with hazard tape, barricades and temporary orange fencing. Flow of workers and equipment into the exclusion zone will be controlled. All personnel in the exclusion zone will wear the proper PPE and have the required OSHA training. All personnel entry to and exit from the exclusion zone will be logged in the project log book.

- The contamination reduction zone is the transition area between the exclusion zone (the contaminated area) and the support zone (clean area). The purpose of the contamination reduction zone is to limit the potential spread of contaminants from the exclusion zone by providing a specific area where equipment and personnel may be decontaminated. All potentially contaminated equipment, tools, and PPE will be cleaned and/or disposed in this area prior to removal from the site.

- The support zone is the area outside the contaminated area or the hotline. No equipment, tools, or personnel should enter the support zone from the exclusion zone without first exiting through the contamination reduction zone. All administrative and support functions will be performed from the support zone.

6.2 SITE VISITATION

Visitors will be permitted in the immediate area of field activities only with prior approval from the NASA-COTR. Approval to enter certain areas may require physical examination and compliance with training requirements. All site visitors shall be briefed on appropriate sections of the Emergency Action Plan section of this HASP prior to entry into potentially hazardous areas. The Site HSO will maintain a visitor log.

7.0 PERSONAL PROTECTION

7.1 PERSONAL PROTECTIVE EQUIPMENT USE

Personal protective equipment (PPE) can offer a high degree of protection only if it is used properly. This section covers the following aspects of PPE use:

- PPE Selection
- Chemical Hazard Evaluation
- Training
- Work Mission Duration
- Personnel Use Factors
- Donning and Doffing
- Fit Testing
- In-Use Monitoring
- Inspection
- Maintenance and Storage

7.2 PERSONAL PROTECTIVE EQUIPMENT SELECTION

There is potential for personnel exposure to hazardous contaminants through inhalation and dermal contact during excavation, decontamination, and sampling activities. Varying levels of personal protection equipment will be mandatory for all site personnel. The purpose of personal protective equipment is to isolate personnel working onsite from the chemical, physical, and biological hazards present onsite. Careful selection of adequate personal protective equipment should protect the respiratory system, skin and body, face and eyes, feet and hands, head, and hearing.

It is anticipated that Level D+ protection will be utilized during the sampling activities. If a higher level of personal protection is required at any time, the Site HSO will instruct personnel to upgrade and the Project HSO will be contacted. Components of all applicable levels of personal protection are listed in Table 7-1.

Some modification in safety apparel (e.g., switching from poly-coated disposable suits to standard disposable suits) may be implemented by the Site HSO in order to balance concerns for full contaminant protection against concerns for the possibility of heat stress resulting from the need to wear more restrictive protective clothing. The use of respiratory protective equipment shall comply with OSHA's requirements as set forth in 29CFR 1910.134.

Level C respiratory protection will normally be provided using NIOSH/MSHA-approved full-face respirators, with HEPA combination filter cartridges approved for removal of specific organic and inorganic vapors, particulates, gases, and fumes. The HEPA filter cartridges will be changed at the end of each work day or when breakthrough occurs, whichever comes first. All team members will be fit-tested for respirators using irritant smoke. Due to difficulties in achieving a proper seal between face and mask, persons with facial hair that interferes with the mask-to-face seal will not be allowed to work in areas requiring respiratory protection.

TABLE 7-1

NASA PLUM BROOK STATION
COMPONENTS OF PERSONAL PROTECTION LEVELS

Level D Protection	Level D+ Protection	Level C Protection
Safety glasses with side shields (or goggles)	Safety glasses with side shields (or goggles)	Hard hat
Hard hat	Hard hat	Poly-coated disposable (or standard disposable) coveralls
Face shield (optional)	Face shield (optional)	Inner gloves of snug-fitting latex or vinyl
Ordinary coveralls	Standard disposable coveralls	Outer gloves of neoprene or nitrile
Ordinary work gloves	Inner gloves of snug-fitting latex or vinyl	Steel-toe, steel-shank work shoes or boots (chemical resistant)
Steel-toe, steel-shank work shoes or boots (chemical resistant)	Outer gloves of neoprene or nitrile	Outer boots of neoprene or butyl rubber
Outer boots of neoprene or butyl rubber (optional)	Steel-toe, steel-shank work shoes or boots (chemical resistant)	Disposable outer "booties"
Disposable outer "booties" (optional)	Outer boots of neoprene or butyl rubber (optional)	Full-face air-purifying respirator (to be worn)**
	Disposable outer "booties"	Taping of gloves and boots to disposable coveralls
	Full-face air-purifying respirator (immediately available)**	

* Respirator to be fitted with NIOSH/MSHA-approved high-efficient filter (HEPA) combination respirator cartridges approved for organic vapors, particulates, gases, and fumes.

** Half-face respirator, face shield, and safety glasses with side shields (or goggles) may be substituted with approval of Health and Safety Officer.

TABLE 7-1 (Continued)

NASA PLUM BROOK STATION
COMPONENTS OF PERSONAL PROTECTION LEVELS
(Continued)

Level B Protection	Level A Protection
Hard hat	Hard hat
Poly-coated disposable (or standard disposable) coveralls	Fully encapsulating, chemical-resistant suit
Inner gloves of snug-fitting latex or vinyl	Inner gloves of snug-fitting latex or vinyl
Outer gloves of neoprene or nitrile	Outer gloves of neoprene or nitrile
Steel-toe, steel-shank work shoes or boots (chemical resistant)	Steel-toe, steel-shank work shoes or boots (chemical resistant)
Outer boots of neoprene or butyl rubber	Disposable outer "booties"
Disposable outer "booties"	Pressure-demand supplied air respirator
Pressure-demand supplied air respirator	5-minute escape bottle
5-minute escape bottle	Two-way radio communications
Two-way radio communications	
Taping of gloves and boots to disposable coveralls	

7.3 EVALUATION OF ONSITE CHEMICAL HAZARDS

For the fullest protection of site personnel, organic and inorganic vapor emissions, oxygen and combustible gas, and airborne dust will be monitored at closely spaced intervals during environmental sampling activities. Monitoring will be accomplished by real-time monitoring equipment, to include an HNu photoionization detector (PID), or equivalent, explosive atmosphere oxygen content will be monitored with a Gastech Model 1641, or equivalent, explosimeter.

The primary purpose of air monitoring is to (1) assess the adequacy of respiratory protection and (2) assess potential hazards in the work area. When any action level presented in Table 9-1 is exceeded during sampling operations, the appropriate responses will be immediately implemented. The specifics of the air monitoring program are provided in Section 8.0.

7.4 PERSONAL USE FACTORS

Certain personal features may jeopardize work safety during equipment use. Precautionary measures will be taken as indicated.

Facial hair and long head hair interfere with respirator fit and visibility. Any facial hair that passes between the face and the sealing surface of the respirator will be prohibited. Even a few days growth of stubble will allow excessive contaminant penetration. Long head hair must be effectively contained within protective hair coverings. OSHA regulations require removal of facial hair that interferes with respirator fit tests.

Punctured ear drums allow contaminants to enter the respiratory tract. Persons with punctured ear drums either should not be allowed onsite or should be required to wear only respirator/suit ensembles which enclose the entire head.

Eyeglasses with conventional earpiece bars may interfere with the full-facepiece respirator-to-face seal. A spectacle kit will be installed in the face masks of workers requiring vision correction.

Contact lenses may absorb vapors and trap contaminants and/or particulates between the lens and the eye, causing irritation, damage, absorption, and an urge to remove the respirator. Contact lens use is not recommended onsite. A spectacle kit will be installed in the face masks of workers requiring vision correction.

Facial features such as scars, hollow temples, very prominent cheekbones, deep skin creases, dentures, or missing teeth may interfere with the respirator-to-face seal. Full dentures should be retained when wearing a respirator; partial dentures may or may not have to be removed, depending on the possibility of swallowing them. Gum and tobacco chewing are prohibited during respirator use and at all times while in the Exclusion Zone or Contamination Reduction Zone.

7.5 RESPIRATOR FIT TESTING

The "fit" or integrity of the facepiece-to-face seal of a respirator affects its performance. A secure fit is important with positive-pressure equipment, and is essential to the safe functioning of negative-pressure equipment, such as air-purifying respirators. Fit test certification will be required for all persons using respirators.

7.6 IN-USE MONITORING

During equipment use, workers will be encouraged to report any perceived problems or difficulties to the Site HSO. These malfunctions include, but are not limited to:

- Discomfort
- Resistance to breathing
- Fatigue due to respirator use
- Interference with vision or communication
- Restriction of movement

7.7 INSPECTION OF PERSONAL PROTECTIVE EQUIPMENT

An effective PPE inspection program features five different inspections:

- Inspection and operational testing of equipment received from the factory or distributor
- Inspection of equipment as it is issued to workers
- Inspection after use or training and prior to maintenance
- Periodic inspection of stored equipment
- Periodic inspection when a question arises concerning the appropriateness of the selected equipment, or when problems with similar equipment arise

Each inspection will cover somewhat different areas in varying degrees of depth. Detailed inspection procedures, where appropriate, are usually available from the manufacturer. Table 7-2 provides PPE inspection checklists.

TABLE 7-2
PLUM BROOK STATION
PERSONAL PROTECTIVE EQUIPMENT INSPECTION CHECKLISTS

CLOTHING

Before use:

- Determine that the clothing material is correct for the specified task at hand.
- Visually inspect for:
  - imperfect seams
  - non-uniform coatings
  - tears
  - malfunctioning closures
- Hold up to light and check for pinholes.
- Flex product:
  - observe for cracks
  - observe for other signs of shelf deterioration
- If the product has been used previously, inspect inside and out for signs of chemical attack:
  - discoloration
  - swelling
  - stiffness

During the work task, periodically inspect for:

- Evidence of chemical attack such as discoloration, swelling, stiffening, and softening. Keep in mind, however, that chemical permeation can occur without any visible effects.
- Closure failure.
- Tears.
- Punctures.
- Seam discontinuities.

TABLE 7-2
(CONTINUED)

GLOVES

Before use:

Pressurize glove to check for pinholes. Either blow into glove, then roll gauntlet towards fingers or inflate glove and hold under water. In either case, no air should escape.

Air-Purifying Respirators

- Inspect air-purifying respirators:
  - before each use to be sure they have been adequately cleaned
  - after each use
  - during cleaning
  - monthly if in storage
- Check material conditions for:
  - signs of pliability
  - signs of deterioration
  - signs of distortion
- Examine cartridges or canisters to ensure that:
  - they are the proper type for the intended use
  - the expiration date has not been passed
  - they have not been opened or used previously
- Check faceshields and lenses for:
  - cracks
  - crazing
  - fogginess

7.8 MAINTENANCE AND STORAGE OF PERSONAL PROTECTIVE EQUIPMENT

7.8.1 Personal Protective Equipment Maintenance

Maintenance of PPE will be performed only by those having specialized training and equipment. The following classification scheme will be used to divide maintenance into three levels:

Level 1: User or wearer maintenance, requiring a few common tools or no tools at all.

Level 2: Shop maintenance which can be performed by the owner's maintenance shop.

Level 3: Specialized maintenance which can be performed only by the factory or an authorized repair depot.

Clothing and respirators must be stored properly to prevent damage or malfunction due to exposure to dust, moisture, sunlight, damaging chemicals, extreme temperatures, and impact. Many equipment failures can be directly attributed to improper storage.

7.8.2 Clothing Storage

- Contaminated clothing will be stored in an area separate from street clothing.
- Contaminated clothing will be stored in a well-ventilated area, with good air flow around each item, if possible.
- Different types and materials of clothing and gloves will not be mixed in storage.

7.8.3 Respirator Storage

- Air-purifying respirators will be dismantled, washed, and disinfected after each use.
- Air-purifying respirators will be stored individually in their original carton or carrying case, or in heat-sealed or resealable plastic bags.

7.9 EVALUATION OF EFFECTIVENESS OF THE PPE PROGRAM

The evaluation of the effectiveness of a PPE program is an ongoing process. The type of equipment used and the overall level of protection will be reevaluated periodically as the amount of information about the site increases, and as workers are required to perform different tasks. Personnel will be encouraged to provide feedback to the Site HSO regarding their perception of the effectiveness of the PPE being used. Personnel will be instructed to upgrade their level of protection if, after discussion with the Site HSO, they feel it is necessary and the Project HSO approves. Any downgrading of personal protection levels must be approved by the Project HSO.

8.0 AIR MONITORING

Air monitoring will be performed throughout the sampling program by trained personnel. Monitoring frequency will be as deemed appropriate by the Site HSO. Air monitoring equipment will be calibrated daily and all data will be recorded in the field notebook and transferred to Instrument Reading Logs. Air will be monitored for total volatiles with a photoionization detector (HNu Model PI 101, or equivalent). Explosive atmosphere/oxygen content will be monitored with an explosimeter (Gastech Model 1641, or equivalent). All air monitoring results indicating zero or non-detect values, and meteorological data (e.g., temperature range, wind speed, wind direction, etc.) will be recorded in the field notebook and will be transferred to Instrument Reading Logs.

8.1 TOTAL VOLATILES

During sampling activities, air monitoring for total volatiles (organic vapors) will be performed using a photoionization detector (HNu Model PI 101, or equivalent) equipped with the standard probe which contains a 10.2 eV lamp. When readings of 5 ppm above background in the breathing zone are consistently observed, work will be stopped and the level of personal protection will be increased to Level C. Following resumption of work, monitoring will take place at least every 10 minutes or for every sample retrieved. If readings from 5-50 ppm above background in the breathing zone are observed, and all other air monitoring action levels indicate that sampling can proceed, monitoring will take place continuously. If organic vapor readings exceed 50 ppm above background in the breathing zone, sampling will be halted and the level of protection used by onsite personnel will be reassessed.

8.2 EXPLOSIVE ATMOSPHERE/OXYGEN CONTENT

A Gastech explosimeter Model 1641, or equivalent, will be used to monitor for explosive atmosphere, and percent oxygen content. Monitoring frequencies during sampling activities will be as summarized in Table 9-1. Readings greater than 10% LEL, less than 19.5% oxygen, or greater than 25% oxygen, will require temporary suspension of activities until the Project HSO determines a safe re-entry level.

8.3 WORK STOPPAGE RESPONSES

The following responses will be initiated whenever one or more of the action levels necessitating a work stoppage is exceeded:

- The Site HSO will be consulted immediately.
- All personnel (except as necessary for continued monitoring and contaminant mitigation, if applicable) will be cleared from the work area.

Any chemical release to air, water, or soil must be reported to the Site HSO at once. Any exposure resulting from protective equipment failure must be immediately reported to the Site HSO and to the Project HSO in writing within 24 hours.

8.4 CALIBRATION OF AIR MONITORING EQUIPMENT

Calibration will be performed in accordance with the manufacturers recommended procedures.

TABLE 8-1

NASA PLUM BROOK STATION
ACTION LEVELS DURING SAMPLING ACTIVITIES

Instrument readings in breathing zone unless otherwise noted.
Each action level is independent of all other action levels in determining responses.

Organic Vapors (PID)	Combustibles	Oxygen	Mercury Vapors	Responses
0-5 ppm Above Background	0-10% LEL	19.5-21%	<.05 mg/m^3	• Continue sampling • Level D+ protection • Continue monitoring every 10 minutes/every sample retrieved.
5-25 ppm Above Background, Sustained Reading	10-20% LEL	19.5-21%	.05-.5mg/m^3	• Continue sampling • Level C protection • Continue monitoring every 10 minutes/every sample retrieved.
>25 ppm Above Background, Sustained Reading	>20% LEL	<19.5 or >21%	>.5 mg/m^3	• Discontinue Sampling • Withdraw from area; shut off all engine ignition sources. • Continuous monitoring for organic vapors 200 ft. downwind. • Continuous monitoring for LEL, determination made of safe re-entry. • Continuous 0_2 monitoring, determination made of safe re-entry. • Continuous monitoring for mercury vapor,determination made of safe re-entry.
Visual Dust Monitoring	No Visible Airborne Dust			Continued Operations in Level D+ protection.
	Visible Airborne Dust			Continued operations in Level C protection.

NOTES:

- Air monitoring for action levels will occur in the breathing zone and 24" above ground surface.
- Should organic vapors measure above 5ppm <u>and</u> mercury vapors measure above .05mg/m^3 <u>simultaneously</u>, discontinue sampling until determination is made to re-enter area and potential upgrade to Level B protection.
- If action levels for any one of the monitoring parameters is exceeded, the appropriate responses listed in the right hand column should be taken.

A. Photoionization Detector: The photoionization detector will be calibrated to a benzene surrogate daily (prior to field activities) and the results will be recorded in the field log book and transferred to Instrument Reading Logs.

B. Explosimeter: Once a day, the explosimeter will be calibrated to a methane gas standard. Prior to each use, the oxygen sensor will be air-calibrated at an upwind location. This calibration involves adjusting the meter to read 20.5%, the concentration of oxygen in ambient air.

9.0 HANDLING OF SAMPLES

The collection and analysis of environmental samples will require caution, not only to ensure safety of site sampling and support personnel, but also to ensure accuracy of results. To minimize hazards to lab personnel, sample volumes will be no larger than necessary, and the outside of all sample containers will be wiped clean prior to shipment.

All samples will be prepared for shipment in a designated area, and will be transported only in designated vehicles. In order to preserve sample integrity and to prevent contaminant escape, packaging of samples shall follow standard sampling protocols. All samples will be placed in a sealed shipping container prior to shipment.

10.0 DECONTAMINATION PROCEDURES

10.1 DECONTAMINATION OF PERSONNEL

Decontamination of personnel will be based on the USEPA-approved decontamination procedures (see *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001). Use of disposable sampling equipment where possible will limit decontamination requirements.

Protective clothing, boots, and gloves, will be decontaminated before leaving the sampling area by a thorough soap-and-water wash. Liquid and solid wastes produced during decontamination will be collected and disposed of properly. Disposable items will be bagged, labeled and placed in 55-gallon drums pending disposal. Proper disposal of contaminated PPE will be the responsibility of the SHO. Personnel performing sampling will be advised that all clothing worn under protective clothing (i.e., underwear, shirts, socks, trousers) should be laundered separately from street clothing before re-wearing. If protective clothing is breached and personal clothing becomes contaminated, the personal clothing will be disposed of.

At present, shower facilities will not be provided and personnel will be instructed to take a shower daily upon returning to the hotel or place of residence.

11.0 EMERGENCY ACTION PLAN

11.1 GENERAL

The project management shall make contact with site, fire, security, and other off-site emergency response agencies such as but not limited to, police, fire, ambulance service and hospital emergency rooms prior to beginning work on site. In these contacts, project management shall inform the emergency provider about the nature and duration of work expected on the site and the type of contaminants and the potential health or safety effects of emergencies involving these contaminants. Also at this time the project and the emergency response units shall make arrangements to handle any emergencies that might be anticipated. Contacts have been listed at the front of this HASP.

11.2 IMPLEMENTATION

The on-site supervisor shall implement the Emergency Plan whenever conditions at the site warrant such action. The on-site supervisor will be responsible for assuring the evacuation, emergency treatment, emergency transport of the site personnel as necessary, and notification of emergency response units and the appropriate Management staff. The following conditions may require implementation of the Emergency Plan:

- Fire or explosion on site.
- Serious personal injury.
- Combustible gases or vapors in excess of 10% LEL in the work area.
- Release of hazardous materials, including gases or vapors at levels greater than the maximum use concentrations of the respirators.
- Unsafe working conditions, such as inclement weather.

11.3 EVACUATION

Evacuation of the immediate work area or the site may be required if certain emergency conditions exist as indicated below:

- Immediate Work Area Evacuation - Evacuation of the immediate work area and withdrawal to the designated assembly area will be required if air contaminant concentrations exceed action levels for the level of protection worn.
- Site Evacuation - In the event of a major emergency situation, such as fire, explosion, or significant release of toxic gases, all personnel will evacuate to the assigned assembly areas.

11.4 FIRE OR EXPLOSION

If concentrations of combustible gases or vapors are above 10% LEL in the work zone, or if an actual fire or explosion has taken place, emergency steps may be necessary. These steps may include;

evacuation of the work area, and notification of the fire department or other appropriate emergency response groups as necessary.

11.5 PERSONAL INJURY

At the beginning of field activities, the Project HSO will contact hospital personnel regarding the potential hazards at the site.

First aid for personal injuries will be administered onsite as appropriate by the Site HSO or his designee. If a site worker should require further treatment, he will be decontaminated if possible, depending on the severity of the injury, and transported to the hospital in a vehicle maintained onsite for this purpose. If necessary, an ambulance will be summoned. The onsite vehicle will carry written directions to the hospital as well as a copy a map showing the route to the hospital. Written directions to the hospital are included on the list of emergency contacts attached at the front of this HASP.

All accidents, however insignificant, will be reported to the Onsite Coordinator and the Site HSO, who will report the accident to the Project HSO. All personnel designated to administer first aid will have received a minimum of eight hours training in first aid and CPR, and be certified by the American Red Cross.

11.6 OVERT CHEMICAL EXPOSURE

Skin Contact:	Use copious amounts of soap and water. Wash/rinse affected area thoroughly, then provide appropriate medical attention.
Eye Contact:	Eyewash solution will be provided onsite as appropriate. Eyes should be rinsed for 15 minutes (minimum) upon chemical contamination.
Inhalation:	Move to fresh air and/or, if necessary decon/transport to hospital.
Ingestion:	Decontaminate and transport to emergency medical facility.
Puncture Wound: or Laceration:	Decontaminate and transport to emergency medical facility.

11.7 SPILL CONTAINMENT PROGRAM

The procedures defined in this section outline the actions to be taken to prevent spills and/or address spills associated with the sampling activities.

- All drums and bulk containers used during site activities shall meet the appropriate DOT, OSHA, and EPA regulations for the waste that they will contain.

- Drums and containers shall be inspected and their integrity assured prior to being moved. Drums or containers that cannot be inspected before being moved because of storage conditions, shall be positioned in an accessible location and inspected prior to further handling.

- Operations will be organized so as to minimize the amount of drum or container movement.

- Employees involved with drum or container operations shall be warned of the hazards associated with the containers.

- Where spills, leaks, or ruptures may occur, adequate quantities of spill containment equipment (sorbents) will be stationed in the immediate area. The spill containment program must be sufficient to contain and isolate the entire volume of hazardous substances being transferred.

- Drums or containers that cannot be moved without failure, shall be transferred to a sound container.

- Fire extinguishing equipment meeting 29 CFR part 1910 subpart 1 shall be on hand and ready for use to control fires.

- Bulk containers (temporary water storage tanks, roll-off boxes) will be inspected by the SHO on a daily basis to insure that no liquids are leaking from any container and that roll-offs are properly covered.

- The decontamination facility will be inspected by the SHO on a daily basis to ensure the facility liner is intact and that no leakage has occurred at the facility.

12.0 CONFINED SPACE SAFETY REQUIREMENTS

The scope of services being performed will not require an entry into a confined space. If a confined space entry is deemed necessary, a confined space permit will be applied for from NASA as far in advance as possible. Notification of the possible entry must be far enough in advance to allow for a thorough assessment of the associated hazards and revision of the HASP.

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APPENDIX B

Previous Site Investigation Summaries

APPENDIX B-1

UST Closure Assessment Study,
EBASCO Environmental, 1989

SITE ASSESSMENT FOR TANKS 24, 25, 28, 29, 30, 31, 32, AND 39

AT PLUM BROOK STATION

FOR

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PLUM BROOK STATION
SANDUSKY, OHIO

PREPARED BY:

EBASCO SERVICES, INC.
5000 BRADENTON AVENUE, SUITE 200
DUBLIN, OHIO 43017

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APPENDICES

Appendix A Laboratory Results of the Soil Sampling.

1.0 Introduction

On September 18th through 19th, 1989, the permanent closure-by-removal of eight (8) steel underground storage tanks (USTs) was performed at the NASA Plum Brook Station near Sandusky, Ohio. The tanks removed were No.s 24, 25, 28, 29, 30, 31, 32, and 39. Tank No.s 24 and 25 were located near Building No. 1411. Tank No.s 24 and 25 were 1,000 gallon steel tanks, Tank No. 24 was in use prior to its removal, while Tank No. 25 was not in use at the time of removal. Tank No. 24 had contained waste oil and solvents, while Tank No. 25 had contained fuel oil. Tank No. 28 was a 3,000 gallon tank and Tank No.s 29, 30, and 31 were 770 gallon tanks. These tanks were located east of Building No. 7121. Tank No. 28 had contained waste oil and solvents and was in use until the time of removal. Tank No.s 29, 30, and 31 had stored toluene and these tanks were not in use prior to removal. Tank No. 32 was a 1,500 gallon waste oil and solvents tank located north of Building No. 7131. Tank No. 32 was in use prior to its removal. Tank No. 39, located west of building 8133, was a 250 gallon tank which was not currently in use, but which had previously contained gasoline.

Mr. Jack Graves of the State Fire Marshal's Office was on site to oversee the removal of the tanks. EMPACO Incorporated and Independence Excavating were retained as subcontractors to Turner Construction to remove the tanks.

2.0 Tank Removal

Samples of the soils underlying the tank, the sidewalls of the excavation pit and excavated soils were collected from each of the tank locations at the time of removal in order to determine if a release of tank contents had occurred during the active life of the tank. The performance of the closure assessments indicated that varying degrees of contamination are present. The following sections detail the significant findings of the closure assessments. A complete set of laboratory results is located in Appendix A.

2.1 Tank No.s 29, 30, 31

Tank No.s 29, 30, and 31 were removed on September 18th. Two (2) soil samples were taken from the pit bottom and two (2) samples were taken from the excavated soil. The following table lists the sample numbers and describes the sampling location and the types of analyses performed on each sample.

TABLE 1
Tank No.s 29, 30, 31; Sample IDs, Locations, and Analyses

Sample ID	Location	Analyses
PBS-7121-SS-1	North wall of the tank pit	Volatile Organic Compounds (VOCs), Total Petroleum Hydrocarbons (TPH), EP Toxicity for Lead, Ignitability
PBS-7121-SS-2	South wall of the tank pit	(VOCs), (TPH), EP Toxicity for Lead, Ignitability
PBS-7121-SS-3	Excavated soil	(VOCs), (TPH)
PBS-7121-SS-4	Excavated soil	(VOCs), (TPH), EP Toxicity for Lead, Ignitability

Total petroleum hydrocarbons (TPH) concentrations in the samples ranged from undetected to 287

mg/kg. The VOC analyses showed low levels of volatile organics. Trichloroethene (TCE) had a maximum concentration 200 ug/kg and 1,1,1-trichloroethane (TCA) had a maximum concentration of 610 ug/kg. Figure 1 shows the sampling locations and the concentrations of TPH, TCE, TCA, and carbon tetrachloride for Tank No.s 29, 30 and 31. Lead concentrations were below detection limits for the samples and flashpoints >200°F were determined using the ignitability analysis.

2.2 Tank No. 28

Tank No. 28 was removed on September 18th. Three (3) samples were taken of the pit bottom and two (2) samples were collected from the excavated material. The table below describes the sampling location and the types of analyses done on each sample:

TABLE 2
Tank No. 28 Sample IDs, Locations, and Analyses

Sample ID	Location	Analyses
PBS-7121-SS-5	North wall of tank pit	Volatile Organic Compounds (VOCs), Total Petroleum Hydrocarbons (TPH)
PBS-7121-SS-6	East wall of tank pit	VOCs, TPH
PBS-7121-SS-7	South wall of tank pit	VOCs, TPH
PBS-7121-SS-8	Excavated soil	VOCs, TPH, EP Toxicity for Lead, Ignitability
PBS-7121-SS-9	Excavated soil	VOCs, TPH, EP Toxicity for Lead, Ignitability

Lead concentrations were below detection limits for the samples and flashpoints >200°F were determined using the ignitability analysis. The sample concentrations for total petroleum hydrocarbons ranged from undetected concentrations to 284 mg/kg for the five samples. The samples from tank area No. 28 had very high concentrations of volatile organics. Table 3 shows the compounds which were present in the highest concentrations.

TABLE 3
Maximum Concentrations of Volatile Organics at Tank No. 28 Pit Area

Compounds	Concentration ug/kg
trichloroethene	21142
tetrachloroethene	10048
1,1,1 trichloroethane	7770
1,1 dichloroethane	1214
toluene	628
total Xylenes	532
1,2,4 trimethylbenzene	479
1,3,5 trimethylbenzene	442
carbon tetrachloride	431
methylene chloride	231

Table 3 is not a complete list, but only designates the compounds with the highest concentrations.

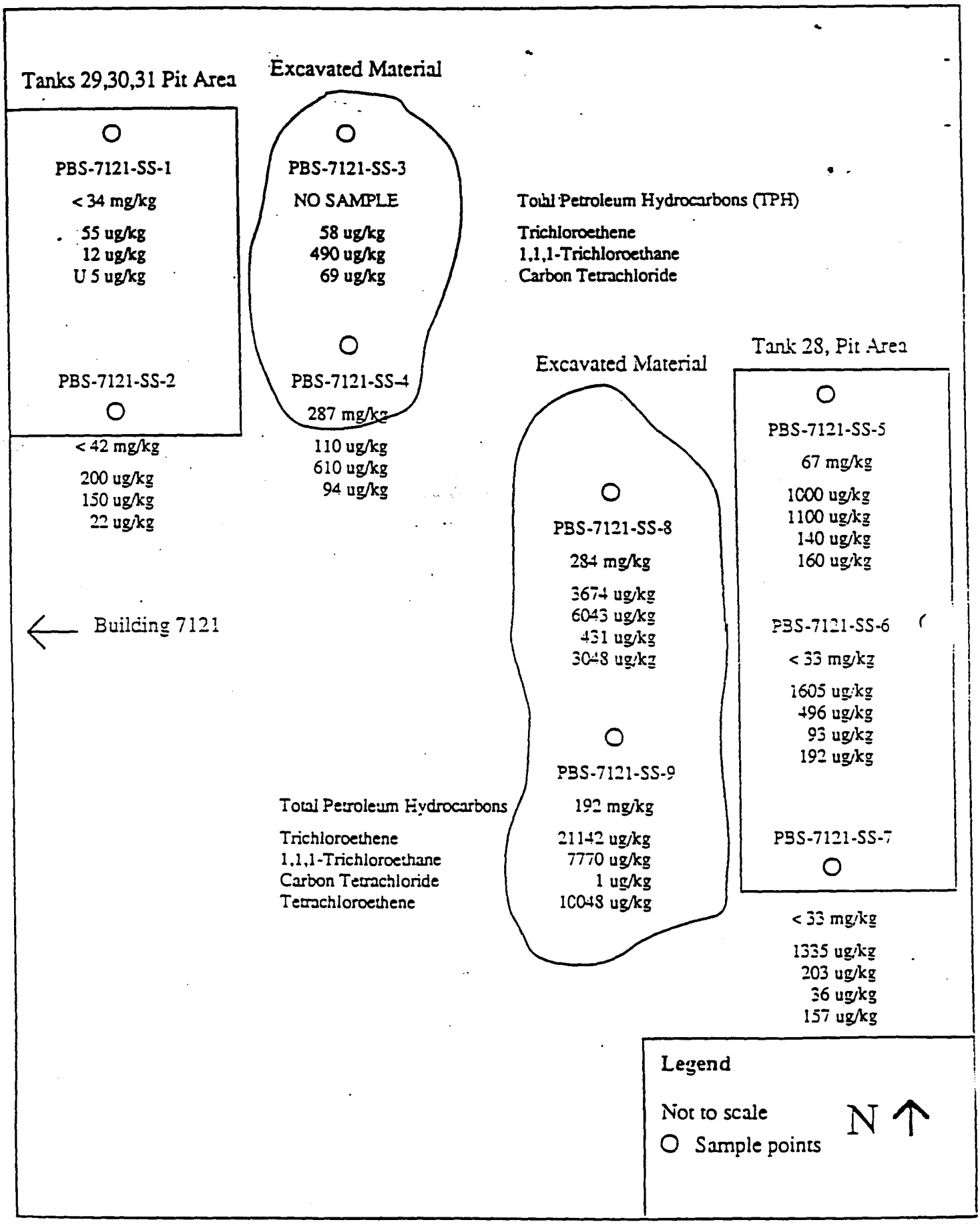

Figure 1; Tanks 28, 29, 30 and 31, east of building 7121
location of soil sampling points and sample concentrations

Figure 1 shows the sample point locations and the associated concentrations for TPH, trichloroethene, 1,1,1-trichloroethane, carbon tetrachloride and tetrachloroethene.

2.3 Tank No. 32

Tank No. 32, located north of Building No. 7131, was excavated on September 18th. Prior to the tank's removal, it was used to store waste oil and solvents. Five (5) samples were taken from this pit area and their location and analyses are listed below.

TABLE 4
Tank No. 32 Sample IDs, Locations, and Analyses

Sample ID	Location	Analyses
PBS-7131-SS-1	West end of pit	Volatile Organic Compounds (VOC), Total Petroleum Hydrocarbons (TPH)
PBS-7131-SS-2	Center of pit	VOC, TPH
PBS-7131-SS-3	East end of pit	VOC, TPH
PBS-7131-SS-4	Excavated soil	VOC, TPH, EP Toxicity for lead, ignitability
PBS-7131-SS-5	Excavated soil	VOC, TPH, EP Toxicity for lead, ignitability

There were no visible signs of contamination during excavation. Analysis of the samples indicated low levels of contamination. The concentrations for TPH and four (4) organic compounds found in the highest concentrations are shown below for each sample.

TABLE 5
Concentrations of TPH and Selected Volatile Organics at Tank No. 32

Sample ID	TPH mg/kg	TCE* ug/kg	1,3,5 trimethylbenzene ug/kg	1,2,4 trimethylbenzene ug/kg	naphthalene ug/kg
PBS-7131-SS-1	120	372	U 1	U 1	4
PBS-7131-SS-2	244	359	U 1	U 1	3
PBS-7131-SS-3	191	606	U 1	U 1	1
PBS-7131-SS-4	<38	464	U 1	1	1
PBS-7131-SS-5	193	728	366	349	159

* TCE - trichloroethene
U - Undetected at the given concentration

Elevated concentrations of trichloroethene were found in each of the five samples. Elevated levels of total petroleum hydrocarbons were found in each sample except PBS-7131-SS-4. Figure 2 shows the sampling locations with their respective concentrations of TPH, TCE, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene and naphthalene.

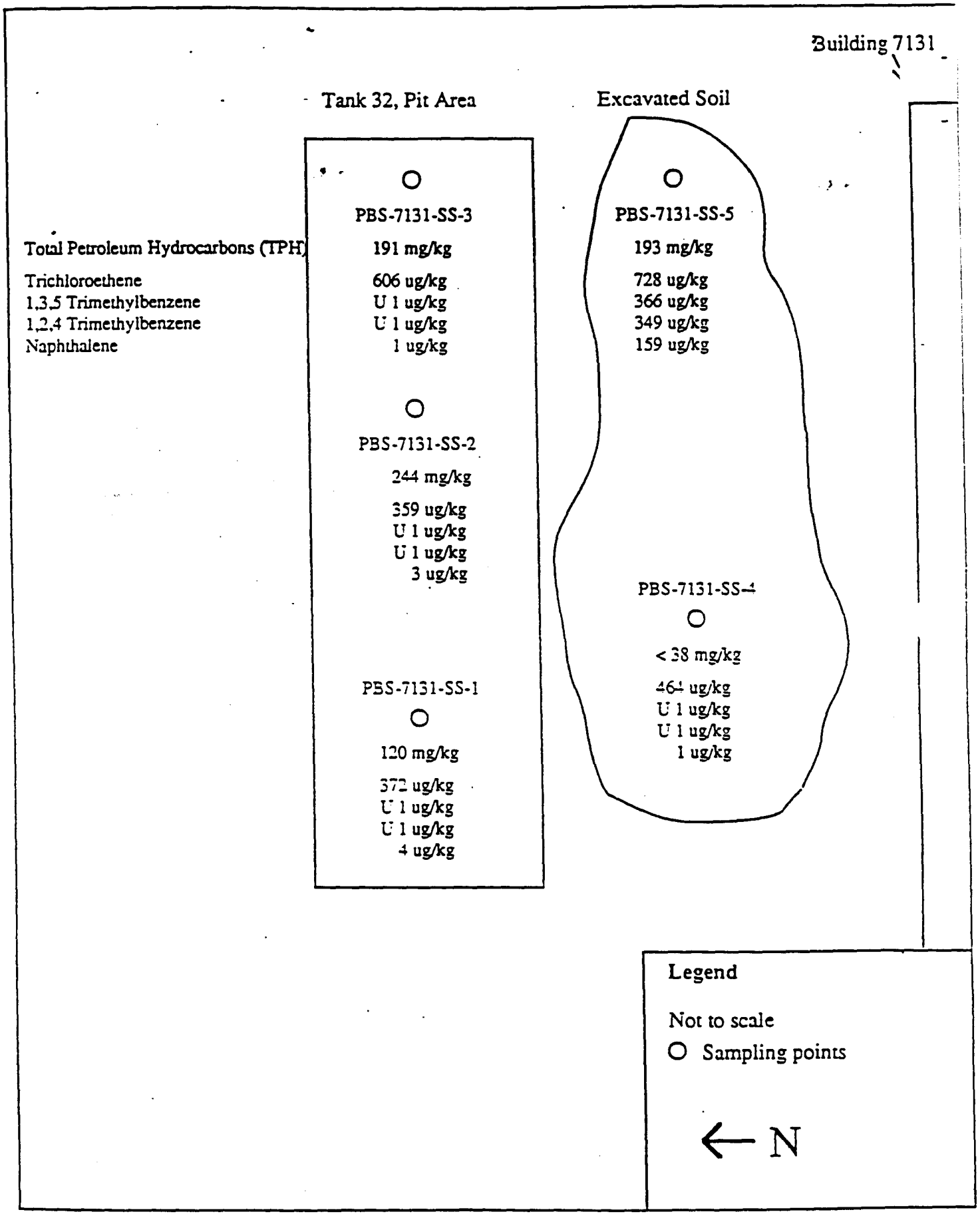

Figure 2; Tank 32, north of building 7131
location of soil sampling points and sample concentrations

TABLE 10
Maximum Concentrations of Volatile Organics at Tank No.s 24 and 25 Pit Area

Compound	Concentration
trichlorofluoromethane	93
methylene chloride	164
1,1-dichloroethane	17
cis-1,2-dichloroethene	362
1,1,1-trichloroethane	1254
carbon tetrachloride	213
trichloroethene	1432
toluene	16
tetrachlorethene	342
ethylbenzene	45
m + p-xylenes	43
o-xylene	23
n-propylbenzene	76
1,3,5-trimethylbenzene	496
tert-butylbenzene	70
1,2,4-trimethylbenzene	541
p-isopropyltoluene	74
naphthalene	1094

3.0 Discussion and Recommendations

It is apparent from the visual inspection and also the laboratory analyses results that contamination has occurred at each of the sites of the eight (8) excavated underground storage tanks. The extent of contamination varies at each tank pit area, from visible contamination at Tank Pit 28, Tank Pit 24 and 25, and Tank Pit 39 to very limited contamination at Tank Pit 32. Levels of contamination at the sites can be compared to the clean up goals of the Ohio State Fire Marshal's Office; Bureau of Underground Storage Tank Regulation (BUSTR). According to Tom Forbes of BUSTR acceptable levels of total petroleum hydrocarbons are approximately 100 mg/kg in soil and 5 ug/kg for volatile organics in soil.

At the pit area of Tanks 29, 30 and 31 contamination is basically limited to elevated levels of trichloroethene (TCE), 1,1,1-trichloroethane and to a lesser extent, carbon tetrachloride. Levels of these three chlorinated organics ranged from undetectable levels to 610 ug/kg in the four soil samples taken from this area. Levels of total petroleum hydrocarbons in the four samples ranged from undetectable levels in two of the samples to 287 mg/kg.

At the Tank 28 pit area there was visible contamination when the tank was removed and the lab analyses showed relatively high levels of contamination of chlorinated organics. Levels of TCE were as high as 21142 ug/kg (21 ppm), while levels of 1,1,1-trichloroethane, carbon tetrachloride, and tetrachlorethene were as high as 10 ppm, levels of total petroleum hydrocarbons ranged from undetectable levels to 284 mg/kg.

At the Tank 32 pit area there was no visible contamination at the time of excavation. The volatile organics analyses showed levels of TCE that ranged from undetectable levels to 606 ug/kg. Concentrations of Total Petroleum Hydrocarbons were as high as 244 mg/kg.

Visible contamination was found at the Tank 39 pit area. Three samples were taken from the pit and excavated soils. The one sample taken from the pit bottom (8133-SS-3) could be considered clean according to the standards set by the Bureau of Underground Storage Tank Regulation. Sample 8133-SS-1 was very contaminated, and was taken from the excavated soil surrounding the tank. The tank was found to have holes in it when it was excavated. This would seem to indicate that contamination is limited to the immediate area where the tank had been buried.

At the pit area of Tanks 24 and 25 elevated levels of total petroleum hydrocarbons and volatile organics were reported in the laboratory analysis results. Total petroleum hydrocarbon levels were as high as 2030 mg/kg. Levels of chlorinated organics (TCE, 1,1,1-trichloroethane, carbon tetrachloride, tetrachloroethene) ranged from undetectable concentrations to 1432 ug/kg.

From the initial soil sampling, it appears that the areas around tank 28 and tanks 24, 25 are the most contaminated. The area of tank 39 has unacceptable levels of TPH and volatile organics, but does not appear to be as contaminated as the areas of tank 28 and tanks 24, 25. The area of tank 32 seems to have very limited contamination. The lab analyses indicated that soil contamination was present around tanks 29, 30 and 31, further investigation will consider the area of tanks 29, 30, and 31 and the area of tank 28 as a single contaminant area due to their proximity.

Because there is soil contamination and possibly groundwater contamination at each of the tank pit areas, it was determined that further investigation and possible remediation will be necessary to accomplish clean closure of each area. A soil gas survey of each of the areas was performed in an effort to determine the lateral extent of the contamination. Preliminary results indicate the need for a complete site characterization to support the screening of the currently available remedial alternatives. Because the majority of the tank areas involve contamination due to solvents and waste oils, OEPA and the Bureau of Underground Storage Tank Regulation (BUSTR) have determined that OEPA will be responsible for future regulatory activity. The Ohio EPA's clean up standards are background or undetectable levels or health based remediation levels supported by risk assessment. According to Hallie Serazin, of the Division of Emergency and Remedial Response, OEPA is developing a statewide background standard for total petroleum hydrocarbons (TPH) and also health based standards for volatile organics. These standards are being developed presently therefore BUSTR's approximate values for undetectable levels of TPH and volatiles in soils are used for reference purposes, when discussing soil contaminant levels at the tank pit areas.

A comprehensive remedial investigation, to include an extensive field sampling program, will be conducted at each of the areas to further quantify the lateral and vertical extent, and the degree of contamination in the soil and groundwater. The Ohio Environmental Protection Agency (OEPA), is the regulatory agency responsible for approving the upcoming site investigation and possible remedial activity.

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI092	Method Number:	8240
Lab Sample Name:	PBS7121SS1,H#5454	Date Analyzed:	890922
Matrix:	Water	Date Collected:	890918
Dilution Factor:	1.1	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/5gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/l	Detection Limit	
Chloromethane		11	U
Bromomethane		11	U
Vinyl Chloride	3		J
Chloroethane	34		
Methylene Chloride	4		J
Acetone	380		
Acrylonitrile		5	U
Acrolein		5	U
Trichlorofluoromethane	4		J
Carbon Disulfide	1		J
1,1-Dichloroethene	2		J
1,1-Dichloroethane	70		
1,2-Dichloroethene (Total)	3		J
Chloroform		5	U
1,2-Dichloroethane	3		J
2-Butanone	86		
1,1,1-Trichloroethane	12		
Carbon Tetrachloride		5	U
Vinyl Acetate		11	U
Bromodichloromethane		5	U
1,2-Dichloropropane		5	U
trans-1,3-Dichloropropene		5	U
Trichloroethene	36		
Dibromochloromethane		5	U
1,1,2-Trichloroethane		5	U
Benzene		5	U
cis-1,3-Dichloropropene		5	U
2-Chloroethylvinylether		5	U
Bromoform		5	U
4-Methyl-2-Pentanone		11	U
2-Hexanone		11	U
Tetrachloroethene	2		J
1,1,2,2-Tetrachloroethane		5	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI092	Method Number:	8240
Lab Sample Name:	PBS7121SS1,H#5454	Date Analyzed:	890922
Matrix:	Water	Date Collected:	890918
Dilution Factor:	1.1	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/5gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/l	Detection Limit
Toluene	2	J
Chlorobenzene	1	J
Ethylbenzene	1	J
Styrene		5 U
Xylenes (Total)	3	J
m-Xylene	2	J
o + p-Xylene	1	J
1,3 Dichlorobenzene	2	J
1,2 Dichlorobenzene	1	J
1,4 Dichlorobenzene	2	J

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
PBS7121SS1

ab Name: Hittman Ebasco Contract: ESI 7019

ab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

atrix: SOIL Lab Sample ID: HE#5454

ample wt/vol: 5 G Lab File ID: >C1092

evel: LOW Date Received: 09/20/89

Moisture: not dec.____ Date Analyzed: 9/22/89

olumn: PACK Dilution Factor: 1.0676

Number TICs found: ..... CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI102	Method Number:	8240
Lab Sample Name:	PBS7121SS1 1:5,5454	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	NA.
Dilution Factor:	1.0	Date Received:	NA.

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/1gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Chloromethane		10	U
Bromomethane		10	U
Vinyl Chloride		10	U
Chloroethane	5		J
Methylene Chloride	1		J
Acetone	75		
Acrylonitrile		5	U
Acrolein		5	U
Trichlorofluoromethane		5	U
Carbon Disulfide		5	U
1,1-Dichloroethene		5	U
1,1-Dichloroethane	11		
1,2-Dichloroethene (Total)		5	U
Chloroform		5	U
1,2-Dichloroethane		5	U
2-Butanone		5	U
1,1,1-Trichloroethane	3		J
Carbon Tetrachloride		5	U
Vinyl Acetate		10	U
Bromodichloromethane		5	U
1,2-Dichloropropane		5	U
trans-1,3-Dichloropropene		5	U
Trichloroethene	55		
Dibromochloromethane		5	U
1,1,2-Trichloroethane		5	U
Benzene		5	U
cis-1,3-Dichloropropene		5	U
2-Chloroethylvinylether		5	U
Bromoform		5	U
4-Methyl-2-Pentanone		10	U
2-Hexanone		10	U
Tetrachloroethene		5	U
1,1,2,2-Tetrachloroethane		5	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI102	Method Number:	8240
Lab Sample Name:	PBS7121SS1 1:5,5454	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	NA.
Dilution Factor:	1.0	Date Received:	NA.

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/1gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Toluene		5	U
Chlorobenzene		5	U
Ethylbenzene		5	U
Styrene		5	U
Xylenes (Total)		5	U
m-Xylene		5	U
o + p-Xylene		5	U
1,3 Dichlorobenzene		5	U
1,2 Dichlorobenzene		5	U
1,4 Dichlorobenzene		5	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PB5/121551

ab Name: Hittman Ebasco Contract: ESI 7019

ab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

atrix: SOIL Lab Sample ID: #5454 1:5

ample wt/vol: 1 G Lab File ID: >C1102

evel: LOW Date Received: 09/20/89

Moisture: not dec.____ Date Analyzed: 9/23/89

olumn: PACK Dilution Factor: 5.3380

Number TICs found: CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
PBS7121555

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: #5458 1:5

Sample wt/vol: 1 G Lab File ID: >C1110

Level: LOW Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/25/89

Column: PACK Dilution Factor: 5.4385

Number TICs Found: CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
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VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS/121555

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: #5458 1:5

Sample wt/vol: 1 G Lab File ID: >C1110

Level: LOW Date Received: 09/20/89

% Moisture: not dec._____ Date Analyzed: 9/25/89

Column: PACK Dilution Factor: 5.4385

Number TICs found: CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
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23.					
24.					
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26.					
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI095	Method Number:	8240
Lab Sample Name:	PBS7121SS2,#HE5455	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.3	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/5gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Chloromethane		13	U
Bromomethane		13	U
Vinyl Chloride		13	U
Chloroethane		13	U
Methylene Chloride	4		J
Acetone		13	U
Acrylonitrile		7	U
Acrolein		7	U
Trichlorofluoromethane	3		J
Carbon Disulfide		7	U
1,1-Dichloroethene		7	U
1,1-Dichloroethane	3		J
1,2-Dichloroethene (Total)		7	U
Chloroform		7	U
1,2-Dichloroethane		7	U
2-Butanone		7	U
1,1,1-Trichloroethane	150		
Carbon Tetrachloride	22		
Vinyl Acetate		13	U
Bromodichloromethane		7	U
1,2-Dichloropropane		7	U
trans-1,3-Dichloropropene		7	U
Trichloroethene	200		
Dibromochloromethane		7	U
1,1,2-Trichloroethane		7	U
Benzene		7	U
cis-1,3-Dichloropropene		7	U
2-Chloroethylvinylether		7	U
Bromoform		7	U
4-Methyl-2-Pentanone		13	U
2-Hexanone		13	U
Tetrachloroethene	6		J
1,1,2,2-Tetrachloroethane		7	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI095	Method Number:	8240
Lab Sample Name:	PBS7121SS2,#HE5455	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.3	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/5gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Toluene	2		J
Chlorobenzene		7	U
Ethylbenzene		7	U
Styrene		7	U
Xylenes (Total)		7	U
m-Xylene		7	U
o + p-Xylene		7	U
1,3 Dichlorobenzene		7	U
1,2 Dichlorobenzene		7	U
1,4 Dichlorobenzene		7	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS7121SS2

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: HE#5455

Sample wt/vol: 5 G Lab File ID: >C1095

Level: LOW Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/22/89

Column: PACK Dilution Factor: 1.3016

Number TICs found: ..... CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI096	Method Number:	8240
Lab Sample Name:	PBS7121SS3,HE#5456	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.0	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/5gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Chloromethane		10	U
Bromomethane		10	U
Vinyl Chloride		10	U
Chloroethane		10	U
Methylene Chloride		5	U
Acetone		10	U
Acrylonitrile		5	U
Acrolein		5	U
Trichlorofluoromethane		5	U
Carbon Disulfide		5	U
1,1-Dichloroethene	1		J
1,1-Dichloroethane	2		J
1,2-Dichloroethene (Total)		5	U
Chloroform		5	U
1,2-Dichloroethane		5	U
2-Butanone		5	U
1,1,1-Trichloroethane	97		
Carbon Tetrachloride	14		
Vinyl Acetate		10	U
Bromodichloromethane		5	U
1,2-Dichloropropane		5	U
trans-1,3-Dichloropropene		5	U
Trichloroethene	11		
Dibromochloromethane		5	U
1,1,2-Trichloroethane		5	U
Benzene		5	U
cis-1,3-Dichloropropene		5	U
2-Chloroethylvinylether		5	U
Bromoform		5	U
4-Methyl-2-Pentanone		10	U
2-Hexanone		10	U
Tetrachloroethene	1		J
1,1,2,2-Tetrachloroethane		5	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI103	Method Number:	8240
Lab Sample Name:	PBS7121SS3 1:5,5456	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.0	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/1gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit
Toluene		5 U
Chlorobenzene		5 U
Ethylbenzene		5 U
Styrene		5 U
Xylenes (Total)		5 U
m-Xylene		5 U
o + p-Xylene		5 U
1,3 Dichlorobenzene		5 U
1,2 Dichlorobenzene		5 U
1,4 Dichlorobenzene		5 U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS7121553

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: HE#5456

Sample wt/vol: 5 G Lab File ID: >C1096

Level: LOW Date Received: 09/20/89

% Moisture: not dec._____ Date Analyzed: 9/22/89

Column: PACK Dilution Factor: 1.0000

Number TICs Found: CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI103	Method Number:	8240
Lab Sample Name:	PBS7121SS3 1:5,5456	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	5.2	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/1gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Chloromethane		52	U
Bromomethane		52	U
Vinyl Chloride		52	U
Chloroethane		52	U
Methylene Chloride		26	U
Acetone		52	U
Acrylonitrile		26	U
Acrolein		26	U
Trichlorofluoromethane		26	U
Carbon Disulfide		26	U
1,1-Dichloroethene	6		J
1,1-Dichloroethane	8		J
1,2-Dichloroethene (Total)		26	U
Chloroform		26	U
1,2-Dichloroethane		26	U
2-Butanone		26	U
1,1,1-Trichloroethane	490		
Carbon Tetrachloride	69		
Vinyl Acetate		52	U
Bromodichloromethane		26	U
1,2-Dichloropropane		26	U
trans-1,3-Dichloropropene		26	U
Trichloroethene	58		
Dibromochloromethane		26	U
1,1,2-Trichloroethane		26	U
Benzene		26	U
cis-1,3-Dichloropropene		26	U
2-Chloroethylvinylether		26	U
Bromoform		26	U
4-Methyl-2-Pentanone		52	U
2-Hexanone		52	U
Tetrachloroethene	5		J
1,1,2,2-Tetrachloroethane		26	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI103	Method Number:	8240
Lab Sample Name:	PBS7121SS3 1:5,5456	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	5.2	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/1gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit
Toluene		26 U
Chlorobenzene		26 U
Ethylbenzene		26 U
Styrene		26 U
Xylenes (Total)		26 U
m-Xylene		26 U
o + p-Xylene		26 U
1,3 Dichlorobenzene		26 U
1,2 Dichlorobenzene		26 U
1,4 Dichlorobenzene		26 U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS/121553

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: #5456 1:5

Sample wt/vol: 1 G Lab File ID: >C1103

Level: LOW Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/23/89

Column: PACK Dilution Factor: 5.2148

Number TICs found: CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI097	Method Number:	8240
Lab Sample Name:	PBS7121SS4,#HE5457	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.0	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/5gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Chloromethane		10	U
Bromomethane		10	U
Vinyl Chloride		10	U
Chloroethane		10	U
Methylene Chloride	2		J
Acetone		10	U
Acrylonitrile		5	U
Acrolein		5	U
Trichlorofluoromethane	3		J
Carbon Disulfide	2		J
1,1-Dichloroethene	13		
1,1-Dichloroethane	9		
1,2-Dichloroethene (Total)		5	U
Chloroform		5	U
1,2-Dichloroethane		5	U
2-Butanone		5	U
1,1,1-Trichloroethane	610		
Carbon Tetrachloride	94		
Vinyl Acetate		10	U
Bromodichloromethane		5	U
1,2-Dichloropropane		5	U
trans-1,3-Dichloropropene		5	U
Trichloroethene	77		
Dibromochloromethane		5	U
1,1,2-Trichloroethane	1		J
Benzene		5	U
cis-1,3-Dichloropropene		5	U
2-Chloroethylvinylether		5	U
Bromoform		5	U
4-Methyl-2-Pentanone		10	U
2-Hexanone	7		J
Tetrachloroethene	7		
1,1,2,2-Tetrachloroethane		5	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI097	Method Number:	8240
Lab Sample Name:	PBS7121SS4,#HE5457	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.0	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/5gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Toluene	1		J
Chlorobenzene	1		J
Ethylbenzene		5	U
Styrene		5	U
Xylenes (Total)		5	U
m-Xylene		5	U
o + p-Xylene		5	U
1,3 Dichlorobenzene		5	U
1,2 Dichlorobenzene		5	U
1,4 Dichlorobenzene		5	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS7121SS4

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: HE#5457

Sample wt/vol: 5 G Lab File ID: >C1097

Level: LOW Date Received: 09/20/89

% Moisture: not dec._____ Date Analyzed: 9/22/89

Column: PACK Dilution Factor: 1.0321

Number TICs found: CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI104	Method Number:	8240
Lab Sample Name:	PBS7121SS4 1:5,5457	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	5.2	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/1gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Chloromethane		52	U
Bromomethane		52	U
Vinyl Chloride		52	U
Chloroethane		52	U
Methylene Chloride		26	U
Acetone		52	U
Acrylonitrile		26	U
Acrolein		26	U
Trichlorofluoromethane		26	U
Carbon Disulfide		26	U
1,1-Dichloroethene	6		J
1,1-Dichloroethane	6		J
1,2-Dichloroethene (Total)		26	U
Chloroform		26	U
1,2-Dichloroethane		26	U
2-Butanone		26	U
1,1,1-Trichloroethane	410		
Carbon Tetrachloride	56		
Vinyl Acetate		52	U
Bromodichloromethane		26	U
1,2-Dichloropropane		26	U
trans-1,3-Dichloropropene		26	U
Trichloroethene	110		
Dibromochloromethane		26	U
1,1,2-Trichloroethane		26	U
Benzene		26	U
cis-1,3-Dichloropropene		26	U
2-Chloroethylvinylether		26	U
Bromoform		26	U
4-Methyl-2-Pentanone		52	U
2-Hexanone		52	U
Tetrachloroethene	8		J
1,1,2,2-Tetrachloroethane		26	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI104	Method Number:	8240
Lab Sample Name:	PBS7121SS4 1:5,5457	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	5.2	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/1gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Toluene		26	U
Chlorobenzene		26	U
Ethylbenzene		26	U
Styrene		26	U
Xylenes (Total)		26	U
m-Xylene		26	U
o + p-Xylene		26	U
1,3 Dichlorobenzene		26	U
1,2 Dichlorobenzene		26	U
1,4 Dichlorobenzene		26	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS7121SS4

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: #5457 1:5

Sample wt/vol: 1 G Lab File ID: >C1104

Level: LOW Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/23/89

Column: PACK Dilution Factor: 5.1705

Number TICs found: CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI098	Method Number:	8240
Lab Sample Name:	PBS7121SS5,#HE5458	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.3	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/5gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Chloromethane		13	U
Bromomethane		13	U
Vinyl Chloride		13	U
Chloroethane		13	U
Methylene Chloride	6		J
Acetone	6		J
Acrylonitrile		6	U
Acrolein		6	U
Trichlorofluoromethane	7		
Carbon Disulfide		6	U
1,1-Dichloroethene	6		J
1,1-Dichloroethane	35		
1,2-Dichloroethene (Total)	19		
Chloroform		6	U
1,2-Dichloroethane		6	U
2-Butanone		6	U
1,1,1-Trichloroethane	760		
Carbon Tetrachloride	100		
Vinyl Acetate		13	U
Bromodichloromethane		6	U
1,2-Dichloropropane		6	U
trans-1,3-Dichloropropene		6	U
Trichloroethene	850		
Dibromochloromethane		6	U
1,1,2-Trichloroethane	3		J
Benzene		6	U
cis-1,3-Dichloropropene		6	U
2-Chloroethylvinylether		6	U
Bromoform		6	U
4-Methyl-2-Pentanone		13	U
2-Hexanone		13	U
Tetrachloroethene	110		
1,1,2,2-Tetrachloroethane	1		J

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI098	Method Number:	8240
Lab Sample Name:	PBS7121SS5,#HE5458	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.3	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/5gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Toluene	19		
Chlorobenzene		6	U
Ethylbenzene		6	U
Styrene		6	U
Xylenes (Total)	5		J
m-Xylene	3		J
o + p-Xylene	2		J
1,3 Dichlorobenzene		6	U
1,2 Dichlorobenzene		6	U
1,4 Dichlorobenzene		6	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS7121SS5

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: HE#5458

Sample wt/vol: 5 G Lab File ID: >C1098

Level: LOW Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/22/89

Column: PACK Dilution Factor: 1.2877

Number TICs found: CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI105	Method Number:	8240
Lab Sample Name:	PBS7121SS5 1:5,5458	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	5.4	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/1gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Chloromethane		54	U
Bromomethane		54	U
Vinyl Chloride		54	U
Chloroethane		54	U
Methylene Chloride		27	U
Acetone		54	U
Acrylonitrile		27	U
Acrolein		27	U
Trichlorofluoromethane		27	U
Carbon Disulfide		27	U
1,1-Dichloroethene	8		J
1,1-Dichloroethane	47		
1,2-Dichloroethene (Total)	19		J
Chloroform		27	U
1,2-Dichloroethane		27	U
2-Butanone		27	U
1,1,1-Trichloroethane	1100		
Carbon Tetrachloride	140		
Vinyl Acetate		54	U
Bromodichloromethane		27	U
1,2-Dichloropropane		27	U
trans-1,3-Dichloropropene		27	U
Trichloroethene	1000		
Dibromochloromethane		27	U
1,1,2-Trichloroethane	6		J
Benzene		27	U
cis-1,3-Dichloropropene		27	U
2-Chloroethylvinylether		27	U
Bromoform		27	U
4-Methyl-2-Pentanone		54	U
2-Hexanone		54	U
Tetrachloroethene	160		
1,1,2,2-Tetrachloroethane		27	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI105	Method Number:	8240
Lab Sample Name:	PBS7121SS5 1:5,5458	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	5.4	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/1gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Toluene	25		J
Chlorobenzene		27	U
Ethylbenzene		27	U
Styrene		27	U
Xylenes (Total)		27	U
m-Xylene		27	U
o + p-Xylene		27	U
1,3 Dichlorobenzene		27	U
1,2 Dichlorobenzene		27	U
1,4 Dichlorobenzene		27	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PB57121555

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: #5458 1:5

Sample wt/vol: 1 G Lab File ID: >C1105

Level: LOW Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/23/89

Column: PACK Dilution Factor: 5.4385

Number TICs found: CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI110	Method Number:	8240
Lab Sample Name:	PBS7121SS5 1:5,5458	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	5.4	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/1gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Chloromethane		54	U
Bromomethane		54	U
Vinyl Chloride		54	U
Chloroethane		54	U
Methylene Chloride	45		
Acetone	28		J
Acrylonitrile		27	U
Acrolein		27	U
Trichlorofluoromethane		27	U
Carbon Disulfide		27	U
1,1-Dichloroethene		27	U
1,1-Dichloroethane	27		J
1,2-Dichloroethene (Total)	11		J
Chloroform		27	U
1,2-Dichloroethane		27	U
2-Butanone		27	U
1,1,1-Trichloroethane	530		
Carbon Tetrachloride	73		
Vinyl Acetate		54	U
Bromodichloromethane		27	U
1,2-Dichloropropane		27	U
trans-1,3-Dichloropropene		27	U
Trichloroethene	880		
Dibromochloromethane		27	U
1,1,2-Trichloroethane		27	U
Benzene		27	U
cis-1,3-Dichloropropene		27	U
2-Chloroethylvinylether		27	U
Bromoform		27	U
4-Methyl-2-Pentanone		54	U
2-Hexanone		54	U
Tetrachloroethene	94		
1,1,2,2-Tetrachloroethane		27	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>CI110	Method Number:	8240
Lab Sample Name:	PBS7121SS5 1:5,5458	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	5.4	Date Received:	890920

Sample Info.: GC/MS C,LB,ESI-7019,10ul IS-21,SS-20/1gms P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/kg	Detection Limit	
Toluene	15		J
Chlorobenzene		27	U
Ethylbenzene		27	U
Styrene		27	U
Xylenes (Total)		27	U
m-Xylene		27	U
o + p-Xylene		27	U
1,3 Dichlorobenzene		27	U
1,2 Dichlorobenzene		27	U
1,4 Dichlorobenzene		27	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI077	Method Number:	8240
Lab Sample Name:	PBS7121SS6 #5459	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.3	Date Received:	890920

Sample Info.: GC/MS A,LB,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
Dichlorodifluoromethane		1. U
Chloromethane		1. U
Vinyl Chloride		1. U
Bromomethane		1. U
Chloroethane		1. U
Trichlorofluoromethane	3.	
1,1-Dichloroethene		1. U
Methylene Chloride	5.	
trans-1,2-Dichloroethene		1. U
1,1-Dichloroethane	12.	
cis-1,2-Dichloroethene	60.	
2,2-Dichloropropane		1. U
Chloroform		1. U
Bromochloromethane		1. U
1,1,1-Trichloroethane	442.	
1,1-Dichloropropene		1. U
Carbon Tetrachloride	93.	
1,2-Dichloroethane	3.	
Benzene	0.	J
Trichloroethene	890.	
1,2-Dichloropropane		1. U
Bromodichloromethane		1. U
Dibromomethane		1. U
Toluene	22.	
1,1,2-Trichloroethane	4.	
1,3-Dichloropropane		1. U
Tetrachloroethene	119.	
Dibromochloromethane		1. U
1,2-Dibromoethane - EDB		1. U
Chlorobenzene		1. U
Ethylbenzene	3.	
1,1,1,2-Tetrachloroethane		1. U
m + p-Xylenes	4.	

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data Fi e:	>AI077	Method Number:	8240
Lab Sample Name:	PBS7121SS6 #5459	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.3	Date Received:	890920

Sample Info.: GC/MS A,LB,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
o-Xylene	2.	
Styrene		1. U
1,1,2,2-Tetrachloroethane		1. U
Isopropylbenzene		1. U
Bromoform		1. U
1,2,3-Trichloropropane		1. U
n-Propylbenzene		1. U
Bromobenzene		1. U
1,3,5-Trimethylbenzene	5.	
4-Chlorotoluene		1. U
2-Chlorotoluene		1. U
tert-Butylbenzene		1. U
1,2,4-Trimethylbenzene	6.	
sec-Butylbenzene		1. U
p-Isopropyltoluene		1. U
1,3-Dichlorobenzene		1. U
1,4-Dichlorobenzene		1. U
n-Butylbenzene		1. U
1,2-Dichlorobenzene		1. U
1,2-Dibromo-3-Chloropropane		1. U
1,2,4-Trichlorobenzene		1. U
Hexachlorobutadiene		1. U
Naphthalene	4.	
1,2,3-Trichlorobenzene		1. U

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VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS7121SS6

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASR SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: HE#5459

Sample wt/vol: 5 G Lab File ID: >A1077

Level: LOW Date Received: 09/20/89

% Moisture: not dec._____ Date Analyzed: 9/23/89

Column: W.B. Dilution Factor: 1.2902

Number TICs found: 6

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		Unknown	28.03	15.	
2.	91576	Naphthalene, 2-methyl- (8C19	29.02	12.	
3.		Unknown	29.42	13.	
4.	544763	Hexadecane (8C19C1)	30.52	15.	
5.	581420	Naphthalene, 2,6-dimethyl- (	32.02	12.	
6.		Unknown	32.75	11.	
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HITTMAN EBASCO ASSOCIA[illegible], Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI109	Method Number:	8240
Lab Sample Name:	PBS7121SS6 #5459 1/10	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	12.9	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,.5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
Dichlorodifluoromethane		13. U
Chloromethane		13. U
Vinyl Chloride		13. U
Bromomethane		13. U
Chloroethane		13. U
Trichlorofluoromethane		13. U
1,1-Dichloroethene		13. U
Methylene Chloride	231.	
trans-1,2-Dichloroethene		13. U
1,1-Dichloroethane		13. U
cis-1,2-Dichloroethene	37.	
2,2-Dichloropropane		13. U
Chloroform		13. U
Bromochloromethane		13. U
1,1,1-Trichloroethane	496.	
1,1-Dichloropropene		13. U
Carbon Tetrachloride		13. U
1,2-Dichloroethane		13. U
Benzene		13. U
Trichloroethene	1605.	
1,2-Dichloropropane		13. U
Bromodichloromethane		13. U
Dibromomethane		13. U
Toluene	23.	
1,1,2-Trichloroethane		13. U
1,3-Dichloropropane		13. U
Tetrachloroethene	192.	
Dibromochloromethane		13. U
1,2-Dibromoethane - EDB		13. U
Chlorobenzene		13. U
Ethylbenzene		13. U
1,1,1,2-Tetrachloroethane		13. U
m + p-Xylenes		13. U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI109	Method Number:	8240
Lab Sample Name:	PBS7121SS6 #5459 1:10	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	12.9	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,.5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		13.	U
Styrene		13.	U
1,1,2,2-Tetrachloroethane		13.	U
Isopropylbenzene		13.	U
Bromoform		13.	U
1,2,3-Trichloropropane		13.	U
n-Propylbenzene		13.	U
Bromobenzene		13.	U
1,3,5-Trimethylbenzene		13.	U
4-Chlorotoluene		13.	U
2-Chlorotoluene		13.	U
tert-Butylbenzene		13.	U
1,2,4-Trimethylbenzene		13.	U
sec-Butylbenzene		13.	U
p-Isopropyltoluene		13.	U
1,3-Dichlorobenzene		13.	U
1,4-Dichlorobenzene		13.	U
n-Butylbenzene		13.	U
1,2-Dichlorobenzene		13.	U
1,2-Dibromo-3-Chloropropane		13.	U
1,2,4-Trichlorobenzene		13.	U
Hexachlorobutadiene		13.	U
Naphthalene	20.		
1,2,3-Trichlorobenzene		13.	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

FBS7121556 7/01

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: 5459 7/7D

Sample wt/vol: .5 G Lab File ID: >A1109

Level: LOW Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/25/89

Column: W.B. Dilution Factor: 166.45

Number TICs Found: 0

CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI078	Method Number:	8240
Lab Sample Name:	PBS7121SS7 #5460	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.3	Date Received:	890920

Sample Info.: GC/MS A,LB,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		1.	U
Chloromethane		1.	U
Vinyl Chloride		1.	U
Bromomethane		1.	U
Chloroethane		1.	U
Trichlorofluoromethane	13.		
1,1-Dichloroethene		1.	U
Methylene Chloride	19.		
trans-1,2-Dichloroethene		1.	U
1,1-Dichloroethane	20.		
cis-1,2-Dichloroethene	28.		
2,2-Dichloropropane		1.	U
Chloroform		1.	U
Bromochloromethane		1.	U
1,1,1-Trichloroethane	177.		
1,1-Dichloropropene		1.	U
Carbon Tetrachloride	36.		
1,2-Dichloroethane		1.	U
Benzene	0.		J
Trichloroethene	851.		
1,2-Dichloropropane		1.	U
Bromodichloromethane		1.	U
Dibromomethane		1.	U
Toluene	2.		
1,1,2-Trichloroethane	4.		
1,3-Dichloropropane		1.	U
Tetrachloroethene	88.		
Dibromochloromethane		1.	U
1,2-Dibromoethane - EDB		1.	U
Chlorobenzene		1.	U
Ethylbenzene	1.		J
1,1,1,2-Tetrachloroethane		1.	U
m + p-Xylenes	0.		J

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI078	Method Number:	8240
Lab Sample Name:	PBS7121SS7 #5460	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.3	Date Received:	890920

Sample Info.: GC/MS A,LB,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		1.	U
Styrene		1.	U
1,1,2,2-Tetrachloroethane		1.	U
Isopropylbenzene		1.	U
Bromoform		1.	U
1,2,3-Trichloropropane		1.	U
n-Propylbenzene		1.	U
Bromobenzene		1.	U
1,3,5-Trimethylbenzene		1.	U
4-Chlorotoluene		1.	U
2-Chlorotoluene		1.	U
tert-Butylbenzene		1.	U
1,2,4-Trimethylbenzene	0.		J
sec-Butylbenzene		1.	U
p-Isopropyltoluene		1.	U
1,3-Dichlorobenzene		1.	U
1,4-Dichlorobenzene		1.	U
n-Butylbenzene		1.	U
1,2-Dichlorobenzene		1.	U
1,2-Dibromo-3-Chloropropane		1.	U
1,2,4-Trichlorobenzene		1.	U
Hexachlorobutadiene		1.	U
Naphthalene	1.		
1,2,3-Trichlorobenzene		1.	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PRS7121557

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: HE#5460

Sample wt/vol: 5 G Lab File ID: >A10/8

Level: LOW Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/23/89

Column: W.B. Dilution Factor: 1.2/24

Number TICs found: 3

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		Unknown	8.85	6.	
2.		Unknown	13.89	13.	
3.	581408	Naphthalene, 2,3-dimethyl- (	32.83	12.	
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI110	Method Number:	8240
Lab Sample Name:	PBS7121SS7 #5460 1110	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	12.7	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,.5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
Dichlorodifluoromethane		13. U
Chloromethane		13. U
Vinyl Chloride		13. U
Bromomethane		13. U
Chloroethane		13. U
Trichlorofluoromethane		13. U
1,1-Dichloroethene		13. U
Methylene Chloride	249.	
trans-1,2-Dichloroethene		13. U
1,1-Dichloroethane		13. U
cis-1,2-Dichloroethene		13. U
2,2-Dichloropropane		13. U
Chloroform		13. U
Bromochloromethane		13. U
1,1,1-Trichloroethane	203.	
1,1-Dichloropropene		13. U
Carbon Tetrachloride		13. U
1,2-Dichloroethane		13. U
Benzene		13. U
Trichloroethene	1335.	
1,2-Dichloropropane		13. U
Bromodichloromethane		13. U
Dibromomethane		13. U
Toluene		13. U
1,1,2-Trichloroethane		13. U
1,3-Dichloropropane		13. U
Tetrachloroethene	157.	
Dibromochloromethane		13. U
1,2-Dibromoethane - EDB		13. U
Chlorobenzene		13. U
Ethylbenzene		13. U
1,1,1,2-Tetrachloroethane		13. U
m + p-Xylenes		13. U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI110	Method Number:	8240
Lab Sample Name:	PBS7121SS7 #5460 1110	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	12.7	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,.5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		13.	U
Styrene		13.	U
1,1,2,2-Tetrachloroethane		13.	U
Isopropylbenzene		13.	U
Bromoform		13.	U
1,2,3-Trichloropropane		13.	U
n-Propylbenzene		13.	U
Bromobenzene		13.	U
1,3,5-Trimethylbenzene		13.	U
4-Chlorotoluene		13.	U
2-Chlorotoluene		13.	U
tert-Butylbenzene		13.	U
1,2,4-Trimethylbenzene		13.	U
sec-Butylbenzene		13.	U
p-Isopropyltoluene		13.	U
1,3-Dichlorobenzene		13.	U
1,4-Dichlorobenzene		13.	U
n-Butylbenzene		13.	U
1,2-Dichlorobenzene		13.	U
1,2-Dibromo-3-Chloropropane		13.	U
1,2,4-Trichlorobenzene		13.	U
Hexachlorobutadiene		13.	U
Naphthalene		13.	U
1,2,3-Trichlorobenzene		13.	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PRS7121557 110

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: 5460 110

Sample wt/vol: .5 G Lab File ID: >A1110

Level: LOW Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/25/89

Column: W.B. Dilution Factor: 161.91

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
3.					
4.					
5.					
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI079	Method Number:	8240
Lab Sample Name:	PBS7121SS8 #5461	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.3	Date Received:	890920

Sample Info.: GC/MS A,LB,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		1.	U
Chloromethane		1.	U
Vinyl Chloride		1.	U
Bromomethane		1.	U
Chloroethane	10.		
Trichlorofluoromethane	28.		
1,1-Dichloroethene	19.		
Methylene Chloride	28.		
trans-1,2-Dichloroethene	2.		
1,1-Dichloroethane	197.		
cis-1,2-Dichloroethene	32.		
2,2-Dichloropropane		1.	U
Chloroform	1.		J
Bromochloromethane		1.	U
1,1,1-Trichloroethane	2246.		
1,1-Dichloropropene		1.	U
Carbon Tetrachloride	431.		
1,2-Dichloroethane	4.		
Benzene	1.		J
Trichloroethene	1658.		
1,2-Dichloropropane		1.	U
Bromodichloromethane		1.	U
Dibromomethane		1.	U
Toluene	82.		
1,1,2-Trichloroethane	15.		
1,3-Dichloropropane		1.	U
Tetrachloroethene	517.		
Dibromochloromethane		1.	U
1,2-Dibromoethane - EDB		1.	U
Chlorobenzene		1.	U
Ethylbenzene	6.		
1,1,1,2-Tetrachloroethane		1.	U
m + p-Xylenes	10.		

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI079	Method Number:	8240
Lab Sample Name:	PBS7121SS8 #5461	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.3	Date Received:	890920

Sample Info.: GC/MS A,LB,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
o-Xylene	6.	
Styrene		1. U
1,1,2,2-Tetrachloroethane		1. U
Isopropylbenzene	2.	
Bromoform		1. U
1,2,3-Trichloropropane		1. U
n-Propylbenzene	3.	
Bromobenzene		1. U
1,3,5-Trimethylbenzene	22.	
4-Chlorotoluene		1. U
2-Chlorotoluene		1. U
tert-Butylbenzene	2.	
1,2,4-Trimethylbenzene	15.	
sec-Butylbenzene		1. U
p-Isopropyltoluene		1. U
1,3-Dichlorobenzene		1. U
1,4-Dichlorobenzene		1. U
n-Butylbenzene		1. U
1,2-Dichlorobenzene		1. U
1,2-Dibromo-3-Chloropropane		1. U
1,2,4-Trichlorobenzene		1. U
Hexachlorobutadiene		1. U
Naphthalene	5.	
1,2,3-Trichlorobenzene		1. U

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VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS7121SS8

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: HE#5461

Sample wt/vol: 5 G Lab File ID: >A1079

Level: LOW Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/23/89

Column: W.B. Dilution Factor: 1.2905

Number TICs found: 19

CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		Unknown	13.81	10.	
2.		Unknown	17.28	11.	
3.		Unknown	21.38	15.	
4.	1758889	Benzene, 2-ethyl-1,4-dimethyl	23.13	10.	
5.	95932	Benzene, 1,2,4,5-tetramethyl	23.87	8.	
6.	874419	Benzene, 1-ethyl-2,4-dimethyl	24.05	30.	
7.	527537	Benzene, 1,2,3,5-tetramethyl	24.93	10.	
8.		Unknown	25.99	11.	
9.		Unknown	26.86	13.	
10.		Unknown	27.45	12.	
11.		Unknown	27.71	11.	
12.		Unknown	28.03	20.	
13.	90120	Naphthalene, 1-methyl- (8C19	28.99	16.	
14.		Unknown	29.39	28.	
15.		Unknown	29.72	10.	
16.		Unknown	30.52	14.	
17.		Unknown	31.18	23.	
18.	581420	Naphthalene, 2,6-dimethyl- (	31.98	30.	
19.	571619	Naphthalene, 1,5-dimethyl- (	32.75	20.	
20.					
21.					
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28.					
29.					
30.					

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VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS7121SS8

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: HE#5461

Sample wt/vol: 5 G Lab File ID: >A1079

Level: LOW Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/23/89

Column: W.B. Dilution Factor: 1.2905

Number TICs found: 19

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		Unknown	13.81	10.	
2.		Unknown	17.28	11.	
3.		Unknown	21.38	15.	
4.	1758889	Benzene, 2-ethyl-1,4-dimethyl	23.13	10.	
5.	95932	Benzene, 1,2,4,5-tetramethyl	23.87	8.	
6.	874419	Benzene, 1-ethyl-2,4-dimethyl	24.05	30.	
7.	527537	Benzene, 1,2,3,5-tetramethyl	24.93	10.	
8.		Unknown	25.99	11.	
9.		Unknown	26.86	13.	
10.		Unknown	27.45	12.	
11.		Unknown	27.71	11.	
12.		Unknown	28.03	20.	
13.	90120	Naphthalene, 1-methyl- (8C19	28.99	16.	
14.		Unknown	29.39	28.	
15.		Unknown	29.72	10.	
16.		Unknown	30.52	14.	
17.		Unknown	31.18	23.	
18.	581420	Naphthalene, 2,6-dimethyl- (	31.98	30.	
19.	571619	Naphthalene, 1,5-dimethyl- (	32.75	20.	
20.					
21.					
22.					
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI104	Method Number:	8240
Lab Sample Name:	PBS7121SS8 #5461 1:25	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	32.3	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,ML,500ul,5uL IS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
Dichlorodifluoromethane		32. U
Chloromethane		32. U
Vinyl Chloride		32. U
Bromomethane		32. U
Chloroethane		32. U
Trichlorofluoromethane		32. U
1,1-Dichloroethene		32. U
Methylene Chloride	38.	
trans-1,2-Dichloroethene		32. U
1,1-Dichloroethane	97.	
cis-1,2-Dichloroethene		32. U
2,2-Dichloropropane		32. U
Chloroform		32. U
Bromochloromethane		32. U
1,1,1-Trichloroethane	2536.	
1,1-Dichloropropene		32. U
Carbon Tetrachloride		32. U
1,2-Dichloroethane		32. U
Benzene		32. U
Trichloroethene	3674.	
1,2-Dichloropropane		32. U
Bromodichloromethane		32. U
Dibromomethane		32. U
Toluene	79.	
1,1,2-Trichloroethane		32. U
1,3-Dichloropropane		32. U
Tetrachloroethene	961.	
Dibromochloromethane		32. U
1,2-Dibromoethane - EDB		32. U
Chlorobenzene		32. U
Ethylbenzene		32. U
1,1,1,2-Tetrachloroethane		32. U
m + p-Xylenes		32. U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI104	Method Number:	8240
Lab Sample Name:	PBS7121SS8 #5461 1:25	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	32.3	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,ML,500ul,5uL IS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		32.	U
Styrene		32.	U
1,1,2,2-Tetrachloroethane		32.	U
Isopropylbenzene		32.	U
Bromoform		32.	U
1,2,3-Trichloropropane		32.	U
n-Propylbenzene		32.	U
Bromobenzene		32.	U
1,3,5-Trimethylbenzene		32.	U
4-Chlorotoluene		32.	U
2-Chlorotoluene		32.	U
tert-Butylbenzene		32.	U
1,2,4-Trimethylbenzene		32.	U
sec-Butylbenzene		32.	U
p-Isopropyltoluene		32.	U
1,3-Dichlorobenzene		32.	U
1,4-Dichlorobenzene		32.	U
n-Butylbenzene		32.	U
1,2-Dichlorobenzene		32.	U
1,2-Dibromo-3-Chloropropane		32.	U
1,2,4-Trichlorobenzene		32.	U
Hexachlorobutadiene		32.	U
Naphthalene	88.		
1,2,3-Trichlorobenzene	55.		

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PRS/121558

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: #5461 1:25

Sample wt/vol: .2 G Lab File ID: >A1104

Level: MED Date Received: 09/20/89

% Moisture: not dec._____ Date Analyzed: 9/25/89

Column: W.B. Dilution Factor: 1.0000

Number TICs found: 20

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI067	Method Number:	8240
Lab Sample Name:	PBS7131SS3 #5465	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.2	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		1.	U
Chloromethane		1.	U
Vinyl Chloride		1.	U
Bromomethane		1.	U
Chloroethane		1.	U
Trichlorofluoromethane		1.	U
1,1-Dichloroethene		1.	U
Methylene Chloride	7.		
trans-1,2-Dichloroethene		1.	U
1,1-Dichloroethane		1.	U
cis-1,2-Dichloroethene		1.	U
2,2-Dichloropropane		1.	U
Chloroform		1.	U
Bromochloromethane		1.	U
1,1,1-Trichloroethane	6.		
1,1-Dichloropropene		1.	U
Carbon Tetrachloride		1.	U
1,2-Dichloroethane		1.	U
Benzene		1.	U
Trichloroethene	417.		
1,2-Dichloropropane		1.	U
Bromodichloromethane		1.	U
Dibromomethane		1.	U
Toluene	1.		J
1,1,2-Trichloroethane		1.	U
1,3-Dichloropropane		1.	U
Tetrachloroethene		1.	U
Dibromochloromethane		1.	U
1,2-Dibromoethane - EDB		1.	U
Chlorobenzene		1.	U
Ethylbenzene		1.	U
1,1,1,2-Tetrachloroethane		1.	U
m + p-Xylenes		1.	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI067	Method Number:	8240
Lab Sample Name:	PBS7131SS3 #5465	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.2	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		1.	U
Styrene		1.	U
1,1,2,2-Tetrachloroethane		1.	U
Isopropylbenzene		1.	U
Bromoform		1.	U
1,2,3-Trichloropropane		1.	U
n-Propylbenzene		1.	U
Bromobenzene		1.	U
1,3,5-Trimethylbenzene		1.	U
4-Chlorotoluene		1.	U
2-Chlorotoluene		1.	U
tert-Butylbenzene		1.	U
1,2,4-Trimethylbenzene		1.	U
sec-Butylbenzene		1.	U
p-Isopropyltoluene		1.	U
1,3-Dichlorobenzene		1.	U
1,4-Dichlorobenzene		1.	U
n-Butylbenzene		1.	U
1,2-Dichlorobenzene		1.	U
1,2-Dibromo-3-Chloropropane		1.	U
1,2,4-Trichlorobenzene		1.	U
Hexachlorobutadiene		1.	U
Naphthalene	1.		J
1,2,3-Trichlorobenzene		1.	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS7131SS3

ab Name: Hittman Ebasco Contract: ESI 7019

ab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

atrix: SOIL Lab Sample ID: HE#5465

ample wt/vol: 5 G Lab File ID: >A1067

evel: LOW Date Received: 09/20/89

Moisture: not dec.____ Date Analyzed: 9/22/89

olumn: W.B. Dilution Factor: 1.1858

Number TICs found: 6 CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		Unknown	13.70	11.	
2.		Unknown	28.03	9.	
		Unknown	28.98	7.	
		Unknown	29.42	7.	
5.		Unknown	30.51	10.	
6.		Unknown	32.78	8.	
7.					
8.					
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI095	Method Number:	8240
Lab Sample Name:	PBS7131SS3 #5465 115	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	5.9	Date Received:	890920

Sample Info.: GC/MS A,RC,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
Dichlorodifluoromethane		6. U
Chloromethane		6. U
Vinyl Chloride		6. U
Bromomethane		6. U
Chloroethane		6. U
Trichlorofluoromethane		6. U
1,1-Dichloroethene		6. U
Methylene Chloride		6. U
trans-1,2-Dichloroethene		6. U
1,1-Dichloroethane		6. U
cis-1,2-Dichloroethene		6. U
2,2-Dichloropropane		6. U
Chloroform		6. U
Bromochloromethane		6. U
1,1,1-Trichloroethane		6. U
1,1-Dichloropropene		6. U
Carbon Tetrachloride		6. U
1,2-Dichloroethane		6. U
Benzene		6. U
Trichloroethene	606.	
1,2-Dichloropropane		6. U
Bromodichloromethane		6. U
Dibromomethane		6. U
Toluene		6. U
1,1,2-Trichloroethane		6. U
1,3-Dichloropropane		6. U
Tetrachloroethene		6. U
Dibromochloromethane		6. U
1,2-Dibromoethane - EDB		6. U
Chlorobenzene		6. U
Ethylbenzene		6. U
1,1,1,2-Tetrachloroethane		6. U
m + p-Xylenes		6. U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI095	Method Number:	8240
Lab Sample Name:	PBS7131SS3 #5465 1:5	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	5.9	Date Received:	890920

Sample Info.: GC/MS A,RC,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
o-Xylene		6. U
Styrene		6. U
1,1,2,2-Tetrachloroethane		6. U
Isopropylbenzene		6. U
Bromoform		6. U
1,2,3-Trichloropropane		6. U
n-Propylbenzene		6. U
Bromobenzene		6. U
1,3,5-Trimethylbenzene		6. U
4-Chlorotoluene		6. U
2-Chlorotoluene		6. U
tert-Butylbenzene		6. U
1,2,4-Trimethylbenzene		6. U
sec-Butylbenzene		6. U
p-Isopropyltoluene		6. U
1,3-Dichlorobenzene		6. U
1,4-Dichlorobenzene		6. U
n-Butylbenzene		6. U
1,2-Dichlorobenzene		6. U
1,2-Dibromo-3-Chloropropane		6. U
1,2,4-Trichlorobenzene		6. U
Hexachlorobutadiene		6. U
Naphthalene		6. U
1,2,3-Trichlorobenzene		6. U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PRS7131553 MS

ab Name: Hittman Ebasco Contract: ESI 7019

ab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

atrix: SOIL Lab Sample ID: 5465 MS

ample wt/vol: 1 G Lab File ID: >A1055

evel: LOW Date Received: 09/20/89

Moisture: not dec.____ Date Analyzed: 9/24/89

olumn: PACK Dilution Factor: 7.0300

Number TICs Found: 0 CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI068	Method Number:	8240
Lab Sample Name:	PBS7131SS4 #5466	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.2	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
Dichlorodifluoromethane		1. U
Chloromethane		1. U
Vinyl Chloride		1. U
Bromomethane		1. U
Chloroethane		1. U
Trichlorofluoromethane		1. U
1,1-Dichloroethene		1. U
Methylene Chloride	6.	
trans-1,2-Dichloroethene		1. U
1,1-Dichloroethane		1. U
cis-1,2-Dichloroethene		1. U
2,2-Dichloropropane		1. U
Chloroform		1. U
Bromochloromethane		1. U
1,1,1-Trichloroethane	6.	
1,1-Dichloropropene		1. U
Carbon Tetrachloride		1. U
1,2-Dichloroethane		1. U
Benzene		1. U
Trichloroethene	464.	
1,2-Dichloropropane		1. U
Bromodichloromethane		1. U
Dibromomethane		1. U
Toluene	1.	
1,1,2-Trichloroethane		1. U
1,3-Dichloropropane		1. U
Tetrachloroethene	9.	
Dibromochloromethane		1. U
1,2-Dibromoethane - EDB		1. U
Chlorobenzene		1. U
Ethylbenzene		1. U
1,1,1,2-Tetrachloroethane		1. U
m + p-Xylenes		1. U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI068	Method Number:	8240
Lab Sample Name:	PBS7131SS4 #5466	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.2	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		1.	U
Styrene		1.	U
1,1,2,2-Tetrachloroethane		1.	U
Isopropylbenzene		1.	U
Bromoform		1.	U
1,2,3-Trichloropropane		1.	U
n-Propylbenzene		1.	U
Bromobenzene		1.	U
1,3,5-Trimethylbenzene		1.	U
4-Chlorotoluene		1.	U
2-Chlorotoluene		1.	U
tert-Butylbenzene		1.	U
1,2,4-Trimethylbenzene	1.		J
sec-Butylbenzene		1.	U
p-Isopropyltoluene		1.	U
1,3-Dichlorobenzene		1.	U
1,4-Dichlorobenzene		1.	U
n-Butylbenzene		1.	U
1,2-Dichlorobenzene		1.	U
1,2-Dibromo-3-Chloropropane		1.	U
1,2,4-Trichlorobenzene		1.	U
Hexachlorobutadiene		1.	U
Naphthalene	1.		J
1,2,3-Trichlorobenzene		1.	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS7131SS4

ab Name: Hittman Ebasco Contract: ESI 7019

ab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

atrix: SOIL Lab Sample ID: HE#5466

ample wt/vol: 5 G Lab File ID: >A1U68

evel: LOW Date Received: 09/20/89

Moisture: not dec.____ Date Analyzed: 9/22/89

olumn: W.B. Dilution Factor: 1.1972

Number TICs found: 5 CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Unknown	13.73	7.	
	Unknown	24.04	8.	
	Unknown	25.98	11.	
4.	Unknown	28.02	13.	
5.	Unknown	29.38	9.	
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HITTMAN EDASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI096	Method Number:	8240
Lab Sample Name:	PBS7131SS4 #5466 115	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	6.0	Date Received:	890920

Sample Info.: GC/MS A,RC,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
Dichlorodifluoromethane		6. U
Chloromethane		6. U
Vinyl Chloride		6. U
Bromomethane		6. U
Chloroethane		6. U
Trichlorofluoromethane		6. U
1,1-Dichloroethene		6. U
Methylene Chloride		6. U
trans-1,2-Dichloroethene		6. U
1,1-Dichloroethane		6. U
cis-1,2-Dichloroethene		6. U
2,2-Dichloropropane		6. U
Chloroform		6. U
Bromochloromethane		6. U
1,1,1-Trichloroethane	23.	
1,1-Dichloropropene		6. U
Carbon Tetrachloride	2.	J
1,2-Dichloroethane		6. U
Benzene		6. U
Trichloroethene	419.	
1,2-Dichloropropane		6. U
Bromodichloromethane		6. U
Dibromomethane		6. U
Toluene		6. U
1,1,2-Trichloroethane		6. U
1,3-Dichloropropane		6. U
Tetrachloroethene	17.	
Dibromochloromethane		6. U
1,2-Dibromoethane - EDB		6. U
Chlorobenzene		6. U
Ethylbenzene		6. U
1,1,1,2-Tetrachloroethane		6. U
m + p-Xylenes		6. U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI096	Method Number:	8240
Lab Sample Name:	PBS7131SS4 #5466 1:5	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	6.0	Date Received:	890920

Sample Info.: GC/MS A,RC,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
o-Xylene		6. U
Styrene		6. U
1,1,2,2-Tetrachloroethane		6. U
Isopropylbenzene		6. U
Bromoform		6. U
1,2,3-Trichloropropane		6. U
n-Propylbenzene		6. U
Bromobenzene		6. U
1,3,5-Trimethylbenzene		6. U
4-Chlorotoluene		6. U
2-Chlorotoluene		6. U
tert-Butylbenzene		6. U
1,2,4-Trimethylbenzene		6. U
sec-Butylbenzene		6. U
p-Isopropyltoluene		6. U
1,3-Dichlorobenzene		6. U
1,4-Dichlorobenzene		6. U
n-Butylbenzene		6. U
1,2-Dichlorobenzene		6. U
1,2-Dibromo-3-Chloropropane		6. U
1,2,4-Trichlorobenzene		6. U
Hexachlorobutadiene		6. U
Naphthalene		6. U
1,2,3-Trichlorobenzene		6. U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS7131554 115

ab Name: Hittman Ebasco Contract: ESI 7019

ab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

atrix: SOIL Lab Sample ID: 5466 115

mple wt/vol: 1 G Lab File ID: >A1096

evel: LOW Date Received: 09/20/89

Moisture: not dec.____ Date Analyzed: 9/24/89

olumn: W.B Dilution Factor: 7.1400

CONCENTRATION UNITS:

umber TICs found: 0 (ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI076	Method Number:	8240
Lab Sample Name:	PBS7131SS5 #5467	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.2	Date Received:	890920

Sample Info.: GC/MS A,LB,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		1.	U
Chloromethane		1.	U
Vinyl Chloride		1.	U
Bromomethane		1.	U
Chloroethane		1.	U
Trichlorofluoromethane	17.		
1,1-Dichloroethene		1.	U
Methylene Chloride	16.		
trans-1,2-Dichloroethene		1.	U
1,1-Dichloroethane	40.		
cis-1,2-Dichloroethene		1.	U
2,2-Dichloropropane		1.	U
Chloroform		1.	U
Bromochloromethane		1.	U
1,1,1-Trichloroethane		1.	U
1,1-Dichloropropene		1.	U
Carbon Tetrachloride		1.	U
1,2-Dichloroethane	370.		
Benzene	0.		J
Trichloroethene		1.	U
1,2-Dichloropropane		1.	U
Bromodichloromethane		1.	U
Dibromomethane		1.	U
Toluene		1.	U
1,1,2-Trichloroethane		1.	U
1,3-Dichloropropane		1.	U
Tetrachloroethene		1.	U
Dibromochloromethane		1.	U
1,2-Dibromoethane - EDB		1.	U
Chlorobenzene		1.	U
Ethylbenzene	2.		
1,1,1,2-Tetrachloroethane		1.	U
m + p-Xylenes	2.		

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI076	Method Number:	8240
Lab Sample Name:	PBS7131SS5 #5467	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.2	Date Received:	890920

Sample Info.: GC/MS A,LB,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
o-Xylene		1. U
Styrene		1. U
1,1,2,2-Tetrachloroethane		1. U
Isopropylbenzene		1. U
Bromoform		1. U
1,2,3-Trichloropropane		1. U
n-Propylbenzene		1. U
Bromobenzene		1. U
1,3,5-Trimethylbenzene	366.	
4-Chlorotoluene		1. U
2-Chlorotoluene		1. U
tert-Butylbenzene		1. U
1,2,4-Trimethylbenzene	349.	
sec-Butylbenzene		1. U
p-Isopropyltoluene		1. U
1,3-Dichlorobenzene		1. U
1,4-Dichlorobenzene		1. U
n-Butylbenzene		1. U
1,2-Dichlorobenzene		1. U
1,2-Dibromo-3-Chloropropane		1. U
1,2,4-Trichlorobenzene		1. U
Hexachlorobutadiene		1. U
Naphthalene	159.	
1,2,3-Trichlorobenzene		1. U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
PRS7131SS5

o Name: Hittman Ebasco Contract: ESI 7019

o Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

trix: SOIL Lab Sample ID: HE#5467

mple wt/vol: 5 G Lab File ID: >A1076

vel: LOW Date Received: 09/20/89

Moisture: not dec.____ Date Analyzed: 9/23/89

lumn: W.B. Dilution Factor: 1.1550

lumber TICs found: 20 CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI069	Method Number:	8240
Lab Sample Name:	PBS7131SS5 #5467	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.2	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		1.	U
Chloromethane		1.	U
Vinyl Chloride		1.	U
Bromomethane		1.	U
Chloroethane		1.	U
Trichlorofluoromethane		1.	U
1,1-Dichloroethene		1.	U
Methylene Chloride	2.		
trans-1,2-Dichloroethene		1.	U
1,1-Dichloroethane		1.	U
cis-1,2-Dichloroethene		1.	U
2,2-Dichloropropane		1.	U
Chloroform		1.	U
Bromochloromethane		1.	U
1,1,1-Trichloroethane	10.		
1,1-Dichloropropene		1.	U
Carbon Tetrachloride	1.		J
1,2-Dichloroethane		1.	U
Benzene	0.		J
Trichloroethene	172.		
1,2-Dichloropropane		1.	U
Bromodichloromethane		1.	U
Dibromomethane		1.	U
Toluene		1.	U
1,1,2-Trichloroethane		1.	U
1,3-Dichloropropane		1.	U
Tetrachloroethene		1.	U
Dibromochloromethane		1.	U
1,2-Dibromoethane - EDB		1.	U
Chlorobenzene		1.	U
Ethylbenzene		1.	U
1,1,1,2-Tetrachloroethane		1.	U
m + p-Xylenes		1.	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI069	Method Number:	8240
Lab Sample Name:	PBS7131SS5 #5467	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.2	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		1.	U
Styrene		1.	U
1,1,2,2-Tetrachloroethane		1.	U
Isopropylbenzene		1.	U
Bromoform		1.	U
1,2,3-Trichloropropane		1.	U
n-Propylbenzene		1.	U
Bromobenzene		1.	U
1,3,5-Trimethylbenzene		1.	U
4-Chlorotoluene		1.	U
2-Chlorotoluene		1.	U
tert-Butylbenzene		1.	U
1,2,4-Trimethylbenzene		1.	U
sec-Butylbenzene		1.	U
p-Isopropyltoluene		1.	U
1,3-Dichlorobenzene		1.	U
1,4-Dichlorobenzene		1.	U
n-Butylbenzene		1.	U
1,2-Dichlorobenzene		1.	U
1,2-Dibromo-3-Chloropropane		1.	U
1,2,4-Trichlorobenzene		1.	U
Hexachlorobutadiene		1.	U
Naphthalene	0.		J
1,2,3-Trichlorobenzene		1.	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PRS/131555

b Name: Hittman Ebasco Contract: ESI 7019

b Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

trix: SOIL Lab Sample ID: HE#5467

mple wt/vol: 5 G Lab File ID: >A1069

vel: LOW Date Received: 09/20/89

Moisture: not dec.____ Date Analyzed: 9/22/89

olumn: W.B. Dilution Factor: 1.1550

Number TICs found: 8 CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		Unknown	8.87	7.	
		Unknown	13.51	8.	
		Unknown	27.47	9.	
4.		Unknown	29.12	22.	
5.		Unknown	29.37	48.	
6.		Unknown	31.97	45.	
7.		Unknown	32.41	12.	
8.		Unknown	33.50	9.	
9.					
10.					
11.					
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI111	Method Number:	8240
Lab Sample Name:	PBS7131SS5 #5467 1:5	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	5.8	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,1g,5uL IS,5S/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
Dichlorodifluoromethane		6. U
Chloromethane		6. U
Vinyl Chloride		6. U
Bromomethane		6. U
Chloroethane		6. U
Trichlorofluoromethane		6. U
1,1-Dichloroethene		6. U
Methylene Chloride	70.	
trans-1,2-Dichloroethene		6. U
1,1-Dichloroethane		6. U
cis-1,2-Dichloroethene		6. U
2,2-Dichloropropane		6. U
Chloroform		6. U
Bromochloromethane		6. U
1,1,1-Trichloroethane		6. U
1,1-Dichloropropene		6. U
Carbon Tetrachloride		6. U
1,2-Dichloroethane		6. U
Benzene		6. U
Trichloroethene	728.	
1,2-Dichloropropane		6. U
Bromodichloromethane		6. U
Dibromomethane		6. U
Toluene		6. U
1,1,2-Trichloroethane		6. U
1,3-Dichloropropane		6. U
Tetrachloroethene		6. U
Dibromochloromethane		6. U
1,2-Dibromoethane - EDB		6. U
Chlorobenzene		6. U
Ethylbenzene		6. U
1,1,1,2-Tetrachloroethane		6. U
m + p-Xylenes		6. U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI111	Method Number:	8240
Lab Sample Name:	PBS7131SS5 #5467 115	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	5.8	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,1g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		6.	U
Styrene		6.	U
1,1,2,2-Tetrachloroethane		6.	U
Isopropylbenzene		6.	U
Bromoform		6.	U
1,2,3-Trichloropropane		6.	U
n-Propylbenzene		6.	U
Bromobenzene		6.	U
1,3,5-Trimethylbenzene		6.	U
4-Chlorotoluene		6.	U
2-Chlorotoluene		6.	U
tert-Butylbenzene		6.	U
1,2,4-Trimethylbenzene		6.	U
sec-Butylbenzene		6.	U
p-Isopropyltoluene		6.	U
1,3-Dichlorobenzene		6.	U
1,4-Dichlorobenzene		6.	U
n-Butylbenzene		6.	U
1,2-Dichlorobenzene		6.	U
1,2-Dibromo-3-Chloropropane		6.	U
1,2,4-Trichlorobenzene		6.	U
Hexachlorobutadiene		6.	U
Naphthalene		6.	U
1,2,3-Trichlorobenzene		6.	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS7131555 /:5T

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: 5467 /:5

Sample wt/vol: 1 G Lab File ID: >A1111

Level: LOW Date Received: 09/20/89

Moisture: not dec.____ Date Analyzed: 9/25/89

Column: W.B. Dilution Factor: 33.35

Number TICs found: 0 CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
5.					
6.					
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI105	Method Number:	8240
Lab Sample Name:	PBS7121SS8 #5461MS 1:25	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	32.3	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,ML,500ul,5uL IS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
Dichlorodifluoromethane		32. U
Chloromethane		32. U
Vinyl Chloride		32. U
Bromomethane		32. U
Chloroethane		32. U
Trichlorofluoromethane		32. U
1,1-Dichloroethene		
Methylene Chloride	141.	
trans-1,2-Dichloroethene		32. U
1,1-Dichloroethane	254.	
cis-1,2-Dichloroethene		32. U
2,2-Dichloropropane		32. U
Chloroform		32. U
Bromochloromethane		32. U
1,1,1-Trichloroethane	6043.	
1,1-Dichloropropene		32. U
Carbon Tetrachloride		32. U
1,2-Dichloroethane		32. U
Benzene		
Trichloroethene		
1,2-Dichloropropane		32. U
Bromodichloromethane		32. U
Dibromomethane		32. U
Toluene		
1,1,2-Trichloroethane		32. U
1,3-Dichloropropane		32. U
Tetrachloroethene	3048.	
Dibromochloromethane		32. U
1,2-Dibromoethane - EDB		32. U
Chlorobenzene		
Ethylbenzene	86.	
1,1,1,2-Tetrachloroethane		32. U
m + p-Xylenes	55.	

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI105	Method Number:	8240
Lab Sample Name:	PBS7121SS8 #5461MS 1:25	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	32.3	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,ML,500ul,5uL IS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		32.	U
Styrene		32.	U
1,1,2,2-Tetrachloroethane		32.	U
Isopropylbenzene		32.	U
Bromoform		32.	U
1,2,3-Trichloropropane		32.	U
n-Propylbenzene		32.	U
Bromobenzene		32.	U
1,3,5-Trimethylbenzene		32.	U
4-Chlorotoluene		32.	U
2-Chlorotoluene		32.	U
tert-Butylbenzene		32.	U
1,2,4-Trimethylbenzene		32.	U
sec-Butylbenzene		32.	U
p-Isopropyltoluene		32.	U
1,3-Dichlorobenzene		32.	U
1,4-Dichlorobenzene		32.	U
n-Butylbenzene		32.	U
1,2-Dichlorobenzene		32.	U
1,2-Dibromo-3-Chloropropane		32.	U
1,2,4-Trichlorobenzene		32.	U
Hexachlorobutadiene		32.	U
Naphthalene		32.	U
1,2,3-Trichlorobenzene		32.	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI106	Method Number:	8240
Lab Sample Name:	PBS7121SS8 #5461MSD 1/25	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	32.3	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,ML,500ul,5uL IS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
Dichlorodifluoromethane		32. U
Chloromethane		32. U
Vinyl Chloride		32. U
Bromomethane		32. U
Chloroethane		32. U
Trichlorofluoromethane		32. U
1,1-Dichloroethene		
Methylene Chloride	116.	
trans-1,2-Dichloroethene		32. U
1,1-Dichloroethane	135.	
cis-1,2-Dichloroethene		32. U
2,2-Dichloropropane		32. U
Chloroform		32. U
Bromochloromethane		32. U
1,1,1-Trichloroethane	3192.	
1,1-Dichloropropene		32. U
Carbon Tetrachloride		32. U
1,2-Dichloroethane		32. U
Benzene		
Trichloroethene		
1,2-Dichloropropane		32. U
Bromodichloromethane		32. U
Dibromomethane		32. U
Toluene		
1,1,2-Trichloroethane		32. U
1,3-Dichloropropane		32. U
Tetrachloroethene	1504.	
Dibromochloromethane		32. U
1,2-Dibromoethane - EDB		32. U
Chlorobenzene		
Ethylbenzene		32. U
1,1,1,2-Tetrachloroethane		32. U
m + p-Xylenes		32. U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI10C	Method Number:	8240
Lab Sample Name:	PBS7121SS8 #5461MSD 1.25	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	32.3	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,ML,500ul,5uL IS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		32.	U
Styrene		32.	U
1,1,2,2-Tetrachloroethane		32.	U
Isopropylbenzene		32.	U
Bromoform		32.	U
1,2,3-Trichloropropane		32.	U
n-Propylbenzene		32.	U
Bromobenzene		32.	U
1,3,5-Trimethylbenzene		32.	U
4-Chlorotoluene		32.	U
2-Chlorotoluene		32.	U
tert-Butylbenzene		32.	U
1,2,4-Trimethylbenzene		32.	U
sec-Butylbenzene		32.	U
p-Isopropyltoluene		32.	U
1,3-Dichlorobenzene		32.	U
1,4-Dichlorobenzene		32.	U
n-Butylbenzene		32.	U
1,2-Dichlorobenzene		32.	U
1,2-Dibromo-3-Chloropropane		32.	U
1,2,4-Trichlorobenzene		32.	U
Hexachlorobutadiene		32.	U
Naphthalene		32.	U
1,2,3-Trichlorobenzene		32.	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI080	Method Number:	8240
Lab Sample Name:	PBS7121SS9 #5462	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.3	Date Received:	890920

Sample Info.: GC/MS A,LB,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		1.	U
Chloromethane		1.	U
Vinyl Chloride		1.	U
Bromomethane		1.	U
Chloroethane		1.	U
Trichlorofluoromethane	13.		
1,1-Dichloroethene	44.		
Methylene Chloride	3.		
trans-1,2-Dichloroethene	1.		J
1,1-Dichloroethane	754.		
cis-1,2-Dichloroethene	188.		
2,2-Dichloropropane		1.	U
Chloroform	1.		J
Bromochloromethane		1.	U
1,1,1-Trichloroethane	3442.		
1,1-Dichloropropene		1.	U
Carbon Tetrachloride	1.		J
1,2-Dichloroethane	96.		
Benzene	2.		
Trichloroethene	723.		
1,2-Dichloropropane		1.	U
Bromodichloromethane	1.		J
Dibromomethane		1.	U
Toluene	628.		
1,1,2-Trichloroethane	212.		
1,3-Dichloropropane		1.	U
Tetrachloroethene	1107.		
Dibromochloromethane		1.	U
1,2-Dibromoethane - EDB		1.	U
Chlorobenzene		1.	U
Ethylbenzene	216.		
1,1,1,2-Tetrachloroethane		1.	U
m + p-Xylenes	258.		

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI080	Method Number:	8240
Lab Sample Name:	PBS7121SS9 #5462	Date Analyzed:	890923
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.3	Date Received:	890920

Sample Info.: GC/MS A,LB,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene	101.		
Styrene		1.	U
1,1,2,2-Tetrachloroethane	4.		
Isopropylbenzene	10.		
Bromoform		1.	U
1,2,3-Trichloropropane		1.	U
n-Propylbenzene	31.		
Bromobenzene		1.	U
1,3,5-Trimethylbenzene	297.		
4-Chlorotoluene		1.	U
2-Chlorotoluene		1.	U
tert-Butylbenzene	40.		
1,2,4-Trimethylbenzene	319.		
sec-Butylbenzene	8.		
p-Isopropyltoluene	22.		
1,3-Dichlorobenzene		1.	U
1,4-Dichlorobenzene	1.		J
n-Butylbenzene		1.	U
1,2-Dichlorobenzene	0.		J
1,2-Dibromo-3-Chloropropane		1.	U
1,2,4-Trichlorobenzene	1.		
Hexachlorobutadiene		1.	U
Naphthalene	201.		
1,2,3-Trichlorobenzene	2.		

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PRS7121559

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: HE#5462

Sample wt/vol: 5 G Lab File ID: >A1080

Level: LOW Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/23/89

Column: W.B. Dilution Factor: 1.2994

Number TICs Found: 20

CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		Unknown	5.30	110.	
2.		Unknown	7.27	85.	
3.		Unknown	10.09	340.	
4.		Unknown	13.01	1300.	
5.		Unknown	14.07	150.	
6.	565617	2-Pentanone, 3-methyl- (8C19	14.55	210.	
7.	535773	Benzene, 1-methyl-3-(1-methyl	23.15	23.	
8.		Unknown	23.44	46.	
9.	527537	Benzene, 1,2,3,5-tetramethyl	23.88	29.	
10.	874419	Benzene, 1-ethyl-2,4-dimethyl	24.07	100.	
11.		Unknown	24.29	38.	
12.	95932	Benzene, 1,2,4,5-tetramethyl	24.91	31.	
13.		Unknown	25.13	20.	
14.		Unknown	25.61	27.	
15.		Unknown	28.03	48.	
16.	90120	Naphthalene, 1-methyl- (8C19	28.98	68.	
17.	91576	Naphthalene, 2-methyl- (8C19	29.67	37.	
18.		Unknown	30.52	46.	
19.	571619	Naphthalene, 1,5-dimethyl- (	32.02	31.	
20.	569415	Naphthalene, 1,8-dimethyl- (	32.75	24.	
21.					
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI107	Method Number:	8240
Lab Sample Name:	PBS7121SS9 #5462 1162	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	81.2	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,ML,200ul,5uL IS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
Dichlorodifluoromethane		81. U
Chloromethane		81. U
Vinyl Chloride		81. U
Bromomethane		81. U
Chloroethane		81. U
Trichlorofluoromethane		81. U
1,1-Dichloroethene		81. U
Methylene Chloride	141.	
trans-1,2-Dichloroethene		81. U
1,1-Dichloroethane	1214.	
cis-1,2-Dichloroethene	152.	
2,2-Dichloropropane		81. U
Chloroform		81. U
Bromochloromethane		81. U
1,1,1-Trichloroethane	7770.	
1,1-Dichloropropene		81. U
Carbon Tetrachloride		81. U
1,2-Dichloroethane		81. U
Benzene		81. U
Trichloroethene	21142.	
1,2-Dichloropropane		81. U
Bromodichloromethane		81. U
Dibromomethane		81. U
Toluene	1101.	
1,1,2-Trichloroethane		81. U
1,3-Dichloropropane		81. U
Tetrachloroethene	10048.	
Dibromochloromethane		81. U
1,2-Dibromoethane - EDB		81. U
Chlorobenzene		81. U
Ethylbenzene	411.	
1,1,1,2-Tetrachloroethane		81. U
m + p-Xylenes	395.	

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI107	Method Number:	8240
Lab Sample Name:	PBS7121SS9 #5462 1:62	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	81.2	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,ML,200ul,5uL IS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
o-Xylene	137.	
Styrene		81. U
1,1,2,2-Tetrachloroethane		81. U
Isopropylbenzene		81. U
Bromoform		81. U
1,2,3-Trichloropropane		81. U
n-Propylbenzene		81. U
Bromobenzene		81. U
1,3,5-Trimethylbenzene	442.	
4-Chlorotoluene		81. U
2-Chlorotoluene		81. U
tert-Butylbenzene		81. U
1,2,4-Trimethylbenzene	479.	
sec-Butylbenzene		81. U
p-Isopropyltoluene		81. U
1,3-Dichlorobenzene		81. U
1,4-Dichlorobenzene		81. U
n-Butylbenzene		81. U
1,2-Dichlorobenzene		81. U
1,2-Dibromo-3-Chloropropane		81. U
1,2,4-Trichlorobenzene		81. U
Hexachlorobutadiene		81. U
Naphthalene	268.	
1,2,3-Trichlorobenzene		81. U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
PBS/121SS9

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: #5462 1:62

Sample wt/vol: .08 G Lab File ID: >R1107

Level: MED Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/25/89

Column: W.B. Dilution Factor: 81.2124

Number TICs found: 7

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		Unknown	23.14	22000.	
2.		Unknown	23.47	31000.	
3.	112403	Dodecane (8C19C1)	24.05	110000.	
4.		Unknown	24.27	37000.	
5.		Unknown	25.99	50000.	
6.	90120	Naphthalene, 1-methyl- (8C19	28.99	28000.	
7.		Unknown	30.52	33000.	
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI117	Method Number:	8240
Lab Sample Name:	PBS7121SS9 #5462	Date Analyzed:	890926
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	162.4	Date Received:	890920

Sample Info.: GC/MS A,DC, ,ML,100ul,5uL IS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		162.	U
Chloromethane		162.	U
Vinyl Chloride		162.	U
Bromomethane		162.	U
Chloroethane		162.	U
Trichlorofluoromethane		162.	U
1,1-Dichloroethene		162.	U
Methylene Chloride	49.		J
trans-1,2-Dichloroethene		162.	U
1,1-Dichloroethane	1164.		
cis-1,2-Dichloroethene	181.		
2,2-Dichloropropane		162.	U
Chloroform		162.	U
Bromochloromethane		162.	U
1,1,1-Trichloroethane	5325.		
1,1-Dichloropropene		162.	U
Carbon Tetrachloride		162.	U
1,2-Dichloroethane		162.	U
Benzene	14.		J
Trichloroethene	16401.		
1,2-Dichloropropane		162.	U
Bromodichloromethane		162.	U
Dibromomethane		162.	U
Toluene	605.		
1,1,2-Trichloroethane		162.	U
1,3-Dichloropropane		162.	U
Tetrachloroethene	5376.		
Dibromochloromethane		162.	U
1,2-Dibromoethane - EDB		162.	U
Chlorobenzene		162.	U
Ethylbenzene		162.	U
1,1,1,2-Tetrachloroethane		162.	U
m + p-Xylenes	53.		J

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI117	Method Number:	8240
Lab Sample Name:	PBS7121SS9 #5462	Date Analyzed:	890926
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	162.4	Date Received:	890920

Sample Info.: GC/MS A,DC, ,ML,100ul,5uL IS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		162.	U
Styrene		162.	U
1,1,2,2-Tetrachloroethane		162.	U
Isopropylbenzene		162.	U
Bromoform		162.	U
1,2,3-Trichloropropane		162.	U
n-Propylbenzene		162.	U
Bromobenzene		162.	U
1,3,5-Trimethylbenzene	167.		
4-Chlorotoluene		162.	U
2-Chlorotoluene		162.	U
tert-Butylbenzene		162.	U
1,2,4-Trimethylbenzene	186.		
sec-Butylbenzene		162.	U
p-Isopropyltoluene		162.	U
1,3-Dichlorobenzene		162.	U
1,4-Dichlorobenzene		162.	U
n-Butylbenzene		162.	U
1,2-Dichlorobenzene		162.	U
1,2-Dibromo-3-Chloropropane		162.	U
1,2,4-Trichlorobenzene		162.	U
Hexachlorobutadiene		162.	U
Naphthalene	149.		J
1,2,3-Trichlorobenzene		162.	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PRS7121SS9

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: 5462

Sample wt/vol: .01 G Lab File ID: >A1117

Level: MED Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/26/89

Column: W.B. Dilution Factor: 105468

Number TICs found: 0 CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
3.					
4.					
5.					
6.					
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8.					
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI065	Method Number:	8240
Lab Sample Name:	PBS7131SS1 #5463	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.2	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		1.	U
Chloromethane		1.	U
Vinyl Chloride		1.	U
Bromomethane		1.	U
Chloroethane		1.	U
Trichlorofluoromethane		1.	U
1,1-Dichloroethene		1.	U
Methylene Chloride	7.		
trans-1,2-Dichloroethene		1.	U
1,1-Dichloroethane		1.	U
cis-1,2-Dichloroethene		1.	U
2,2-Dichloropropane		1.	U
Chloroform		1.	U
Bromochloromethane		1.	U
1,1,1-Trichloroethane	3.		
1,1-Dichloropropene		1.	U
Carbon Tetrachloride		1.	U
1,2-Dichloroethane		1.	U
Benzene		1.	U
Trichloroethene	372.		
1,2-Dichloropropane		1.	U
Bromodichloromethane		1.	U
Dibromomethane		1.	U
Toluene	0.		J
1,1,2-Trichloroethane		1.	U
1,3-Dichloropropane		1.	U
Tetrachloroethene		1.	U
Dibromochloromethane		1.	U
1,2-Dibromoethane - EDB		1.	U
Chlorobenzene		1.	U
Ethylbenzene		1.	U
1,1,1,2-Tetrachloroethane		1.	U
m + p-Xylenes		1.	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI065	Method Number:	8240
Lab Sample Name:	PBS7131SS1 #5463	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.2	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		1.	U
Styrene		1.	U
1,1,2,2-Tetrachloroethane		1.	U
Isopropylbenzene		1.	U
Bromoform		1.	U
1,2,3-Trichloropropane		1.	U
n-Propylbenzene		1.	U
Bromobenzene		1.	U
1,3,5-Trimethylbenzene		1.	U
4-Chlorotoluene		1.	U
2-Chlorotoluene		1.	U
tert-Butylbenzene		1.	U
1,2,4-Trimethylbenzene		1.	U
sec-Butylbenzene		1.	U
p-Isopropyltoluene		1.	U
1,3-Dichlorobenzene		1.	U
1,4-Dichlorobenzene		1.	U
n-Butylbenzene		1.	U
1,2-Dichlorobenzene		1.	U
1,2-Dibromo-3-Chloropropane		1.	U
1,2,4-Trichlorobenzene		1.	U
Hexachlorobutadiene		1.	U
Naphthalene	1.		J
1,2,3-Trichlorobenzene		1.	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PBS7131551

Lab Name: Hittman Ebasco Contract: ESI 7019

Lab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

Matrix: SOIL Lab Sample ID: HE#5463

Sample wt/vol: 5 G Lab File ID: >A1065

Level: LOW Date Received: 09/20/89

Moisture: not dec.____ Date Analyzed: 9/22/89

Column: W.B. Dilution Factor: 1.2012

Number TICs found: 3 CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
		Unknown	13.70	8.	
		Unknown	28.03	8.	
3.		Unknown	29.38	9.	
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25.					
[illegible]					
[illegible]					
28.					
29.					
30.					

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI093	Method Number:	8240
Lab Sample Name:	PBS7131SS1 #5463 115	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	6.0	Date Received:	890920

Sample Info.: GC/MS A,RC,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		6.	U
Chloromethane		6.	U
Vinyl Chloride		6.	U
Bromomethane		6.	U
Chloroethane		6.	U
Trichlorofluoromethane		6.	U
1,1-Dichloroethene		6.	U
Methylene Chloride		6.	U
trans-1,2-Dichloroethene		6.	U
1,1-Dichloroethane		6.	U
cis-1,2-Dichloroethene		6.	U
2,2-Dichloropropane		6.	U
Chloroform		6.	U
Bromochloromethane		6.	U
1,1,1-Trichloroethane		6.	U
1,1-Dichloropropene		6.	U
Carbon Tetrachloride		6.	U
1,2-Dichloroethane		6.	U
Benzene		6.	U
Trichloroethene	301.		
1,2-Dichloropropane		6.	U
Bromodichloromethane		6.	U
Dibromomethane		6.	U
Toluene		6.	U
1,1,2-Trichloroethane		6.	U
1,3-Dichloropropane		6.	U
Tetrachloroethene		6.	U
Dibromochloromethane		6.	U
1,2-Dibromoethane - EDB		6.	U
Chlorobenzene		6.	U
Ethylbenzene		6.	U
1,1,1,2-Tetrachloroethane		6.	U
m + p-Xylenes		6.	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI093	Method Number:	6240
Lab Sample Name:	PBS7131SS1 #5463 1.5	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	6.0	Date Received:	890920

Sample Info.: GC/MS A,RC,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		6.	U
Styrene		6.	U
1,1,2,2-Tetrachloroethane		6.	U
Isopropylbenzene		6.	U
Bromoform		6.	U
1,2,3-Trichloropropane		6.	U
n-Propylbenzene		6.	U
Bromobenzene		6.	U
1,3,5-Trimethylbenzene		6.	U
4-Chlorotoluene		6.	U
2-Chlorotoluene		6.	U
tert-Butylbenzene		6.	U
1,2,4-Trimethylbenzene		6.	U
sec-Butylbenzene		6.	U
p-Isopropyltoluene		6.	U
1,3-Dichlorobenzene		6.	U
1,4-Dichlorobenzene		6.	U
n-Butylbenzene		6.	U
1,2-Dichlorobenzene		6.	U
1,2-Dibromo-3-Chloropropane		6.	U
1,2,4-Trichlorobenzene		6.	U
Hexachlorobutadiene	14.		
Naphthalene	4.		J
1,2,3-Trichlorobenzene	18.		

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.
PBS7131551 /15

ab Name: Hittman Ebasco Contract: ESI 7019

ab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

atrix: SOIL Lab Sample ID: 5463 /15

ample wt/vol: 1 G Lab File ID: >A1093

evel: LOW Date Received: 09/20/89

% Moisture: not dec.____ Date Analyzed: 9/24/89

olumn: PACK Dilution Factor: 7.2100

Number TICs found: 0 CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
3.					
4.					
5.					
6.					
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI066	Method Number:	8240
Lab Sample Name:	PBS7131SS2 #5464	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.2	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit
Dichlorodifluoromethane		1. U
Chloromethane		1. U
Vinyl Chloride		1. U
Bromomethane		1. U
Chloroethane		1. U
Trichlorofluoromethane		1. U
1,1-Dichloroethene		1. U
Methylene Chloride		1. U
trans-1,2-Dichloroethene		1. U
1,1-Dichloroethane		1. U
cis-1,2-Dichloroethene		1. U
2,2-Dichloropropane		1. U
Chloroform		1. U
Bromochloromethane		1. U
1,1,1-Trichloroethane	3.	
1,1-Dichloropropene		1. U
Carbon Tetrachloride		1. U
1,2-Dichloroethane		1. U
Benzene		1. U
Trichloroethene	359.	
1,2-Dichloropropane		1. U
Bromodichloromethane		1. U
Dibromomethane		1. U
Toluene		1. U
1,1,2-Trichloroethane		1. U
1,3-Dichloropropane		1. U
Tetrachloroethene		1. U
Dibromochloromethane		1. U
1,2-Dibromoethane - EDB		1. U
Chlorobenzene		1. U
Ethylbenzene		1. U
1,1,1,2-Tetrachloroethane		1. U
m + p-Xylenes		1. U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI066	Method Number:	8240
Lab Sample Name:	PBS7131SS2 #5464	Date Analyzed:	890922
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	1.2	Date Received:	890920

Sample Info.: GC/MS A,TN,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		1.	U
Styrene		1.	U
1,1,2,2-Tetrachloroethane		1.	U
Isopropylbenzene		1.	U
Bromoform		1.	U
1,2,3-Trichloropropane		1.	U
n-Propylbenzene		1.	U
Bromobenzene		1.	U
1,3,5-Trimethylbenzene		1.	U
4-Chlorotoluene		1.	U
2-Chlorotoluene		1.	U
tert-Butylbenzene		1.	U
1,2,4-Trimethylbenzene		1.	U
sec-Butylbenzene		1.	U
p-Isopropyltoluene		1.	U
1,3-Dichlorobenzene		1.	U
1,4-Dichlorobenzene		1.	U
n-Butylbenzene		1.	U
1,2-Dichlorobenzene		1.	U
1,2-Dibromo-3-Chloropropane		1.	U
1,2,4-Trichlorobenzene		1.	U
Hexachlorobutadiene		1.	U
Naphthalene	1.		J
1,2,3-Trichlorobenzene		1.	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

FRS7131SS2

ab Name: Hittman Ebasco Contract: ESI 7019

ab Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

atrix: SOIL Lab Sample ID: HH#5464

ample wt/vol: 5 G Lab File ID: >A1066

evel: LOW Date Received: 09/20/89

Moisture: not dec._____ Date Analyzed: 9/22/89

olumn: W.B. Dilution Factor: 1.2158

Number TICs found: 2 CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
		Unknown	8.88	6.	
		Unknown	29.13	9.	
3.					
4.					
5.					
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HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI094	Method Number:	8240
Lab Sample Name:	PBS7131552 #5464 1.5	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	6.1	Date Received:	890920

Sample Info.: GC/MS A,RC,ESI7019,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		6.	U
Chloromethane		6.	U
Vinyl Chloride		6.	U
Bromomethane		6.	U
Chloroethane		6.	U
Trichlorofluoromethane		6.	U
1,1-Dichloroethene		6.	U
Methylene Chloride		6.	U
trans-1,2-Dichloroethene		5.	U
1,1-Dichloroethane		5.	U
cis-1,2-Dichloroethene		5.	U
2,2-Dichloropropane		6.	U
Chloroform		5.	U
Bromochloromethane		6.	U
1,1,1-Trichloroethane		6.	U
1,1-Dichloropropene		6.	U
Carbon Tetrachloride		5.	U
1,2-Dichloroethane		5.	U
Benzene		6.	U
Trichloroethene	301.		
1,2-Dichloropropane		6.	U
Bromodichloromethane		6.	U
Dibromomethane		6.	U
Toluene	9.		J
1,1,2-Trichloroethane		6.	U
1,3-Dichloropropane		6.	U
Tetrachloroethene		6.	U
Dibromochloromethane		6.	U
1,2-Dibromoethane - EDB		6.	U
Chlorobenzene		6.	U
Ethylbenzene		6.	U
1,1,1,2-Tetrachloroethane		6.	U
m + p-Xylenes		6.	U

HITTMAN EBASCO ASSOCIATES, Inc.
VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AI094	Method Number:	S240
Lab Sample Name:	PBS7131SS2 #5484 115	Date Analyzed:	890925
Matrix:	Soil	Date Collected:	890918
Dilution Factor:	6.1	Date Received:	890920

Sample Info.: GC/MS A,RC,ESI7018,5g,5uL IS,SS/5mls P&T

U = not detected
J = estimated value, below detection limit

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		6.	U
Styrene		6.	U
1,1,2,2-Tetrachloroethane		6.	U
Isopropylbenzene		6.	U
Bromoform		6.	U
1,2,3-Trichloropropane		6.	U
n-Propylbenzene		6.	U
Bromobenzene		6.	U
1,3,5-Trimethylbenzene		6.	U
4-Chlorotoluene		6.	U
2-Chlorotoluene		6.	U
tert-Butylbenzene		6.	U
1,2,4-Trimethylbenzene		6.	U
sec-Butylbenzene		6.	U
p-Isopropyltoluene		6.	U
1,3-Dichlorobenzene		6.	U
1,4-Dichlorobenzene		6.	U
n-Butylbenzene		6.	U
1,2-Dichlorobenzene		6.	U
1,2-Dibromo-3-Chloropropane		6.	U
1,2,4-Trichlorobenzene		6.	U
Hexachlorobutadiene		6.	U
Naphthalene	3.		J
1,2,3-Trichlorobenzene		6.	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

PRS7131552 115

b Name: Hittman Ebasco Contract: ESI 7019

b Code: HITMAN Case No: NASA SAS No: N.A. SDG No: N.A.

trix: SOIL Lab Sample ID: 5464 115

mple wt/vol: 1 G Lab File ID: >A1094

vel: LOW Date Received: 09/20/89

Moisture: not dec.____ Date Analyzed: 9/24/89

lumn: PACK Dilution Factor: 7.3900

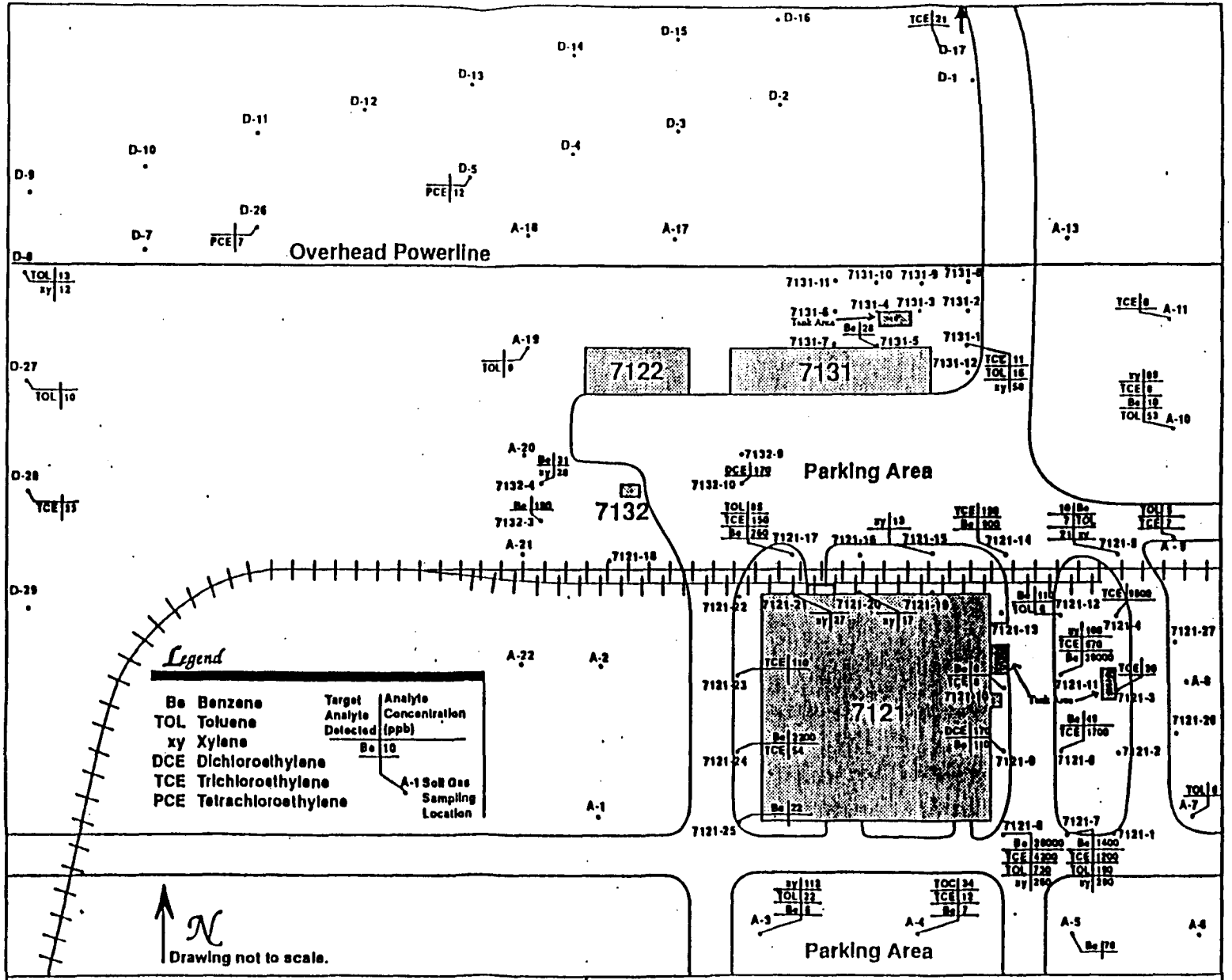
Number TICs Found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
30.					

APPENDIX B-2

Soil Gas Survey, EBASCO Environmental, 1989



Prepared for: National Aeronautics and Space Administration

Prepared by: Ebasco Environmental

Figure 6 Detection of Target Analytes at the Maintainance Area Plum Brook Station; Sandusky, Ohio

TABLE 3-7
Soil Gas Survey Results for
the Garage and Maintenance Tank Area

SAMPLE ID	CONCENTRATIONS (ppb) DCE	BENZENE	TCE	TOLUENE	PCE	XYLENE	NOTES
	dl=5	dl=5	dl=5	dl=5	dl=5	dl=10	
7121-1							
7121-2							*
7121-3			20				
7121-3			22				
7121-4			4600				
7121-4			9500				
7121-5		10		6.7		21	*
7121-6		49	1700				*
7121-7				190		290	*
7121-7		1400	1200	22		22	*
7121-8		26000	4200	730		260	*
7121-9	23	59					*
7121-9	170	110					*
7121-10		5.4	8.2				
7121-11		39000	670			100	*
7121-12		110		5.5			
7121-13							
7121-14		900	120				*
7121-14		120	12				*
7121-15						13	
7121-15						12	
7121-16							
7121-17		260	150	85			*
7121-18							
7121-19							
7121-20						17	
7121-21						27	
7121-22							
7121-23			110				
7121-23			140				
7121-24		2200	54				*
7121-25		22					*
7121-26							
7121-27							

NOTES:
Blank cell indicates below detection limit (<dl)
A sample listed twice is a field duplicate
* indicates multipie peak response commonly associated with a fuel product

TABLE 3-7 (Continued)
Soil Gas Survey Results for
the Garage and Maintenance Tank Area

SAMPLE ID	CONCENTRATIONS (ppb) DCE	BENZENE	TCE	TOLUENE	PCE	XYLENE	NOTES
	dl=5	dl=5	dl=5	dl=5	dl=5	dl=10	
7131-1			11	16		58	*
7131-2							
7131-3							
7131-4							
7131-5		28					*
7131-5							
7131-6							
7131-7							
7131-8							
7131-9							
7131-10							
7131-11							
7131-12							
7132-3		25					*
7132-3		190					*
7132-4		31				28	*
7132-9							*
7132-10	170						*
A1							
A2							
A3		5.6		22		112	*
A3							*
A4		7.1	12	34			*
A5		78					*
A6							
A7				5.9			*
A8							
A9			6.8	4.7			*
A10		9.7	7.4			89	*
A10				53			*
A11			7.7				*
A13							

NOTES:

Blank cell indicates below detection limit (<dl)

A sample listed twice is a field duplicate

* indicates multiple peak response commonly associated with a fuel product

TABLE 3-7 (Continued)
Soil Gas Survey Results for
the Garage and Maintenance Tank Area

SAMPLE ID	CONCENTRATIONS (ppb) DCE	BENZENE	TCE	TOLUENE	PCE	XYLENE	NOTES
	dl=5	dl=5	dl=5	dl=5	dl=5	dl=10	
A17							*
A18							*
A19				8.6			*
A20							
A21							
A22							
D1							
D2							
D4							
D5					12		
D5					6.1		
D26					6.4		
D26					6.8		
D7							
D8				13		12	
D9							
D10							
D11							
D12							
D13							
D14							
D15							
D16							
D17							
D17			21				
D27				9.7			
D28			23				
D29							
E1			42				

NOTES:

Blank cell indicates below detection limit (<dl)

A sample listed twice is a field duplicate

* indicates multiple peak response commonly associated with a fuel product

APPENDIX B-3

Soil and Groundwater Sampling and Analyses, EBASCO Environmental, 1991

NASA PLUM BROOK STATION

UNDERGROUND STORAGE TANK
CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY

- PHASE I REPORT -
November 1991

Prepared for:

WARNER/OSBORN/PARDEE
26777 Lorain Road
Suite 500
North Olmsted, Ohio 44070

For Submittal to:

NASA LEWIS RESEARCH CENTER
21000 Brookpark Road
Cleveland, Ohio 44135

Prepared by:

EBASCO ENVIRONMENTAL
A Division of Ebasco Services Incorporated

5000 Bradenton Avenue
Suite 200
Dublin, Ohio 43017

1.0 INTRODUCTION

This report summarizes the work performed during the first phase of an underground storage tank (UST) Corrective Actions Remedial Investigation / Feasibility Study (RI/FS) at the NASA Plum Brook Station (PBS). The projected scope of the overall investigation was detailed in the PBS UST Corrective Actions RI/FS Work Plan developed by NASA and Ebasco Environmental (August, 1990 - Final Draft).

1.1 Objectives

The USTs at PBS have been the subject of study since new UST regulations went into effect in 1988. The ultimate objective of the federally and state-mandated UST corrective actions requirements is the cleanup of contaminated soil and ground water associated with leaking USTs. The purpose of the overall Corrective Actions RI/FS project of which the current investigation is an initial element, is to: characterize the nature and extent of any contamination in the soil, ground or surface water which has resulted from leaking UST systems at four (4) separate areas at PBS; evaluate the currently available remedial alternatives for addressing this contamination; and develop a Corrective Actions Plan for the UST sites for managing the associated risks to human health and the environment.

The primary objectives of the current investigation were to compile all the currently available data from the previous and current investigations for each of the four (4) Tank Areas, determine the contaminants present at each Tank Area (and consequently, the contaminants not present), conclude which detected contaminants were logically and physically linked to the reported contents of the former USTs and identify the pathways by which the residual contamination present may spread. A secondary objective of the investigation was to document either the presence or absence of contaminants at each Tank Area so that a more efficient, targeted analytical program could be designed for any future characterization work that may be required.

1.2 Project Background

To comply with the 1988 regulations, twenty (20) USTs at the NASA Lewis Research Center (LeRC) and nineteen (19) USTs at PBS were identified as requiring study under a UST Compliance Program. The tanks were designated for study based on information contained in LeRC and PBS UST inventory listings. In the fall of 1989, three more tanks at LeRC were located, identified, and scheduled for removal. All forty-two tanks contained petroleum products, hazardous spent solvents or unknown products.

A UST Compliance Program was designed by Ebasco Environmental and NASA to assure that the LeRC (which administratively includes PBS) was in compliance with the applicable state and federal regulatory requirements for USTs. As part of implementing

this program, the fourteen (14) tanks at PBS were removed, and UST Closure Assessments were conducted by Ebasco. The locations of these former tank areas a shown in Figure 1-1. Table 1-1 summarizes the principal events of the PBS UST project history. Sampling and monitoring performed during the closure assessments indicated that the tanks had been leaking or that spills had apparently occurred. As a result, a 3-phase Corrective Actions Remedial Investigation / Feasibility Study (RI/FS) for the PBS was developed to characterize the nature and extent of any contamination, and to evaluate the currently available remedial alternatives for addressing the contamination. Phase I was the preliminary characterization effort aimed at describing current conditions at the tank areas. Phase II of the plan was the Remedial Investigation, and Phase III was the Feasibility Study.

Previously, the tank areas were assessed during tank closure activities, and during an initial field program which included limited soil excavation, soil sampling, ground water monitoring well installation, and soil gas surveys. The additional characterization activities performed in this study focus on determining the full nature of the residual contamination, and the potential for off-site migration of contaminants.

1.3 Facility Background Information

The Plum Brook Station is located approximately 4 miles south of Sandusky, Ohio, and covers approximately 6500 acres. Approximately 160 structures, many of them storag facilities, are located at the Plum Brook Station (Environmental Resources Document for NASA Lewis Research Center, May 1983). Much of the facilities at PBS are inactive currently. Activities associated with the four primary areas of investigation during the Phase 1 study are discussed as follows. Building 7131 at the Garage and Maintenance area continues to be used for vehicle and equipment maintenance, and is currently staffed with two to three employees. The remaining buildings in the Garage and Maintenance area, Buildings 7122 and 7121, are not staffed and are not in active use. During the Phase 1 investigation, operations were taking place at the Space Power Facility (SPF) and are expected to continue on an intermittent basis during the near future as various projects are undertaken at the SPF. The pump station, Building 8133, is staffed by two employees currently. The reactor area is inactive currently and no staff is assigned to the area. In total there are approximately 100 people working at the Plum Brook Station, most of whom are not regularly in the four Phase 1 areas of concern.

Acreage within the boundary of the site is primarily unused open space comprised of woodland, brushland and grassland. Approximately 23% of the site is associated with facilities and site operations (Environmental Resources Document for NASA Lewis Research Center, 1990).

The land immediately surrounding the site is used as a rural residential area with homes along the adjacent roadways. Farm fields and open fields with some wooded tracts

account for the remainder of the immediate surrounding properties.

There are 130 ground water well beyond the Plum Brook Station boundary which are within a four mile radius of the site. None of these ground water wells are within 3/4 of a mile of any of the tank areas included in the Phase 1 investigation.

The Plum Brook Station is underlain by lucustrine glacial deposits and consolidated sedimentary rock. The lucustrine deposits are composed of clays and silts. These deposits were settled out of glacial lakes. The lake sediments are approximately 5 to 20 feet thick. Lucustrine deposits are poorly drained (Environmental Resources Document for NASA Lewis Research Center, May 1983).

The bedrock of the area is consolidated sedimentary rock. The regional dip of the strata is easterly, and younger rocks crop out progressively from west to east. The bedrock is limestone in the western part of the facility and shale in the eastern portion. The limestone formations have considerable variation in physical and chemical structure; nevertheless, the limestone has high porosity and makes excellent aquifers. The shale material has little porosity, except for fractures near the surface (Environmental Resources Document for NASA Lewis Research Center, May 1983).

1.4 Previous Investigations

Nineteen (19) USTs at PBS were identified as requiring study under a UST Compliance Program developed by Ebasco in 1989. From late June through December of 1989, fourteen (14) USTs were removed from the PBS in accordance with this program. Table 1-2 identifies the tanks, indicates the areas from which they were removed, and notes the type of material reported to have been stored in each tank given the best available records.

The removal of the USTs included the performance of a closure assessment as required by regulation. In addition, an initial remediation effort was conducted at the Garage and Maintenance Area (Building No. 7132), and soil gas surveys were performed at three of the four tank areas as indicated in Table 1-1. The results of each of these prior investigations is included in the appropriate subsections of Section 3.0.

TABLE 1-2

PBS USTs Removed During the 1989 Calendar Year

Location	No. of Tanks	Capacity (Gallons)	Contents
Garage and Maintenance Area:			
Building 7121	1	3,000	waste oil and solvents
	3	700	acetone, TCE, and TCA, respectively
Building 7131	1	1,500	waste oil
Building 7132	3	9,000	gasoline
Space Power Facility:			
Building 1411	2	1,000	waste oil
Pump Station:			
Building 8133	1	750	gasoline/diesel
Reactor Area:			
Building 1131	2	7,900	gasoline/diesel and fuel
	1	500	waste oil and solvents

2.0 ASSESSMENT METHODOLOGY

2.1 Overview of the Phase I Field Investigation Program

This section details the sampling locations and describes the sampling methods which were used during the Phase I field investigation, which started in November 1990 and continued into May 1991. The following sections outline the procedures which were used and the locations of samples collected during each portion of the field program. The field activities involved in the Phase I field investigation included soil borings and sampling, well installation, ground water sampling, and sediment sampling.

2.1.1 Sample and Sample Location Identifiers

All of the field samples and the sampling locations in the Phase I field investigation are identified by a standard nomenclature. The location identifiers (IDs) have three segments to the character string, while the sample identifiers have the same three segments and a fourth segment indicating the sample medium. Both the location and sample IDs have as the first segment of the identifier PBS, indicating Plum Brook Station. Both also have as the second portion of the identifier an area code, either GM (Garage and Maintenance Area), SP (Space Power Facility), PS (Pump Station), or RA (Reactor Area). During the previous closure assessments the four digit building number, such as 1411 for the Space Power Facility, was used as the location code. Following the area code, the field samples have a segment identifying the sample medium, either SB (soil boring), GW (ground water), or SS (sediment). Both the sample and location identifiers end in the sequential number assigned to each location in each area of concern. An example of a location code would be PBS-GM-06, denoting the sixth boring location at the Garage and Maintenance Area. An example of a sample code would be PBS-RA-SB-04, denoting a soil boring sample at the fourth boring location at the Reactor Area.

2.1.2 Soil Borings and Monitoring Well Installations

Soil borings were completed at 23 locations at the four different UST areas of concern at the Plum Brook Station. Of these 23 soil borings, 20 were completed as ground water monitoring wells. Although it was expected that 22 of the 23 soil boring locations would be completed as wells, two locations were not completed as wells because of a lack of ground water. The boring log for each location can be found in Appendix E.

All of the well casing materials, including screens, risers and bottom caps, was 304 stainless steel. A sand pack of #5 Medium Blast sand was poured around the screened portion of each well. A bentonite seal was then placed above the sand pack to prevent infiltration. All of the wells were then finished with a concrete base and an above ground

aluminum well protector. Well logs with well construction diagrams and elevations c be found in Appendix F. As the final part of the well installation and prior to the grou water sampling, each of the 20 monitoring wells was developed. Well development consisted of removing from 4 to 5 well volumes with a hand bailer.

2.1.3 Subsurface Soil Sample Collection

Hollow stem auger drilling, using 4 1/4" augers, was used to complete all of the soil borings during the Phase I field effort. Continuous split spoon sampling was performed during the drilling at each boring location. The split spoons used were 24" in length and 2" in diameter.

The split spoon samples were scanned with a photoionization detector (PID) and any readings above background levels were noted. The recovery, composition, consistency, and color of the soil samples were recorded in the field log book and are reported in the boring logs in Appendix E.

A portion of each split spoon sample was placed in a stainless steel bowl to be composited and then placed in sample containers for transport to the analytical laboratory. The exception to this routine involved the collection of the volatiles sample. One split spoon was selected between 5 feet and 15 feet below the ground surface to be the volatiles sample. The depth at which the volatiles sample was taken was determined by scanning with the PID for elevated levels of volatiles. The sample containers for th volatiles analysis were immediately filled and sealed after the split spoon was opened and scanned with the PID.

Prior to setting up at each boring location, the split spoons and drilling equipment, including augers, rods, drill bit and tools, were decontaminated. A portable steam washer was used to decontaminate this equipment. Potable water was used for the steam wash. No solvents were used during the decontamination process.

2.1.4 Ground Water Sample Collection

Ground water sampling was conducted at one background location and one contaminated location for each of the four areas for a total of eight unique ground water samples. The schedule below lists the wells that were sampled at each area and also denotes whether the well was considered to be a contaminated location or a background location prior to sampling:

TANK AREA	PRESUMED BACKGROUND LOCATION	PRESUMED CONTAMINATED LOCATION
Garage and Maintenance Area	PBS-GM-02	PBS-GM-06
Space Power Facility	PBS-SP-01	PBS-SP-06
Pump Station	PBS-PS-04	PBS-PS-02
Reactor Area	PBS-RA-01	PBS-RA-04

Each of the eight wells sampled was purged of three well volumes prior to taking the ground water samples. Both the well purging and the sampling was done with a stainless steel bailer which was decontaminated prior to use at each monitoring well. The bailers were disassembled and washed in a solution of distilled water and trisodium phosphate, and then rinsed with distilled water. No solvents were used during the decontamination of the bailers.

2.1.5 Sediment/Surface Water Grab Sample Collection

Five sediment samples were collected as part of the field investigation. Two samples each were collected at the Garage and Maintenance Area and the Space Power Facility, and one was collected at the Pump Station. All of the samples collected were sampled from the drainage channels near the former tank locations. As there were no drainage channels near the former tank locations at the Reactor Area, no sediment sample was collected at that area. The sediment samples from other areas were collected using a stainless steel trowel and were placed in the sample jars for transport to the laboratory.

2.1.6 Sample Shipment and Chain of Custody

All of the field samples collected, including subsurface soils, ground water and sediment, were submitted to Hittman Ebasco for laboratory analysis. Chain of custody forms were submitted to the laboratory with each set of samples submitted. Chain of custody forms included each sample identifier, the sample matrix, the required analyses, and sample collection date. Samples were submitted via an overnight delivery service on a daily basis and were received by the laboratory within 24 hours of shipment. Samples were logged in at the lab and the chain of custody forms were returned. Chain of custody forms are included in Appendix G.

2.1.7 Ground Water Level Measurements

Two rounds of ground water level measurements were taken. The first set of ground water level measurements was taken during well development in January 1991. The

second set of measurements was taken on May 9, 1991 to get a second set of data for determining ground water flow characteristics. An electronic ground water level indicator was used both times to obtain the water levels relative to the top of the well casings. These data along with the surveying information provided by the NASA Facilities Engineering Division were used to assess ground water flow at the four former UST areas.

2.2 Overview of the Data Evaluation Process

2.2.1 Laboratory Data Quality Assurance and Quality Control

All of the samples collected during the Phase I field program were analyzed by Hittman Ebasco Associates. All analytical laboratory data was generated using Data Quality Objective (DQO) Level 4. This level requires full laboratory analytical procedures in accordance with USEPA recognized quality control. Since the primary use of Phase I data, at this time, is to focus Phase II, DQO Level 4 was not employed for independent data validation of data from the laboratory. Data validation was performed by the laboratory in accordance with Contract Laboratory Protocols (CLP) and independent data validation can be completed in the future to qualify the data for use in the risk assessment.

All of the field samples, duplicates and field blanks were analyzed for the Target Compound List (TCL) volatiles, semivolatiles, and pesticides/PCBs and Target Analyte List (TAL) metals and cyanide and Total Petroleum Hydrocarbons (TPH). Trip blanks were analyzed for TCL volatiles. The TCL/TAL analyses were completed following USEPA Contract Laboratory Protocols (CLP) for laboratory data quality standards. The TPH analysis was performed in accordance with EPA method 418.1. The laboratory results for the TCL/TAL analyses were reported following stringent quality requirements for laboratory blanks and laboratory data validation. The laboratory sample data reporting forms (Form 1) are shown in Appendix H for each sample. A number of samples were reanalyzed due to inconsistencies in lab quality control, such as matrix spike recoveries out of the acceptable range. For samples that had more than one sample result both sample results were reported.

Following the TCL volatiles and semivolatiles analysis Hittman Ebasco conducted a library search to identify Tentatively Identified Compounds (TICs). Numerous TICs were identified for various samples and these TICs are shown on the Form 1 for each sample in Appendix H. The TICs were not considered in the analysis of the Phase I data for various reasons, first the very nature of TICs, i.e. compounds that are tentatively identified, makes them very suspect, also according the Hittman Ebasco representatives TICs can often be an indication of natural background hydrocarbons, related to this is the fact that no correlation was found between the TICs and compounds suspected to be

stored in the removed underground storage tanks.

The Contract Required Quantitation Limits (CRQL) for TCL/TAL analyses as set forth in the CLP were met for the field samples and QA samples during the Phase I operations. Soil sample results from Hittman Ebasco were reported on a wet weight basis as CLP requires, because of this the soil samples results have slightly varying quantitation limits due to variations in moisture content of the various soil samples. This is not unusual with soil samples because of the varying soil characteristics and water content of each unique sample. Sample quantitation limits that vary greatly from the CRQL are a result of sample dilution due to elevated levels of contaminants in the sample.

2.2.2 Analytical Results for Organic Compounds

The results of analyses for organic compounds in the soil, ground water and sediment samples taken at the site during past studies and the current investigation have been compiled and presented for each Tank Area in Section 3. In general, the set of organics analyzed for in the past studies varied somewhat between studies and across the Tank Areas. Consistent analyses were performed for all samples taken during the current investigation. In this Report, results for all detected and undetected (but tested for) organics have been presented as they appeared in the earlier original study reports. Contaminant data from the previous investigations were summarized in a manner chosen to best convey the nature and extent of any organics contamination present in a manner consistent with the number of samples taken, the analyses performed on those samples, and the quality of the data.

The organics data from the current investigation related to Volatile Organic Compounds, semivolatile organic compounds (B/N/A extractables), pesticides, polychlorinated biphenyls (PCBs), and Total Petroleum Hydrocarbons (TPH). With very few exceptions, the organic compounds analyzed for in the soil, ground water, and sediment samples are not naturally occurring at levels detectable by standard techniques. As such, finding such a compound in a sample at a concentration above the detection limit is indicative of anthropogenic contamination. All detected organics were, therefore, highlighted in this Report. A notable exception to this generality may be the Total Petroleum Hydrocarbons. Natural oil-bearing shales and limestones are present in the PBS area. The soil borings conducted for the current investigation encountered shale bedrock beneath two of the Tank Areas (areas where the borings were terminated at the bedrock). It is possible that rock samples from these areas may contain some detectable concentration of natural TPH. However, the soil samples taken from the borings made for the current investigation consisted of the overburden material (either naturally occurring or fill) which would not be expected to have detectable TPH content. As such, the TPH detected in the current overburden samples was generally taken to be indicative of UST leakage or spills especially if concentrations exceeded about 40-50 mg/Kg.

The procedure used to compile and review the analytical data generated during the current investigation involved the following:

1. The raw data sheets from the laboratory were examined and the data was compiled into a series of comprehensive data tables. A data table was constructed for each Tank Area/environmental medium combination. This amounted to a total of 15 major tables, representing the results of soil, ground water, and sediment testing at each of the four areas (except for sediments at the Reactor Area), and four tables showing the results of the trip blanks and the soil, ground water, and sediment field blanks. These tables are included as Appendices A (soil results), B (ground water results), C (sediment results), and D (blank results). A separate table was constructed for each Tank Area within Appendices A, B and C, with Table 1 pertaining to the Garage and Maintenance Area, Table 2 to the Space Power Facility, Table 3 to the Pump Station and Table 4 to the Reactor Area. Each appendix table contains the results of each analysis or reanalysis performed for every sample in that Tank Area, and includes all analytes, whether or not they were detected. Undetected results were noted by the appropriate quantitative detection limit and the "U" qualifier. Each appendix table lists the analytical results in the following order: volatile organic compounds, semivolatile organic compounds, pesticides/PCBs, metals, cyanide, and TPH. The identification number, type, depth of collection and date of collection also are noted for each individual sample

2. The full set of data for each Tank Area was examined with respect to QA/QC, observation of contamination in blanks, and identification of possible laboratory contaminants. This review included direct discussions with the laboratory. Based on this review and analysis, six organic compounds were identified to be probable laboratory contaminants (Methylene Chloride, Acetone, Carbon Disulfide, bis (2-Ethylhexyl)phthalate, Butylbenzylphthalate and Di-n-Octylphthalate) and one pesticide (Endosulfan Sulfate) was determined to be spurious due to its general presence in the blanks. These compounds were not further considered in relation to UST contamination.

3. The reviewed data on organics were summarized in both graphical and tabular form for each Tank Area. Contaminant maps were developed which identified where the various contaminants were detected at each area and at what concentration. A separate contaminant map was developed for the soil, ground water, and sediment data for each area. These are presented and discussed below. The identified laboratory and blank contaminants were not included on these contaminant maps. Secondly, summary tables of the organics detected at each tank area were compiled. These tables list all detected organics and identify the maximum

concentration of each compound detected in each of the three environmental media and at what frequency they were detected (e.g., 3/7 representing detections in 3 out of 7 samples taken in that medium at that Tank Area). These summary tables also are presented and discussed in Section 3.

2.2.3 Analytical Results for Inorganic Compounds

Inorganics were not analyzed in any of the prior investigations, but were analyzed during the current investigation. Metals may have been associated with the USTs, in that metal complexes have historically been added to fuels and lubricating oils, to enhance their performance. Examples include zinc, barium, nickel, lead, and vanadium. Waste solvents may also have become contaminated with metals through physical or chemical reaction mechanisms. These inorganics represent possible contamination from the former fuel, waste oil, and waste solvent USTs.

Unlike the vast majority of the organics tested for, the inorganics are naturally occurring in soils. Many of these inorganics, however, are not associated with significant health risks in connection with a broad range of soil concentrations and plausible exposures, and others are actually required by the body. As such, detection of an inorganic in a soil sample is not automatically a concern. The natural presence of inorganics in soils dictates that some criteria be developed for judging if the level of the inorganic detected is significantly greater than naturally occurring levels. Frequently, the "background" concentration is used as this criterion. As the natural background level of an inorganic typically varies by 2 or 3 orders of magnitude, depending on where in the United States the soil is, a measurement of local background concentration is required for making judgments about possible anthropogenic sources of inorganics contamination.

As was previously noted, a set of the soil borings were located in areas thought not to be influenced by the contamination from the leaking USTs. Two locations were chosen from each of the four Tank Areas. However, upon review of the laboratory results of the soil analyses from these samples, four of the eight samples were found to contain organics contamination (PBS-GM-SB-02, PBS-PS-SB-01, PBS-PS-SB-04, PBS-SP-SB-02). As organics contamination could be linked to inorganics contamination, the four samples showing organics contamination were not considered in calculating the local background inorganics concentration statistics used in this Report. The concentrations measured in the remaining four samples (PBS-GM-SB-01, PBS-RA-SB-01, PBS-RA-SB-06, and PBS-SP-SB-01) were used to characterize the local background inorganics concentrations for this study.

In keeping with the newly established OEPA "How Clean is Clean Policy" (OEPA, July 26,1991), the following equation was used to calculate "Upper Confidence

Limits" (UCLs) as criteria to compare to on-site inorganic concentrations to dtermine if they are statistically greater than background:

$$X + k(a)$$

where, X = mean background concentration of compound
a = relative standard deviation of background data
k = tolerance factor.

These are shown for inorganics in Table 2-1. When available, Table 2-1 also shows two other criteria with regard to the inorganics. The first was published ranges of natural soil inorganics concentrations for the United States. As has been noted, these ranges are characteristically wide, displaying significant regional variability. The second criteria examined was the Soil Clean-Up Criteria being enforced by the State of New Jersey. While these criteria are not enforceable in Ohio, they provide an indication of the cut-off levels of inorganics that have been used as soil remediation targets in other places. The State of Ohio currently has not established criteria for inorganic clean-up in soils.

Taken together, the method used to evaluate the analytical results for inorganics in the soils from the current investigation was to (refer to Table 2-1):

1. Establish the "local background" concentration of each inorganic tested for by averaging the four background samples and calculating their standard deviation.

2. Calculating the OEPA criteria for comparison to background (i.e., the UCLs).

3. Compare the measured inorganics concentrations from each soil sample to the UCL determined in Step 2. If this concentration was not exceeded, determine that no problem was indicated. If this concentration was exceeded, proceed to Step 4.

4. Determine if the inorganic exceeding the UCL is a natural nutrient or element not typically of concern for health reasons. If the inorganic is not typically considered a health risk in soils at these levels, determine that no problem was indicated. If the inorganic did not fall into one of these two categories, proceed to Step 5.

5. Compare the sample concentration to the United States background range and the New Jersey Soil Clean-Up Criteria (when these criteria exist). Determine whether the measured concentration fell outside the United States range or exceeded the New Jersey criteria. If it did neither,

determine that no problem was indicated, otherwise, flag the inorganic and location as a possible concern.

The results of applying this sequential data analysis approach to the information collected during the current investigation is reported for each Tank Area in Section 3.

2.2.4 Ground Water Level Contours

The two sets of monitoring well ground water level measurements, taken in May and January, were combined with the wellhead surveying data to generate ground water contour maps for each Tank Area. Separate contour maps were drawn for May and January for each location. These maps showed the apparent local ground water flow patterns at each Tank Area, including the influence of existing structures and topography.

In addition, the May ground water level measurements from each Tank Area were combined to create an overall PBS ground water contour map. This map depicts the overall site ground water flow direction, when local influences are netted out. The ground water contour maps for each Tank Area and time of year, as well as the overall site contour map, are presented and discussed in Section 3.

2.2.5 Boring Logs and Well Logs

Field measurements and observations during the installation of the boreholes and monitoring wells in the current investigation were used to develop the Boring Logs and Well Logs contained in Appendices E and F, respectively. This information was used to develop a general characterization of the soils and near surface stratigraphy at each of the four Tank Areas. These descriptions are presented and discussed in Section 3.

TABLE 2-1
Criteria Used for Comparisons
of Inorganics in Soils to Background Levels

INORGANICS	Mean Conc. in Bkgd. Samples (n=4) (mg/Kg)	Standard Deviation	k Tolerance Factor	OEPA Criteria Mean + k x s.d.	Range of U.S. Bkgd. Conc.(1) (mg/Kg)	New Jer Soil Clea Criteria((mg/Kg)
Aluminum	9845	3650	5.145	28624.25	NA	NA
Antimony	1.83	0.08	5.145	2.24	NA	NA
Arsenic	6.53	2.65	5.145	20.16	1.1-16.7	20
Barium	79.8	42.6	5.145	298.98	NA	400
Beryllium	0.46	0.04	5.145	0.67	1-7	NA
Cadmium	2.48	0.95	5.145	7.37	0.01-1	3
Calcium (N)	16165	8380	5.145	59280.10	NA	NA
Chromium	16.1	4.51	5.145	39.30	1-1500	100
Cobalt	11.1	6.7	5.145	45.57	NA	NA
Copper	18	5.4	5.145	45.78	2-200	170
Iron (N)	25075	9036	5.145	71565.22	NA	NA
Lead	9.95	3.16	5.145	26.21	2-200	250-1000
Magnesium (N)	5630	1728	5.145	14520.56	NA	
Manganese (N)	590	478	5.145	3049.31	NA	
Mercury	0.11	0.007	5.145	0.15	0.01-4.8	1
Nickel	33	20.36	5.145	137.75	3-550	100
Potassium	964	597	5.145	4035.57	NA	NA
Selenium	3.82	5.3	5.145	31.09	0.01-6	4
Silver	0.63	0.05	5.145	0.89	0.01-5	5
Sodium (N)	585	270	7.655	2651.85	NA	NA
Thallium	0.86	0.04	5.145	1.07	NA	NA
Vanadium	26.5	12.1	5.145	88.75	NA	NA
Zinc	59	24.4	5.145	184.54	10-3000	350
Cyanide	1.23	0.08	5.145	1.64	NA	NA

NOTES

NA Not Available

(N) Nutrient / Not of Health Concern under These Conditions

(1) NJDEP, Summary of Approaches to Soil Cleanup Levels, Table 1

3.0 SITE CHARACTERIZATION FINDINGS

This section summarizes the studies conducted at each of the four tank areas, presents the results of the studies, describes the contamination observed and the potential pathways for contaminant migration. The locations of the four former PBS UST Areas are shown on Figure 3-1.

For purposes of gaining some perspective on ground water flow, the theoretical Darcy's Law flow velocity was calculated for the overburden aquifer using the measured ground water level gradients and the theoretical hydraulic conductivity values for the soil units encountered at each Tank Area (a maximum of 10^{-5} meters per second for fine sand to a minimum of 10^{-13} for clay, silt, or glacial till). It must be highlighted that the hydraulic conductivities used were characteristic published values reported to correspond to the standard soil types encountered. No Tank Area-specific hydraulic conductivity (aquifer) tests were conducted. As such, the calculational results must be considered to be illustrative at best. Taking the maximum theoretical hydraulic conductivity for the various soil units observed to be present at each Tank Area, the maximum horizontal ground water flow velocities associated with the January and May 1991 were calculated as

$$V_{df} = [K (h_1 - h_2)]/L$$

where,

V_{df}	=	Darcy's Flow Velocity
K	=	Theoritical hydraulic conductivity
$(h_1 - h_2)$	=	Difference in hydraulic head
L	=	Distance along the flow path between the points where h_1 and h_2 were measured.

It must be emphasized that this estimate is based on the theoretical performance of a homogeneous water-bearing layer consisting entirely of the most transmissive soil type. This would generally be expected to be conservative, or leading to flow velocities higher than what might actually be observed. All of the boreholes exhibited multiple soil units, and many of these units are reported to have characteristic hydraulic conductivities many orders of magnitude lower than the value used to scale the maximum flow velocity. These factors would indicate that horizontal flow velocities in undisturbed areas (i.e., areas with no buried utility lines, building foundations, or other preferential pathway structures) would be lower than the calculated values. On the other hand, a coarse gravel utility trench or roadbed would be expected to allow for faster ground water migration along its length. These preferential migration rates typically would be many times larger than the theoretical Darcy Law rates that were calculated.

The ground water flow direction and velocity in the bedrock aquifer have not been investigated.

3.1 Garage and Maintenance Area

A total of eight (8) USTs were removed from the Garage and Maintenance Area. The former UST locations are shown in Figure 3-2.

On July 5, 1989, the permanent closure-by-removal of three 9,000 gallon steel USTs was performed at Building No. 7132. These three tanks (7132-1 (#33), 7132-2 (#34) and 7132-3 (#35)) had previously contained petroleum fuels. Gasoline was stored in Tanks 7132-1 and 7132-2, and diesel fuel was stored in 7132-3. All three tanks were installed in 1942. Tank 7132-2 was in service until the week prior to removal. Tanks 7132-1 and 7132-3 had been taken out of service earlier due to suspected leakage. The tanks were removed in order to comply with a notice from the State Fire Marshall's Office.

Tanks 7121-2 (#29), 7121-3 (#30) and 7121-4 (#31) were removed on September 18, 1989. Each 700-gallon steel tank was installed in 1964 and contained solvents. When inventoried prior to removal, they were all found to contain water.

Tank 7121-1 (#28) had a 3,000 gallon capacity, and was installed in 1942. This steel tank was reported to contain waste oil and solvents until it was removed on September 18, 1989.

Finally, Tank 7131-1 (#32), located north of Building No. 7131, was excavated on September 18, 1989. Prior to its removal, the 1,500 gallon steel tank was used to store waste oil and solvents.

3.1.1 Previous Investigations and Results

The activities conducted at the Garage and Maintenance Area have included UST closure assessments, the installation of ground water monitoring wells, an initial remedial effort, and a soil gas survey. These efforts are reviewed below.

3.1.1.1 UST Closure Assessments and Initial Remediation Efforts

During the UST removal operations, closure assessments were performed. This assessment included a visual site inspection, soil and water sampling, and inspection of the tanks after removal. The tanks were inspected by the Ebasco representative onsite and by John Graves of the Inspection Division of the State Fire Marshall's Office.

Tanks 7132-1 (#33), 7132-2 (#34) and 7132-3 (#35)

The three (3) USTs adjacent to Building No. 7132 were located in a common pit in a

grassy area just west of the large paved area. The visual inspection yielded no evidence of spillage in the grass, and evidence of only minor spillage at the Pump Island and on the surrounding asphalt.

Several areas of corrosion were noted on each tank. Tank 7132-3 (#35) had a hole in it at the seam at the top of the vent end of the tank. A dark area with a sheen was noted in the soil about five feet west of the fill end of Tank 7132-1 (#33).

Soil samples were taken from the bottom of the tank pit, as well as from the piles of excavated soil and from beneath the Pump Island that was adjacent to these tanks. In general, three samples were taken from the bottom of the tank pit for each removed tank: one from the end where the tank's fill connection was; one from the end where the tank's vent was; and one at a point between these two. In the case of Tank 7132-1 (#33), the vent end sample could not be collected as the wall of the excavation had collapsed. One soil sample also was taken from each of the four piles of soil removed from the pit. A soil sample was taken from the area beneath the Pump Island.

Soil samples were also taken during the installation of the four boreholes that were subsequently completed as monitoring wells. Two samples were analyzed from each boring, one from the capillary fringe and another from the saturated layer at the top of the aquifer.

These sampling locations are identified on Figure 3-3. All soil samples were analyzed for the BTEX (Benzene, Toluene, Ethylbenzene and Xylene) compounds and Total Petroleum Hydrocarbons (TPH). The samples taken from the excavated soil piles were also analyzed for ignitability and EP Toxicity lead. The results of these soil analyses are presented in Table 3-1.

Surface water and liquid samples also were taken and analyzed from this area. The first sample was taken of the water collected in the pit on the day of the tank removal. This water exhibited a noticeable oily sheen. The second sample, taken a week later, was of a rust-colored seep mixture of water and soil from the east end of the Tank 7132-3 pit. Shortly thereafter, two additional surface water samples were taken from the pit areas associated with Tanks 7132-1 and 7132-3, as shown on Figure 3-3. The surface water samples were analyzed for the BTEX compounds and TPH. The results of these surface water analyses are presented in Table 3-2.

Ground water samples were taken from the four monitoring wells that were installed. Figure 3-3 also shows the locations of these wells. The ground water samples were analyzed for the BTEX compounds and TPH. The results of these analyses are presented in Table 3-3.

The combined results indicated that contamination was present in the pit bottom, the gathered surface water, and in the soil beneath the Pump Island. Small amounts of

contamination were detected in the soils excavated from the pits. These excavated soils all had EP Toxicity results <500 ug/L Lead and Flashpoints greater than 200°F. Of the samples collected from the soil borings, the results indicated slightly elevated levels of BTEX in Boreholes 1 and 3, and lower concentrations of contaminants in Boreholes 2 and 4. The ground water results showed elevated levels of BTEX only in Monitoring Well 1, no levels above the detection limits for BTEX in the other wells, and <1.0 mg/L TPH in all of the wells.

Based on the soil and ground water sampling associated with the closure assessment, it was determined that additional soil had to be removed from the tank pit, given the level of contamination remaining. Soil in the tank pit was scanned with a photoionization detector to determine how much soil should be removed and from what locations. Additional soil was removed from around the former location of the Pump Island, the tank pit walls and the tank pit floor. The depth of the excavation in the area of the tanks following this soil removal was approximately 13 feet.

Soil samples were again collected from the bottom of the tank pit upon completion of this excavation. Six soil samples were collected in the area beneath the former tanks and six samples were taken from the area east of the tanks in the area of the Pump Island, as shown in Figure 3-4. These samples were analyzed for Benzene, Toluene, Ethylbenzene, Xylene and TPH. The laboratory analysis results are shown in Table 3-4. These samples had undetectable or low levels of these contaminants with the exception of sample 7132-SS-2 which was taken from the center of the tank pit. Sample 7132-SS-2 had a Benzene concentration of 420 ug/Kg. After discussion with the Ohio State Bureau of Underground Storage Tank Regulation it was determined that an additional 1-1.5 feet of soil should be removed from the tank bottom before the excavation was backfilled. This additional excavating was completed and the tank pit was backfilled.

Tanks 7121-1 (#28), 7121-2 (#29), 7121-3 (#30) and 7121-4 (#31)

Three soil samples were taken from the bottom of the pit from which Tank #28 was pulled, and two samples of the excavated soil were analyzed. All five samples were analyzed for Volatile Organic Compounds (VOCs) and TPH. The excavated soil samples also were tested for EP Toxicity lead and ignitability. The sample locations for Tank #28 are shown on Figure 3-5. Two soil samples were taken from the bottom of the pit from which Tanks #29, #30 and #31 were pulled and two samples of the excavated soil from this pit were analyzed. All four soil samples from this area were analyzed for VOCs and TPH, while one sample of the excavated soil and the sample taken from the south wall of the tank pit were also analyzed for EP Toxicity lead and ignitability.

The results of these analyses are shown in Table 3-5. In general, the soils associated with Tank #28 were found to be contaminated with a greater number of compounds and at higher concentrations than the soils at Tanks #29, #30 and #31. The soils from Tanks #29, #30 and #31 showed concentrations of 1,1,1-Trichloroethane and Trichloroethene at

levels of hundreds of ppb, with several other compounds at the tens of ppb level. The soils associated with Tank #28 showed highly elevated levels of a number of compounds. Trichloroethene and Tetrachloroethene were reported at tens of ppm levels; Toluene was at the 1 ppm level; and nine other organics were reported at concentrations of hundreds of ppb. Thirty different organics were detected in the Tank #28 soils while twenty four were detected in the Tank #29, #30 and #31 soils at a lower frequency. The maximum TPH concentrations in the samples for these two areas were nearly identical, at 284 and 287 ppm, respectively. EP Toxicity concentrations for lead were all below the detection limit and no soil sample exhibited a Flashpoint less than 200°F.

Tank 7131-1 (#32)

Three soil samples were taken from the bottom of the pit from which Tank #32 was pulled, and two samples of the excavated soil were analyzed. All five samples were analyzed for VOCs and TPH. The excavated soil samples also were tested for EP Toxicity lead and ignitability. The sample locations for Tank #32 are shown on Figure 3-6. The results of these analyses are shown in Table 3-6.

There were no visible signs of contamination during excavation of the tanks. Laboratory analysis of the soil samples indicated low levels of contamination, at less than ppm levels, were present. Elevated concentrations of trichloroethene were found in each of the five samples. Elevated levels of total petroleum hydrocarbons were found in each sample except for one collected from the excavated soil. Sixteen different compounds were detected at ppb levels in these soils.

3.1.1.2 Soil Gas Survey

In October, 1989, a soil gas survey was conducted at the Garage and Maintenance Area. The survey encompassed the area around Building Nos. 7121, 7122, 7131 and 7132. A total of 76 soil gas samples were collected and analyzed from this area. Numerous underground utilities cross the study area. Underground utilities are often packed in gravel beds or other highly permeable fill beds which can provide a preferential conduit for liquid and vapor migration. As such, the locations of the known underground utilities were considered when determining the soil gas sampling locations. Also considered were the building foundations and surface topography.

Soil gas samples were collected in the following manner. A solid steel probe was advanced 3 to 4 feet into the ground and then withdrawn. A sampling probe with a slightly larger diameter was then advanced 2 feet into the hole. Gas was purged from the sampling probe using a hand-operated vacuum pump. A sample was then collected from the top of the sampling probe upstream of the vacuum pump. A 1.0 ml sample was extracted, injected into a portable gas chromatograph (GC), and analyzed. The GC was calibrated to quantify Dichloroethene (DCE), Benzene, Trichloroethene (TCE), Toluene,

Tetrachlorethene (PCE), and Xylene. All concentrations were reported in microliters of analyte vapor per 1,000 liters of air (parts per billion (ppb)).

The results of the soil gas survey are shown in Table 3-7. Figures 3-7 and 3-8 show the sampling locations, compounds detected and the compound concentrations. Figure 3-7 highlights the relative distribution of the fuel-related compounds while Figure 3-8 focuses on the distribution of detected organic solvent materials. Most of the areas sampled showed measurable levels of one or more of the target compounds. The highest concentrations detected were found near former UST locations, along building foundations, roads, railroad tracks or along buried utility lines. A more area-specific summary is presented below for each Tank Area.

Building No. 7121

Two sampling locations at the southeast corner of Building No. 7121 (7121-7 and 7121-8) contained the highest levels of solvents detected at the Garage and Maintenance Area. These points are near two areas east of Building No. 7121 where four tanks containing waste oil and solvents were removed. The area east of Building No. 7121 exhibited the highest levels of fuel products found at the Garage and Maintenance Area. In general, all sides of Building No. 7121 exhibited some level of contamination from fuel products and solvents. This may be due to migration from one or more sources, or to numerous surface spills.

A pattern of TCE contamination is evident in samples 7121-4,6,7,8 and 11 as seen on Figure 3-8. Sample 7121-4 had the highest concentration of TCE, 9500 ppb. Samples 7121-6,7,8 and 11 also had soil gas concentrations of TCE above 670 ppb. Lower concentrations of contamination, both from fuel products and solvents, were found in the grassy areas east and west of Building No. 7121 and under the parking lots north and south of Building No. 7121, with concentrations ranging from 250 to 5 ppb. Concentrations of this magnitude combined with the sporadic detections and concentrations of any given analyte are indicative of low-level soil or ground water contamination.

The discovery of relatively high levels of both fuel product and waste solvent contamination along the entire east end of Building No. 7121 on either side of the former tank locations suggest a zone of relatively permeable soil in this location or the presence of preferential pathways in the North-South direction. An examination of the underground utilities in this area (refer to NASA Drawing No. PF-65180) reveals the presence of the Garage Road roadbed, an 8" sanitary sewer line, and two 6" fire water supply lines running right through this area. These structures and features could be serving as preferential migration pathways for the movement of these soluble contaminants in ground water. The foundation of Building No. 7121 and the railroad bed north of the Building may be acting to distribute the east side contamination all around the Building.

Building No. 7131

One UST containing waste oil was removed from the north side of Building No. 7131. The results of ten of the twelve soil gas samples taken in the area of the removed tank, showed no target analytes, fuel products or solvent compounds, above the detection limits (see Figures 3-7 and 3-8). Samples 7131-1 and 7131-5 indicated contamination from fuel products, with total hydrocarbon concentrations of 270 ppb and 86 ppb, respectively.

Building No. 7132

Three USTs, containing gasoline and diesel fuel, were removed from the area west of Building No. 7132. Two samples (7132-3 and 7132-4) near the tank pit indicated contamination from fuel products, but no target solvent compounds. In addition, sample A-19 contained detectable levels of fuel products and solvents that may be due to a small, isolated spill in the vicinity of Building Nos. 7132 and 7122 or to ground water contamination migrating from the source at Building No. 7132.

Area Northwest of the Garage and Maintenance Area

Samples collected north and northwest of the Garage and Maintenance Area indicated low level contamination from fuel products, TCE and PCE in concentrations ranging from 23 to 7 ppb. The special distribution of the contaminants detected appears to be sporadic, and indicated that low-level soil or ground water contamination may be present.

3.1.2 Current Investigation and Results

The field activities at the Garage and Maintenance Area associated with the current investigation were conducted on the following dates:

Soil Sampling: 11/27/90, 11/29/90, 11/30/90, 12/4/90 and 12/7/90
Ground Water Sampling: 1/15/91
Sediment Sampling: 1/11/91
Ground Water Level Measurements: 1/9/91, 5/9/91

The results of these sampling and analysis activities, are presented below.

3.1.2.1 Soil Sampling and Analyses

Seven of the 23 borings were completed at the Garage and Maintenance Area (Figure 3-9). Six of these locations were finished as ground water monitoring wells. The seven borings ranged in depth from 16 feet to 29 feet. Soil borings at locations PBS-GM-01 and PBS-GM-02 were advanced to the shale bedrock which was 27 feet and 29 feet

below the ground surface respectively. Prior to drilling it had been assumed that bedrock would be encountered at approximately 15 feet. After the first two borings were completed, it was decided that it was unnecessary to advance the boring to bedrock and subsequent borings were completed at an impermeable layer below the water table that would allow for monitoring the tank pit.

Of the six soil borings completed as monitoring wells, PBS-GM-01 and PBS-GM-02 were intended to be indicative of background conditions. The four remaining boring locations which were completed as monitoring wells, PBS-GM-03 through PBS-GM-06, were placed to help characterize the contamination at the Garage and Maintenance Area. The seventh location which was planned as a boring, but was not to be finished as a well, was located near the sewer line at the southeast corner of Building No. 7121. It was suspected, because of a previous sewer study, that contamination may have traveled along the sewer line and therefore a boring was located near this line. The six monitoring well locations and the soil boring location are shown in Figure 3-9.

3.1.2.1.1 Physical and General Stratigraphic Characteristics

Based on the seven boreholes made at the Garage and Maintenance Area as part of the current investigation, the overburden material at the Garage and Maintenance Area has an average thickness of 28 feet. Figure 3-10 presents a generalized stratigraphic section for the Garage and Maintenance Area showing the types of soils and their orders of occurrence. This section is based only on the seven borings made for this study. The surface soil in this area is predominantly brown fine sand with a mean thickness of 4 feet (In certain locations, this sand is overlain by 1 to 2 feet of gravel fill material.). The brown fine sand is underlain by grey sandy-clayey silt, except at the PBS-GM-02 location. The thickness of this grey sandy-clayey silt unit ranges from 1 to 12 feet. Beneath this unit is a layer of grey clayey silt. Where this unit is present, it ranges in thickness from 2 to 11 feet. The clayey silt is underlain by grey silty clay, with an average thickness of 4 feet. This unit is followed by a layer of grey sand which ranges in thickness from 3 to 8 feet, and is underlain by clayey silt. The clayey silt exhibited an average thickness of 3 to 8 feet. This unit overlies the grey shale bedrock. The top of bedrock is at an elevation of approximately 610 feet at borehole location PBS-GM-01 in the southeast corner of the Tank Area. This corresponds to an overburden thickness of 27 feet at this location. In the northern-most part of this Tank Area, at borehole location PBS-GM-02, the brown fine sand is underlain by grey fine sand, 4 feet in thickness, followed by a grey sandy-silt unit which is 7 feet in thickness. The top of bedrock at this location occurs at an elevation of approximately 607 feet (with a corresponding 29 foot overburden layer thickness).

3.1.2.1.2 Nature and Extent of Contamination

Seven soil borings were made at the Garage and Maintenance Area as part of the current investigation. These samples were composited over the total depth of the boring except for the volatiles samples which were taken at depths ranging from 4 to 12 feet below the ground surface. The complete results of the chemical analyses of these samples are presented in Table A-1 in Appendix A. A summary of the detected organic compounds is presented in Table 3-8. Excluding the probable laboratory contaminants, ten (10) different volatile organic compounds were detected in this set of samples and no semivolatile organics, pesticides or PCBs were found. 2-Butanone and 1,1,1-Trichloroethane were found at low ppm levels. Three of the seven samples contained none of the organics tested for at detectable levels (excluding the lab contaminants.) The distribution of the organics detected in the soils at this tank area is presented in Figure 3-11. Highlighted in this figure are the general presence of solvent compounds on the east side of Building No. 7121, a relative hot spot of solvents off the northeast corner of the building, and some TPH contamination northwest of the former location of Tanks 7132-1 (#33), 7132-2 (#34), and 7132-3 (#35). One unexpected result was the detection of both fuel and solvent related organics at sampling location PBS-GM-SB-02 (north of Building No. 7131 along the Garage Road). This location had originally been chosen as a local background sample. Using the inorganics comparison methodology and criteria described earlier, no inorganics were indicated to be of concern in the soils at the Garage and Maintenance Area. Three inorganics, calcium (72200 mg/Kg), magnesium (20100 mg/Kg) and mercury (0.19 mg/Kg) were detected at levels exceeding the UCL (see Table 2-1) indicating concentrations significantly higher than local background concentration.

3.1.2.2 Ground Water Sampling and Analysis

3.1.2.2.1 Nature and Extent of Contamination

Two ground water samples were taken at the Garage and Maintenance Area as part of the current investigation, one from a well expected to be heavily contaminated (PBS-GM-06) and one from a well expected to be clean (PBS-GM-02). At the time of the ground water sampling the expected ground water flow was unknown and was assumes to follow a northwesterly direction, for this reason PBS-GM-02 was expected to be a background location. Following the determination of ground water flow patterns it was found that PBS-GM-02 was down gradient of the contaminated areas and therefore was not a valid background location. Because ground water from only two wells at each tank area was sampled and the ground water flow direction was not known prior to sampling this result is understandable. The complete results of the chemical analyses of these samples are presented in Table B-1 in Appendix B. A summary of the detected organic compounds is presented in Table 3-8. Four solvent compounds were detected in these samples at concentrations less than 120 ppb. The highest measured concentration was associated

with 1,1,1-Trichloroethane in the well expected to be contaminated, at 120 ppb. Unexpectedly, a trace level of Trichloroethene (7 ppb) was detected in the "background" well (PBS-GM-02). This contamination was detected in both the original and duplicate sample taken at this location. The other background monitoring well was not sampled at this time. For future work PBS-GM-02 should not be considered as representing background conditions. Excluding the probable laboratory contaminants, no semivolatile compounds were detected in the ground water samples. Trace levels of Beta-BHC were detected in both samples at the Garage and Maintenance Area. BHC (Benzene Hexachloride) is a mixture of isomers of 1,2,3,4,5,6-Hexachlorocyclohexane and is a common insecticide. The detection of BHC at this location is not apparently linked to the contents of the former USTs at the focus of the current investigation. The distribution of the organics detected in the ground water at this tank area in January is presented in Figure 3-12. Highlighted in this figure are the presence of solvents in the ground water east of Building No. 7121 and the presence of trace levels of TCE in the intended background well.

3.1.2.2.2 Ground Water Flow

Figures 3-13 and 3-14 present the local ground water elevation contours developed from the January 9, 1991 and May 9, 1991 ground water level measurements, respectively. The ground water flow direction indicated for the January measurements was toward the North-North-West (NNW), whereas in May it was more directly toward the Northwest (NW). As can be seen, there appears to be seasonal fluctuation in both ground water flow direction and elevation given these two sets of measurements. The measured ground water level was approximately 1 foot lower in May, as compared to January, at the Garage and Maintenance Area. These Tank Area-specific ground water contours should also be compared to the ground water level contours developed for the entire Plum Brook Station based on the May 1991 data. This site map is presented in Figure 3-15. This larger scale ground water contour map shows an overall flow direction toward the NNW in this general area of the PBS. At the time of the Phase I investigation all of the locations of the excavated tanks were below the ground water surface.

Theoretical Darcy's Law flow velocity was calculated for the overburden aquifer using the measured ground water level gradients and the theoretical hydraulic conductivity values for the soil units encountered at this Tank Area. Taking the maximum theoretical hydraulic conductivity for the various soil units observed to be present at this Tank Area, the maximum horizontal ground water flow velocities associated with the January and May 1991 were calculated to be 1.9 and 3.4 feet per year, respectively. It must be emphasized that this estimate is based on the theoretical performance of a homogeneous water-bearing layer consisting entirely of the most transmissive soil type. The theoretical horizontal ground water velocities calculated would suggest that horizontal migration of the UST contaminants in the overburden aquifer would be relatively slow and not

significant relative to preferential migration along buried lines or structures.

3.1.2.3 Sediment Sampling and Analysis

Two sediment samples were taken at the Garage and Maintenance Area as part of the current investigation. Sample PBS-GM-SS-01 was collected from a drainage ditch east of the northeast corner of Building No. 7121 and near the former locations of Tank #28 and Tanks #29, #30 and #31. Sample PBS-GM-SS-02 was taken from a drainage ditch north of Building No. 7131 and Tank #32. Both of these drainage ditches channel water from the former UST areas toward the east. The locations of these samples are shown on Figure 3-16. The complete results of the chemical analyses of these samples are presented in Table C-1 in Appendix.C. A summary of the detected organic compounds is presented in Table 3-8.

3.1.2.3.1 Nature and Extent of Contamination

Excluding the compounds identified as being probable laboratory contaminants, only one volatile organic compound was detected in the sediment samples at this location: 1,1-Dichloroethane (at 21 ppb). While it is generally not common to find volatile organics in near surface soil or sediment samples, the presence of 1,1-Dichloroethane at these low levels in the one sediment sample is probably due to the unavoidable amount of ice and moisture that was contained in the sediment sample when it was collected and sent to the laboratory in mid-January. As can be seen in Table 3-8, 1,1-Dichloroethane was present in all media at the Garage and Maintenance Area. Table 3-8 also indicates that a broad range of semivolatile polycyclic aromatic hydrocarbons (PAHs) were detected in the ditch sediments at concentrations up to 4 ppm. The distribution of the organics detected in the sediments at this tank area is presented in Figure 3-17.

PAHs comprise a diverse family of substituted and unsubstituted polycyclic and heterocyclic aromatic compounds. PAHs are typically formed as a result of incomplete combustion of organic compounds in the presence of insufficient oxygen. Common sources of PAHs are fossil fuel (coal and oil) derivatives and combustion sources (e.g., automobiles, incinerators, asphalt, fires). PAHs characteristically exhibit a great tendency to adhere to soils and sediments. Given these properties, and the fact that no PAHs were detected in the subsurface soil or ground water at this tank area, the source of the contamination represented in Table 3-8 is indicated to be surface materials containing PAHs (or with PAHs adhering to them) washing into the drainage ditches. As both sediment sampling locations were very near asphalt or macadam road surfaces, it is likely that the detected semivolatile PAHs in the Garage and Maintenance Area ditch sediments are due to roadway run-off and gasoline and diesel vehicle tailpipe emissions, and not to the former USTs or their contents.

3.1.3 Conclusions for Garage and Maintenance Area

Upon examination of the combined results of both the previous and current studies, a fairly consistent picture of the current conditions at the Garage and Maintenance Area can be formed.

The Building No. 7132 USTs clearly had leaked based on the visual inspection of the pulled tanks and the initial soil and ground water sampling performed. Based on the tank pit soil sampling, the initial remediation effort appears to have eliminated the highly contaminated soil and product which would have been a continuing source of contamination. The subsequent soil gas survey indicated low levels of the fuel and solvent target compounds in the undisturbed areas just west and north of the former UST area. The most recent sampling identified an elevated TPH concentration in the soil sample taken in this area. The ground water in this particular location was not sampled under the current investigation.

The Building No. 7131 UST also appear to have leaked, based on the initial soil sampling conducted, despite the fact that no visible evidence of contamination was seen during the removal process. The soil gas survey performed indicated that very little residual fuel or solvent contamination was present at this location. The most recent sampling also indicated no residual soil contamination. The monitoring well at this location was not sampled under the current investigation.

The Building No. 7121 UST location is clearly contaminated with a mixture of fuel product and solvents. The closure assessment shows much greater contamination in association with Tank #28 (which was formerly under the grassy area east of Building No. 7121) than with the three USTs formerly located next to the northeast corner of the building. Significantly elevated concentrations of a number of solvents were measured here. The subsequent soil gas survey reinforced these findings and identified pockets of high contamination just east of Building No. 7121 and apparent migration of lower levels of contamination to the north and south (apparently along buried utilities and pipelines) and to the west (along the building foundation and railroad track roadbed). The most recent sampling confirmed the presence and levels of solvent contamination in the soils in the area east of Building No. 7121. Solvent contamination also was found in the ground water sample taken from this area during the current investigation.

UST contamination at the Garage and Maintenance Area was limited to a range of volatile organic compounds and TPH. The trace levels of semivolatile contamination found in the Garage and Maintenance Area sediment samples would not appear to be associated with the former USTs. No PCBs and no UST related pesticides were detected and no inorganics were highlighted as problematic based on the sampling.

Transport and migration of contamination from the former UST locations at this Tank

Area would appear to be linked to ground water movement. Migration along preferential flow pathways associated with man-made structures would appear to be greater than migration through the undisturbed soil. These preferential pathways appear to have themselves become secondary sources of contamination in some areas.

3.2 Space Power Facility

On September 18 and 19, 1989 two (2) USTs were removed from the Space Power Facility (SPF). The tanks were located in a common pit adjacent to the south foundation wall of Building No. 1411, near the boiler room. Figure 3-1 shows the location of the SPF at the Plum Brook Station. Both of the 1,000 gallon-capacity steel tanks were installed in 1968. Tank 1411-1 (#24) contained waste oil and solvents, and was in use until it was removed. Tank 1411-2 (#25) previously contained fuel oil, but was out of use and contained water when it was removed.

3.2.1 Previous Investigations and Results

The activities conducted at the Space Power Facility have included a closure assessment and a soil gas survey. These activities are reviewed below.

3.2.1.1 UST Closure Assessment

As part of the UST removal operation, a closure assessment was completed. The assessment included a visual site inspection, soil sample collection and analysis, and examination of the tanks after removal. The tanks were inspected by the Ebasco representatives onsite and by John Graves of the Inspection Division of the State Fire Marshall's Office.

Tank 1411-1 (#24) was removed on September 18, 1989 and Tank 1411-2 (#25) was removed on September 19, 1989 from the area south of Building No. 1411 between two driveways. During excavation, shale bedrock was encountered approximately twelve (12) feet below the ground surface. Soil sampling was performed in the excavation on September 19th. A total of nine (9) soil samples were collected. Four (4) samples were taken from the pile of excavated material, and analyzed for VOCs, TPH, EP Toxicity lead and ignitability. The remaining five (5) samples were taken from the walls and bottom of the pit. One of these was analyzed for VOCs, TPH, EP Toxicity lead, and ignitability, and the others were analyzed for VOCs and TPH. These sampling locations are identified on Figure 3-18.

VOC contamination was found in the soils. A total of 35 different compounds were detected in the soil samples analyzed. Table 3-9 shows the highest concentrations

TABLE 3-1
Results of Soil Analyses for the Building 7132 Tank Area
at the Garage and Maintenance Area

	Benzene ug/Kg	Toluene ug/Kg	Ethylbenzene ug/Kg	Xylene ug/Kg	TPH mg/Kg
Ohio EPA standards*	6	4000	6000	28000	40
Pit Bottom Samples					
7132-SS-1F	320	39	200	1100	341.7
7132-SS-1M	14000	8700	3600	19000	48.5
7132-SS-2F	3400	550	420 U	5200	56.6
7132-SS-2V	43000	30000	11000	96000	616.6
7132-SS-2M	2200 U	2900	2200 U	7600	503
7132-SS-3F	120	56	150	1900	186
7132-SS-3V	140 U	1100	280	5100	29
7132-SS-3M	4 U	4 U	4.9	12	253.8
Pump Island Sample					
7132-SSPI-1	2800	54000	47000	400000	2817
Soil Pile Samples**					
7132-SSP-1	0.22 U	0.22 U	0.22 U	0.22 U	76
7132-SSP-2	0.23 U	0.23 U	0.41	1.3	67
7132-SSP-3	1.3	0.47	0.28 U	0.28 U	83
7132-SSP-4	0.23 U	0.23 U	10	5.1	621
Soil Boring Samples					
7132-SB-1CAP	15.03	1.5	1.06	4.74	38 U
7132-SB-1SAT	14.42	1.41	0.69	3.23	39 U
7132-SB-2CAP	0.31	0.56	0.31	0.65	47 U
7132-SB-2SAT	0.26	0.31	0.39	0.39	51
7132-SB-3CAP	0.44	2.37	0.69	1.57	46 U
7132-SB-3SAT	0.26	0.42	0.26	0.3	39 U
7132-SB-4CAP	0.25	0.31	0.25	0.235	38 U
7132-SB-4SAT	0.24	0.35	0.26	0.25	38

U Undetected

* Ohio EPA Document #PP0103200, Interim Final Guidance on Petroleum Contaminated Soil; March 25, 1991

** All soil samples exhibited EP Tox Lead <500 ug/L and Flashpoint >200 F.

TABLE 3-2
Results of Surface Water Analyses for the Building 7132 Tank Area
at the Garage and Maintenance Area

	Benzene ug/L	Toluene ug/L	Ethylbenzene ug/L	Xylene ug/L	TPH mg/L
Standing Water Samples					
7132-SW-1SH	55	18	20	79	35
7132-SW-1A	2 U	2 U	2 U	2 U	1 U
7132-SW-3A	2 U	2 U	2 U	2 U	56.2
Seep Material Sample					
7132-SW-3SE	2 U	2 U	2 U	2 U	1.6 U

U Undetected

TABLE 3-3
Results of Ground Water Analyses for the Building 7132 Tank Area
at the Garage and Maintenance Area

	Benzene ug/L	Toluene ug/L	Ethylbenzene ug/L	Xylene ug/L	TPH mg/L
Monitoring Well Samples					
7132-GW-1	58	1.6	0.4	6.1	1 U
7132-GW-2	0.2 U	0.18	0.2 U	0.2 U	1 U
7132-GW-3	0.2 U	0.2 U	0.2 U	0.2 U	1 U
7132-GW-4	0.2 U	0.2 U	0.2 U	0.2 U	1 U
7132-GW-4DUP	0.2 U	0.2 U	0.2 U	0.2 U	1 U

U Undetected

TABLE 3-4
Results of the Soil Analyses during the Additional Soil Excavation
at the Building 7132 Tank Area at the Garage and Maintenance Area

	Benzene ug/Kg	Toluene ug/Kg	Ethylbenzene ug/Kg	Xylene ug/Kg	TPH mg/Kg
Soil Samples					
7132-SS-1	0.26 U	1.10	0.26 U	0.35	166
7132-SS-2	420.00	8.90	0.79	4.00	132
7132-SS-3	3.10	0.85	0.25 U	0.27	159
7132-SS-4	3.20	3.80	0.59	2.70	190
7132-SS-5	0.25 U	1.60	0.25 U	0.25 U	121
7132-SS-6	0.24 U	1.10	0.24 U	0.24 U	118
7132-PI-1	0.24 U	1.20	0.24 U	1.70	79
7132-PI-2	0.95	9.50	2.30	5.60	39 U
7132-PI-3	0.46	7.70	0.25 U	0.25 U	40 U
7132-PI-4	0.60	3.00	0.37	0.94	40 U
7132-PI-5	1.30	0.64	0.25 U	0.25 U	81
7132-PI-6	0.30	1.80	0.25 U	0.25 U	41 U

U Undetected

TABLE 3-5
Results of Soil Analyses for the Building 7121 Tank Area
at the Garage and Maintenace Area

	Maximum Concentration Detected in Soil			
	Building 7121 Tank #28		Building 7121 Tanks #29, #30, #31	
Volatile Organic Compounds	ug/Kg	Frequency	ug/Kg	Frequency
Dichlorodifluoromethane	ND	-	ND	-
Chloromethane	ND	-	ND	-
Vinyl Chloride	ND	-	3	1 / 4
Bromomethane	ND	-	ND	-
Chloroethane	10	1 / 5	34	1 / 4
Trichlorofluoromethane	28	5 / 5	4	3 / 4
1,1 Dichloroethene	44	3 / 5	13	3 / 4
Methylene Chloride	249	5 / 5	4	3 / 4
trans-1,2-Dichloroethene	2	2 / 4	ND	-
1,1 Dichloroethane	1214	5 / 5	70	4 / 4
cis-1,2 Dichloroethene	188	4 / 4	ND	-
2,2 Dichloropropane	ND	-	ND	-
Chloroform	1	2 / 4	ND	-
Bromochloromethane	ND	-	ND	-
1,1,1-Trichloroethane	7700	5 / 5	610	4 / 4
1,1 Dichloropropene	ND	-	ND	-
Carbon Tetrachloride	431	5 / 5	94	3 / 4
1,2 Dichloroethane	96	3 / 5	3	1 / 4
Benzene	14	2 / 5	ND	-
Trichloroethene	21142	5 / 5	200	4 / 4
1,2 Dichloropropane	ND	-	ND	-
Bromodichloromethane	1	1 / 5	ND	-
Dibromomethane	ND	-	ND	-
Toluene	1101	5 / 5	2	3 / 4
1,1,2-Trichloroethane	212	5 / 5	1	1 / 4
1,3 Dichloropropane	ND	-	ND	-
Tetrachloroethene	10048	5 / 5	8	4 / 4
Dibromochloromethane	ND	-	ND	-
1,2-Dibromomethane-EDB	ND	-	ND	-
Chlorobenzene	ND	-	1	2 / 4
Ethylbenzene	411	4 / 5	1	1 / 4
1,1,1,2-Tetrachloroethane	ND	-	ND	-
m & p -Xylenes	395	4 / 5	2	1 / 4
o-Xylene	137	4 / 5	1	1 / 4
Styrene	ND	-	ND	-
1,1,2,2-Tetrachloroethane	4	2 / 5	ND	-
Isopropylbenzene	10	2 / 4	ND	-
Bromoform	ND	-	ND	-
1,2,3- Trichloropropane	ND	-	ND	-
n-Propylbenzene	31	2 / 4	ND	-
Bromobenzene	ND	-	ND	-
1,3,5 Trimethylbenzene	442	3 / 4	ND	-

ND Not Detected

TABLE 3-5 Continued
Results of Soil Analyses for the Building 7121 Tank Area
at the Garage and Maintenace Area

	Maximum Concentration Detected in Soil			
	Building 7121 Tank #28		Building 7121 Tanks #29, #30, #31	
Volatile Organic Compounds	ug/Kg	Frequency	ug/Kg	Frequency
4-Chlorotoluene	ND	-	ND	-
2-Chlorotoluene	ND	-	ND	-
tert-Butylbenzene	40	2 / 4	ND	-
1,2,4 Trimethylbenzene	479	3 / 4	ND	-
sec-Butylbenzene	8	1 / 4	ND	-
p-Isopropyltoluene	22	1 / 4	ND	-
1,3 Dichlorobenzene	ND	-	2	1 / 4
1,4 Dichlorobenzene	1	1 / 4	2	1 / 4
n-Butylbenzene	ND	-	ND	-
1,2 Dichlorobenzene	ND	-	1	1 / 4
1,2-Dibromo-3-Chloropropane	ND	-	ND	-
1,2,4 Trichlorobenzene	1	1 / 4	ND	-
Hexachlorobutadiene	ND	-	ND	-
Naphthalene	268	4 / 4	ND	-
1,2,3 Trichlorobenzene	55	2 / 4	ND	-
Acetone	28	1 / 1	380	1 / 4
Acrylonitrile	ND	-	ND	-
Acrolein	ND	-	ND	-
Carbon Disulfide	ND	-	2	2 / 4
1,2-Dichloroethene (Total)	19	1 / 1	3	1 / 4
2-Butanone	ND	-	86	1 / 4
Vinyl Acetate	ND	-	ND	-
trans-1,3-Dichloropropene	ND	-	ND	-
cis-1,3-Dichloropropene	ND	-	ND	-
2-Chloroethylvinylether	ND	-	ND	-
4-Methyl-2-Pentanone	ND	-	ND	-
2-Hexanone	ND	-	7	1 / 4
TPH (mg/Kg)	284	3 / 5	287	1 / 3

ND Not Detected

TABLE 3-6
Results of Soil Analyses for the Building 7131 Tank Area
at the Garage and Maintenace Area

	Maximum Concentration Detected in Soil	
	Building 7131 Tank #32	
Volatile Organic Compounds	ug/Kg	Frequency
Dichlorodifluoromethane	ND	-
Chloromethane	ND	-
Vinyl Chloride	ND	-
Bromomethane	ND	-
Chloroethane	ND	-
Trichlorofluoromethane	17	1 / 5
1,1 Dichloroethene	ND	-
Methylene Chloride	70	4 / 5
trans-1,2-Dichloroethene	ND	-
1,1 Dichloroethane	40	1 / 5
cis-1,2 Dichloroethene	ND	-
2,2 Dichloropropane	ND	-
Chloroform	ND	-
Bromochloromethane	ND	-
1,1,1-Trichloroethane	23	5 / 5
1,1 Dichloropropene	ND	-
Carbon Tetrachloride	2	2 / 5
1,2 Dichloroethane	370	1 / 5
Benzene	ND	-
Trichloroethene	728	5 / 5
1,2 Dichloropropane	ND	-
Bromodichloromethane	ND	-
Dibromomethane	ND	-
Toluene	1	2 / 5
1,1,2-Trichloroethane	ND	-
1,3 Dichloropropane	ND	-
Tetrachloroethene	17	1 / 5
Dibromochloromethane	ND	-
1,2-Dibromomethane-EDB	ND	-
Chlorobenzene	ND	-
Ethylbenzene	2	1 / 5
1,1,1,2-Tetrachloroethane	ND	-
m-Xylene	2	1 / 5
o&p-Xylene	ND	-
Styrene	ND	-
1,1,2,2-Tetrachloroethane	ND	-
Isopropylbenzene	ND	-
Bromoform	ND	-
1,2,3- Trichloropropane	ND	-
n-Propylbenzene	ND	-
Bromobenzene	ND	-
1,3,5-Trimethylbenzene	366	1 / 5

ND Not Detected

TABLE 3-6 Continued
Results of Soil Analyses for the Building 7131 Tank Area
at the Garage and Maintenace Area

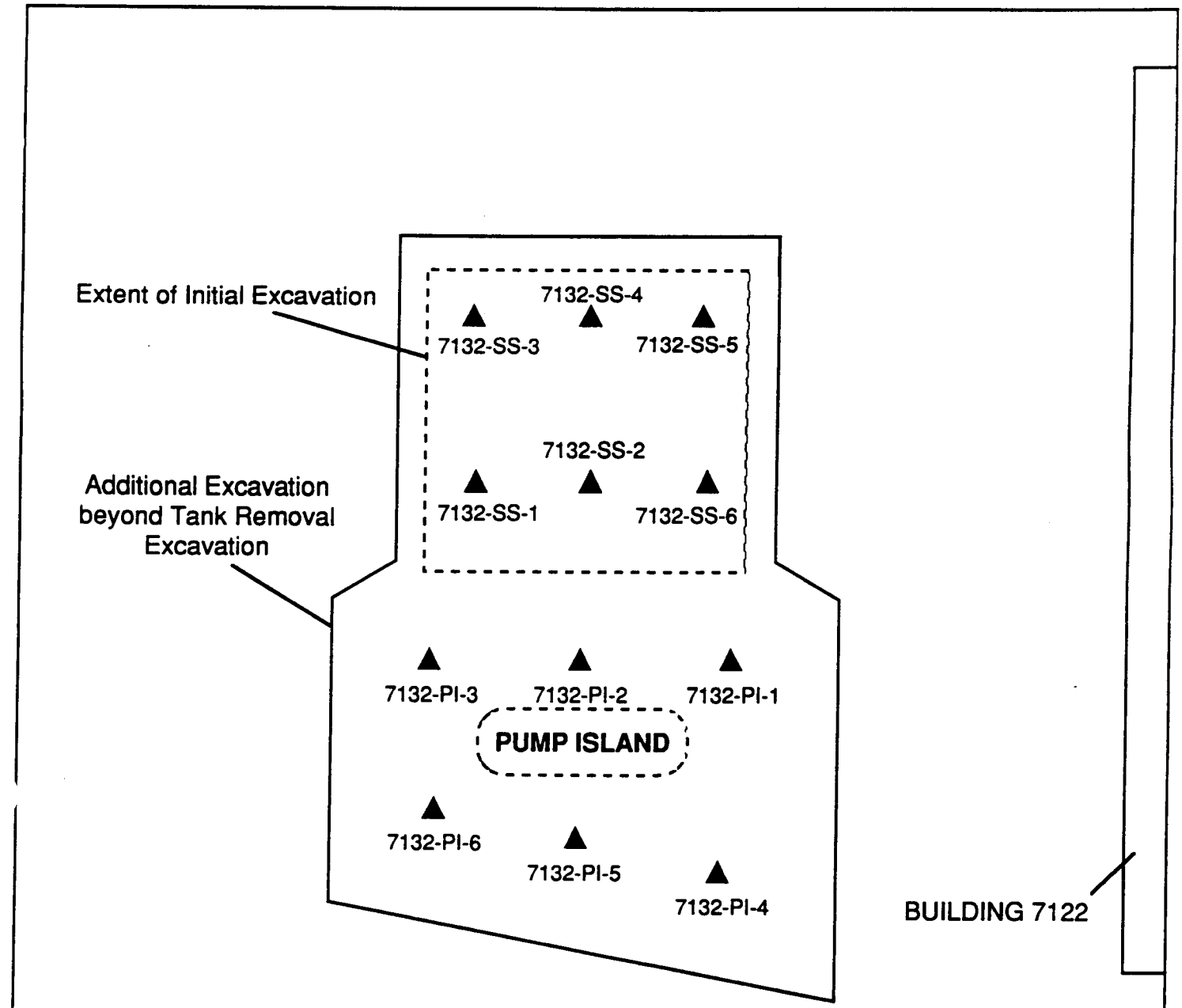
	Maximum Concentration Detected in Soil	
	Building 7131 Tank #32	
Volatile Organic Compounds	ug/Kg	Frequency
4-Chlorotoluene	ND	-
2-Chlorotoluene	ND	-
tert-Butylbenzene	ND	-
1,2,4-Trimethylbenzene	349	2 / 5
sec-Butylbenzene	ND	-
p-Isopropyltoluene	ND	-
1,3 Dichlorobenzene	ND	-
1,4 Dichlorobenzene	ND	-
n-Butylbenzene	ND	-
1,2 Dichlorobenzene	ND	-
1,2-Dibromo-3-Chloropropane	ND	-
1,2,4-Trichlorobenzene	ND	-
Hexachlorobutadiene	14	1 / 5
Napthalene	159	5 / 5
1,2,3-Trichlorobenzene	18	1 / 5
TPH (mg/Kg)	244	4 / 5

ND Not Detected

TABLE 3-8
SUMMARY OF ORGANIC CONTAMINANTS DETECTED AT THE GARAGE AND MAINTENANCE AREA.

GARAGE AND MAINTENANCE AREA	MAXIMUM CONCENTRATION DETECTED IN					
	SOIL		GROUND WATER		SEDIMENT	
VOLATILE ORGANIC COMPOUNDS	ug/Kg	Freq.	ug/L	Freq.	ug/Kg	Freq.
Methylene Chloride *	120	6/7	ND		21	2/2
Acetone *	110	6/7	ND		94	2/2
Carbon Disulfide *	400 E	6/7	ND		ND	
1,1-Dichloroethene	61	1/7	20	1/2	ND	
1,1-Dichloroethane	50	2/7	24	1/2	21	1/2
2-Butanone	6200	1/7	ND		ND	
1,1,1-Trichloroethane	2000	3/7	120	1/2	ND	
Carbon Tetrachloride	260	1/7	ND		ND	
Bromodichloromethane	6	1/7	ND		ND	
Trichloroethene	55	1/7	7	1/2	ND	
Tetrachloroethene	24	1/7	ND		ND	
1,1,2,2-Tetrachloroethane	35	2/7	ND		ND	
Ethylbenzene	21	1/7	ND		ND	
SEMIVOLATILE ORGANIC COMPOUNDS	ug/Kg	Freq.	ug/L	Freq.	ug/Kg	Freq.
Phenanthrene	ND		ND		1200 J	2/2
Anthracene	ND		ND		220 J	1/2
Fluoranthene	ND		ND		3700	2/2
Pyrene	ND		ND		2200	2/2
Butylbenzylphthalate	ND		6 J	1/2	ND	
Benzo(a)anthracene	ND		ND		1200 J	2/2
Chrysene	ND		ND		1600 J	2/2
bis(2-Ethylhexyl)phthalate *	5400	7/7	7 J	1/2	4300	1/2
Di-n-octyl Phthalate	ND		14	1/2	ND	
Benzo(b)fluoranthene	ND		ND		2400	2/2
Benzo(k)fluoranthene	ND		ND		2200	2/2
Benzo(a)pyrene	ND		ND		850 J	1/2
Indeno(1,2,3-cd)pyrene	ND		ND		850 J	1/2
Dibenzo(a,h)anthracene	ND		ND		280 J	1/2
Benzo(g,h,i)perylene	ND		ND		710 J	1/2
PESTICIDE / PCBs COMPOUNDS	ug/Kg	Freq.	ug/L	Freq.	ug/Kg	Freq.
Beta-BHC	ND		0.19	2/2	82	2/2
Delta-BHC	ND		ND		370	1/2
TOTAL PETROLEUM HYDROCARBONS	mg/Kg	Freq.	mg/L	Freq.	mg/Kg	Freq.
TPH	129	2/7	ND		2620	2/2

NOTES : * Probable Laboratory Contaminants (See Text)
J Estimated, Value Below the Quantitation Limit
E Concentration Exceeds Calibration Range of GC/MS Instrument
ND Not Detected



NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY: PHASE I

Sampling Locations Associated with the Additional Excavation at the Building 7132 USTs

GARAGE AND MAINTENANCE AREA

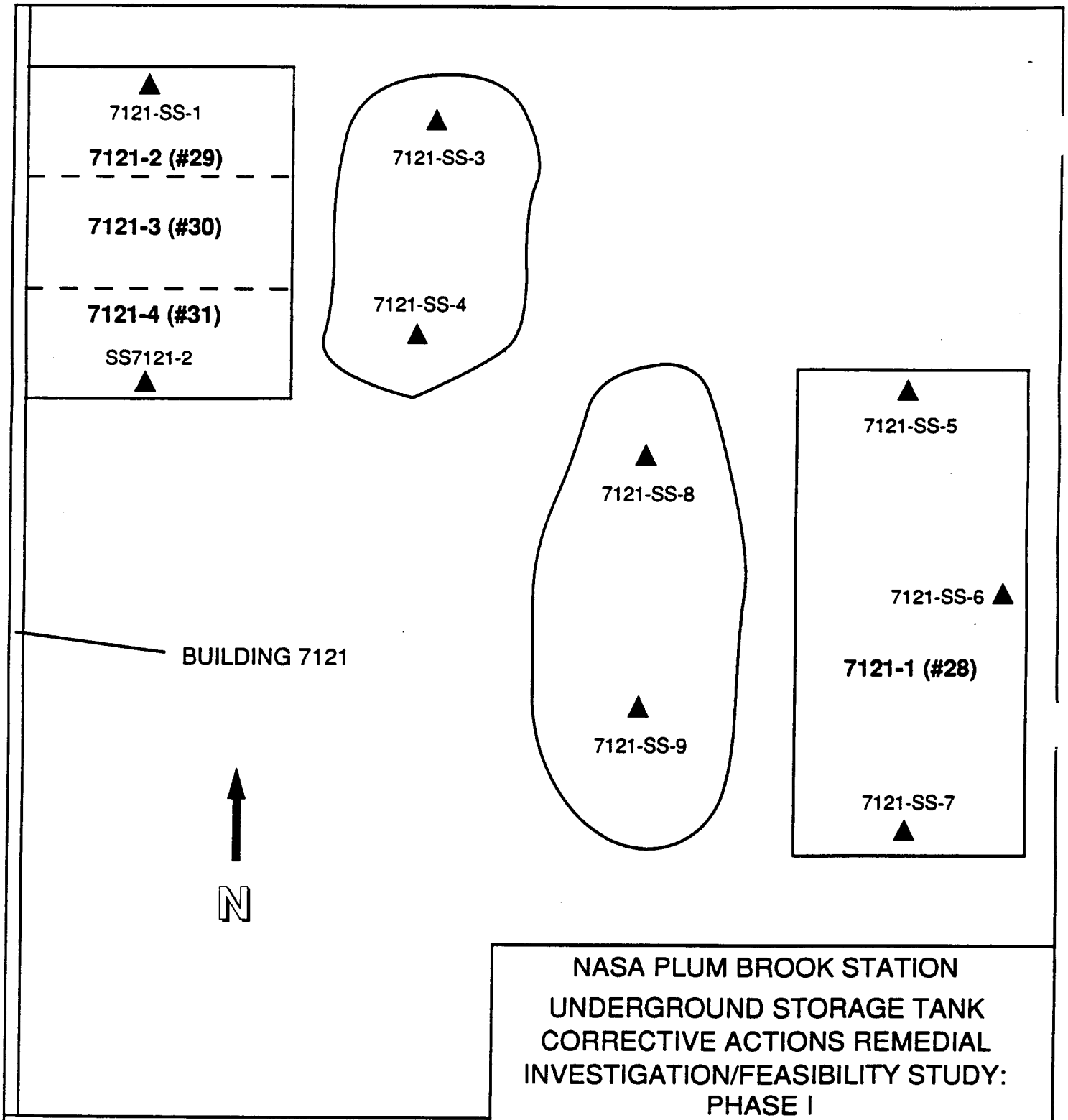
EBASCO ENVIRONMENTAL | NOT TO SCALE

FIGURE 3-4

LEGEND

▲ Soil Sample

□ Tank Pit



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UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY: PHASE I

LEGEND

▲ Soil Sample

Tank Pit

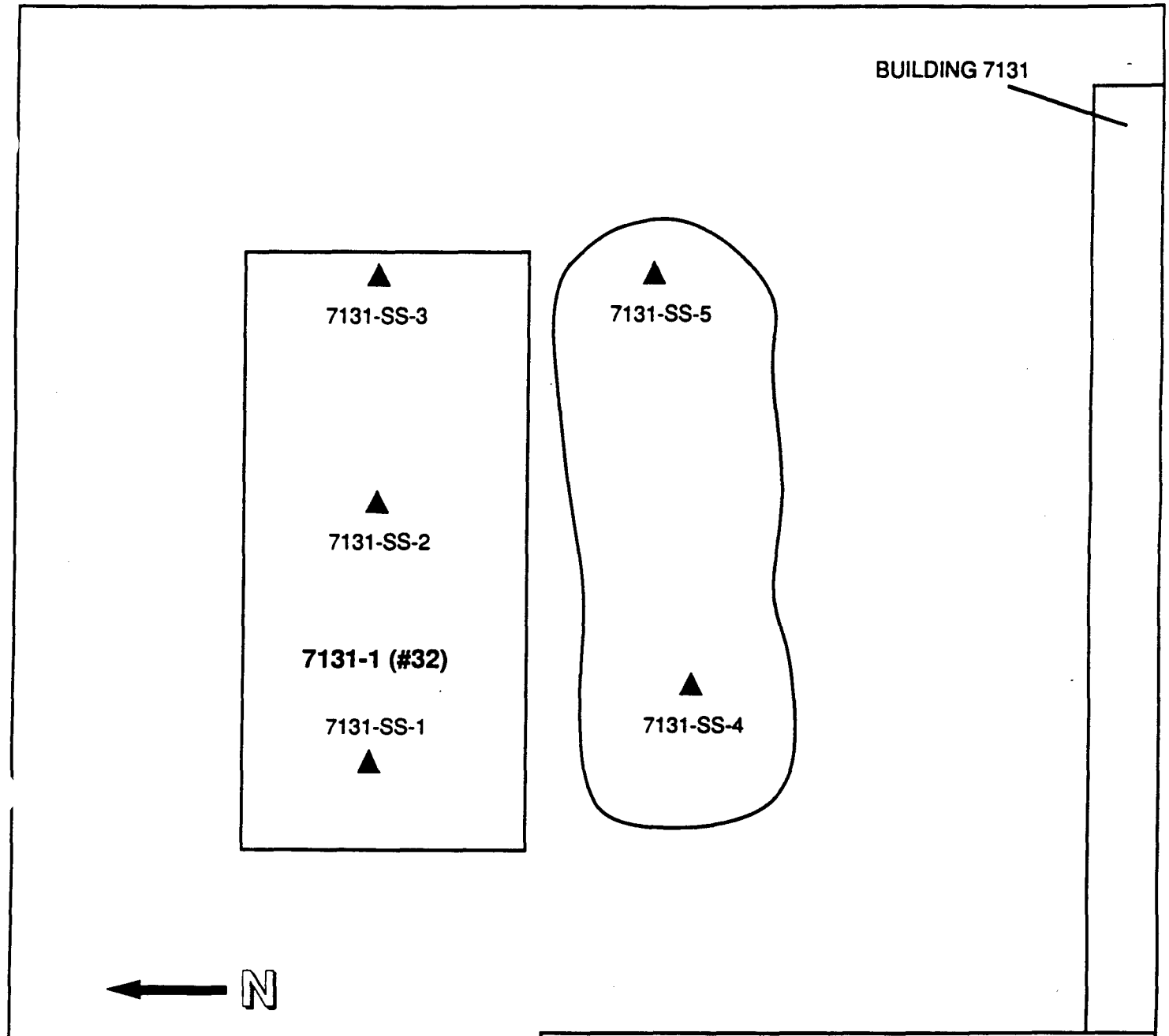
Excavated Soil Pile

Sampling Locations Associated With the Building 7121 USTs

GARAGE AND MAINTENANCE AREA

EBASCO ENVIRONMENTAL | NOT TO SCALE

FIGURE 3-5



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UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY: PHASE I

LEGEND

▲ Soil Sample

Tank Pit

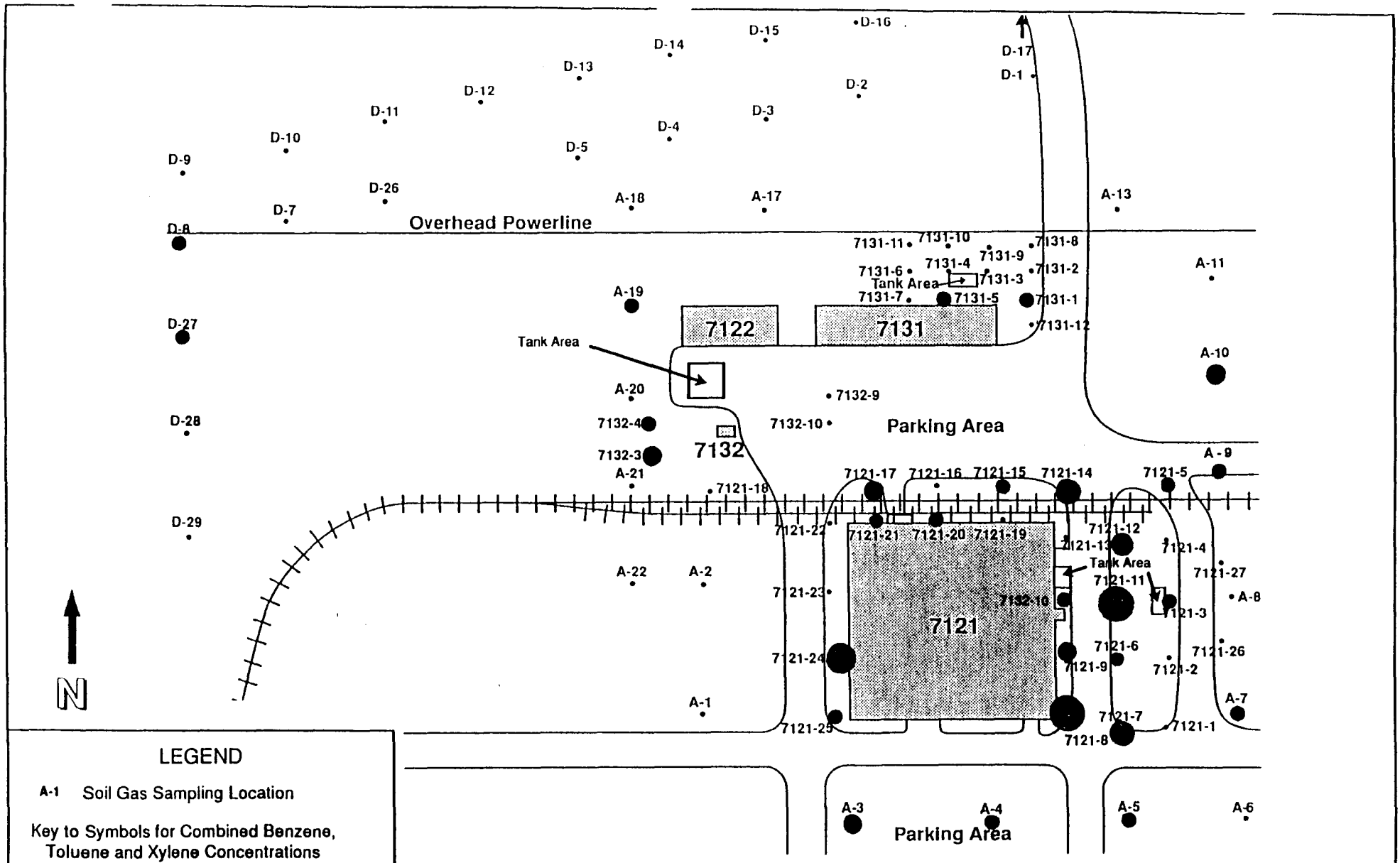
Excavated Soil Pile

Sampling Locations Associated With the Building 7131 UST

GARAGE AND MAINTENANCE AREA

EBASCO ENVIRONMENTAL | NOT TO SCALE

FIGURE 3-6



LEGEND

A-1 Soil Gas Sampling Location

Key to Symbols for Combined Benzene, Toluene and Xylene Concentrations

- Not Detected
- Detected <100 ppb
- 100 - 500 ppb
- 500 - 1000 ppb
- 1000 - 5000 ppb
- >5000 ppb

NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY: PHASE I

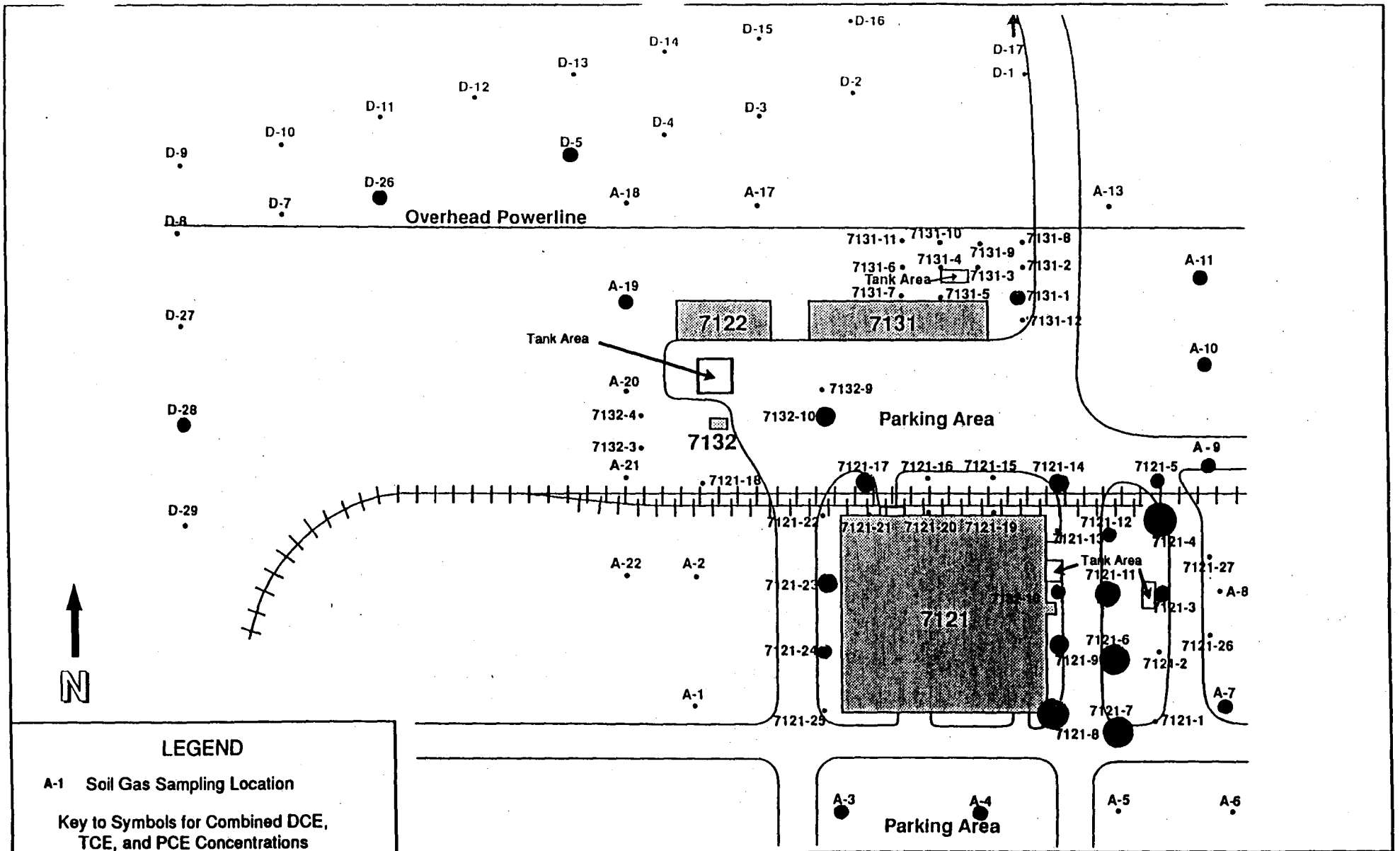
EBASCO ENVIRONM' 'AL

NOT TO SCALE

Soil Gas Sampling Locations and Results for Benzene, Toluene and Xylene

GARAGE AND MAINTENANCE AREA

FIGURE 3-7



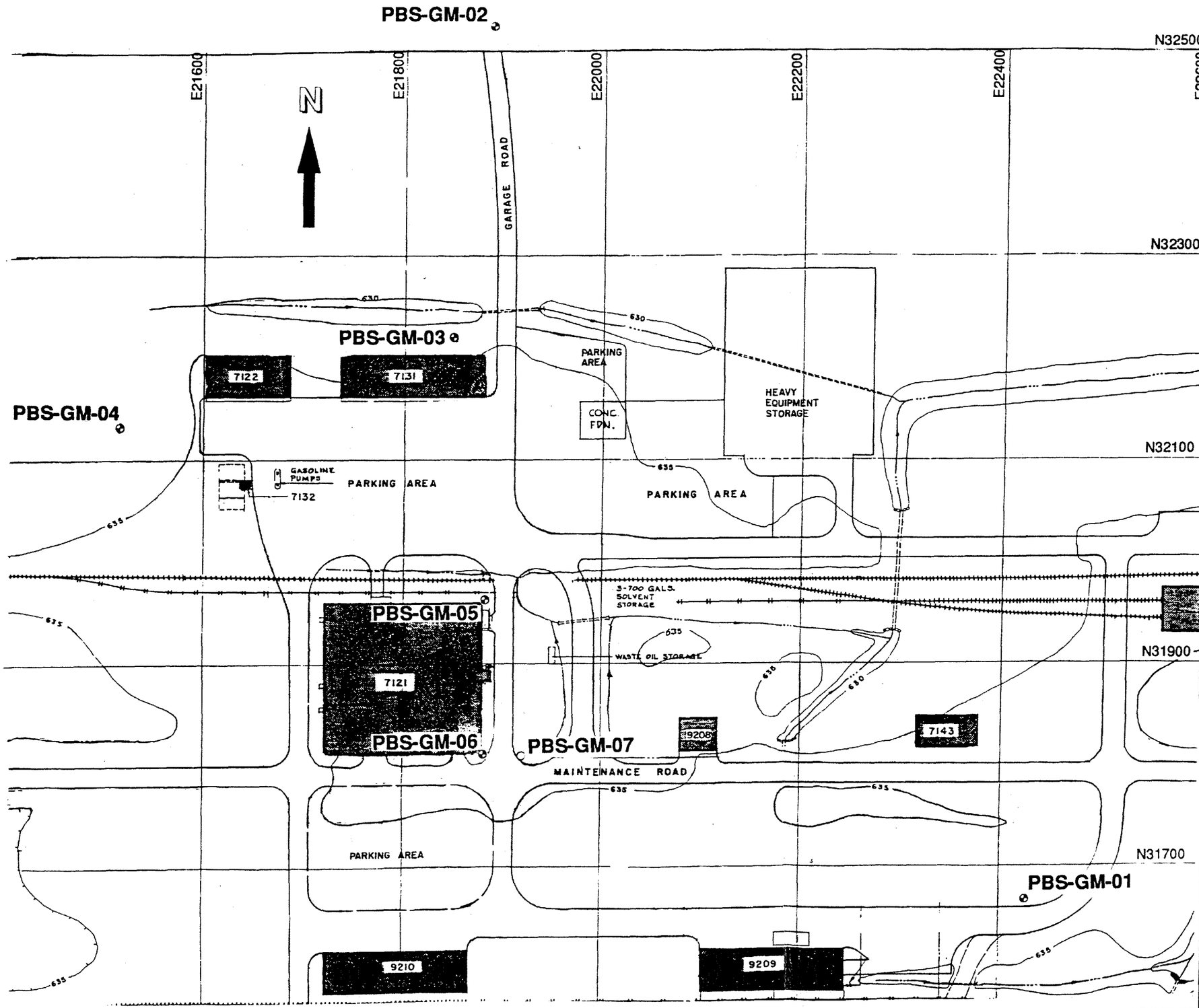
NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY: PHASE I

EBASCO ENVIRONMENTAL | NOT TO SCALE

Soil Gas Sampling Locations and Results for DCE, TCE and PCE

GARAGE AND MAINTENANCE AREA

FIGURE 3-8



LEGEND

- Ground Water Monitoring Well Location
- Soil Boring Location

NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY: PHASE I

Locations of Soil Borings and Ground Water Monitoring Wells

GARAGE AND MAINTENANCE AREA

EBASCO ENVIRONMENTAL | SCALE: 1"=100'

FROM NASA DWG. NO. PF-65180 | **FIGURE 3-9**

Soil Unit	Range of Unit Thickness at the Tank Area
OVERBURDEN	
Fill, Gravel	1' - 2'
Brown Fine Sand	2' - 4'
* Grey Sandy Clayey Silt	1' - 12'
* Grey Clayey Silt	2' - 11'
* Grey Silty Clay	2' - 4'
Grey Sand	3' - 8'
Grey Clayey Silt	3' - 8'
BEDROCK	
Grey Shale	

* Unit not encountered at all borehole locations

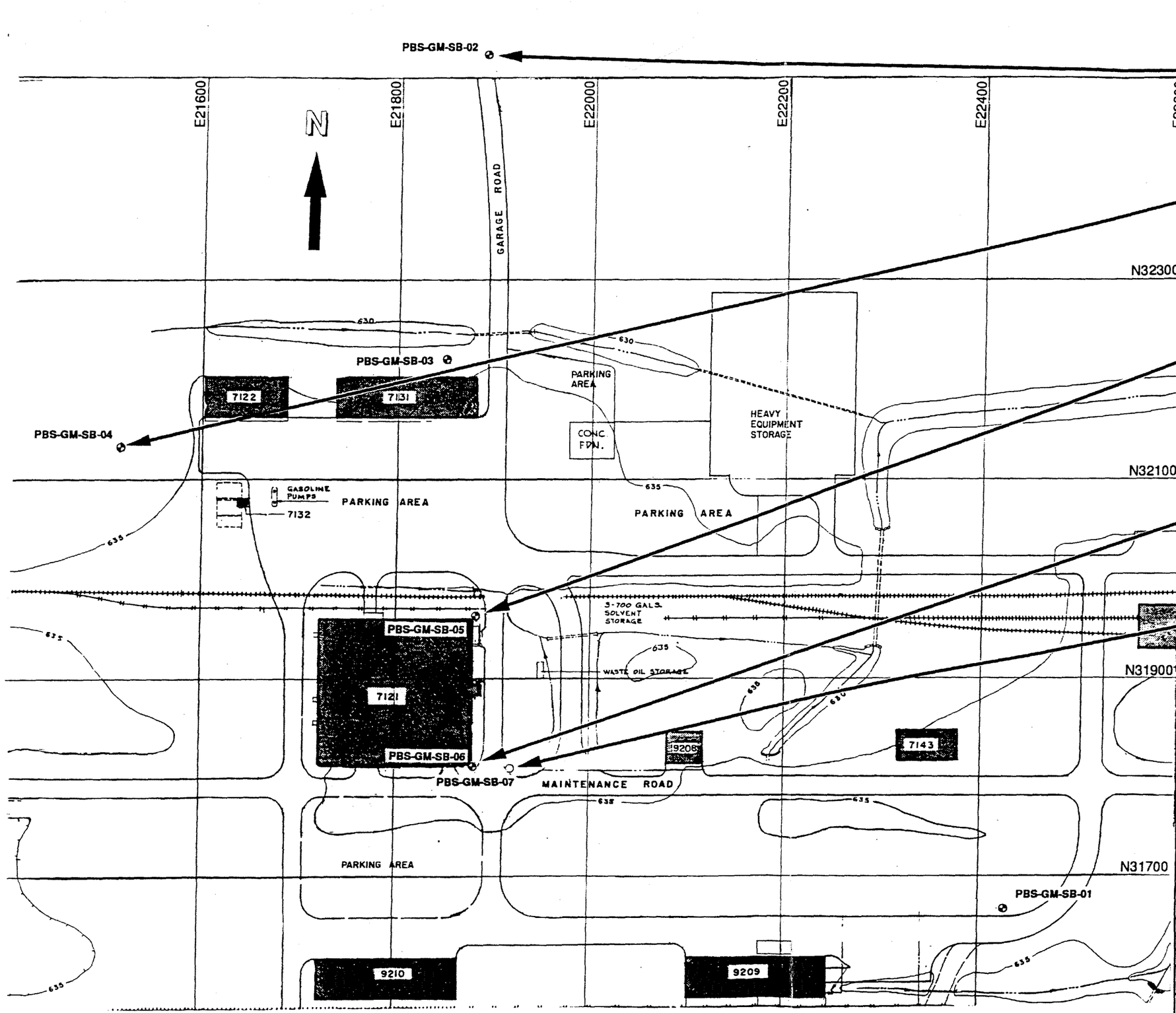
NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY: PHASE I

Generalized Stratigraphic Section

GARAGE AND MAINTENANCE AREA

EBASCO ENVIRONMENTAL | NOT TO SCALE

FIGURE 3-10



PBS-GM-SB02	Conc.
Bromodichloromethane	6 ug/Kg
1,1,2,2-Tetrachloroethane	35 ug/Kg
Ethylbenzene	21 ug/Kg
Total Petroleum Hydrocarbons	106 mg/Kg

PBS-GM-SB04	Conc.
Total Petroleum Hydrocarbons	129 mg/Kg

PBS-GM-SB05	Conc.
1,1-Dichloroethene	61 ug/Kg
1,1-Dichloroethane	50 ug/Kg
2-Butanone	6200 ug/Kg
1,1,1-Trichloroethane	2000 ug/Kg
Carbon Tetrachloride	260 ug/Kg
Trichloroethene	55 ug/Kg
Tetrachloroethane	24 ug/Kg
1,1,2,2-Tetrachloroethane	18 ug/Kg

PBS-GM-SB06	Conc.
1,1-Dichloroethane	12 ug/Kg
1,1,1-Trichloroethane	25 ug/Kg

PBS-GM-SB07	Conc.
1,1,1-Trichloroethane	20 ug/Kg

N32500

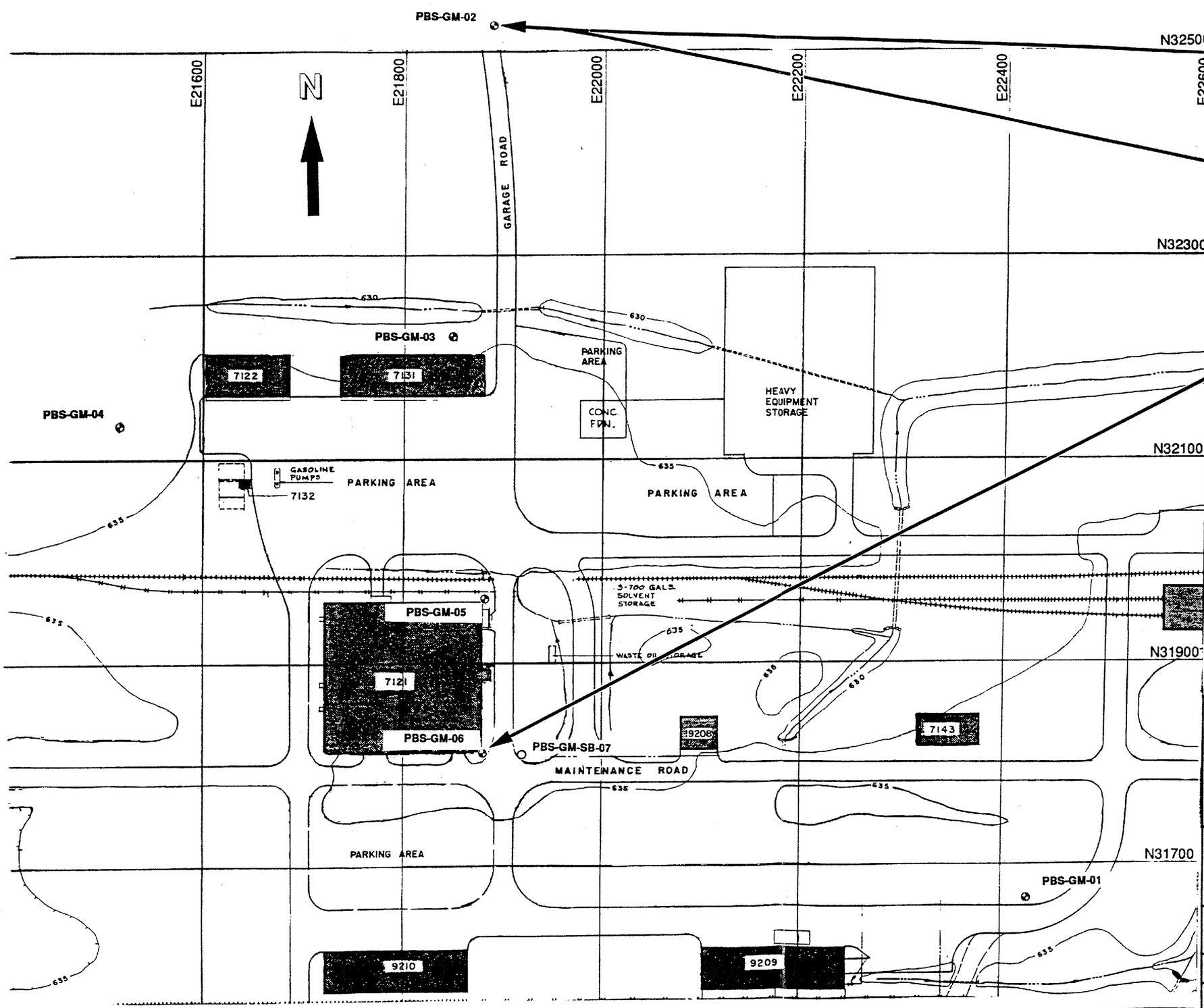
NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATIONS/FEASIBILITY STUDY: PHASE I

Organic Contaminant Concentrations in Soil

GARAGE AND MAINTENANCE AREA

EBASCO ENVIRONMENTAL | SCALE: 1"=100'

FROM NASA DWG. NO. PF-65180 | **FIGURE 3-11**



PBS-GM-GW-02	Conc.
Trichloroethene	7 ug/L
Beta-BHC	0.06 ug/L

PBS-GM-GW-08 (GW-02-DUP)	Conc.
Trichloroethene	7 ug/L
Di-n-octyl Phthalate	14 ug/L
Beta-BHC	0.05 ug/L

PBS-GM-GW-06	Conc.
1,1-Dichloroethene	20 ug/L
1,1-Dichloroethane	24 ug/L
1,1,1-Trichloroethane	120 ug/L
Butylbenzylphthalate	6 J ug/L
Beta-BHC	0.19 ug/L

J = Estimated

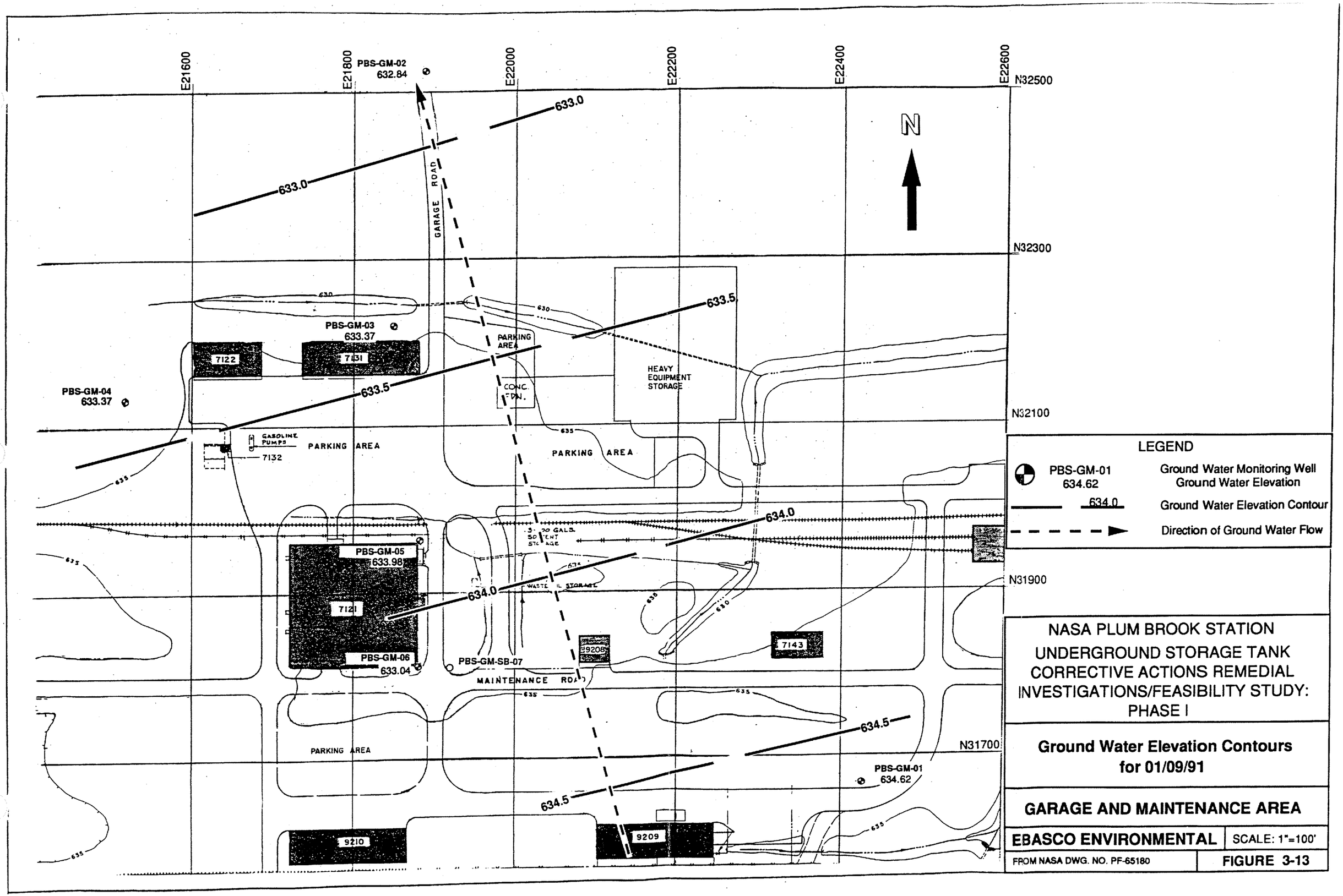
NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATIONS/FEASIBILITY STUDY: PHASE I

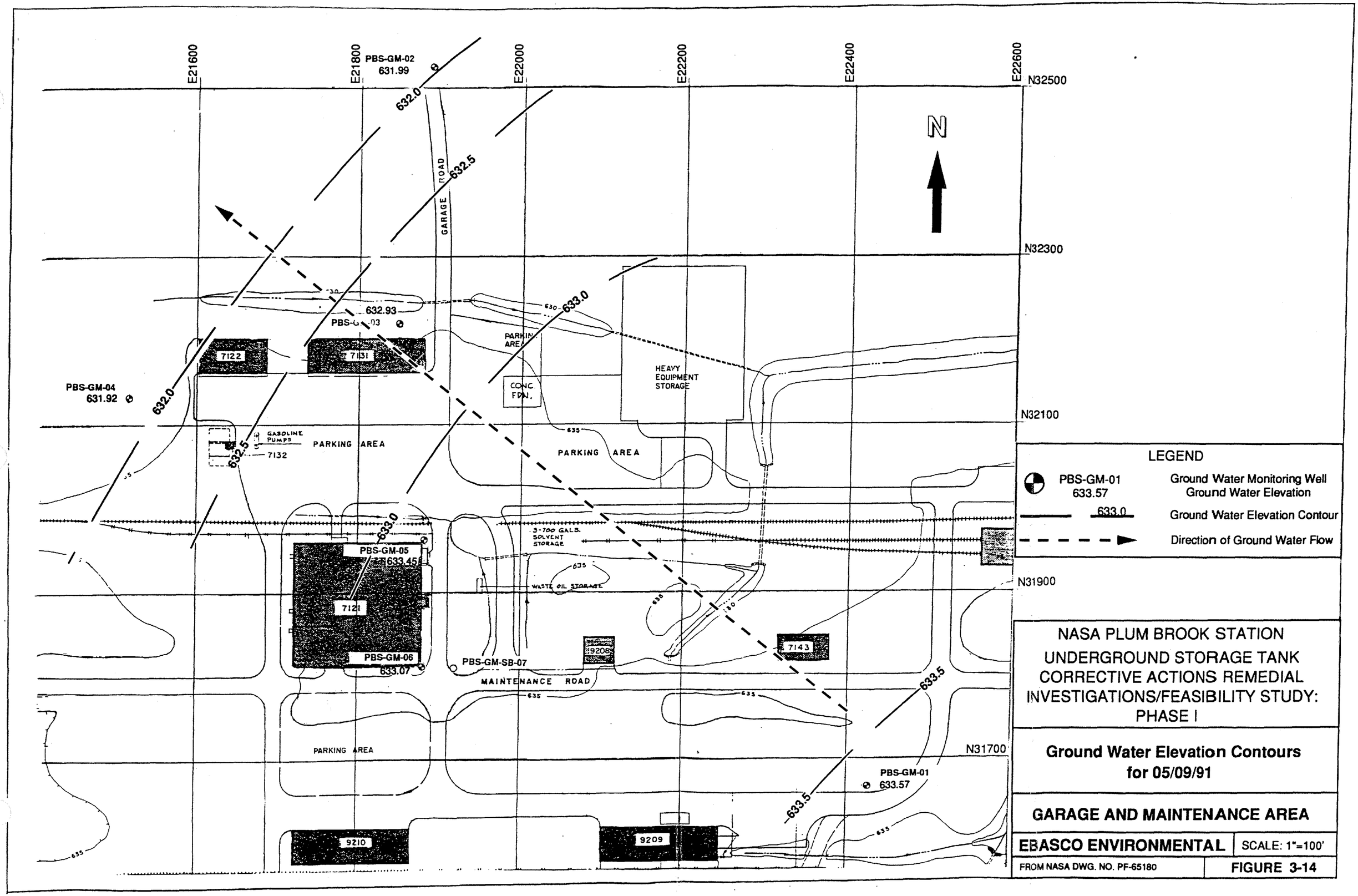
Organic Contaminant Concentrations in Ground Water

GARAGE AND MAINTENANCE AREA

EBASCO ENVIRONMENTAL | SCALE: 1"=100'

FROM NASA DWG. NO. PF-65180 | **FIGURE 3-12**


E21600
E21800
E22000
E22200
E22400
E22600
N32500
N32300
N32100
N31900
N31700
N
PBS-GM-02
632.84
PBS-GM-03
633.37
PBS-GM-04
633.37
PBS-GM-05
633.98
PBS-GM-06
633.04
PBS-GM-SB-07
PBS-GM-01
634.62
633.0
633.5
634.0
634.5
GARAGE ROAD
MAINTENANCE ROAD
PARKING AREA
HEAVY EQUIPMENT STORAGE
CONC. FDN.
GASOLINE PUMPS
7122
7131
7132
7121
7143
9208
9209
9210
LEGEND
PBS-GM-01
634.62
Ground Water Monitoring Well
Ground Water Elevation
634.0
Ground Water Elevation Contour
Direction of Ground Water Flow
NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK
CORRECTIVE ACTIONS REMEDIAL
INVESTIGATIONS/FEASIBILITY STUDY:
PHASE I
Ground Water Elevation Contours
for 01/09/91
GARAGE AND MAINTENANCE AREA
EBASCO ENVIRONMENTAL
SCALE: 1"=100'
FROM NASA DWG. NO. PF-65180
FIGURE 3-13



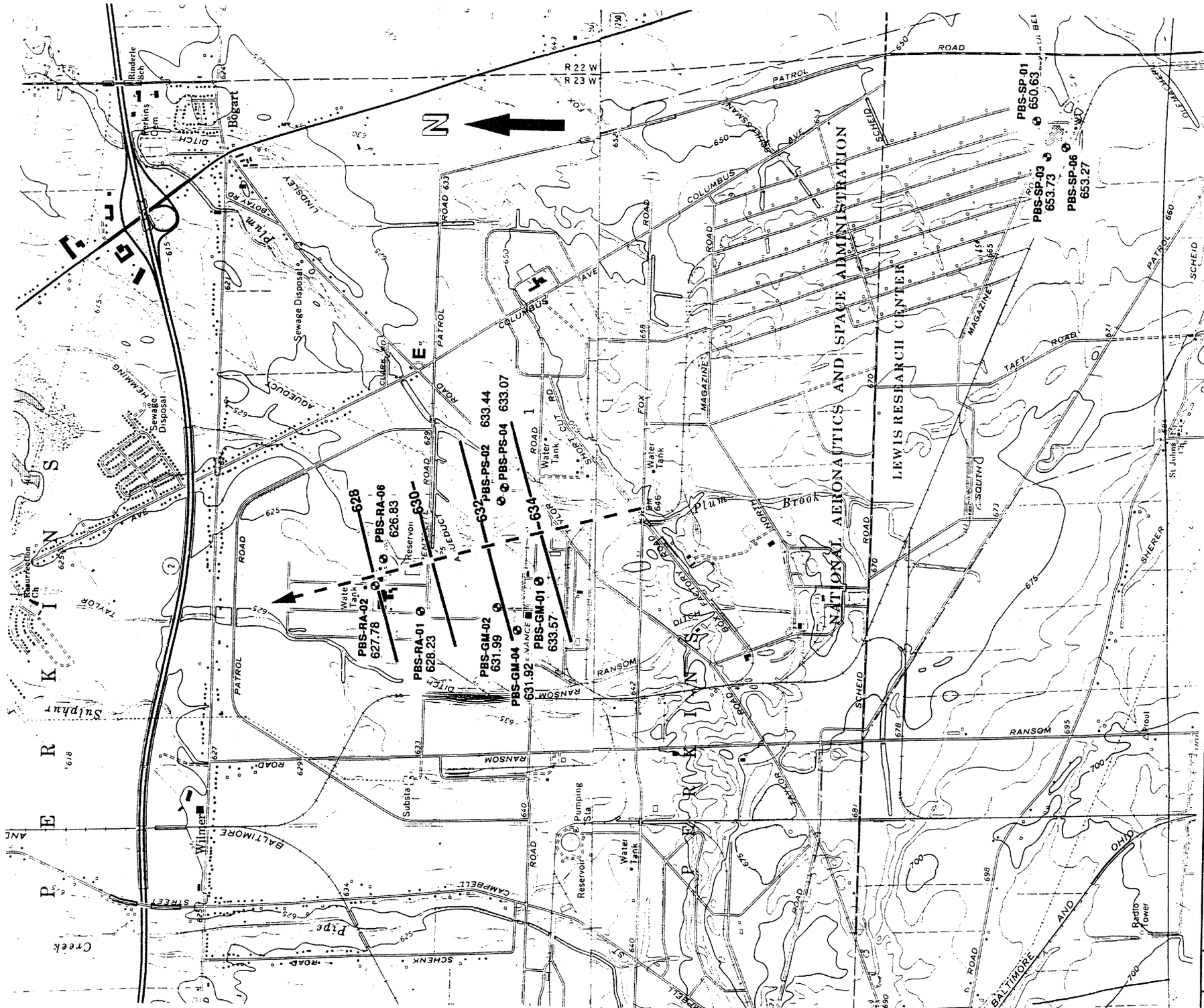
NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATIONS/FEASIBILITY STUDY: PHASE I

Ground Water Elevation Contours for 05/09/91

GARAGE AND MAINTENANCE AREA

EBASCO ENVIRONMENTAL | SCALE: 1"=100'

FROM NASA DWG. NO. PF-65180 | **FIGURE 3-14**



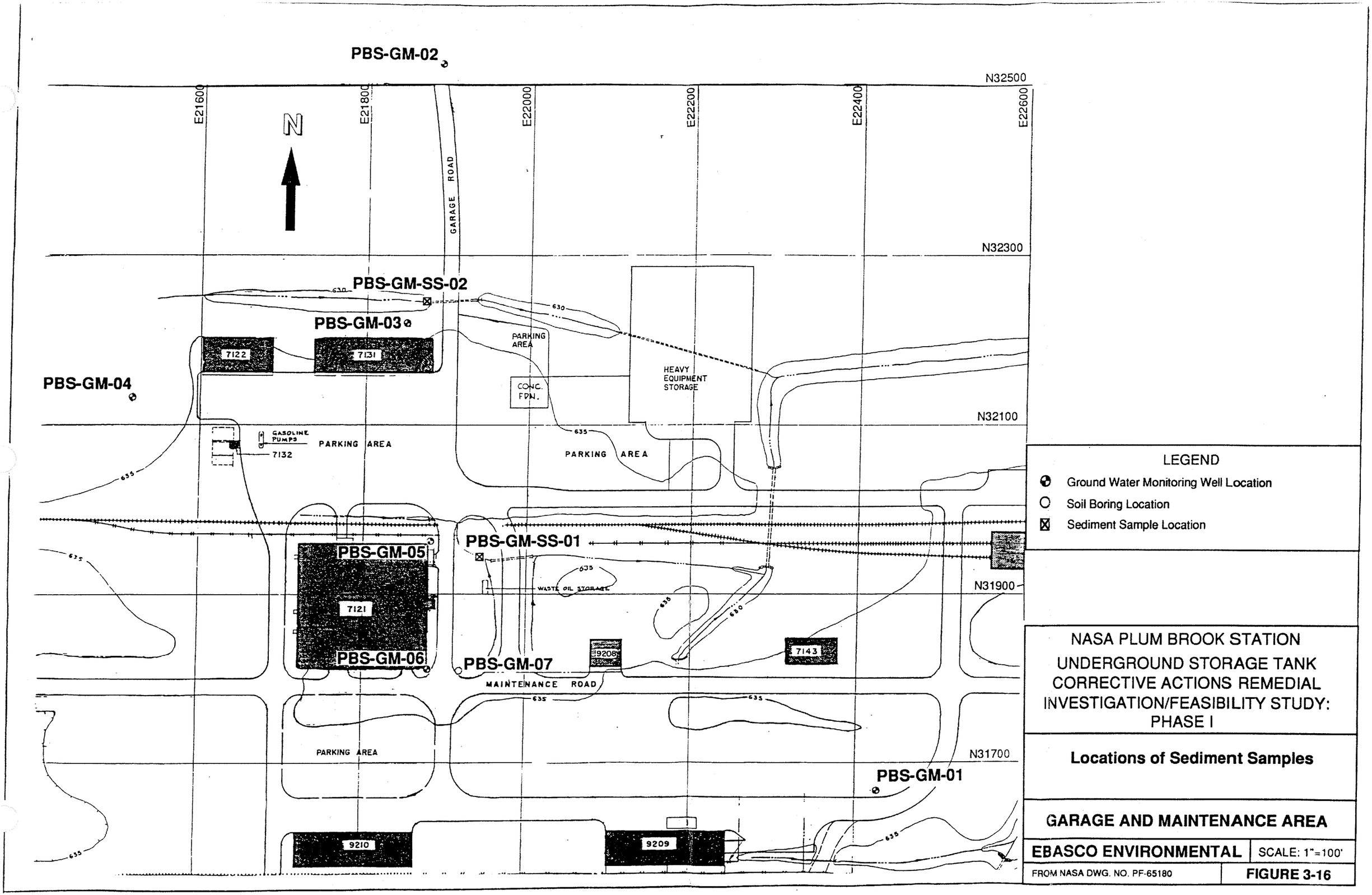
LEGEND

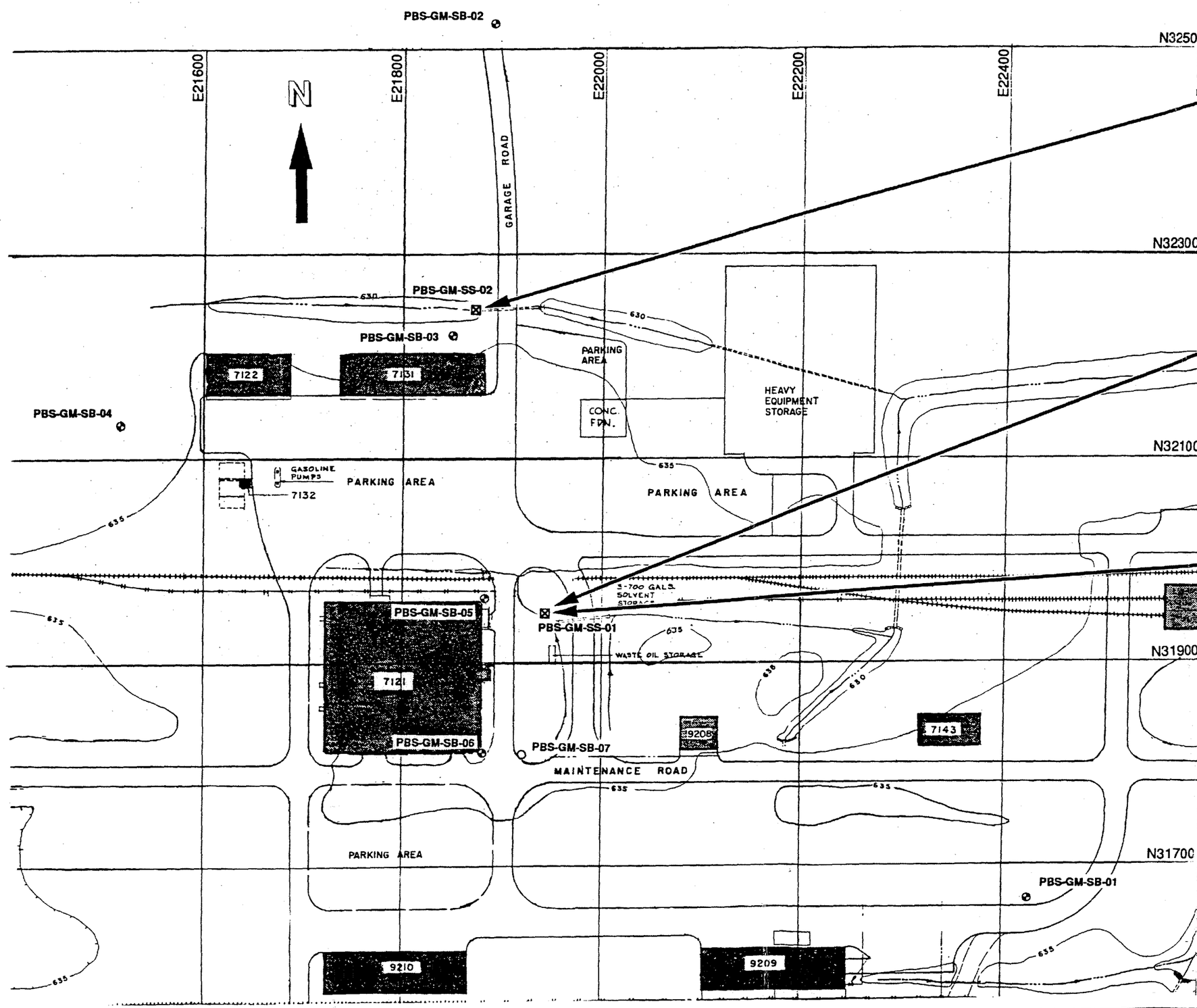
PBS-GM-01 633.57	Ground Water Monitoring Well Ground Water Elevation
634.0	Ground Water Elevation Contour
	Direction of Ground Water Flow

NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATIONS/FEASIBILITY STUDY: PHASE I

Regional Ground Water Elevation Contours for the Plum Brook Station (Based on the 05/09/91 Data)

EBASCO ENVIRONMENTAL	SCALE: 1"=2000'
FROM USGS SANDUSKY & KIMBELL, OHIO 7.5 MINUTE QUADRANGLE TOPO MAPS	**FIGURE 3-15**


PBS-GM-02
N32500
E21600
E21800
E22000
E22200
E22400
E22600
N
GARAGE ROAD
N32300
PBS-GM-SS-02
630
PBS-GM-03
7122
7131
PARKING AREA
HEAVY EQUIPMENT STORAGE
CONC. FDN.
PBS-GM-04
N32100
GASOLINE PUMPS
7132
PARKING AREA
635
PARKING AREA
PBS-GM-05
PBS-GM-SS-01
WASTE OIL STORAGE
N31900
7121
PBS-GM-06
PBS-GM-07
9208
7143
MAINTENANCE ROAD
PARKING AREA
N31700
PBS-GM-01
9210
9209
LEGEND
Ground Water Monitoring Well Location
Soil Boring Location
Sediment Sample Location
NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK
CORRECTIVE ACTIONS REMEDIAL
INVESTIGATION/FEASIBILITY STUDY:
PHASE I
Locations of Sediment Samples
GARAGE AND MAINTENANCE AREA
EBASCO ENVIRONMENTAL
SCALE: 1"=100'
FROM NASA DWG. NO. PF-65180
FIGURE 3-16



PBS-GM-SS-02	Conc.
1,1-Dichloroethane	21 ug/Kg
Phenanthrene	1200 J ug/Kg
Anthracene	220 J ug/Kg
Fluoranthene	3700 ug/Kg
Pyrene	2200 ug/Kg
Benzo(a)anthracene	1200 J ug/Kg
Chrysene	1600 J ug/Kg
Benzo(b)fluoranthene	2400 ug/Kg
Benzo(k)fluoranthene	2200 ug/Kg
Beta-BHC	82 ug/Kg
Delta-BHC	370 ug/Kg
Total Petroleum Hydrocarbons	2620 mg/Kg

PBS-GM-SS-01	Conc.
Phenanthrene	570 J ug/Kg
Fluoranthene	1400 ug/Kg
Pyrene	1000 J ug/Kg
Benzo(a)anthracene	570 J ug/Kg
Chrysene	1000 J ug/Kg
Benzo(b)fluoranthene	1400 ug/Kg
Benzo(k)fluoranthene	1600 ug/Kg
Benzo(a)pyrene	850 J ug/Kg
Indeno(1,2,3-cd)pyrene	850 J ug/Kg
Dibenzo(a,h)anthracene	280 J ug/Kg
Benzo(g,h,i)perylene	710 J ug/Kg
Total Petroleum Hydrocarbons	110 mg/Kg

PBS-GM-SS-03 (SS-01 DUP)	Conc.
Phenanthrene	360 J ug/Kg
Fluoranthene	1100 J ug/Kg
Pyrene	590 J ug/Kg
Benzo(a)anthracene	360 J ug/Kg
Chrysene	590 J ug/Kg
Benzo(b)fluoranthene	710 J ug/Kg
Benzo(k)fluoranthene	950 J ug/Kg
Benzo(a)pyrene	590 J ug/Kg
Indeno(1,2,3-cd)pyrene	590 J ug/Kg
Beta-BHC	40 ug/Kg
Total Petroleum Hydrocarbons	181 mg/Kg

J = Estimated

NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATIONS/FEASIBILITY STUDY: PHASE I

Organic Contaminant Concentrations in Sediment

GARAGE AND MAINTENANCE AREA

EBASCO ENVIRONMENTAL | SCALE: 1"=100'

FROM NASA DWG. NO. PF-65180 | **FIGURE 3-17**

SAMPLE IDENTIFICATION	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Sample Type	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Sample Depth Below Surface	10'-12'	10'-12'	10'-12'	10'-12'	10'-12'	10'-12'	6'-8'	6'-8'
Date Sampled	11-27-90	11-27-90	11-28-90	11-28-90	11-29-90	11-29-90	11-29-90	11-29-90
VOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Chloromethane	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
Bromomethane	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
Vinyl Chloride	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
Chloroethane	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
Methylene Chloride	22	120	6 U	6 U	13	100	25	60
Acetone	110	64	30	82	23	68	25	84
Carbon Disulfide	6 U	10	6 U	6 U	400 E	14	6 U	6
1,1-Dichloroethene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
1,1-Dichloroethane	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloroethene (Total)	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Chloroform	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloroethane	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
2-Butanone	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
1,1,1-Trichloroethane	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Carbon Tetrachloride	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Vinyl Acetate	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
Bromodichloromethane	6 U	6 U	6	6 U	6 U	6 U	6 U	6 U
1,2-Dichloropropane	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
cis-1,3-Dichloropropene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Trichloroethene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Dibromochloromethane	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
1,1,2-Trichloroethane	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Benzene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U

Notes
( ) Denotes sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below Quantitation Limit
E Concentration exceeds calibration range of GC/MS instrument

Laboratory; Hittman Ebasco

SOIL SAMPLE RESULTS FOR THE GARAGE AND MAINTENANCE AREA

SAMPLE IDENTIFICATION	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Sample Type	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Sample Depth Below Surface	10'-12'	10'-12'	10'-12'	10'-12'	10'-12'	10'-12'	6'-8'	6'-8'
Date Sampled	11-27-90	11-27-90	11-28-90	11-28-90	11-29-90	11-29-90	11-29-90	11-29-90
VOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
trans-1,3-Dichloropropene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Bromoform	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
4-Methyl-2-Pentanone	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
2-Hexanone	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
Tetrachloroethene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
1,1,2,2-Tetrachloroethane	6 U	6 U	35	6 U	6 U	6 U	6 U	6 U
Toluene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Chlorobenzene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Ethylbenzene	6 U	6 U	21	6 U	6 U	6 U	6 U	6 U
Styrene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Xylenes (Total)	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U

Notes
( ) Denotes sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below Quantitation Limit
E Concentration exceeds calibration range of GC/MS instrument

Laboratory; Hittman Ebasco

SOIL SAMPLE RESULTS FOR THE GARAGE AND MAINTENANCE AREA

SAMPLE IDENTIFICATION	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Sample Type	Grab	Grab	Grab	Grab	Grab	Grab
Sample Depth Below Surface	8'-10'	8'-10'	4'-6'	4'-6'	4'-6'	4'-6'
Date Sampled	11-30-90	11-30-90	12-4-90	12-4-90	12-7-90	12-7-90
VOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Chloromethane	13 U	2600 U	12 U	12 U	12 U	12 U
Bromomethane	13 U	2600 U	12 U	12 U	12 U	12 U
Vinyl Chloride	13 U	2600 U	12 U	12 U	12 U	12 U
Chloroethane	13 U	2600 U	12 U	12 U	12 U	12 U
Methylene Chloride	8	1300 U	6 U	8	11	120
Acetone	33	2600 U	38	34	12 U	12 U
Carbon Disulfide	27	1300 U	75	6 U	6 U	32
1,1-Dichloroethene	61	1300 U	6 U	6 U	6 U	6 U
1,1-Dichloroethane	50	1300 U	12	4 J	6 U	6 U
1,2-Dichloroethene (Total)	6 U	1300 U	6 U	6 U	6 U	6 U
Chloroform	6 U	1300 U	6 U	6 U	6 U	6 U
1,2-Dichloroethane	6 U	1300 U	6 U	6 U	6 U	6 U
2-Butanone	13 U	6200	12 U	12 U	12 U	12 U
1,1,1-Trichloroethane	1100 E	2000	25	11	20	6 U
Carbon Tetrachloride	260	1300 U	6 U	6 U	6 U	6 U
Vinyl Acetate	13 U	2600 U	12 U	12 U	12 U	12 U
Bromodichloromethane	6 U	1300 U	6 U	6 U	6 U	6 U
1,2-Dichloropropane	6 U	1300 U	6 U	6 U	6 U	6 U
cis-1,3-Dichloropropene	6 U	1300 U	6 U	6 U	6 U	6 U
Trichloroethene	55	1300 U	6 U	6 U	6 U	6 U
Dibromochloromethane	6 U	1300 U	6 U	6 U	6 U	6 U
1,1,2-Trichloroethane	6 U	1300 U	6 U	6 U	6 U	6 U
Benzene	6 U	1300 U	6 U	6 U	6 U	6 U

Notes
( ) Denotes sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below Quantitation Limit
E Concentration exceeds

Laboratory: Hittman Ebasco

SOIL SAMPLE RESULTS FOR THE GARAGE AND MAINTENANCE AREA

SAMPLE IDENTIFICATION	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Sample Type	Grab	Grab	Grab	Grab	Grab	Grab
Sample Depth Below Surface	8'-10'	8'-10'	4'-6'	4'-6'	4'-6'	4'-6'
Date Sampled	11-30-90	11-30-90	12-4-90	12-4-90	12-7-90	12-7-90
VOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
trans-1,3-Dichloropropene	6 U	1300 U	6 U	6 U	6 U	6 U
Bromoform	6 U	1300 U	6 U	6 U	6 U	6 U
4-Methyl-2-Pentanone	13 U	2600 U	12 U	12 U	12 U	12 U
2-Hexanone	13 U	2600 U	12 U	12 U	12 U	12 U
Tetrachloroethene	24	1300 U	6 U	6 U	6 U	6 U
1,1,2,2-Tetrachloroethane	18	1300 U	6 U	6 U	6 U	6 U
Toluene	6 U	1300 U	6 U	6 U	6 U	6 U
Chlorobenzene	6 U	1300 U	6 U	6 U	6 U	6 U
Ethylbenzene	6 U	1300 U	6 U	6 U	6 U	6 U
Styrene	6 U	1300 U	6 U	6 U	6 U	6 U
Xylenes (Total)	6 U	1300 U	6 U	6 U	6 U	6 U

Notes
( ) Denotes sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below Quantitation Limit
E Concentration exceeds

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-27'	0'-27'	0'-29'	0'-29'	0'-18'	0'-18'	0'-16'	0'-16'
Date Sampled	11-27-90	11-27-90	11-28-90	11-28-90	11-29-90	11-29-90	11-29-90	11-29-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Phenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
bis(-2-Chloroethyl) Ether	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2-Chlorophenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
1,3-Dichlorobenzene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
1,4-Dichlorobenzene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Benzyl alcohol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
1,2-Dichlorobenzene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2-Methylphenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
bis(-2-Chloroisopropyl) Ether	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
4-Methylphenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
N-Nitroso-Di-n-propylamine	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Hexachloroethane	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Nitrobenzene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Isophorone	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2-Nitrophenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2,4-Dimethylphenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Benzoic acid	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
bis(-2-Chloroethoxy) methane	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2,4-Dichlorophenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
1,2,4-Trichlorobenzene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Naphthalene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
4-Chloroaniline	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Hexachlorobutadiene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U

Notes
( ) Denote sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below the Quantitation Limit

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-27'	0'-27'	0'-29'	0'-29'	0'-18'	0'-18'	0'-16'	0'-16'
Date Sampled	11-27-90	11-27-90	11-28-90	11-28-90	11-29-90	11-29-90	11-29-90	11-29-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
4-Chloro-3-methylphenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2-Methylnaphthalene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Hexachlorocyclopentadiene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2,4,6-Trichlorophenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2,4,5-Trichlorophenol	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
2-Chloronaphthalene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2-Nitroaniline	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
Dimethyl Phthalate	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Acenaphthylene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2,6-Dinitrotoluene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
3-Nitroaniline	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
Acenaphthene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2,4-Dinitrophenol	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
4-Nitrophenol	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
Dibenzofuran	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2,4-Dinitrotoluene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Diethylphthalate	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
4-Chlorophenyl-phenylether	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Fluorene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
4-Nitroaniline	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
4,6-Dinitro-2-methylphenol	220 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
N-Nitrosodiphenylamine	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
4-Bromophenyl-phenylether	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U

Notes
( ) Denote sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below the Quantitation Limit

Laboratory; Hittman Ebasco

SOIL SAMPLE RESULTS FOR THE GARAGE AND MAINTENANCE AREA

SAMPLE IDENTIFICATION	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-27'	0'-27'	0'-29'	0'-29'	0'-18'	0'-18'	0'-16'	0'-16'
Date Sampled	11-27-90	11-27-90	11-28-90	11-28-90	11-29-90	11-29-90	11-29-90	11-29-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Hexachlorobenzene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Pentachlorophenol	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
Phenanthrene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Anthracene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Di-n-butylphthalate	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Fluoranthene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Pyrene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Butylbenzylphthalate	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
3,3'-Dichlorobenzidine	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Benzo(a)anthracene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Chrysene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
bis(2-Ethylhexyl)phthalate	3600	2300	560	430 J	1100	970	5400	1200
Di-n-octyl Phthalate	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Benzo(b)fluoranthene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Benzo(k)fluoranthene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Benzo(a)pyrene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Indeno(1,2,3-cd)pyrene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Dibenzo(a,h)anthracene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Benzo(g,h,i)perylene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U

Notes
( ) Denote sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below the Quantitation Limit

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-18'	0'-18'	0'-18'	0'-18'	0'-16'	0'-16'
Date Sampled	11-30-90	11-30-90	12-4-90	12-4-90	12-7-90	12-7-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Phenol	460 U	450 U	440 U	440 U	420 U	420 U
bis(-2-Chloroethyl) Ether	460 U	450 U	440 U	440 U	420 U	420 U
2-Chlorophenol	460 U	450 U	440 U	440 U	420 U	420 U
1,3-Dichlorobenzene	460 U	450 U	440 U	440 U	420 U	420 U
1,4-Dichlorobenzene	460 U	450 U	440 U	440 U	420 U	420 U
Benzyl alcohol	460 U	450 U	440 U	440 U	420 U	420 U
1,2-Dichlorobenzene	460 U	450 U	440 U	440 U	420 U	420 U
2-Methylphenol	460 U	450 U	440 U	440 U	420 U	420 U
bis(-2-Chloroisopropyl) Ether	460 U	450 U	440 U	440 U	420 U	420 U
4-Methylphenol	460 U	450 U	440 U	440 U	420 U	420 U
N-Nitroso-Di-n-propylamine	460 U	450 U	440 U	440 U	420 U	420 U
Hexachloroethane	460 U	450 U	440 U	440 U	420 U	420 U
Nitrobenzene	460 U	450 U	440 U	440 U	420 U	420 U
Isophorone	460 U	450 U	440 U	440 U	420 U	420 U
2-Nitrophenol	460 U	450 U	440 U	440 U	420 U	420 U
2,4-Dimethylphenol	460 U	450 U	440 U	440 U	420 U	420 U
Benzoic acid	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
bis(-2-Chloroethoxy) methane	460 U	450 U	440 U	440 U	420 U	420 U
2,4-Dichlorophenol	460 U	450 U	440 U	440 U	420 U	420 U
1,2,4-Trichlorobenzene	460 U	450 U	440 U	440 U	420 U	420 U
Naphthalene	460 U	450 U	440 U	440 U	420 U	420 U
4-Chloroaniline	460 U	450 U	440 U	440 U	420 U	420 U
Hexachlorobutadiene	460 U	450 U	440 U	440 U	420 U	420 U

Notes
( ) Denote sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below the Quantitation Limit

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-18'	0'-18'	0'-18'	0'-18'	0'-16'	0'-16'
Date Sampled	11-30-90	11-30-90	12-4-90	12-4-90	12-7-90	12-7-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
4-Chloro-3-methylphenol	460 U	450 U	440 U	440 U	420 U	420 U
2-Methylnaphthalene	460 U	450 U	440 U	440 U	420 U	420 U
Hexachlorocyclopentadiene	460 U	450 U	440 U	440 U	420 U	420 U
2,4,6-Trichlorophenol	460 U	450 U	440 U	440 U	420 U	420 U
2,4,5-Trichlorophenol	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
2-Chloronaphthalene	460 U	450 U	440 U	440 U	420 U	420 U
2-Nitroaniline	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
Dimethyl Phthalate	460 U	450 U	440 U	440 U	420 U	420 U
Acenaphthylene	460 U	450 U	440 U	440 U	420 U	420 U
2,6-Dinitrotoluene	460 U	450 U	440 U	440 U	420 U	420 U
3-Nitroaniline	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
Acenaphthene	460 U	450 U	440 U	440 U	420 U	420 U
2,4-Dinitrophenol	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
4-Nitrophenol	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
Dibenzofuran	460 U	450 U	440 U	440 U	420 U	420 U
2,4-Dinitrotoluene	460 U	450 U	440 U	440 U	420 U	420 U
Diethylphthalate	460 U	450 U	440 U	440 U	420 U	420 U
4-Chlorophenyl-phenylether	460 U	450 U	440 U	440 U	420 U	420 U
Fluorene	460 U	450 U	440 U	440 U	420 U	420 U
4-Nitroaniline	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
4,6-Dinitro-2-methylphenol	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
N-Nitrosodiphenylamine	460 U	450 U	440 U	440 U	420 U	420 U
4-Bromophenyl-phenylether	460 U	450 U	440 U	440 U	420 U	420 U

Notes
( ) Denote sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below the Quantitation Limit

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-18'	0'-18'	0'-18'	0'-18'	0'-16'	0'-16'
Date Sampled	11-30-90	11-30-90	12-4-90	12-4-90	12-7-90	12-7-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Hexachlorobenzene	460 U	450 U	440 U	440 U	420 U	420 U
Pentachlorophenol	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
Phenanthrene	460 U	450 U	440 U	440 U	420 U	420 U
Anthracene	460 U	450 U	440 U	440 U	420 U	420 U
Di-n-butylphthalate	460 U	450 U	440 U	440 U	420 U	420 U
Fluoranthene	460 U	450 U	440 U	440 U	420 U	420 U
Pyrene	460 U	450 U	440 U	440 U	420 U	420 U
Butylbenzylphthalate	460 U	450 U	440 U	440 U	420 U	420 U
3,3'-Dichlorobenzidine	460 U	450 U	440 U	880 U	420 U	840 U
Benzo(a)anthracene	460 U	450 U	440 U	440 U	420 U	420 U
Chrysene	460 U	450 U	440 U	440 U	420 U	420 U
bis(2-Ethylhexyl)phthalate	1500	360 J	440 U	750	1300	470
Di-n-octyl Phthalate	460 U	450 U	440 U	440 U	420 U	420 U
Benzo(b)fluoranthene	460 U	450 U	440 U	440 U	420 U	420 U
Benzo(k)fluoranthene	460 U	450 U	440 U	440 U	420 U	420 U
Benzo(a)pyrene	460 U	450 U	440 U	440 U	420 U	420 U
Indeno(1,2,3-cd)pyrene	460 U	450 U	440 U	440 U	420 U	420 U
Dibenzo(a,h)anthracene	460 U	450 U	440 U	440 U	420 U	420 U
Benzo(g,h,i)perylene	460 U	450 U	440 U	440 U	420 U	420 U

Notes
( ) Denote sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below the Quantitation Limit

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	GM-SB01	GM-SB02	GM-SB03	GM-SB04	GM-SB05	GM-SB06	GM-SB07
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-27'	0'-29'	0'-18'	0'-16'	0'-18'	0'-18'	0'-16'
Date Sampled	11-27-90	11-28-90	11-29-90	11-29-90	11-30-90	12-4-90	12-7-90
PESTICIDE/PCBs (ug/kg)	GM-SB01	GM-SB02	GM-SB03	GM-SB04	GM-SB05	GM-SB06	GM-SB07
Alpha-BHC	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Beta-BHC	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Delta-BHC	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Gamma-BHC(Lindane)	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Heptachlor	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Aldrin	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Heptachlor Epoxide	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Endosulfan I	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Dieldrin	20 U	20 U	20 U	20 U	21 U	20 U	20 U
4,4-DDE	20 U	20 U	20 U	20 U	21 U	20 U	20 U
Endrin	20 U	20 U	20 U	20 U	21 U	20 U	20 U
Endosulfan II	20 U	20 U	20 U	20 U	21 U	20 U	20 U
4,4-DDD	20 U	20 U	20 U	20 U	21 U	20 U	20 U
Endosulfan Sulfate	20 U	20 U	20 U	20 U	21 U	20 U	20 U
4,4-DDT	20 U	20 U	20 U	20 U	21 U	20 U	20 U
Methoxychlor	100 U	100 U	100 U	100 U	110 U	100 U	100 U
Endrin Ketone	20 U	20 U	20 U	20 U	21 U	20 U	20 U
Chlordane	100 U	100 U	100 U	100 U	110 U	100 U	100 U
Toxaphene	200 U	200 U	200 U	200 U	210 U	200 U	200 U
Aroclor-1016	100 U	100 U	100 U	100 U	110 U	100 U	100 U
Aroclor-1221	100 U	100 U	100 U	100 U	110 U	100 U	100 U
Aroclor-1232	100 U	100 U	100 U	100 U	110 U	100 U	100 U
Aroclor-1242	100 U	100 U	100 U	100 U	110 U	100 U	100 U
Aroclor-1248	100 U	100 U	100 U	100 U	110 U	100 U	100 U
Aroclor-1254	200 U	200 U	200 U	200 U	210 U	200 U	200 U
Aroclor-1260	200 U	200 U	200 U	200 U	210 U	200 U	200 U

Notes
( ) Denote Sample Reanalysis

Qualifiers for Organics
U Undetected

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	GM-SB01	GM-SB02	GM-SB03	GM-SB04	GM-SB05	GM-SB06	GM-SB07
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-27'	0'-29'	0'-18'	0'-16'	0'-18'	0'-18'	0'-16'
Date Sampled	11-27-90	11-28-90	11-29-90	11-29-90	11-30-90	12-4-90	12-7-90
METALS/CYANIDE/TPH (mg/Kg)	GM-SB01	GM-SB02	GM-SB03	GM-SB04	GM-SB05	GM-SB06	GM-SB07
Aluminum	11400.00	8880.00	12400.00	15800.00	7560.00	9100.00	8800.00
Antimony	1.80 U	1.80 U	1.80 U	1.90 U	1.90 U	2.00 U	1.90 U
Arsenic	11.00	4.90	9.50	6.90	6.10	4.30	4.40
Barium	148.00	38.00	75.00	88.00	50.00	51.00	35.00
Beryllium	0.49	0.39 U	0.49	0.51	0.40 U	0.40 U	0.49
Cadmium	3.60	1.20 U	1.20	1.50	1.20 U	1.30 U	2.40
Calcium	4060.00	38200.00	21700.00	72200.00	35200.00	53300.00	22300.00
Chromium	15.00	13.00	20.00	19.00	14.00	20.00	17.00
Cobalt	21.00	9.20	16.00	13.00	7.00	7.20	8.60
Copper	19.00	13.00	17.00	32.00	17.00	12.00	12.00
Iron	32000.00	20200.00	22700.00	32800.00	20700.00	15400.00	18300.00
Lead	12.00	9.80	13.00	10.00	8.00	12.00	11.00
Magnesium	2710.00	14300.00	8150.00	20100.00	14100.00	19500.00	6720.00
Manganese	1400.00	320.00	925.00	625.00	283.00	201.00	356.00
Mercury	0.12	0.11 U	0.11 U	0.11 U	0.11 U	0.19	0.12 U
Nickel	66.00	22.00	36.00	37.00	18.00	15.00	13.00
Potassium	906.00	1250.00	1030.00	2930.00	938.00	1110.00	1510.00
Selenium	0.63 U	12.00 U	12.00 U	13.00 U	12.00 U	0.67 U	0.83 U
Silver	0.61 U	0.60 U	0.61 U	0.63 U	0.62 U	0.64 U	0.61 U
Sodium	804.00	540.00	560.00	909.00	460.00	438.00	298.00
Thallium	0.85 U	0.84 U	0.85 U	0.88 U	0.87	0.90 U	0.86 U
Vanadium	40.00	21.00	23.00	30.00	22.00	19.00	29.00
Zinc	86.00	47.00	63.00	67.00	44.00	48.00	46.00
CYANIDE	1.20 U	1.20 U	1.20 U	1.30 U	1.20 U	1.30 U	1.20 U
TOTAL PETROLEUM HYDROCARBONS (TPH)	36.00 U	106.00	36.00 U	129.00	37.00 U	38.00 U	36.00 U

Notes
( ) Denotes Sample Reanalysis

Qualifiers
U Undetected

Laboratory: Hittman Ebasco

TABLE B-1 GROUND WATER SAMPLE RESULTS FOR THE GARAGE AND MAINTENANCE AREA

SAMPLE IDENTIFICATION	PBS-GM-GW-02	PBS-GM-GW-08 (GM-GW-02 DUP)	(PBS-GM-GW-08)	PBS-GM-GW-06
Date Sampled	1-15-91	1-15-91	1-15-91	1-15-91
VOLATILE ORGANIC COMPOUNDS (ug/L)	PBS-GM-GW-02	PBS-GM-GW-08	(PBS-GM-GW-08)	PBS-GM-GW-06
Chloromethane	10 U	10 U	10 U	10 U
Bromomethane	10 U	10 U	10 U	10 U
Vinyl Chloride	10 U	10 U	10 U	10 U
Chloroethane	10 U	10 U	10 U	10 U
Methylene Chloride	5 U	5 U	5 U	5 U
Acetone	10 U	10 U	10 U	10 U
Carbon Disulfide	5 U	5 U	5 U	5 U
1,1-Dichloroethene	5 U	5 U	5 U	20
1,1-Dichloroethane	5 U	5 U	5 U	24
1,2-Dichloroethene (Total)	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U
2-Butanone	10 U	10 U	10 U	10 U
1,1,1-Trichloroethane	5 U	5 U	5 U	120
Carbon Tetrachloride	5 U	5 U	5 U	5 U
Vinyl Acetate	10 U	10 U	10 U	10 U
Bromodichloromethane	5 U	5 U	5 U	5 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U
Trichloroethene	7	5 U	7	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U
Benzene	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone	10 U	10 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U
Tetrachloroethene	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U
Xylenes (Total)	5 U	5 U	5 U	5 U

( ) Denote Sample Reanalysis

Qualifiers
U Undetected

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	PBS-GM-GW-02	PBS-GM-GW-08 (GM-GW-02 DUP)	PBS-GM-GW-06
Date Sampled	1-15-91	1-15-91	1-15-91
SEMIVOLATILE ORGANIC COMPOUNDS (ug/L)	PBS-GM-GW-02	PBS-GM-GW-08	PBS-GM-GW-06
Phenol	10 U	10 U	10 U
bis(-2-Chloroethyl) Ether	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U
Benzyl alcohol	10 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U
bis(-2-Chloroisopropyl) Ether	10 U	10 U	10 U
4-Methylphenol	10 U	10 U	10 U
N-Nitroso-Di-n-propylamine	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U
Isophorone	10 U	10 U	10 U
2-Nitrophenol	10 U	10 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U
Benzoic acid	50 U	50 U	50 U
bis(-2-Chloroethoxy) methane	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U
Naphthalene	10 U	10 U	10 U
4-Chloroaniline	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	10 U
2,4,5-Trichlorophenol	50 U	50 U	50 U
2-Chloronaphthalene	10 U	10 U	10 U
2-Nitroaniline	50 U	50 U	50 U
Dimethyl Phthalate	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U
3-Nitroaniline	50 U	50 U	50 U
Acenaphthene	10 U	10 U	10 U
2,4-Dinitrophenol	50 U	50 U	50 U
4-Nitrophenol	50 U	50 U	50 U
Dibenzofuran	10 U	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U
Diethylphthalate	10 U	10 U	10 U

Qualifiers
U Undetected
J Estimated, Value Below the Quantitation Limit

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	PBS-GM-GW-02	PBS-GM-GW-08 (GM-GW-02 DUP)	PBS-GM-GW-06
Date Sampled	1-15-91	1-15-91	1-15-91
SEMIVOLATILE ORGANIC COMPOUNDS (ug/L)	PBS-GM-GW-02	PBS-GM-GW-08	PBS-GM-GW-06
4-Chlorophenyl-phenylether	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U
4-Nitroaniline	50 U	50 U	50 U
4,6-Dinitro-2-methylphenol	50 U	50 U	50 U
N-Nitrosodiphenylamine	10 U	10 U	10 U
4-Bromophenyl-phenylether	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U
Pentachlorophenol	50 U	50 U	50 U
Phenanthrene	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U
Di-n-butylphthalate	10 U	10 U	10 U
Fluoranthene	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U
Butylbenzylphthalate	10 U	10 U	6 J
3,3'-Dichlorobenzidine	20 U	20 U	20 U
Benzo(a)anthracene	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U
bis(2-Ethylhexyl)phthalate	10 U	10 U	7 J
Di-n-octyl Phthalate	10 U	14	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	10 U
Dibenzo(a,h)anthracene	10 U	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U	10 U

Qualifiers
U Undetected
J Estimated, Value Below the Quantitation Limit

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	PBS-GM-GW-02	PBS-GM-GW-08 (GM-GW-02 DUP)	PBS-GM-GW-06
Date Sampled	1-15-91	1-15-91	1-15-91
PESTICIDE/PCBs (ug/L)	PBS-GM-GW-02	PBS-GM-GW-08	PBS-GM-GW-06
Alpha-BHC	0.050 U	0.052 U	0.052 U
Beta-BHC	0.056	0.054	0.190
Delta-BHC	0.050 U	0.052 U	0.052 U
Gamma-BHC(Lindane)	0.050 U	0.052 U	0.052 U
Heptachlor	0.050 U	0.052 U	0.052 U
Aldrin	0.050 U	0.052 U	0.052 U
Heptachlor Epoxide	0.050 U	0.052 U	0.052 U
Endosulfan I	0.050 U	0.052 U	0.052 U
Dieldrin	0.100 U	0.100 U	0.100 U
4,4-DDE	0.100 U	0.100 U	0.100 U
Endrin	0.100 U	0.100 U	0.100 U
Endosulfan II	0.100 U	0.100 U	0.100 U
4,4-DDD	0.100 U	0.100 U	0.100 U
Endosulfan Sulfate	0.190 B	0.210 B	1.000 B
4,4-DDT	0.100 U	0.100 U	0.100 U
Methoxychlor	0.500 U	0.520 U	0.520 U
Endrin Ketone	0.100 U	0.100 U	0.100 U
Chlordane	0.500 U	0.520 U	0.520 U
Toxaphene	1.000 U	1.000 U	1.000 U
Aroclor-1016	0.500 U	0.520 U	0.520 U
Aroclor-1221	0.500 U	0.520 U	0.520 U
Aroclor-1232	0.500 U	0.520 U	0.520 U
Aroclor-1242	0.500 U	0.520 U	0.520 U
Aroclor-1248	0.500 U	0.520 U	0.520 U
Aroclor-1254	1.000 U	1.000 U	1.000 U
Aroclor-1260	1.000 U	1.000 U	1.000 U

Qualifiers
U Undetected
B Analyte found in associated blank

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	PBS-GM-GW-02	PBS-GM-GW-08 (GM-GW-02 DUP)	PBS-GM-GW-06
Date Sampled	1-15-91	1-15-91	1-15-91
METALS/CYANIDE (ug/L) TPH (mg/L)	PBS-GM-GW-02	PBS-GM-GW-08	PBS-GM-GW-06
Aluminum	128	104	712
Antimony	3.4 U	3.4 U	3.4 U
Arsenic	3.9	3.3	4.2
Barium	158	133	126
Beryllium	1.6 U	1.6 U	1.6 U
Cadmium	5 U	5 U	5 U
Calcium	68800	70300	99500
Chromium	2.2 U	2.2 U	2.2 U
Cobalt	8.7 U	8.7 U	8.7 U
Copper	11 U	11 U	11 U
Iron	133	139	1060
Lead	1.5 U	1.5 U	1.5 U
Magnesium	28500	29000	23100
Manganese	381	356	893
Mercury	0.2 U	0.2 U	0.5
Nickel	22 U	22 U	22 U
Potassium	9320	9310	1520
Selenium	3.3 U	3.3 U	3.3 U
Silver	2.5 U	2.5 U	2.5 U
Sodium	63900	63500	33300
Thallium	2.4 U	2.4 U	2.4 U
Vanadium	9.2 U	9.2 U	9.2 U
Zinc	35	35	6
CYANIDE	10 U	10 U	10 U
TOTAL PETROLEUM HYDROCARBONS (TPH)	1 U	1 U	1 U

Qualifiers
U Undetected

Laboratory; Hittman Ebasco

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-01

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLIN

COORDINATES: N- 31667 E- 22328

TOTAL DEPTH: 27'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 638.495 MSL

GROUND WATER LEVEL & DATE TAKEN: 634.62 MSL 1/8/91

DATE STARTED: 11-27-90

DATE COMPLETED: 11-27-90

LOGGED BY: S. STOWE / R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		1-2-4-5	VOA Sample GM-SB-01 (GM-SB-01 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH samples composited over total depth)	58	Brown fine SAND, little to trace silt	
		3-3-4-5		63		
5		3-3-4-5		63	Grey sandy clayey SILT	
		2-2-3-4		71		
		1-1-3-5		71		
10		5-7-11-16		63	Grey clayey SILT, trace fine gravel 10'-12'	Saturated VOA sample taken from 10'-12'
		6-7-10-13		100	Grey silty CLAY, little to trace fine gravel (shale), tight, dry	
15		4-6-19-23		75		
		11-16-20-18		63	Grey SAND and SILT, little gravel, little clay	
					Grey SAND, little silt, little gravel, trace clay	
		9-11-14-19		63	Grey clayey SILT, trace fine gravel	
20		6-10-14-22		50		
		4-10 14-20		83		
25		9-9-16-18		75		
		8-20-100		38	Grey shale	
					End of boring at 27"	

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-02

SHEET 1 OF 2

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 32525 E- 21889

TOTAL DEPTH: 29'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 635.805 MSL

GROUND WATER LEVEL & DATE TAKEN: 632.84 MSL 1/8/91

DATE STARTED: 11-28-90

DATE COMPLETED: 11-28-90

LOGGED BY: R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		2-3-4-5	VOA Sample GM-SB-02 GM-SB-02 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH samples composited over total depth	75	Brown medium - fine SAND, some to little silt	
		2-3-3-5		71	Brown sandy SILT, mottled	
5		1-3-3-4		75	Greyish brown fine SAND, some to trace silt, some to trace clay	
		3-4-7-7		83		Saturated
		2-5-5-6		88	Grey sandy SILT	
10		3-4-5-5		83		VOA sample taken from 10'-12'
		3-4-5-6		92		
15		2-3-4-6		96	Grey sandy clayey SILT	
		1-2-4-5		100	Grey clayey SILT	
		3-4-6-7		75	Grey sandy SILT, little gravel	
20		4-6-10-11		71		
		8-16-20-26		75		
25		16-20-27-50/5		92	Grey SAND, some silt, little gravel	
		13-17-18-30		83	Grey clayey SILT	

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-02

SHEET 2 OF 2

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 32525 E- 21889

TOTAL DEPTH: 29'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 635.805 MSL

GROUND WATER LEVEL & DATE TAKEN: 632.84 MSL 1/8/91

DATE STARTED: 11-28-90

DATE COMPLETED: 11-28-90

LOGGED BY: R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		18-50/3			Grey clayey SILT	
30					Shale Bedrock	
					End of boring at 29'	
35						

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-03

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 32220 E- 21849

TOTAL DEPTH: 18'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 636.690 MSL

GROUND WATER LEVEL & DATE TAKEN: 633.37 MSL 1/8/91

DATE STARTED: 11-29-90

DATE COMPLETED: 11-29-90

LOGGED BY: R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		1-2-4-4	VOA Sample GM-SB-03 GM-SB-03 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH samples composited over total depth	50	Brown fine SAND, some silt, mottled	
		2-4-3-4		75		
5		2-3-4-4		71		
					Greyish brown clayey SILT	
		2-5-5-6		83		Saturated
		5-7-9-11		83		
10		3-7-9-11		83		VOA sample taken from 10'-12'
		4-7-8-10		83	Grey clayey SILT, tight	
15		3-3-3-6		92		
		3-4-5-6		92	Grey silty CLAY, tight, dry	
20					End of Boring at 18'	
25						

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-04

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 32132 E- 21517

TOTAL DEPTH: 16'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 634.495 MSL

GROUND WATER LEVEL & DATE TAKEN: 633.37 MSL 1/9/91

DATE STARTED: 11-29-90

DATE COMPLETED: 11-29-90

LOGGED BY: R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		1-1-2-5	VOA Sample GM-SB-04 GM-SB-04 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH sample composited over totaldepth	67	Brown medium to fine SAND, some to little silt, trace clay, mottled	
		3-4-6-8		88		
5		7-8-11 -22		75	Brown sandy SILT lense @ 4'8"-4'10"	Saturated
		11-11 -10-10		75	Grey sandy clayey SILT	VOA sample taken from 6'-8'
		2-4-4-6		83		
10		5-7-9-11		88		
		2-4-4-7		100		
15		2-2-3-5		92	Grey clayey SILT, trace gravel (shale), tight	
					End of Boring at 16'	
20						
25						

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-05

SHEET 1 OF 1

ROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 31961 E- 21882

TOTAL DEPTH: 18'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 637.790 MSL

GROUND WATER LEVEL & DATE TAKEN: 633.98 MSL 1/9/91

DATE STARTED: 11-30-90

DATE COMPLETED: 11-30-90

LOGGED BY: R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		12-8-9-4	VOA Sample GM-SB-05 GM-SB-05 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH samples composited over total depth	58	GRAVEL, some sand	
		2-3-4-7		67	Fine SAND, little silt, mottled	
5		2-4-5-6		71	Brownish grey sandy clayey SILT	
		2-3-4-3		75		Saturated
		1-1-2-3		75	fine gravel @ 8'6" - 8'10"	VOA sample taken from 8'-10'
10		4-8-8-9		83	Fine brown SAND, some silt, little clay Grey clayey SILT, with many sand lenses	
		3-4-4-5		92		
15		3-4-4-6		88	Grey clayey SILT	
		3-4-5-6		92		
20					End of Boring at 18'	
25						

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-06

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 31813 E- 21884

TOTAL DEPTH: 18'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 637.800 MSL

GROUND WATER LEVEL & DATE TAKEN: 633.04 MSL 1/9/91

DATE STARTED: 12-4-90

DATE COMPLETED: 12-4-90

LOGGED BY: R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		2-3-3-5	VOA Sample GM-SB-06 GM-SB-06 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH samples composited over total depth	71	GRAVEL, some sand, little to trace silt	
		2-2-3-6		83	Fine SAND, little silt	
5		2-3-4-6		75	Brownish grey sandy clayey SILT SAND lense from 4'7"-4'9"	VOA sample taken from 8'-10'
		1-3-4-5		88		
		2-4-4-6		92		Saturated
10		3-5-4-4		92	(16) 1/16" SAND lenses from 8' -12'	
		2-4-4-5		92		
15		2-3-3-5		88		
		1-3-3-5		96	Grey silty CLAY	
20					End of Boring at 18'	
25						

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-07

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 31809 E- 21921

TOTAL DEPTH: 16'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 637.845 MSL

GROUND WATER LEVEL & DATE TAKEN: Not finished as a ground water monitoring well

DATE STARTED: 12-5-90

DATE COMPLETED: 12-5-90

LOGGED BY: R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		1-2-2-3	VOA Sample GM-SB-07 GM-SB-07 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH sample composited over totaldepth	67	Brown fine SAND, some to trace silt, mottling	
		2-3-2-4		63		
5		1-3-3-4		71	Greyish sandy clayey SILT, mottling	VOA sample taken from 4'-6'
		2-3-3-3		83		
		1-1-1-2		88		Saturated
10		3-6-9-8		92	(9) 1/16" - 1/8" SAND lenses from 10'5" to 11'4"	
		1-4-6-7		96		
15		2-2-3-5		100	Grey silty CLAY	
20					End of Boring at 16 feet	
25						

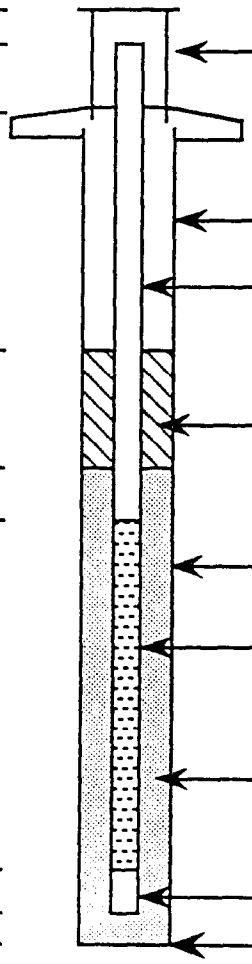
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

EBASCO

PROJECT: NASA PBS CA-RI/FS -PHASE I EFFORT
JOB NO.: WOP 2127.002
DRILLING SUBCONTRACTOR: Belasco Drilling
DRILLER: Rick Fisher

DRILLING METHOD: Hollow Stem Auger
MONITORING WELL NUMBER: PBS-GM-01
DATE OF WELL INSTALLATION: 11-27-90
DATE OF WELL DEVELOPMENT: 1-8-91
GEOLOGIST: S. Stowe, T. Roller

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE
641.230	2.735'
641.215	2.72'
638.495	0'
	3.5'
	5.5'
632	6.5'
612	26.5'
	26.75'
611.5	27'



I.D. OF SURFACE CASING	4"
TYPE OF SURFACE SEAL	Concrete
I.D. OF RISER PIPE	2"
TYPE OF RISER PIPE	304 Stainless St.
TYPE OF SEAL	Bentonite
EMPLACEMENT METHOD	Poured
DIAMETER OF BOREHOLE	4.25"
I.D. OF SCREEN	2"
TYPE OF SCREEN	304 Stainless St.
SCREEN SLOT SIZE	0.01"
SIZE OF FILTER SAND	#5 Medium Blast
EMPLACEMENT METHOD	Poured
LENGTH OF TAILPIPE	3"
BOTTOM OF BORING	

WATER LEVEL MEASUREMENTS

DATE	1-8-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	6.60	7.65								
ELEVATION	634.62	633.57								

UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

EBASCO

PROJECT NASA PBS CA-RI/FS -PHASE I EFFORT

JOB NO. WOP 2127.002

DRILLING SUBCONTRACTOR Belasco Drilling

DRILLER Rick Fisher

DRILLING METHOD Hollow Stem Auger

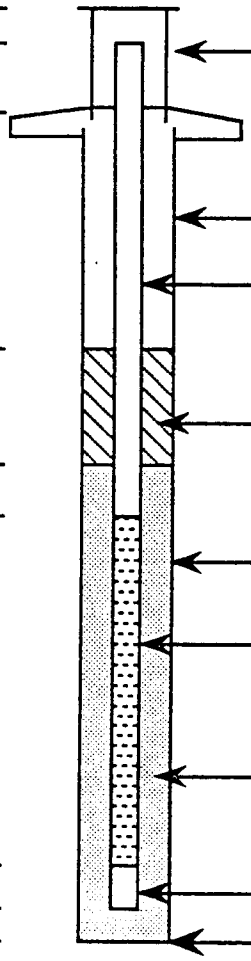
MONITORING WELL NUMBER PBS-GM-02

DATE OF WELL INSTALLATION 11-28-90

DATE OF WELL DEVELOPMENT 1-8-91

ENGINEER T. Roller

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE	
638.125	2.32'	
638.090	2.285'	I.D. OF SURFACE CASING: 4"
635.805	0'	
		TYPE OF SURFACE SEAL: Concrete
		I.D. OF RISER PIPE: 2"
	4'	TYPE OF RISER PIPE: 304 Stainless St.
		TYPE OF SEAL: Bentonite
	6'	EMPLACEMENT METHOD: Poured
627.3	8.5'	
		DIAMETER OF BOREHOLE: 4.25"
		I.D. OF SCREEN: 2"
		TYPE OF SCREEN: 304 Stainless St.
		SCREEN SLOT SIZE: 0.01"
		SIZE OF FILTER SAND: #5 Medium Blast
		EMPLACEMENT METHOD: Poured
607.3	28.5'	
	28.75'	LENGTH OF TAILPIPE: 3"
606.8	29'	BOTTOM OF BORING



WATER LEVEL MEASUREMENTS

DATE	1-8-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	5.25	6.10								
ELEVATION	632.84	631.99								

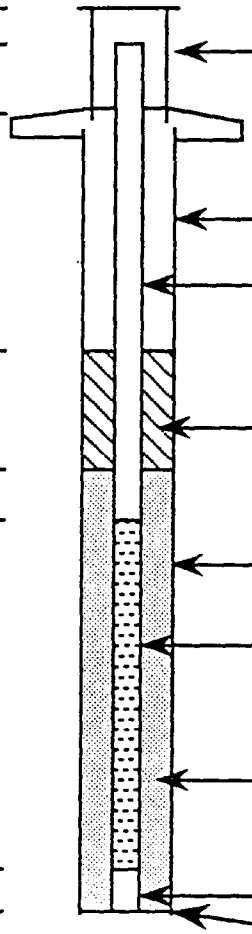
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

EBASCO

PROJECT: NASA PBS CA-RI/FS -PHASE I EFFORT
JOB NO.: WOP 2127.002
DRILLING SUBCONTRACTOR: Belasco Drilling
DRILLER: Rick Fisher

DRILLING METHOD: Hollow Stem Auger
MONITORING WELL NUMBER: PBS-GM-03
DATE OF WELL INSTALLATION: 11-29-90
DATE OF WELL DEVELOPMENT: 1-8-91
ENGINEER: T. Roller

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE	
639.750	3.06'	
639.605	2.915'	I.D. OF SURFACE CASING: 4"
636.690	0'	
		TYPE OF SURFACE SEAL: Concrete
		I.D. OF RISER PIPE: 2"
	4.5'	TYPE OF RISER PIPE: 304 Stainless St.
		TYPE OF SEAL: Bentonite
	6.5'	EMPLACEMENT METHOD: Poured
628.9	7.75'	
		DIAMETER OF BOREHOLE: 4.25"
		I.D. OF SCREEN: 2"
		TYPE OF SCREEN: 304 Stainless St.
		SCREEN SLOT SIZE: 0.01"
		SIZE OF FILTER SAND: #5 Medium Blast
		EMPLACEMENT METHOD: Poured
618.9	17.75'	
618.7	18'	LENGTH OF TAILPIPE: 3"
		BOTTOM OF BORING



WATER LEVEL MEASUREMENTS

DATE	1-8-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	6.24	6.68								
ELEVATION	633.37	632.93								

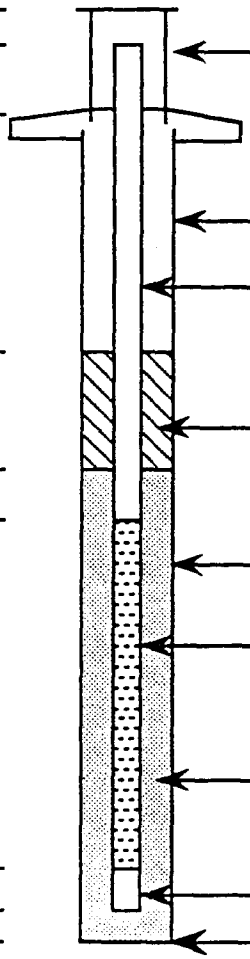
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

EBASCO

PROJECT: NASA PBS CA-RI/FS -PHASE I EFFORT
JOB NO.: WOP 2127.002
DRILLING SUBCONTRACTOR: Belasco Drilling
DRILLER: Rick Fisher

DRILLING METHOD: Hollow Stem Auger
MONITORING WELL NUMBER: PBS-GM-04
DATE OF WELL INSTALLATION: 11-29-90
DATE OF WELL DEVELOPMENT: 1-9-91
ENGINEER: T. Roller

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE	
636.935	2.44'	
637.020	2.525'	I.D. OF SURFACE CASING: 4"
634.495	0'	
		TYPE OF SURFACE SEAL: Concrete
		I.D. OF RISER PIPE: 2"
	2.5'	TYPE OF RISER PIPE: 304 Stainless St.
		TYPE OF SEAL: Bentonite
	4.5'	EMPLACEMENT METHOD: Poured
629	5.5'	
		DIAMETER OF BOREHOLE: 4.25"
		I.D. OF SCREEN: 2"
		TYPE OF SCREEN: 304 Stainless St.
		SCREEN SLOT SIZE: 0.01"
		SIZE OF FILTER SAND: #5 Medium Blast
		EMPLACEMENT METHOD: Poured
619	15.5'	
	15.75'	LENGTH OF TAILPIPE: 3"
618.5	16'	BOTTOM OF BORING



WATER LEVEL MEASUREMENTS

DATE	1-9-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	3.65	5.10								
ELEVATION	633.37	631.92								

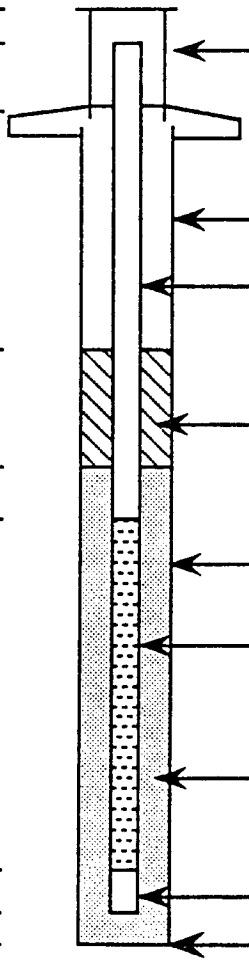
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

EBASCO

PROJECT: NASA PBS CA-RI/FS -PHASE I EFFORT
JOB NO.: WOP 2127.002
DRILLING SUBCONTRACTOR: Belasco Drilling
DRILLER: Rick Fisher

DRILLING METHOD: Hollow Stem Auger
MONITORING WELL NUMBER: PBS-GM-05
DATE OF WELL INSTALLATION: 11-30-90
DATE OF WELL DEVELOPMENT: 1-9-91
ENGINEER: T. Roller

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE	
640.635	2.845'	
640.500	2.71'	I.D. OF SURFACE CASING: 4"
637.790	0'	
		TYPE OF SURFACE SEAL: Concrete
		I.D. OF RISER PIPE: 2"
	4'	TYPE OF RISER PIPE: 304 Stainless St.
		TYPE OF SEAL: Bentonite
	6'	EMPLACEMENT METHOD: Poured
630.3	7.5'	
		DIAMETER OF BOREHOLE: 4.25"
		I.D. OF SCREEN: 2"
		TYPE OF SCREEN: 304 Stainless St.
		SCREEN SLOT SIZE: 0.01"
		SIZE OF FILTER SAND: #5 Medium Blast
		EMPLACEMENT METHOD: Poured
620.3	17.5'	
	17.75'	LENGTH OF TAILPIPE: 3"
619.8	18'	BOTTOM OF BORING



WATER LEVEL MEASUREMENTS

DATE	1-9-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	6.52	7.05								
ELEVATION	633.98	633.45								

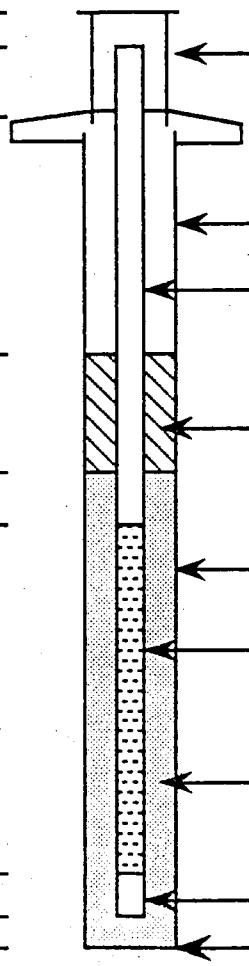
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

EBASCO

PROJECT: NASA PBS CA-RI/FS -PHASE I EFFORT
JOB NO.: WOP 2127.002
DRILLING SUBCONTRACTOR: Belasco Drilling
DRILLER: Rick Fisher

DRILLING METHOD: Hollow Stem Auger
MONITORING WELL NUMBER: PBS-GM-06
DATE OF WELL INSTALLATION: 12-4-90
DATE OF WELL DEVELOPMENT: 1-9-91
ENGINEER: T. Roller

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE	
640.550	2.75'	
640.390	2.59'	I.D. OF SURFACE CASING: 4"
637.800	0'	
		TYPE OF SURFACE SEAL: Concrete
		I.D. OF RISER PIPE: 2"
	4'	TYPE OF RISER PIPE: 304 Stainless St.
		TYPE OF SEAL: Bentonite
	6'	EMPLACEMENT METHOD: Poured
630.3	7.5'	
		DIAMETER OF BOREHOLE: 4.25"
		I.D. OF SCREEN: 2"
		TYPE OF SCREEN: 304 Stainless St.
		SCREEN SLOT SIZE: 0.01"
		SIZE OF FILTER SAND: #5 Medium Blast
		EMPLACEMENT METHOD: Poured
620.3	17.5'	
	17.75'	LENGTH OF TAILPIPE: 3"
619.8	18'	BOTTOM OF BORING



WATER LEVEL MEASUREMENTS

DATE	1-9-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	7.35	7.32								
ELEVATION	633.04	633.07								

SAMPLE IDENTIFICATION	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Sample Type	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Sample Depth Below Surface	10'-12'	10'-12'	10'-12'	10'-12'	10'-12'	10'-12'	6'-8'	6'-8'
Date Sampled	11-27-90	11-27-90	11-28-90	11-28-90	11-29-90	11-29-90	11-29-90	11-29-90
VOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Chloromethane	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
Bromomethane	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
Vinyl Chloride	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
Chloroethane	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
Methylene Chloride	22	120	6 U	6 U	13	100	25	60
Acetone	110	64	30	82	23	68	25	84
Carbon Disulfide	6 U	10	6 U	6 U	400 E	14	6 U	6
1,1-Dichloroethene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
1,1-Dichloroethane	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloroethene (Total)	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Chloroform	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloroethane	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
2-Butanone	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
1,1,1-Trichloroethane	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Carbon Tetrachloride	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Vinyl Acetate	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
Bromodichloromethane	6 U	6 U	6	6 U	6 U	6 U	6 U	6 U
1,2-Dichloropropane	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
cis-1,3-Dichloropropene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Trichloroethene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Dibromochloromethane	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
1,1,2-Trichloroethane	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Benzene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U

Notes
( ) Denotes sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below Quantitation Limit
E Concentration exceeds calibration range of GC/MS instrument

Laboratory; Hittman Ebasco

SOIL SAMPLE RESULTS FOR THE GARAGE AND MAINTENANCE AREA

SAMPLE IDENTIFICATION	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Sample Type	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Sample Depth Below Surface	10'-12'	10'-12'	10'-12'	10'-12'	10'-12'	10'-12'	6'-8'	6'-8'
Date Sampled	11-27-90	11-27-90	11-28-90	11-28-90	11-29-90	11-29-90	11-29-90	11-29-90
VOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
trans-1,3-Dichloropropene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Bromoform	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
4-Methyl-2-Pentanone	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
2-Hexanone	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U
Tetrachloroethene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
1,1,2,2-Tetrachloroethane	6 U	6 U	35	6 U	6 U	6 U	6 U	6 U
Toluene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Chlorobenzene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Ethylbenzene	6 U	6 U	21	6 U	6 U	6 U	6 U	6 U
Styrene	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Xylenes (Total)	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U

Notes
( ) Denotes sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below Quantitation Limit
E Concentration exceeds calibration range of GC/MS instrument

Laboratory; Hittman Ebasco

SOIL SAMPLE RESULTS FOR THE GARAGE AND MAINTENANCE AREA

SAMPLE IDENTIFICATION	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Sample Type	Grab	Grab	Grab	Grab	Grab	Grab
Sample Depth Below Surface	8'-10'	8'-10'	4'-6'	4'-6'	4'-6'	4'-6'
Date Sampled	11-30-90	11-30-90	12-4-90	12-4-90	12-7-90	12-7-90
VOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Chloromethane	13 U	2600 U	12 U	12 U	12 U	12 U
Bromomethane	13 U	2600 U	12 U	12 U	12 U	12 U
Vinyl Chloride	13 U	2600 U	12 U	12 U	12 U	12 U
Chloroethane	13 U	2600 U	12 U	12 U	12 U	12 U
Methylene Chloride	8	1300 U	6 U	8	11	120
Acetone	33	2600 U	38	34	12 U	12 U
Carbon Disulfide	27	1300 U	75	6 U	6 U	32
1,1-Dichloroethene	61	1300 U	6 U	6 U	6 U	6 U
1,1-Dichloroethane	50	1300 U	12	4 J	6 U	6 U
1,2-Dichloroethene (Total)	6 U	1300 U	6 U	6 U	6 U	6 U
Chloroform	6 U	1300 U	6 U	6 U	6 U	6 U
1,2-Dichloroethane	6 U	1300 U	6 U	6 U	6 U	6 U
2-Butanone	13 U	6200	12 U	12 U	12 U	12 U
1,1,1-Trichloroethane	1100 E	2000	25	11	20	6 U
Carbon Tetrachloride	260	1300 U	6 U	6 U	6 U	6 U
Vinyl Acetate	13 U	2600 U	12 U	12 U	12 U	12 U
Bromodichloromethane	6 U	1300 U	6 U	6 U	6 U	6 U
1,2-Dichloropropane	6 U	1300 U	6 U	6 U	6 U	6 U
cis-1,3-Dichloropropene	6 U	1300 U	6 U	6 U	6 U	6 U
Trichloroethene	55	1300 U	6 U	6 U	6 U	6 U
Dibromochloromethane	6 U	1300 U	6 U	6 U	6 U	6 U
1,1,2-Trichloroethane	6 U	1300 U	6 U	6 U	6 U	6 U
Benzene	6 U	1300 U	6 U	6 U	6 U	6 U

Notes
( ) Denotes sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below Quantitation Limit
E Concentration exceeds

Laboratory: Hittman Ebasco

SOIL SAMPLE RESULTS FOR THE GARAGE AND MAINTENANCE AREA

SAMPLE IDENTIFICATION	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Sample Type	Grab	Grab	Grab	Grab	Grab	Grab
Sample Depth Below Surface	8'-10'	8'-10'	4'-6'	4'-6'	4'-6'	4'-6'
Date Sampled	11-30-90	11-30-90	12-4-90	12-4-90	12-7-90	12-7-90
VOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
trans-1,3-Dichloropropene	6 U	1300 U	6 U	6 U	6 U	6 U
Bromoform	6 U	1300 U	6 U	6 U	6 U	6 U
4-Methyl-2-Pentanone	13 U	2600 U	12 U	12 U	12 U	12 U
2-Hexanone	13 U	2600 U	12 U	12 U	12 U	12 U
Tetrachloroethene	24	1300 U	6 U	6 U	6 U	6 U
1,1,2,2-Tetrachloroethane	18	1300 U	6 U	6 U	6 U	6 U
Toluene	6 U	1300 U	6 U	6 U	6 U	6 U
Chlorobenzene	6 U	1300 U	6 U	6 U	6 U	6 U
Ethylbenzene	6 U	1300 U	6 U	6 U	6 U	6 U
Styrene	6 U	1300 U	6 U	6 U	6 U	6 U
Xylenes (Total)	6 U	1300 U	6 U	6 U	6 U	6 U

Notes
( ) Denotes sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below Quantitation Limit
E Concentration exceeds

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-27'	0'-27'	0'-29'	0'-29'	0'-18'	0'-18'	0'-16'	0'-16'
Date Sampled	11-27-90	11-27-90	11-28-90	11-28-90	11-29-90	11-29-90	11-29-90	11-29-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Phenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
bis(-2-Chloroethyl) Ether	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2-Chlorophenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
1,3-Dichlorobenzene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
1,4-Dichlorobenzene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Benzyl alcohol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
1,2-Dichlorobenzene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2-Methylphenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
bis(-2-Chloroisopropyl) Ether	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
4-Methylphenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
N-Nitroso-Di-n-propylamine	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Hexachloroethane	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Nitrobenzene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Isophorone	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2-Nitrophenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2,4-Dimethylphenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Benzoic acid	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
bis(-2-Chloroethoxy) methane	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2,4-Dichlorophenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
1,2,4-Trichlorobenzene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Naphthalene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
4-Chloroaniline	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Hexachlorobutadiene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U

Notes
( ) Denote sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below the Quantitation Limit

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-27'	0'-27'	0'-29'	0'-29'	0'-18'	0'-18'	0'-16'	0'-16'
Date Sampled	11-27-90	11-27-90	11-28-90	11-28-90	11-29-90	11-29-90	11-29-90	11-29-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
4-Chloro-3-methylphenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2-Methylnaphthalene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Hexachlorocyclopentadiene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2,4,6-Trichlorophenol	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2,4,5-Trichlorophenol	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
2-Chloronaphthalene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2-Nitroaniline	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
Dimethyl Phthalate	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Acenaphthylene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2,6-Dinitrotoluene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
3-Nitroaniline	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
Acenaphthene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2,4-Dinitrophenol	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
4-Nitrophenol	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
Dibenzofuran	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
2,4-Dinitrotoluene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Diethylphthalate	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
4-Chlorophenyl-phenylether	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Fluorene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
4-Nitroaniline	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
4,6-Dinitro-2-methylphenol	220 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
N-Nitrosodiphenylamine	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
4-Bromophenyl-phenylether	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U

Notes
( ) Denote sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below the Quantitation Limit

Laboratory; Hittman Ebasco

SOIL SAMPLE RESULTS FOR THE GARAGE AND MAINTENANCE AREA

SAMPLE IDENTIFICATION	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-27'	0'-27'	0'-29'	0'-29'	0'-18'	0'-18'	0'-16'	0'-16'
Date Sampled	11-27-90	11-27-90	11-28-90	11-28-90	11-29-90	11-29-90	11-29-90	11-29-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB01	(GM-SB01)	GM-SB02	(GM-SB02)	GM-SB03	(GM-SB03)	GM-SB04	(GM-SB04)
Hexachlorobenzene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Pentachlorophenol	2200 U	2600 U	2200 U	2700 U	2200 U	2700 U	2200 U	2400 U
Phenanthrene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Anthracene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Di-n-butylphthalate	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Fluoranthene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Pyrene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Butylbenzylphthalate	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
3,3'-Dichlorobenzidine	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Benzo(a)anthracene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Chrysene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
bis(2-Ethylhexyl)phthalate	3600	2300	560	430 J	1100	970	5400	1200
Di-n-octyl Phthalate	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Benzo(b)fluoranthene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Benzo(k)fluoranthene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Benzo(a)pyrene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Indeno(1,2,3-cd)pyrene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Dibenzo(a,h)anthracene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U
Benzo(g,h,i)perylene	450 U	520 U	430 U	540 U	440 U	540 U	450 U	480 U

Notes
( ) Denote sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below the Quantitation Limit

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-18'	0'-18'	0'-18'	0'-18'	0'-16'	0'-16'
Date Sampled	11-30-90	11-30-90	12-4-90	12-4-90	12-7-90	12-7-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Phenol	460 U	450 U	440 U	440 U	420 U	420 U
bis(-2-Chloroethyl) Ether	460 U	450 U	440 U	440 U	420 U	420 U
2-Chlorophenol	460 U	450 U	440 U	440 U	420 U	420 U
1,3-Dichlorobenzene	460 U	450 U	440 U	440 U	420 U	420 U
1,4-Dichlorobenzene	460 U	450 U	440 U	440 U	420 U	420 U
Benzyl alcohol	460 U	450 U	440 U	440 U	420 U	420 U
1,2-Dichlorobenzene	460 U	450 U	440 U	440 U	420 U	420 U
2-Methylphenol	460 U	450 U	440 U	440 U	420 U	420 U
bis(-2-Chloroisopropyl) Ether	460 U	450 U	440 U	440 U	420 U	420 U
4-Methylphenol	460 U	450 U	440 U	440 U	420 U	420 U
N-Nitroso-Di-n-propylamine	460 U	450 U	440 U	440 U	420 U	420 U
Hexachloroethane	460 U	450 U	440 U	440 U	420 U	420 U
Nitrobenzene	460 U	450 U	440 U	440 U	420 U	420 U
Isophorone	460 U	450 U	440 U	440 U	420 U	420 U
2-Nitrophenol	460 U	450 U	440 U	440 U	420 U	420 U
2,4-Dimethylphenol	460 U	450 U	440 U	440 U	420 U	420 U
Benzoic acid	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
bis(-2-Chloroethoxy) methane	460 U	450 U	440 U	440 U	420 U	420 U
2,4-Dichlorophenol	460 U	450 U	440 U	440 U	420 U	420 U
1,2,4-Trichlorobenzene	460 U	450 U	440 U	440 U	420 U	420 U
Naphthalene	460 U	450 U	440 U	440 U	420 U	420 U
4-Chloroaniline	460 U	450 U	440 U	440 U	420 U	420 U
Hexachlorobutadiene	460 U	450 U	440 U	440 U	420 U	420 U

Notes
( ) Denote sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below the Quantitation Limit

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-18'	0'-18'	0'-18'	0'-18'	0'-16'	0'-16'
Date Sampled	11-30-90	11-30-90	12-4-90	12-4-90	12-7-90	12-7-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
4-Chloro-3-methylphenol	460 U	450 U	440 U	440 U	420 U	420 U
2-Methylnaphthalene	460 U	450 U	440 U	440 U	420 U	420 U
Hexachlorocyclopentadiene	460 U	450 U	440 U	440 U	420 U	420 U
2,4,6-Trichlorophenol	460 U	450 U	440 U	440 U	420 U	420 U
2,4,5-Trichlorophenol	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
2-Chloronaphthalene	460 U	450 U	440 U	440 U	420 U	420 U
2-Nitroaniline	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
Dimethyl Phthalate	460 U	450 U	440 U	440 U	420 U	420 U
Acenaphthylene	460 U	450 U	440 U	440 U	420 U	420 U
2,6-Dinitrotoluene	460 U	450 U	440 U	440 U	420 U	420 U
3-Nitroaniline	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
Acenaphthene	460 U	450 U	440 U	440 U	420 U	420 U
2,4-Dinitrophenol	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
4-Nitrophenol	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
Dibenzofuran	460 U	450 U	440 U	440 U	420 U	420 U
2,4-Dinitrotoluene	460 U	450 U	440 U	440 U	420 U	420 U
Diethylphthalate	460 U	450 U	440 U	440 U	420 U	420 U
4-Chlorophenyl-phenylether	460 U	450 U	440 U	440 U	420 U	420 U
Fluorene	460 U	450 U	440 U	440 U	420 U	420 U
4-Nitroaniline	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
4,6-Dinitro-2-methylphenol	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
N-Nitrosodiphenylamine	460 U	450 U	440 U	440 U	420 U	420 U
4-Bromophenyl-phenylether	460 U	450 U	440 U	440 U	420 U	420 U

Notes
( ) Denote sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below the Quantitation Limit

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-18'	0'-18'	0'-18'	0'-18'	0'-16'	0'-16'
Date Sampled	11-30-90	11-30-90	12-4-90	12-4-90	12-7-90	12-7-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	GM-SB05	(GM-SB05)	GM-SB06	(GM-SB06)	GM-SB07	(GM-SB07)
Hexachlorobenzene	460 U	450 U	440 U	440 U	420 U	420 U
Pentachlorophenol	2300 U	2300 U	2200 U	2200 U	2100 U	2100 U
Phenanthrene	460 U	450 U	440 U	440 U	420 U	420 U
Anthracene	460 U	450 U	440 U	440 U	420 U	420 U
Di-n-butylphthalate	460 U	450 U	440 U	440 U	420 U	420 U
Fluoranthene	460 U	450 U	440 U	440 U	420 U	420 U
Pyrene	460 U	450 U	440 U	440 U	420 U	420 U
Butylbenzylphthalate	460 U	450 U	440 U	440 U	420 U	420 U
3,3'-Dichlorobenzidine	460 U	450 U	440 U	880 U	420 U	840 U
Benzo(a)anthracene	460 U	450 U	440 U	440 U	420 U	420 U
Chrysene	460 U	450 U	440 U	440 U	420 U	420 U
bis(2-Ethylhexyl)phthalate	1500	360 J	440 U	750	1300	470
Di-n-octyl Phthalate	460 U	450 U	440 U	440 U	420 U	420 U
Benzo(b)fluoranthene	460 U	450 U	440 U	440 U	420 U	420 U
Benzo(k)fluoranthene	460 U	450 U	440 U	440 U	420 U	420 U
Benzo(a)pyrene	460 U	450 U	440 U	440 U	420 U	420 U
Indeno(1,2,3-cd)pyrene	460 U	450 U	440 U	440 U	420 U	420 U
Dibenzo(a,h)anthracene	460 U	450 U	440 U	440 U	420 U	420 U
Benzo(g,h,i)perylene	460 U	450 U	440 U	440 U	420 U	420 U

Notes
( ) Denote sample reanalysis

Qualifiers for Organics
U Undetected
J Estimated, Value is below the Quantitation Limit

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	GM-SB01	GM-SB02	GM-SB03	GM-SB04	GM-SB05	GM-SB06	GM-SB07
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-27'	0'-29'	0'-18'	0'-16'	0'-18'	0'-18'	0'-16'
Date Sampled	11-27-90	11-28-90	11-29-90	11-29-90	11-30-90	12-4-90	12-7-90
PESTICIDE/PCBs (ug/kg)	GM-SB01	GM-SB02	GM-SB03	GM-SB04	GM-SB05	GM-SB06	GM-SB07
Alpha-BHC	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Beta-BHC	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Delta-BHC	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Gamma-BHC(Lindane)	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Heptachlor	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Aldrin	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Heptachlor Epoxide	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Endosulfan I	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Dieldrin	20 U	20 U	20 U	20 U	21 U	20 U	20 U
4,4-DDE	20 U	20 U	20 U	20 U	21 U	20 U	20 U
Endrin	20 U	20 U	20 U	20 U	21 U	20 U	20 U
Endosulfan II	20 U	20 U	20 U	20 U	21 U	20 U	20 U
4,4-DDD	20 U	20 U	20 U	20 U	21 U	20 U	20 U
Endosulfan Sulfate	20 U	20 U	20 U	20 U	21 U	20 U	20 U
4,4-DDT	20 U	20 U	20 U	20 U	21 U	20 U	20 U
Methoxychlor	100 U	100 U	100 U	100 U	110 U	100 U	100 U
Endrin Ketone	20 U	20 U	20 U	20 U	21 U	20 U	20 U
Chlordane	100 U	100 U	100 U	100 U	110 U	100 U	100 U
Toxaphene	200 U	200 U	200 U	200 U	210 U	200 U	200 U
Aroclor-1016	100 U	100 U	100 U	100 U	110 U	100 U	100 U
Aroclor-1221	100 U	100 U	100 U	100 U	110 U	100 U	100 U
Aroclor-1232	100 U	100 U	100 U	100 U	110 U	100 U	100 U
Aroclor-1242	100 U	100 U	100 U	100 U	110 U	100 U	100 U
Aroclor-1248	100 U	100 U	100 U	100 U	110 U	100 U	100 U
Aroclor-1254	200 U	200 U	200 U	200 U	210 U	200 U	200 U
Aroclor-1260	200 U	200 U	200 U	200 U	210 U	200 U	200 U

Notes
( ) Denote Sample Reanalysis

Qualifiers for Organics
U Undetected

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	GM-SB01	GM-SB02	GM-SB03	GM-SB04	GM-SB05	GM-SB06	GM-SB07
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-27'	0'-29'	0'-18'	0'-16'	0'-18'	0'-18'	0'-16'
Date Sampled	11-27-90	11-28-90	11-29-90	11-29-90	11-30-90	12-4-90	12-7-90
METALS/CYANIDE/TPH (mg/Kg)	GM-SB01	GM-SB02	GM-SB03	GM-SB04	GM-SB05	GM-SB06	GM-SB07
Aluminum	11400.00	8880.00	12400.00	15800.00	7560.00	9100.00	8800.00
Antimony	1.80 U	1.80 U	1.80 U	1.90 U	1.90 U	2.00 U	1.90 U
Arsenic	11.00	4.90	9.50	6.90	6.10	4.30	4.40
Barium	148.00	38.00	75.00	88.00	50.00	51.00	35.00
Beryllium	0.49	0.39 U	0.49	0.51	0.40 U	0.40 U	0.49
Cadmium	3.60	1.20 U	1.20	1.50	1.20 U	1.30 U	2.40
Calcium	4060.00	38200.00	21700.00	72200.00	35200.00	53300.00	22300.00
Chromium	15.00	13.00	20.00	19.00	14.00	20.00	17.00
Cobalt	21.00	9.20	16.00	13.00	7.00	7.20	8.60
Copper	19.00	13.00	17.00	32.00	17.00	12.00	12.00
Iron	32000.00	20200.00	22700.00	32800.00	20700.00	15400.00	18300.00
Lead	12.00	9.80	13.00	10.00	8.00	12.00	11.00
Magnesium	2710.00	14300.00	8150.00	20100.00	14100.00	19500.00	6720.00
Manganese	1400.00	320.00	925.00	625.00	283.00	201.00	356.00
Mercury	0.12	0.11 U	0.11 U	0.11 U	0.11 U	0.19	0.12 U
Nickel	66.00	22.00	36.00	37.00	18.00	15.00	13.00
Potassium	906.00	1250.00	1030.00	2930.00	938.00	1110.00	1510.00
Selenium	0.63 U	12.00 U	12.00 U	13.00 U	12.00 U	0.67 U	0.83 U
Silver	0.61 U	0.60 U	0.61 U	0.63 U	0.62 U	0.64 U	0.61 U
Sodium	804.00	540.00	560.00	909.00	460.00	438.00	298.00
Thallium	0.85 U	0.84 U	0.85 U	0.88 U	0.87	0.90 U	0.86 U
Vanadium	40.00	21.00	23.00	30.00	22.00	19.00	29.00
Zinc	86.00	47.00	63.00	67.00	44.00	48.00	46.00
CYANIDE	1.20 U	1.20 U	1.20 U	1.30 U	1.20 U	1.30 U	1.20 U
TOTAL PETROLEUM HYDROCARBONS (TPH)	36.00 U	106.00	36.00 U	129.00	37.00 U	38.00 U	36.00 U

Notes
( ) Denotes Sample Reanalysis

Qualifiers
U Undetected

Laboratory: Hittman Ebasco

TABLE B-1 GROUND WATER SAMPLE RESULTS FOR THE GARAGE AND MAINTENANCE AREA

SAMPLE IDENTIFICATION	PBS-GM-GW-02	PBS-GM-GW-08 (GM-GW-02 DUP)	(PBS-GM-GW-08)	PBS-GM-GW-06
Date Sampled	1-15-91	1-15-91	1-15-91	1-15-91
VOLATILE ORGANIC COMPOUNDS (ug/L)	PBS-GM-GW-02	PBS-GM-GW-08	(PBS-GM-GW-08)	PBS-GM-GW-06
Chloromethane	10 U	10 U	10 U	10 U
Bromomethane	10 U	10 U	10 U	10 U
Vinyl Chloride	10 U	10 U	10 U	10 U
Chloroethane	10 U	10 U	10 U	10 U
Methylene Chloride	5 U	5 U	5 U	5 U
Acetone	10 U	10 U	10 U	10 U
Carbon Disulfide	5 U	5 U	5 U	5 U
1,1-Dichloroethene	5 U	5 U	5 U	20
1,1-Dichloroethane	5 U	5 U	5 U	24
1,2-Dichloroethene (Total)	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U
2-Butanone	10 U	10 U	10 U	10 U
1,1,1-Trichloroethane	5 U	5 U	5 U	120
Carbon Tetrachloride	5 U	5 U	5 U	5 U
Vinyl Acetate	10 U	10 U	10 U	10 U
Bromodichloromethane	5 U	5 U	5 U	5 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U
Trichloroethene	7	5 U	7	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U
Benzene	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone	10 U	10 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U
Tetrachloroethene	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U
Xylenes (Total)	5 U	5 U	5 U	5 U

( ) Denote Sample Reanalysis

Qualifiers
U Undetected

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	PBS-GM-GW-02	PBS-GM-GW-08 (GM-GW-02 DUP)	PBS-GM-GW-06
Date Sampled	1-15-91	1-15-91	1-15-91
SEMIVOLATILE ORGANIC COMPOUNDS (ug/L)	PBS-GM-GW-02	PBS-GM-GW-08	PBS-GM-GW-06
Phenol	10 U	10 U	10 U
bis(-2-Chloroethyl) Ether	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U
Benzyl alcohol	10 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U
bis(-2-Chloroisopropyl) Ether	10 U	10 U	10 U
4-Methylphenol	10 U	10 U	10 U
N-Nitroso-Di-n-propylamine	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U
Isophorone	10 U	10 U	10 U
2-Nitrophenol	10 U	10 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U
Benzoic acid	50 U	50 U	50 U
bis(-2-Chloroethoxy) methane	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U
Naphthalene	10 U	10 U	10 U
4-Chloroaniline	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	10 U
2,4,5-Trichlorophenol	50 U	50 U	50 U
2-Chloronaphthalene	10 U	10 U	10 U
2-Nitroaniline	50 U	50 U	50 U
Dimethyl Phthalate	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U
3-Nitroaniline	50 U	50 U	50 U
Acenaphthene	10 U	10 U	10 U
2,4-Dinitrophenol	50 U	50 U	50 U
4-Nitrophenol	50 U	50 U	50 U
Dibenzofuran	10 U	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U
Diethylphthalate	10 U	10 U	10 U

Qualifiers
U Undetected
J Estimated, Value Below the Quantitation Limit

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	PBS-GM-GW-02	PBS-GM-GW-08 (GM-GW-02 DUP)	PBS-GM-GW-06
Date Sampled	1-15-91	1-15-91	1-15-91
SEMIVOLATILE ORGANIC COMPOUNDS (ug/L)	PBS-GM-GW-02	PBS-GM-GW-08	PBS-GM-GW-06
4-Chlorophenyl-phenylether	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U
4-Nitroaniline	50 U	50 U	50 U
4,6-Dinitro-2-methylphenol	50 U	50 U	50 U
N-Nitrosodiphenylamine	10 U	10 U	10 U
4-Bromophenyl-phenylether	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U
Pentachlorophenol	50 U	50 U	50 U
Phenanthrene	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U
Di-n-butylphthalate	10 U	10 U	10 U
Fluoranthene	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U
Butylbenzylphthalate	10 U	10 U	6 J
3,3'-Dichlorobenzidine	20 U	20 U	20 U
Benzo(a)anthracene	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U
bis(2-Ethylhexyl)phthalate	10 U	10 U	7 J
Di-n-octyl Phthalate	10 U	14	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	10 U
Dibenzo(a,h)anthracene	10 U	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U	10 U

Qualifiers
U Undetected
J Estimated, Value Below the Quantitation Limit

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	PBS-GM-GW-02	PBS-GM-GW-08 (GM-GW-02 DUP)	PBS-GM-GW-06
Date Sampled	1-15-91	1-15-91	1-15-91
PESTICIDE/PCBs (ug/L)	PBS-GM-GW-02	PBS-GM-GW-08	PBS-GM-GW-06
Alpha-BHC	0.050 U	0.052 U	0.052 U
Beta-BHC	0.056	0.054	0.190
Delta-BHC	0.050 U	0.052 U	0.052 U
Gamma-BHC(Lindane)	0.050 U	0.052 U	0.052 U
Heptachlor	0.050 U	0.052 U	0.052 U
Aldrin	0.050 U	0.052 U	0.052 U
Heptachlor Epoxide	0.050 U	0.052 U	0.052 U
Endosulfan I	0.050 U	0.052 U	0.052 U
Dieldrin	0.100 U	0.100 U	0.100 U
4,4-DDE	0.100 U	0.100 U	0.100 U
Endrin	0.100 U	0.100 U	0.100 U
Endosulfan II	0.100 U	0.100 U	0.100 U
4,4-DDD	0.100 U	0.100 U	0.100 U
Endosulfan Sulfate	0.190 B	0.210 B	1.000 B
4,4-DDT	0.100 U	0.100 U	0.100 U
Methoxychlor	0.500 U	0.520 U	0.520 U
Endrin Ketone	0.100 U	0.100 U	0.100 U
Chlordane	0.500 U	0.520 U	0.520 U
Toxaphene	1.000 U	1.000 U	1.000 U
Aroclor-1016	0.500 U	0.520 U	0.520 U
Aroclor-1221	0.500 U	0.520 U	0.520 U
Aroclor-1232	0.500 U	0.520 U	0.520 U
Aroclor-1242	0.500 U	0.520 U	0.520 U
Aroclor-1248	0.500 U	0.520 U	0.520 U
Aroclor-1254	1.000 U	1.000 U	1.000 U
Aroclor-1260	1.000 U	1.000 U	1.000 U

Qualifiers
U Undetected
B Analyte found in associated blank

Laboratory; Hittman Ebasco

SAMPLE IDENTIFICATION	PBS-GM-GW-02	PBS-GM-GW-08 (GM-GW-02 DUP)	PBS-GM-GW-06
Date Sampled	1-15-91	1-15-91	1-15-91
METALS/CYANIDE (ug/L) TPH (mg/L)	PBS-GM-GW-02	PBS-GM-GW-08	PBS-GM-GW-06
Aluminum	128	104	712
Antimony	3.4 U	3.4 U	3.4 U
Arsenic	3.9	3.3	4.2
Barium	158	133	126
Beryllium	1.6 U	1.6 U	1.6 U
Cadmium	5 U	5 U	5 U
Calcium	68800	70300	99500
Chromium	2.2 U	2.2 U	2.2 U
Cobalt	8.7 U	8.7 U	8.7 U
Copper	11 U	11 U	11 U
Iron	133	139	1060
Lead	1.5 U	1.5 U	1.5 U
Magnesium	28500	29000	23100
Manganese	381	356	893
Mercury	0.2 U	0.2 U	0.5
Nickel	22 U	22 U	22 U
Potassium	9320	9310	1520
Selenium	3.3 U	3.3 U	3.3 U
Silver	2.5 U	2.5 U	2.5 U
Sodium	63900	63500	33300
Thallium	2.4 U	2.4 U	2.4 U
Vanadium	9.2 U	9.2 U	9.2 U
Zinc	35	35	6
CYANIDE	10 U	10 U	10 U
TOTAL PETROLEUM HYDROCARBONS (TPH)	1 U	1 U	1 U

Qualifiers
U Undetected

Laboratory; Hittman Ebasco

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-01

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLIN

COORDINATES: N- 31667 E- 22328

TOTAL DEPTH: 27'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 638.495 MSL

GROUND WATER LEVEL & DATE TAKEN: 634.62 MSL 1/8/91

DATE STARTED: 11-27-90

DATE COMPLETED: 11-27-90

LOGGED BY: S. STOWE / R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		1-2-4-5	VOA Sample GM-SB-01 (GM-SB-01 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH samples composited over total depth)	58	Brown fine SAND, little to trace silt	
		3-3-4-5		63		
5		3-3-4-5		63	Grey sandy clayey SILT	
		2-2-3-4		71		
		1-1-3-5		71		
10		5-7-11-16		63	Grey clayey SILT, trace fine gravel 10'-12'	Saturated VOA sample taken from 10'-12'
		6-7-10-13		100	Grey silty CLAY, little to trace fine gravel (shale), tight, dry	
15		4-6-19-23		75		
		11-16-20-18		63	Grey SAND and SILT, little gravel, little clay	
					Grey SAND, little silt, little gravel, trace clay	
		9-11-14-19		63	Grey clayey SILT, trace fine gravel	
20		6-10-14-22		50		
		4-10 14-20		83		
25		9-9-16-18		75		
		8-20-100		38	Grey shale	
					End of boring at 27"	

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-02

SHEET 1 OF 2

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 32525 E- 21889

TOTAL DEPTH: 29'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 635.805 MSL

GROUND WATER LEVEL & DATE TAKEN: 632.84 MSL 1/8/91

DATE STARTED: 11-28-90

DATE COMPLETED: 11-28-90

LOGGED BY: R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		2-3-4-5	VOA Sample GM-SB-02 GM-SB-02 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH samples composited over total depth	75	Brown medium - fine SAND, some to little silt	
		2-3-3-5		71	Brown sandy SILT, mottled	
5		1-3-3-4		75	Greyish brown fine SAND, some to trace silt, some to trace clay	
		3-4-7-7		83		Saturated
		2-5-5-6		88	Grey sandy SILT	
10		3-4-5-5		83		VOA sample taken from 10'-12'
		3-4-5-6		92		
15		2-3-4-6		96	Grey sandy clayey SILT	
		1-2-4-5		100	Grey clayey SILT	
		3-4-6-7		75	Grey sandy SILT, little gravel	
20		4-6-10-11		71		
		8-16-20-26		75		
25		16-20-27-50/5		92	Grey SAND, some silt, little gravel	
		13-17-18-30		83	Grey clayey SILT	

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-02

SHEET 2 OF 2

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 32525 E- 21889

TOTAL DEPTH: 29'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 635.805 MSL

GROUND WATER LEVEL & DATE TAKEN: 632.84 MSL 1/8/91

DATE STARTED: 11-28-90

DATE COMPLETED: 11-28-90

LOGGED BY: R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		18-50/3			Grey clayey SILT	
30					Shale Bedrock	
					End of boring at 29'	
35						

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-03

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 32220 E- 21849

TOTAL DEPTH: 18'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 636.690 MSL

GROUND WATER LEVEL & DATE TAKEN: 633.37 MSL 1/8/91

DATE STARTED: 11-29-90

DATE COMPLETED: 11-29-90

LOGGED BY: R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		1-2-4-4	VOA Sample GM-SB-03 GM-SB-03 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH samples composited over total depth	50	Brown fine SAND, some silt, mottled	
		2-4-3-4		75		
5		2-3-4-4		71		
					Greyish brown clayey SILT	
		2-5-5-6		83		Saturated
		5-7-9-11		83		
10		3-7-9-11		83		VOA sample taken from 10'-12'
		4-7-8-10		83	Grey clayey SILT, tight	
15		3-3-3-6		92		
		3-4-5-6		92	Grey silty CLAY, tight, dry	
20					End of Boring at 18'	
25						

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-04

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 32132 E- 21517

TOTAL DEPTH: 16'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 634.495 MSL

GROUND WATER LEVEL & DATE TAKEN: 633.37 MSL 1/9/91

DATE STARTED: 11-29-90

DATE COMPLETED: 11-29-90

LOGGED BY: R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		1-1-2-5	VOA Sample GM-SB-04 GM-SB-04 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH sample composited over totaldepth	67	Brown medium to fine SAND, some to little silt, trace clay, mottled	
		3-4-6-8		88		
5		7-8-11 -22		75	Brown sandy SILT lense @ 4'8"-4'10"	Saturated
		11-11 -10-10		75	Grey sandy clayey SILT	VOA sample taken from 6'-8'
		2-4-4-6		83		
10		5-7-9-11		88		
		2-4-4-7		100		
15		2-2-3-5		92	Grey clayey SILT, trace gravel (shale), tight	
					End of Boring at 16'	
20						
25						

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-05

SHEET 1 OF 1

ROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 31961 E- 21882

TOTAL DEPTH: 18'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 637.790 MSL

GROUND WATER LEVEL & DATE TAKEN: 633.98 MSL 1/9/91

DATE STARTED: 11-30-90

DATE COMPLETED: 11-30-90

LOGGED BY: R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		12-8-9-4	VOA Sample GM-SB-05 GM-SB-05 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH samples composited over total depth	58	GRAVEL, some sand	
		2-3-4-7		67	Fine SAND, little silt, mottled	
5		2-4-5-6		71	Brownish grey sandy clayey SILT	
		2-3-4-3		75		Saturated
		1-1-2-3		75	fine gravel @ 8'6" - 8'10"	VOA sample taken from 8'-10'
10		4-8-8-9		83	Fine brown SAND, some silt, little clay Grey clayey SILT, with many sand lenses	
		3-4-4-5		92		
15		3-4-4-6		88	Grey clayey SILT	
		3-4-5-6		92		
20					End of Boring at 18'	
25						

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-06

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 31813 E- 21884

TOTAL DEPTH: 18'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 637.800 MSL

GROUND WATER LEVEL & DATE TAKEN: 633.04 MSL 1/9/91

DATE STARTED: 12-4-90

DATE COMPLETED: 12-4-90

LOGGED BY: R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		2-3-3-5	VOA Sample GM-SB-06 GM-SB-06 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH samples composited over total depth	71	GRAVEL, some sand, little to trace silt	
		2-2-3-6		83	Fine SAND, little silt	
5		2-3-4-6		75	Brownish grey sandy clayey SILT SAND lense from 4'7"-4'9"	VOA sample taken from 8'-10'
		1-3-4-5		88		
		2-4-4-6		92		Saturated
10		3-5-4-4		92	(16) 1/16" SAND lenses from 8' -12'	
		2-4-4-5		92		
15		2-3-3-5		88		
		1-3-3-5		96	Grey silty CLAY	
20					End of Boring at 18'	
25						

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-GM-SB-07

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 31809 E- 21921

TOTAL DEPTH: 16'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 637.845 MSL

GROUND WATER LEVEL & DATE TAKEN: Not finished as a ground water monitoring well

DATE STARTED: 12-5-90

DATE COMPLETED: 12-5-90

LOGGED BY: R. T. ROLLER

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		1-2-2-3	VOA Sample GM-SB-07 GM-SB-07 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH sample composited over totaldepth	67	Brown fine SAND, some to trace silt, mottling	
		2-3-2-4		63		
5		1-3-3-4		71	Greyish sandy clayey SILT, mottling	VOA sample taken from 4'-6'
		2-3-3-3		83		
		1-1-1-2		88		Saturated
10		3-6-9-8		92	(9) 1/16" - 1/8" SAND lenses from 10'5" to 11'4"	
		1-4-6-7		96		
15		2-2-3-5		100	Grey silty CLAY	
20					End of Boring at 16 feet	
25						

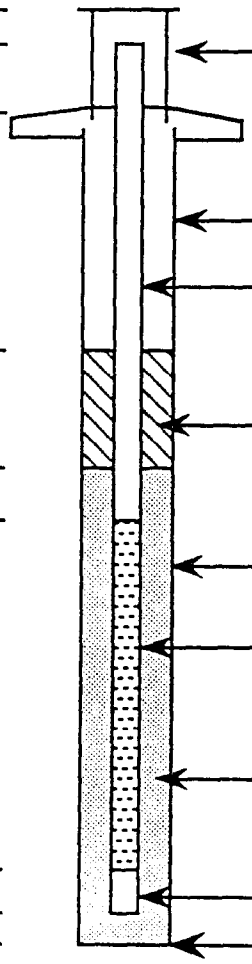
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

EBASCO

PROJECT: NASA PBS CA-RI/FS -PHASE I EFFORT
JOB NO.: WOP 2127.002
DRILLING SUBCONTRACTOR: Belasco Drilling
DRILLER: Rick Fisher

DRILLING METHOD: Hollow Stem Auger
MONITORING WELL NUMBER: PBS-GM-01
DATE OF WELL INSTALLATION: 11-27-90
DATE OF WELL DEVELOPMENT: 1-8-91
GEOLOGIST: S. Stowe, T. Roller

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE
641.230	2.735'
641.215	2.72'
638.495	0'
	3.5'
	5.5'
632	6.5'
612	26.5'
	26.75'
611.5	27'



I.D. OF SURFACE CASING	4"
TYPE OF SURFACE SEAL	Concrete
I.D. OF RISER PIPE	2"
TYPE OF RISER PIPE	304 Stainless St.
TYPE OF SEAL	Bentonite
EMPLACEMENT METHOD	Poured
DIAMETER OF BOREHOLE	4.25"
I.D. OF SCREEN	2"
TYPE OF SCREEN	304 Stainless St.
SCREEN SLOT SIZE	0.01"
SIZE OF FILTER SAND	#5 Medium Blast
EMPLACEMENT METHOD	Poured
LENGTH OF TAILPIPE	3"
BOTTOM OF BORING	

WATER LEVEL MEASUREMENTS

DATE	1-8-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	6.60	7.65								
ELEVATION	634.62	633.57								

UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

EBASCO

PROJECT NASA PBS CA-RI/FS -PHASE I EFFORT

JOB NO. WOP 2127.002

DRILLING SUBCONTRACTOR Belasco Drilling

DRILLER Rick Fisher

DRILLING METHOD Hollow Stem Auger

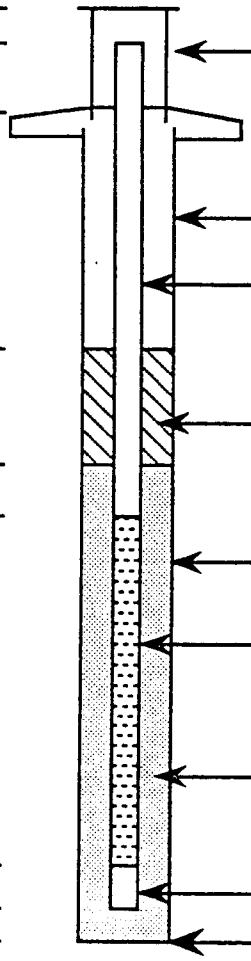
MONITORING WELL NUMBER PBS-GM-02

DATE OF WELL INSTALLATION 11-28-90

DATE OF WELL DEVELOPMENT 1-8-91

ENGINEER T. Roller

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE	
638.125	2.32'	
638.090	2.285'	I.D. OF SURFACE CASING: 4"
635.805	0'	
		TYPE OF SURFACE SEAL: Concrete
		I.D. OF RISER PIPE: 2"
	4'	TYPE OF RISER PIPE: 304 Stainless St.
		TYPE OF SEAL: Bentonite
	6'	EMPLACEMENT METHOD: Poured
627.3	8.5'	
		DIAMETER OF BOREHOLE: 4.25"
		I.D. OF SCREEN: 2"
		TYPE OF SCREEN: 304 Stainless St.
		SCREEN SLOT SIZE: 0.01"
		SIZE OF FILTER SAND: #5 Medium Blast
		EMPLACEMENT METHOD: Poured
607.3	28.5'	
	28.75'	LENGTH OF TAILPIPE: 3"
606.8	29'	BOTTOM OF BORING



WATER LEVEL MEASUREMENTS

DATE	1-8-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	5.25	6.10								
ELEVATION	632.84	631.99								

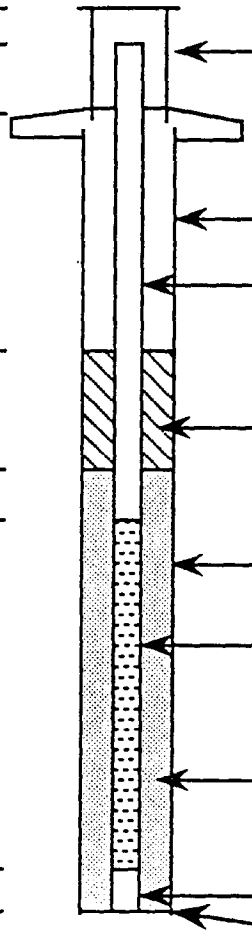
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

EBASCO

PROJECT: NASA PBS CA-RI/FS -PHASE I EFFORT
JOB NO.: WOP 2127.002
DRILLING SUBCONTRACTOR: Belasco Drilling
DRILLER: Rick Fisher

DRILLING METHOD: Hollow Stem Auger
MONITORING WELL NUMBER: PBS-GM-03
DATE OF WELL INSTALLATION: 11-29-90
DATE OF WELL DEVELOPMENT: 1-8-91
ENGINEER: T. Roller

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE	
639.750	3.06'	
639.605	2.915'	I.D. OF SURFACE CASING: 4"
636.690	0'	
		TYPE OF SURFACE SEAL: Concrete
		I.D. OF RISER PIPE: 2"
	4.5'	TYPE OF RISER PIPE: 304 Stainless St.
		TYPE OF SEAL: Bentonite
	6.5'	EMPLACEMENT METHOD: Poured
628.9	7.75'	
		DIAMETER OF BOREHOLE: 4.25"
		I.D. OF SCREEN: 2"
		TYPE OF SCREEN: 304 Stainless St.
		SCREEN SLOT SIZE: 0.01"
		SIZE OF FILTER SAND: #5 Medium Blast
		EMPLACEMENT METHOD: Poured
618.9	17.75'	
618.7	18'	LENGTH OF TAILPIPE: 3"
		BOTTOM OF BORING



WATER LEVEL MEASUREMENTS

DATE	1-8-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	6.24	6.68								
ELEVATION	633.37	632.93								

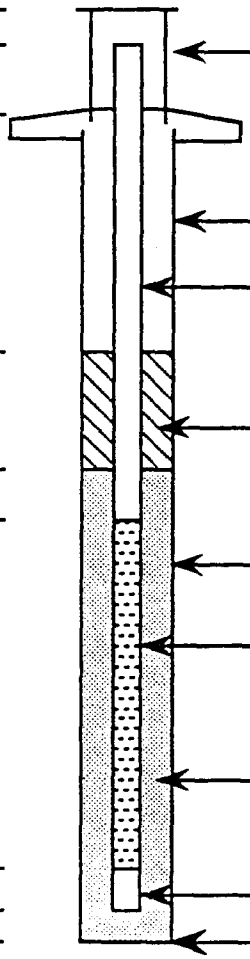
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

EBASCO

PROJECT: NASA PBS CA-RI/FS -PHASE I EFFORT
JOB NO.: WOP 2127.002
DRILLING SUBCONTRACTOR: Belasco Drilling
DRILLER: Rick Fisher

DRILLING METHOD: Hollow Stem Auger
MONITORING WELL NUMBER: PBS-GM-04
DATE OF WELL INSTALLATION: 11-29-90
DATE OF WELL DEVELOPMENT: 1-9-91
ENGINEER: T. Roller

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE	
636.935	2.44'	
637.020	2.525'	I.D. OF SURFACE CASING: 4"
634.495	0'	
		TYPE OF SURFACE SEAL: Concrete
		I.D. OF RISER PIPE: 2"
	2.5'	TYPE OF RISER PIPE: 304 Stainless St.
		TYPE OF SEAL: Bentonite
	4.5'	EMPLACEMENT METHOD: Poured
629	5.5'	
		DIAMETER OF BOREHOLE: 4.25"
		I.D. OF SCREEN: 2"
		TYPE OF SCREEN: 304 Stainless St.
		SCREEN SLOT SIZE: 0.01"
		SIZE OF FILTER SAND: #5 Medium Blast
		EMPLACEMENT METHOD: Poured
619	15.5'	
	15.75'	LENGTH OF TAILPIPE: 3"
618.5	16'	BOTTOM OF BORING



WATER LEVEL MEASUREMENTS

DATE	1-9-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	3.65	5.10								
ELEVATION	633.37	631.92								

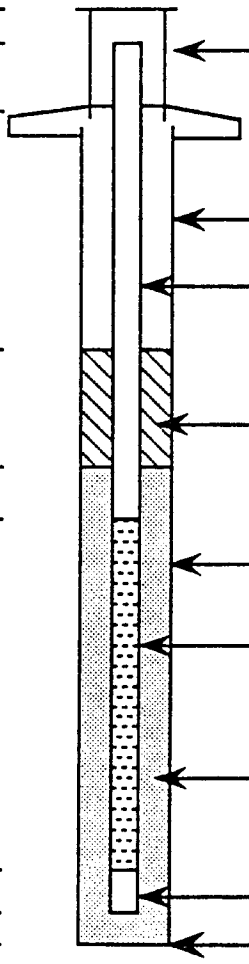
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

EBASCO

PROJECT: NASA PBS CA-RI/FS -PHASE I EFFORT
JOB NO.: WOP 2127.002
DRILLING SUBCONTRACTOR: Belasco Drilling
DRILLER: Rick Fisher

DRILLING METHOD: Hollow Stem Auger
MONITORING WELL NUMBER: PBS-GM-05
DATE OF WELL INSTALLATION: 11-30-90
DATE OF WELL DEVELOPMENT: 1-9-91
ENGINEER: T. Roller

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE	
640.635	2.845'	
640.500	2.71'	I.D. OF SURFACE CASING: 4"
637.790	0'	
		TYPE OF SURFACE SEAL: Concrete
		I.D. OF RISER PIPE: 2"
	4'	TYPE OF RISER PIPE: 304 Stainless St.
		TYPE OF SEAL: Bentonite
	6'	EMPLACEMENT METHOD: Poured
630.3	7.5'	
		DIAMETER OF BOREHOLE: 4.25"
		I.D. OF SCREEN: 2"
		TYPE OF SCREEN: 304 Stainless St.
		SCREEN SLOT SIZE: 0.01"
		SIZE OF FILTER SAND: #5 Medium Blast
		EMPLACEMENT METHOD: Poured
620.3	17.5'	
	17.75'	LENGTH OF TAILPIPE: 3"
619.8	18'	BOTTOM OF BORING



WATER LEVEL MEASUREMENTS

DATE	1-9-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	6.52	7.05								
ELEVATION	633.98	633.45								

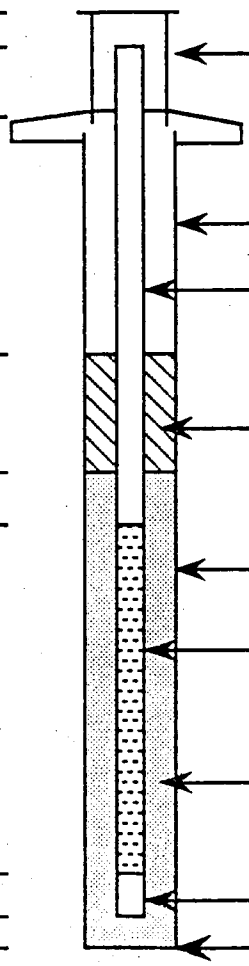
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

EBASCO

PROJECT: NASA PBS CA-RI/FS -PHASE I EFFORT
JOB NO.: WOP 2127.002
DRILLING SUBCONTRACTOR: Belasco Drilling
DRILLER: Rick Fisher

DRILLING METHOD: Hollow Stem Auger
MONITORING WELL NUMBER: PBS-GM-06
DATE OF WELL INSTALLATION: 12-4-90
DATE OF WELL DEVELOPMENT: 1-9-91
ENGINEER: T. Roller

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE	
640.550	2.75'	
640.390	2.59'	I.D. OF SURFACE CASING: 4"
637.800	0'	
		TYPE OF SURFACE SEAL: Concrete
		I.D. OF RISER PIPE: 2"
	4'	TYPE OF RISER PIPE: 304 Stainless St.
		TYPE OF SEAL: Bentonite
	6'	EMPLACEMENT METHOD: Poured
630.3	7.5'	
		DIAMETER OF BOREHOLE: 4.25"
		I.D. OF SCREEN: 2"
		TYPE OF SCREEN: 304 Stainless St.
		SCREEN SLOT SIZE: 0.01"
		SIZE OF FILTER SAND: #5 Medium Blast
		EMPLACEMENT METHOD: Poured
620.3	17.5'	
	17.75'	LENGTH OF TAILPIPE: 3"
619.8	18'	BOTTOM OF BORING

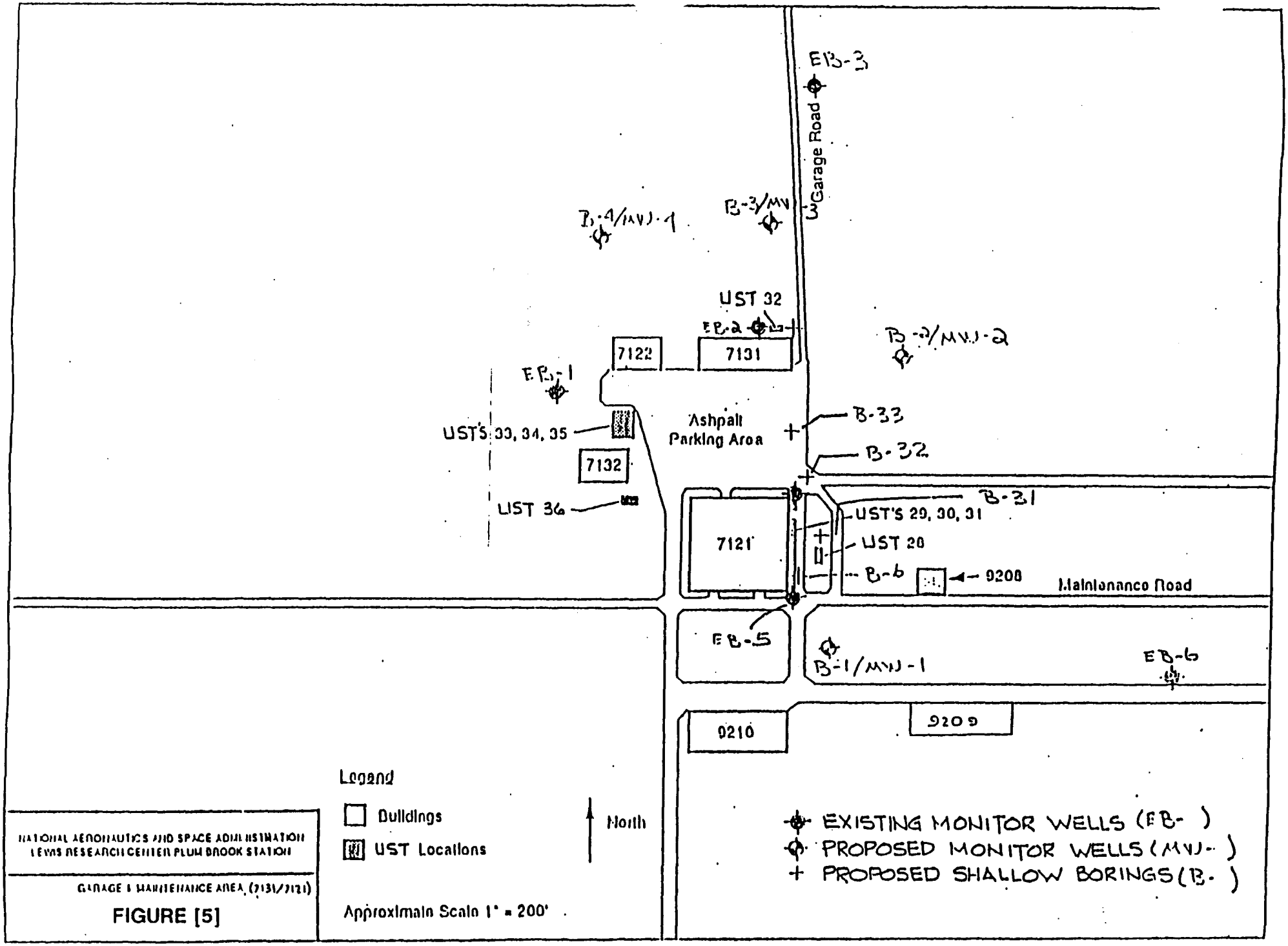


WATER LEVEL MEASUREMENTS

DATE	1-9-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	7.35	7.32								
ELEVATION	633.04	633.07								

APPENDIX B-4

Soil and Groundwater Sampling and Analyses, Morrison Knudsen Corporation, 1993


EB-3
Garage Road
B-4/MW-1
B-3/MW
UST 32
EB-2
7122
7131
B-2/MW-2
EB-1
UST'S 33, 34, 35
Ashpalt
Parking Area
B-33
B-32
7132
UST 36
B-31
UST'S 29, 30, 31
7121
UST 28
B-6
9208
Maintenance Road
EB-5
B-1/MW-1
EB-6
9210
9209
Legend
Buildings
UST Locations
North
EXISTING MONITOR WELLS (EB-)
PROPOSED MONITOR WELLS (MW-)
PROPOSED SHALLOW BORINGS (B-)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LEWIS RESEARCH CENTER PLUM BROOK STATION
GARAGE & MAINTENANCE AREA (7131/7121)
FIGURE [5]
Approximain Scale 1" = 200'

TPH RESULTS FOR SOIL

BUILDINGS 7121/7131
TASK NO. 6105-006

BORING NUMBER	SAMPLE DEPTH	TPH (418.1) (mg/kg)[1]
B1	0'-2'	10
B1	2'-4'	< 10
B1	8'-10'	17
B2	2'-4'	39
B2	6'-8'	< 10
B2	10'-12'	< 10
B3	4'-6'	< 10
B3	2'-4'	< 10
B3	6'-8'	< 10
B4	4'-6'	< 10
B4[D(2)]	4'-6'	< 10
B4	6'-8'	< 10
B4	10'-12'	< 10
B5	0'-2'	8,200
B5[D(2)]	0'-2'	1,700
B5	2'-4'	36
B5	4'-6'	130
B6	1'-3'	27
B6	3'-5'	34
B6	5'-7'	< 10
B-31-1	2'-4'	11.0
B-31-2	4'-6'	2.2
B-32-1	4'-6'	2.8
B-32-2	6'-8'	3.2
B-33-1	0'-2'	< 2.0
B-33-2	2'-4'	< 2.0
B-33-2D	2'-4'	< 2.0
B-33-3	4'-6'	< 2.0

[1]mg/kg = parts per million

[2] D = Duplicate Sample

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS IN SOIL

BUILDINGS 7121/7131
TASK NO. 6105-006

BORING NUMBER	SAMPLE DEPTH	COMPOUND	RESULT (ug/kg) (1)	PQL (ug/L) (2)
B1	0'-2'	---	---(3)	---
B1	2'-4'	---	---	---
B1	8'-10'	---	---	---
B2	2'-4'	---	---	---
B2	6'-8'	TETRAHYDROFURAN(4)	243	10
B2	10'-12'	---	---	---
B3	4'-6'	---	---	---
B3	2'-4'	---	---	---
B3	6'-8'	TETRAHYDROFURAN(4)	287	10
B4	4'-6'	---	---	---
B4 D(5)	4'-6'	---	---	---
B4	6'-8'	1,1-DICHLOROETHANE	19.4	5
B4	6'-8'	1,1,1-TRICHLOROETHANE	16.8	5
B4	10'-12'	---	---	---
B5	0'-2'	---	---	---
B5 D(5)	0'-2'	---	---	---
B5	2'-4'	---	---	---
B5	4'-6'	---	---	---
B6	1'-3'	ACETONE	64.6	50
B6	3'-5'	ACETONE	106	10
B6	3'-5'	2-BUTANONE (MEK)(4)	50	10
B6	5'-7'	1,1,1-TRICHLOROETHANE	65.2	5
B-31-1	2'-4'	METHYLENE CHLORIDE	7.45	
B-31-1	2'-4'	TOLUENE	6.44	
B-31-2	4'-6'	1,1,1-TCA	17.8	
B-31-2	4'-6'	NAPHTHALENE(6)	5.60	
B-31-2	4'-6'	1,2,3-(6) TRICHLOROBENZENE	5.08	

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS IN SOIL

BUILDINGS 7121/7131
TASK NO. 6105-006

BORING NUMBER	SAMPLE DEPTH	COMPOUND	RESULT (ug/kg) (1)	PQL (ug/L) (2)
B-32-1	4'-6'	METHYLENE CHLORIDE	12.2	
B-32-1	4'-6'	1,1,1-TCA	82.2	
B-32-2	6'-8'	METHYLENE CHLORIDE	10.3	
B-32-2	6'-8'	1,1,1-TCA	43.3	
B-32-2	6'-8'	TOLUENE	7.43	
B-33-1	0'-2'	TOLUENE	10.2	
B-33-2	2'-4'	1,1,1-TCA	8.94	
B-33-2D	2'-4'	---	---	
B-33-3	4'-6'	1,1,1-TCA	7.50	

(1) ug/kg = ppb

(2) PQL = Practical Quantification Limit

(3) --- = Compound/Concentrations Below PQL

(4) = Tetrahydrofuran and 2-Butanone (MEK) are Laboratory Contaminants, per BEC Labs

(5) D = Duplicate Sample

(6) = Laboratory reported that "detected amount of this compound probably due to carry over from previous samples."

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01647
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-1
5/5/93 1700

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
Acrolein	10	< 10
Acrylonitrile	10	< 10
Acetone	10	< 10
Benzene	1	< 1
Bromodichloromethane	1	< 1
Bromoform	1	< 1
Bromomethane	1	< 1
2-Butanone (MEK)	10	< 10
Carbon disulfide	1	< 1
Carbon tetrachloride	1	< 1
Chlorobenzene	1	< 1
Chlorodibromomethane	1	< 1
Chloroethane	2	< 2
2-Chloroethyl vinyl ether	2	< 2
Chloroform	1	< 1
Chloromethane	1	< 1
1,2-Dibromoethane (EDB)	1	< 1
Dibromomethane	1	< 1
1,2-Dichlorobenzene	1	< 1
1,3-Dichlorobenzene	1	< 1
1,4-Dichlorobenzene	1	< 1
1,4-Dichloro-2-butene	2	< 2
Dichlorodifluoromethane	1	< 1
1,1-Dichloroethane	1	< 1
1,2-Dichloroethane	1	< 1
1,1-Dichloroethene	1	< 1
cis-1,2-Dichloroethene	1	< 1
trans-1,2-Dichloroethene	1	< 1
1,2-Dichloropropane	1	< 1
cis-1,3-Dichloropropene	1	< 1

date completed:	tech:	approved by:
5/17/93	JM	Edward Hunt

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01647
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-1
5/5/93 1700

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
trans-1,3-Dichloropropene	1	< 1
Ethyl acetate	2	< 2
Ethyl benzene	1	< 1
Ethyl ether	2	< 2
Ethyl methacrylate	1	< 1
2-Hexanone	2	< 2
Methylene chloride	1	< 1
Methyl iodide	1	< 1
4-Methyl-2-pentanone (MIBK)	10	< 10
Naphthalene	1	< 1
Styrene	1	< 1
1,1,1,2-Tetrachloroethane	1	< 1
1,1,2,2-Tetrachloroethane	1	< 1
Tetrachloroethene	1	< 1
Tetrahydrofuran	2	< 2
Toluene	1	< 1
1,1,1-Trichloroethane	1	< 1
1,1,2-Trichloroethane	1	< 1
Trichloroethene	1	< 1
Trichlorofluoromethane	1	< 1
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1	< 1
1,2,3-Trichloropropane	1	< 1
Vinyl acetate	2	< 2
Vinyl chloride	1	< 1
m & p-Xylenes	1	< 1
o-Xylene	1	< 1

date completed:	tech:	approved by:
5/17/93	JM	Edward Shiroot

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01647
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-1
5/5/93 1700

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	104%	76-114
Toluene-d8	101%	88-110
4-Bromofluorobenzene	99.7%	86-115

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/17/93	JM	Edward Thiel

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01648
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-2
5/6/93 0800

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
Acrolein	10	< 10
Acrylonitrile	10	< 10
Acetone	10	< 10
Benzene	1	< 1
Bromodichloromethane	1	< 1
Bromoform	1	< 1
Bromomethane	1	< 1
2-Butanone (MEK)	10	< 10
Carbon disulfide	1	< 1
Carbon tetrachloride	1	< 1
Chlorobenzene	1	< 1
Chlorodibromomethane	1	< 1
Chloroethane	2	< 2
2-Chloroethyl vinyl ether	2	< 2
Chloroform	1	< 1
Chloromethane	1	< 1
1,2-Dibromoethane (EDB)	1	< 1
Dibromomethane	1	< 1
1,2-Dichlorobenzene	1	< 1
1,3-Dichlorobenzene	1	< 1
1,4-Dichlorobenzene	1	< 1
1,4-Dichloro-2-butene	2	< 2
Dichlorodifluoromethane	1	< 1
1,1-Dichloroethane	1	< 1
1,2-Dichloroethane	1	< 1
1,1-Dichloroethene	1	< 1
cis-1,2-Dichloroethene	1	< 1
trans-1,2-Dichloroethene	1	< 1
1,2-Dichloropropane	1	< 1
cis-1,3-Dichloropropene	1	< 1

date completed:	tech:	approved by:
5/17/93	JM	

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01648
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-2
5/6/93 0800

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
trans-1,3-Dichloropropene	1	< 1
Ethyl acetate	2	< 2
Ethyl benzene	1	< 1
Ethyl ether	2	< 2
Ethyl methacrylate	1	< 1
2-Hexanone	2	< 2
Methylene chloride	1	< 1
Methyl iodide	1	< 1
4-Methyl-2-pentanone (MIBK)	10	< 10
Naphthalene	1	< 1
Styrene	1	< 1
1,1,1,2-Tetrachloroethane	1	< 1
1,1,2,2-Tetrachloroethane	1	< 1
Tetrachloroethene	1	< 1
Tetrahydrofuran	2	< 2
Toluene	1	< 1
1,1,1-Trichloroethane	1	< 1
1,1,2-Trichloroethane	1	< 1
Trichloroethene	1	< 1
Trichlorofluoromethane	1	< 1
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1	< 1
1,2,3-Trichloropropane	1	< 1
Vinyl acetate	2	< 2
Vinyl chloride	1	< 1
m & p-Xylenes	1	< 1
o-Xylene	1	< 1

date completed:	tech:	approved by:
5/17/93	JM	Edward Hewitt

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01648
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-2
5/6/93 0800

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	97.2%	76-114
Toluene-d8	95.4%	88-110
4-Bromofluorobenzene	98.1%	86-115

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01649
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-2-A
5/6/93 0800

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
Acrolein	10	< 10
Acrylonitrile	10	< 10
Acetone	10	< 10
Benzene	1	< 1
Bromodichloromethane	1	< 1
Bromoform	1	< 1
Bromomethane	1	< 1
2-Butanone (MEK)	10	< 10
Carbon disulfide	1	< 1
Carbon tetrachloride	1	< 1
Chlorobenzene	1	< 1
Chlorodibromomethane	1	< 1
Chloroethane	2	< 2
2-Chloroethyl vinyl ether	2	< 2
Chloroform	1	< 1
Chloromethane	1	< 1
1,2-Dibromoethane (EDB)	1	< 1
Dibromomethane	1	< 1
1,2-Dichlorobenzene	1	< 1
1,3-Dichlorobenzene	1	< 1
1,4-Dichlorobenzene	1	< 1
1,4-Dichloro-2-butene	2	< 2
Dichlorodifluoromethane	1	< 1
1,1-Dichloroethane	1	< 1
1,2-Dichloroethane	1	< 1
1,1-Dichloroethene	1	< 1
cis-1,2-Dichloroethene	1	< 1
trans-1,2-Dichloroethene	1	< 1
1,2-Dichloropropane	1	< 1
cis-1,3-Dichloropropene	1	< 1

date completed:	tech:	approved by:
5/17/93	JM	Edward Shriver

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no.: 93C01649
p.o. no.: 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-2-A
5/6/93 0800

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
trans-1,3-Dichloropropene	1	< 1
Ethyl acetate	2	< 2
Ethyl benzene	1	< 1
Ethyl ether	2	< 2
Ethyl methacrylate	1	< 1
2-Hexanone	2	< 2
Methylene chloride	1	< 1
Methyl iodide	1	< 1
4-Methyl-2-pentanone (MIBK)	10	< 10
Naphthalene	1	< 1
Styrene	1	< 1
1,1,1,2-Tetrachloroethane	1	< 1
1,1,2,2-Tetrachloroethane	1	< 1
Tetrachloroethene	1	< 1
Tetrahydrofuran	2	< 2
Toluene	1	< 1
1,1,1-Trichloroethane	1	< 1
1,1,2-Trichloroethane	1	< 1
Trichloroethene	1	< 1
Trichlorofluoromethane	1	< 1
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1	< 1
1,2,3-Trichloropropane	1	< 1
Vinyl acetate	2	< 2
Vinyl chloride	1	< 1
m & p-Xylenes	1	< 1
o-Xylene	1	< 1

date completed:	tech:	approved by:
5/17/93	JM	Edward Shuert

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01649
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-2-A
5/6/93 0800

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	103%	76-114
Toluene-d8	97.0%	88-110
4-Bromofluorobenzene	101%	86-115

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/17/93	JM	

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01650
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-3
5/6/93 0815

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
Acrolein	10	< 10
Acrylonitrile	10	< 10
Acetone	10	< 10
Benzene	1	< 1
Bromodichloromethane	1	< 1
Bromoform	1	< 1
Bromomethane	1	< 1
2-Butanone (MEK)	10	< 10
Carbon disulfide	1	< 1
Carbon tetrachloride	1	< 1
Chlorobenzene	1	< 1
Chlorodibromomethane	1	< 1
Chloroethane	2	< 2
2-Chloroethyl vinyl ether	2	< 2
Chloroform	1	< 1
Chloromethane	1	< 1
1,2-Dibromoethane (EDB)	1	< 1
Dibromomethane	1	< 1
1,2-Dichlorobenzene	1	< 1
1,3-Dichlorobenzene	1	< 1
1,4-Dichlorobenzene	1	< 1
1,4-Dichloro-2-butene	2	< 2
Dichlorodifluoromethane	1	< 1
1,1-Dichloroethane	1	< 1
1,2-Dichloroethane	1	< 1
1,1-Dichloroethene	1	< 1
cis-1,2-Dichloroethene	1	< 1
trans-1,2-Dichloroethene	1	< 1
1,2-Dichloropropane	1	< 1
cis-1,3-Dichloropropene	1	< 1

date completed:	tech:	approved by:
5/17/93	JM	Edward Steiner

[illegible] written approval of the [illegible]

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01650
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-3
5/6/93 0815

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
trans-1,3-Dichloropropene	1	< 1
Ethyl acetate	2	< 2
Ethyl benzene	1	< 1
Ethyl ether	2	< 2
Ethyl methacrylate	1	< 1
2-Hexanone	2	< 2
Methylene chloride	1	< 1
Methyl iodide	1	< 1
4-Methyl-2-pentanone (MIBK)	10	< 10
Naphthalene	1	< 1
Styrene	1	< 1
1,1,1,2-Tetrachloroethane	1	< 1
1,1,2,2-Tetrachloroethane	1	< 1
Tetrachloroethene	1	< 1
Tetrahydrofuran	2	< 2
Toluene	1	< 1
1,1,1-Trichloroethane	1	< 1
1,1,2-Trichloroethane	1	< 1
Trichloroethene	1	< 1
Trichlorofluoromethane	1	< 1
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1	< 1
1,2,3-Trichloropropane	1	< 1
Vinyl acetate	2	< 2
Vinyl chloride	1	< 1
m & p-Xylenes	1	< 1
o-Xylene	1	< 1

date completed:	tech:	approved by:
5/17/93	JM	Edward Shiret

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01650
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-3
5/6/93 0815

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	103%	76-114
Toluene-d8	98.9%	88-110
4-Bromofluorobenzene	101%	86-115

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01651
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-4
5/6/93 0830

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
Acrolein	10	< 10
Acrylonitrile	10	< 10
Acetone	10	< 10
Benzene	1	< 1
Bromodichloromethane	1	< 1
Bromoform	1	< 1
Bromomethane	1	< 1
2-Butanone (MEK)	10	< 10
Carbon disulfide	1	< 1
Carbon tetrachloride	1	< 1
Chlorobenzene	1	< 1
Chlorodibromomethane	1	< 1
Chloroethane	2	< 2
2-Chloroethyl vinyl ether	2	< 2
Chloroform	1	< 1
Chloromethane	1	< 1
1,2-Dibromoethane (EDB)	1	< 1
Dibromomethane	1	< 1
1,2-Dichlorobenzene	1	< 1
1,3-Dichlorobenzene	1	< 1
1,4-Dichlorobenzene	1	< 1
1,4-Dichloro-2-butene	2	< 2
Dichlorodifluoromethane	1	< 1
1,1-Dichloroethane	1	18.0
1,2-Dichloroethane	1	< 1
1,1-Dichloroethene	1	1.74
cis-1,2-Dichloroethene	1	< 1
trans-1,2-Dichloroethene	1	< 1
1,2-Dichloropropane	1	< 1
cis-1,3-Dichloropropene	1	< 1

date completed:	tech:	approved by:
5/17/93	JM	Edward Shiel

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01651
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-4
5/6/93 0830

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
trans-1,3-Dichloropropene	1	< 1
Ethyl acetate	2	< 2
Ethyl benzene	1	< 1
Ethyl ether	2	< 2
Ethyl methacrylate	1	< 1
2-Hexanone	2	< 2
Methylene chloride	1	< 1
Methyl iodide	1	< 1
4-Methyl-2-pentanone (MIBK)	10	< 10
Naphthalene	1	< 1
Styrene	1	< 1
1,1,1,2-Tetrachloroethane	1	< 1
1,1,2,2-Tetrachloroethane	1	< 1
Tetrachloroethene	1	< 1
Tetrahydrofuran	2	< 2
Toluene	1	< 1
1,1,1-Trichloroethane	1	< 1
1,1,2-Trichloroethane	1	< 1
Trichloroethene	1	< 1
Trichlorofluoromethane	1	< 1
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1	< 1
1,2,3-Trichloropropane	1	< 1
Vinyl acetate	2	< 2
Vinyl chloride	1	< 1
m & p-Xylenes	1	< 1
o-Xylene	1	< 1

date completed:	tech:	approved by:
5/17/93	JM	Edward Fluit

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01651
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - MW-4
5/6/93 0830

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	98.9%	76-114
Toluene-d8	98.0%	88-110
4-Bromofluorobenzene	100%	86-115

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/17/93	JM	Edward Thiemet

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01662
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - EB-1
5/10/93 0950

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
Acrolein	10	< 10
Acrylonitrile	10	< 10
Acetone	10	< 10
Benzene	1	< 1
Bromodichloromethane	1	< 1
Bromoform	1	< 1
Bromomethane	1	< 1
2-Butanone (MEK)	10	< 10
Carbon disulfide	1	< 1
Carbon tetrachloride	1	< 1
Chlorobenzene	1	< 1
Chlorodibromomethane	1	< 1
Chloroethane	2	< 2
2-Chloroethyl vinyl ether	2	< 2
Chloroform	1	< 1
Chloromethane	1	< 1
1,2-Dibromoethane (EDB)	1	< 1
Dibromomethane	1	< 1
1,2-Dichlorobenzene	1	< 1
1,3-Dichlorobenzene	1	< 1
1,4-Dichlorobenzene	1	< 1
1,4-Dichloro-2-butene	2	< 2
Dichlorodifluoromethane	1	< 1
1,1-Dichloroethane	1	< 1
1,2-Dichloroethane	1	< 1
1,1-Dichloroethene	1	< 1
cis-1,2-Dichloroethene	1	< 1
trans-1,2-Dichloroethene	1	< 1
1,2-Dichloropropane	1	< 1
cis-1,3-Dichloropropene	1	< 1

date completed:	tech:	approved by:
5/17/93	LNT	Edward Shimet

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01662
p.o. no. 2F2-4065-2435

sample description: 4065-6106-006 PLUM BROOK UST STUDY
7121/7131 - EB-1
5/10/93 0950

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
trans-1,3-Dichloropropene	1	< 1
Ethyl acetate	2	< 2
Ethyl benzene	1	< 1
Ethyl ether	2	< 2
Ethyl methacrylate	1	< 1
2-Hexanone	2	< 2
Methylene chloride	1	< 1
Methyl iodide	1	< 1
4-Methyl-2-pentanone (MIBK)	10	< 10
Naphthalene	1	< 1
Styrene	1	< 1
1,1,1,2-Tetrachloroethane	1	< 1
1,1,2,2-Tetrachloroethane	1	< 1
Tetrachloroethene	1	< 1
Tetrahydrofuran	2	< 2
Toluene	1	< 1
1,1,1-Trichloroethane	1	< 1
1,1,2-Trichloroethane	1	< 1
Trichloroethene	1	< 1
Trichlorofluoromethane	1	< 1
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1	< 1
1,2,3-Trichloropropane	1	< 1
Vinyl acetate	2	< 2
Vinyl chloride	1	< 1
m & p-Xylenes	1	< 1
o-Xylene	1	< 1

date completed: 5/17/93 | tech: LNT | approved by: Edward Shiner

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01662
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - EB-1
5/10/93 0950

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	108%	76-114
Toluene-d8	98.3%	88-110
4-Bromofluorobenzene	102%	86-115

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed: 5/17/93
tech: LNT
approved by: Edward Shiett

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01663
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - EB-2
5/10/93 0930

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
Acrolein	10	< 10
Acrylonitrile	10	< 10
Acetone	10	< 10
Benzene	1	< 1
Bromodichloromethane	1	< 1
Bromoform	1	< 1
Bromomethane	1	< 1
2-Butanone (MEK)	10	< 10
Carbon disulfide	1	< 1
Carbon tetrachloride	1	< 1
Chlorobenzene	1	< 1
Chlorodibromomethane	1	< 1
Chloroethane	2	< 2
2-Chloroethyl vinyl ether	2	< 2
Chloroform	1	< 1
Chloromethane	1	< 1
1,2-Dibromoethane (EDB)	1	< 1
Dibromomethane	1	< 1
1,2-Dichlorobenzene	1	< 1
1,3-Dichlorobenzene	1	< 1
1,4-Dichlorobenzene	1	< 1
1,4-Dichloro-2-butene	2	< 2
Dichlorodifluoromethane	1	< 1
1,1-Dichloroethane	1	< 1
1,2-Dichloroethane	1	< 1
1,1-Dichloroethene	1	< 1
cis-1,2-Dichloroethene	1	< 1
trans-1,2-Dichloroethene	1	< 1
1,2-Dichloropropane	1	< 1
cis-1,3-Dichloropropene	1	< 1

date completed:	tech:	approved by:
5/17/93	LNT	Edward Hurst

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01663
p.o. no. 2F2-4065-2435

sample description: 4065-6106-006 PLUM BROOK UST STUDY
7121/7131 - EB-2
5/10/93 0930

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
trans-1,3-Dichloropropene	1	< 1
Ethyl acetate	2	< 2
Ethyl benzene	1	< 1
Ethyl ether	2	< 2
Ethyl methacrylate	1	< 1
2-Hexanone	2	< 2
Methylene chloride	1	< 1
Methyl iodide	1	< 1
4-Methyl-2-pentanone (MIBK)	10	< 10
Naphthalene	1	< 1
Styrene	1	< 1
1,1,1,2-Tetrachloroethane	1	< 1
1,1,2,2-Tetrachloroethane	1	< 1
Tetrachloroethene	1	< 1
Tetrahydrofuran	2	< 2
Toluene	1	< 1
1,1,1-Trichloroethane	1	9.88
1,1,2-Trichloroethane	1	< 1
Trichloroethene	1	< 1
Trichlorofluoromethane	1	< 1
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1	< 1
1,2,3-Trichloropropane	1	< 1
Vinyl acetate	2	< 2
Vinyl chloride	1	< 1
m & p-Xylenes	1	< 1
o-Xylene	1	< 1

date completed: 5/17/93 | tech: LNT | approved by: Edward Shuirt

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01663
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - EB-2
5/10/93 0930

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	107%	76-114
Toluene-d8	97.1%	88-110
4-Bromofluorobenzene	104%	86-115

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01664
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - EB-3
0940

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
Acrolein	10	< 10
Acrylonitrile	10	< 10
Acetone	10	< 10
Benzene	1	< 1
Bromodichloromethane	1	< 1
Bromoform	1	< 1
Bromomethane	1	< 1
2-Butanone (MEK)	10	< 10
Carbon disulfide	1	< 1
Carbon tetrachloride	1	< 1
Chlorobenzene	1	< 1
Chlorodibromomethane	1	< 1
Chloroethane	2	< 2
2-Chloroethyl vinyl ether	2	< 2
Chloroform	1	< 1
Chloromethane	1	< 1
1,2-Dibromoethane (EDB)	1	< 1
Dibromomethane	1	< 1
1,2-Dichlorobenzene	1	< 1
1,3-Dichlorobenzene	1	< 1
1,4-Dichlorobenzene	1	< 1
1,4-Dichloro-2-butene	2	< 2
Dichlorodifluoromethane	1	< 1
1,1-Dichloroethane	1	< 1
1,2-Dichloroethane	1	< 1
1,1-Dichloroethene	1	< 1
cis-1,2-Dichloroethene	1	< 1
trans-1,2-Dichloroethene	1	< 1
1,2-Dichloropropane	1	< 1
cis-1,3-Dichloropropene	1	< 1

date completed: 5/17/93 | tech: LNT | approved by: Edward Stuart

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01664
p.o. no. 2F2-4065-2435

sample description: 4065-6106-006 PLUM BROOK UST STUDY
7121/7131 - EB-3
0940

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
trans-1,3-Dichloropropene	1	< 1
Ethyl acetate	2	< 2
Ethyl benzene	1	< 1
Ethyl ether	2	< 2
Ethyl methacrylate	1	< 1
2-Hexanone	2	< 2
Methylene chloride	1	< 1
Methyl iodide	1	< 1
4-Methyl-2-pentanone (MIBK)	10	< 10
Naphthalene	1	< 1
Styrene	1	< 1
1,1,1,2-Tetrachloroethane	1	< 1
1,1,2,2-Tetrachloroethane	1	< 1
Tetrachloroethene	1	< 1
Tetrahydrofuran	2	< 2
Toluene	1	< 1
1,1,1-Trichloroethane	1	< 1
1,1,2-Trichloroethane	1	< 1
Trichloroethene	1	< 1
Trichlorofluoromethane	1	< 1
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1	< 1
1,2,3-Trichloropropane	1	< 1
Vinyl acetate	2	< 2
Vinyl chloride	1	< 1
m & p-Xylenes	1	< 1
o-Xylene	1	< 1

date completed:	tech:	approved by:
5/17/93	LNT	Edward Shuitt

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01664
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - EB-3
0940

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	110%	76-114
Toluene-d8	98.0%	88-110
4-Bromofluorobenzene	104%	86-115

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/17/93	LNT	

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01665
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - EB-4
0900

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
Acrolein	10	< 10
Acrylonitrile	10	< 10
Acetone	10	< 10
Benzene	1	< 1
Bromodichloromethane	1	< 1
Bromoform	1	< 1
Bromomethane	1	< 1
2-Butanone (MEK)	10	< 10
Carbon disulfide	1	< 1
Carbon tetrachloride	1	< 1
Chlorobenzene	1	< 1
Chlorodibromomethane	1	< 1
Chloroethane	2	4.13
2-Chloroethyl vinyl ether	2	< 2
Chloroform	1	< 1
Chloromethane	1	< 1
1,2-Dibromoethane (EDB)	1	< 1
Dibromomethane	1	< 1
1,2-Dichlorobenzene	1	< 1
1,3-Dichlorobenzene	1	< 1
1,4-Dichlorobenzene	1	< 1
1,4-Dichloro-2-butene	2	< 2
Dichlorodifluoromethane	1	< 1
1,1-Dichloroethane	1	48.5
1,2-Dichloroethane	1	< 1
1,1-Dichloroethene	1	51.6
cis-1,2-Dichloroethene	1	2.93
trans-1,2-Dichloroethene	1	< 1
1,2-Dichloropropane	1	< 1
cis-1,3-Dichloropropene	1	< 1

date completed:	tech:	approved by:
5/18/93	LNT	Edward Kunst

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01665
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - EB-4
0900

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
trans-1,3-Dichloropropene	1	< 1
Ethyl acetate	2	< 2
Ethyl benzene	1	< 1
Ethyl ether	2	< 2
Ethyl methacrylate	1	< 1
2-Hexanone	2	< 2
Methylene chloride	1	< 1
Methyl iodide	1	< 1
4-Methyl-2-pentanone (MIBK)	10	< 10
Naphthalene	1	< 1
Styrene	1	< 1
1,1,1,2-Tetrachloroethane	1	< 1
1,1,2,2-Tetrachloroethane	1	< 1
Tetrachloroethene	1	5.72
Tetrahydrofuran	2	< 2
Toluene	1	< 1
1,1,1-Trichloroethane	1	551
1,1,2-Trichloroethane	1	2.13
Trichloroethene	1	13.4
Trichlorofluoromethane	1	< 1
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1	< 1
1,2,3-Trichloropropane	1	< 1
Vinyl acetate	2	< 2
Vinyl chloride	1	< 1
m & p-Xylenes	1	< 1
o-Xylene	1	< 1

date completed: 5/18/93 | tech: LNT | approved by:

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01665
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - EB-4
0900

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	113%	76-114
Toluene-d8	98.6%	88-110
4-Bromofluorobenzene	104%	86-115

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/18/93	LNT	Edward Thiel

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01666
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - EB-5
0845

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)	
Acrolein	10	< 10	
Acrylonitrile	10	< 10	
Acetone	10	< 10	
Benzene	1	< 1	
Bromodichloromethane	1	< 1	
Bromoform	1	< 1	
Bromomethane	1	< 1	
2-Butanone (MEK)	10	< 10	
Carbon disulfide	1	< 1	
Carbon tetrachloride	1	< 1	
Chlorobenzene	1	< 1	
Chlorodibromomethane	1	< 1	
Chloroethane	2	2.17	
2-Chloroethyl vinyl ether	2	< 2	
Chloroform	1	< 1	(0.702)
Chloromethane	1	< 1	
1,2-Dibromoethane (EDB)	1	< 1	
Dibromomethane	1	< 1	
1,2-Dichlorobenzene	1	< 1	
1,3-Dichlorobenzene	1	< 1	
1,4-Dichlorobenzene	1	< 1	
1,4-Dichloro-2-butene	2	< 2	
Dichlorodifluoromethane	1	< 1	
1,1-Dichloroethane	1	112	
1,2-Dichloroethane	1	< 1	
1,1-Dichloroethene	1	52.9	
cis-1,2-Dichloroethene	1	< 1	
trans-1,2-Dichloroethene	1	< 1	
1,2-Dichloropropane	1	< 1	
cis-1,3-Dichloropropene	1	< 1	

date completed:	tech:	approved by:
5/17/93	LNT	

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01666
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - EB-5
0845

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
trans-1,3-Dichloropropene	1	< 1
Ethyl acetate	2	< 2
Ethyl benzene	1	< 1
Ethyl ether	2	< 2
Ethyl methacrylate	1	< 1
2-Hexanone	2	< 2
Methylene chloride	1	< 1
Methyl iodide	1	< 1
4-Methyl-2-pentanone (MIBK)	10	< 10
Naphthalene	1	< 1
Styrene	1	< 1
1,1,1,2-Tetrachloroethane	1	< 1
1,1,2,2-Tetrachloroethane	1	< 1
Tetrachloroethene	1	< 1
Tetrahydrofuran	2	< 2
Toluene	1	< 1
1,1,1-Trichloroethane	1	1,130
1,1,2-Trichloroethane	1	1.25
Trichloroethene	1	5.60
Trichlorofluoromethane	1	< 1
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1	< 1
1,2,3-Trichloropropane	1	< 1
Vinyl acetate	2	< 2
Vinyl chloride	1	< 1
m & p-Xylenes	1	< 1
o-Xylene	1	< 1

date completed: 5/17/93
tech: LNT
approved by: Edward Thiel

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01666
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - EB-5
0845

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	104%	76-114
Toluene-d8	96.1%	88-110
4-Bromofluorobenzene	101%	86-115

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed: 5/17/93
tech: LNT
approved by:

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01667
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - EB-6
1045

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
Acrolein	10	< 10
Acrylonitrile	10	< 10
Acetone	10	< 10
Benzene	1	< 1
Bromodichloromethane	1	< 1
Bromoform	1	< 1
Bromomethane	1	< 1
2-Butanone (MEK)	10	< 10
Carbon disulfide	1	< 1
Carbon tetrachloride	1	< 1
Chlorobenzene	1	< 1
Chlorodibromomethane	1	< 1
Chloroethane	2	< 2
2-Chloroethyl vinyl ether	2	< 2
Chloroform	1	< 1
Chloromethane	1	< 1
1,2-Dibromoethane (EDB)	1	< 1
Dibromomethane	1	< 1
1,2-Dichlorobenzene	1	< 1
1,3-Dichlorobenzene	1	< 1
1,4-Dichlorobenzene	1	< 1
1,4-Dichloro-2-butene	2	< 2
Dichlorodifluoromethane	1	< 1
1,1-Dichloroethane	1	< 1
1,2-Dichloroethane	1	< 1
1,1-Dichloroethene	1	< 1
cis-1,2-Dichloroethene	1	< 1
trans-1,2-Dichloroethene	1	< 1
1,2-Dichloropropane	1	< 1
cis-1,3-Dichloropropene	1	< 1

date completed: 5/17/93 | tech: LNT | approved by: [signature]

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01667
p.o. no. 2F2-4065-2435

sample description: 4065-6106-006 PLUM BROOK UST STUDY
7121/7131 - EB-6
1045

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
trans-1,3-Dichloropropene	1	< 1
Ethyl acetate	2	< 2
Ethyl benzene	1	< 1
Ethyl ether	2	< 2
Ethyl methacrylate	1	< 1
2-Hexanone	2	< 2
Methylene chloride	1	< 1
Methyl iodide	1	< 1
4-Methyl-2-pentanone (MIBK)	10	< 10
Naphthalene	1	< 1
Styrene	1	< 1
1,1,1,2-Tetrachloroethane	1	< 1
1,1,2,2-Tetrachloroethane	1	< 1
Tetrachloroethene	1	< 1
Tetrahydrofuran	2	< 2
Toluene	1	< 1
1,1,1-Trichloroethane	1	< 1
1,1,2-Trichloroethane	1	< 1
Trichloroethene	1	< 1
Trichlorofluoromethane	1	< 1
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1	< 1
1,2,3-Trichloropropane	1	< 1
Vinyl acetate	2	< 2
Vinyl chloride	1	< 1
m & p-Xylenes	1	< 1
o-Xylene	1	< 1

date completed: 5/17/93
tech: LNT
approved by: Edward Shuck

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01667
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
7121/7131 - EB-6
1045

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	111%	76-114
Toluene-d8	98.5%	88-110
4-Bromofluorobenzene	103%	86-115

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/17/93	LNT	Edward Stewart

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01330
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 -[redacted]/MW1 0-2 FT
4/23/93 0945

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

date completed	tech	approved by:
5/4/93	LNT	Edward Hunt

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01330
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 - B1/MW1 0-2 FT
4/23/93 0945

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

date completed	tech:	approved by:
5/4/93	LNT	Edward Shimit

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01330
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 - B1/MW1 0-2 FT
4/23/93 0945

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	108%	70-121
Toluene-d8	94.6%	81-117
4-Bromofluorobenzene	93.6%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/4/93	LNT	Edward Shirer

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01331
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 - B1/MW1 2-4 FT
4/23/93 0945

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

date completed	tech	approved by:
5/4/93	LNT	Edward Hewit

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01331
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 - B1/MW1 2-4 FT
4/23/93 0945

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

date completed	tech.	approved by:
5/4/93	LNT	Edward Shuert

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01331
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 - B1/MW1 2-4 FT
4/23/93 0945

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	116%	70-121
Toluene-d8	98.2%	81-117
4-Bromofluorobenzene	93.8%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed	tech	approved by
5/4/93	LNT	Edward Shirot

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01332
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 - B1'MW1 8-10 FT
4/23/93 0947

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

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5/4/93	LNT	Edward Shuit

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01332
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 - B1/MW1 8-10 FT
4/23/93 0947

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

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5/4/93	LNT	Edward J. Hunt

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01332
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 - B1-MW1 8-10 FT
4/23/93 0947

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	112%	70-121
Toluene-d8	93.4%	81-117
4-Bromofluorobenzene	99.1%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

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5/4/93	LNT	Edward Thurston

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01428
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-2 2'-4'
4/26/93 16:30

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (ug/Kg)	RESULT (ug/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

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5/4/93	LNT	Edward Shuett

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01428
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-2 2'-4'
4/26/93 16:30

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01403
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-2 10'-12'
4/26/93 16:40

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

date completed	tech	approved by:
5/4/93	LNT	Edward Stuart

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01403
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-2 10'-12'
4/26/93 16:40

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01428
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-2 2'-4'
4/26/93 16:30

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	115%	70-121
Toluene-d8	94.0%	81-117
4-Bromofluorobenzene	98.3%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01429
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-2 6'-8'
4/26/93 16:35

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

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Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01429
p.o. no. 1-2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-2 6'-8'
4/26/93 16:35

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	243
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

date completed: 5/5/93
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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01429
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-2 6'-8'
4/26/93 16:35

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	109%	70-121
Toluene-d8	93.8%	81-117
4-Bromofluorobenzene	99.2%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/5/93	LNT	Edward Shuett

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01403
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-2 10'-12'
4/26/93 16:40

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	112%	70-121
Toluene-d8	92.0%	81-117
4-Bromofluorobenzene	97.9%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01411
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B3 4'-6'
4/27/93 08:37

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

date completed:	tech:	approved by:
5/4/93	LNT	Edward Steiner

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-3
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01411
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B3 4'-6'
4/27/93 08:37

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

date completed:	tech:	approved by:
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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01411
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B3 4'-6'
4/27/93 08:37

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	115%	70-121
Toluene-d8	93.7%	81-117
4-Bromofluorobenzene	99.3%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01412
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B3 2'-4'
4/27/93 08:30

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

date completed:	tech:	approved by:
5/4/93	LNT	

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01412
p.o. no. 2F2-4065-2935

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B3 2'-4'
4/27/93 08:30

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

date completed	tech:	approved by:
5/4/93	LNT	Edward Steiner

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01412
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B3 2'-4'
4/27/93 08:30

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	115%	70-121
Toluene-d8	96.2%	81-117
4-Bromofluorobenzene	104%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01413
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B3 6'-8'
4/27/93 08:40

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)	
Acrolein	50	< 50	
Acrylonitrile	50	< 50	
Acetone	50	< 50	
Benzene	5	< 5	
Bromodichloromethane	5	< 5	
Bromoform	5	< 5	
Bromomethane	5	< 5	
2-Butanone (MEK)	50	< 50	(34.3)
Carbon disulfide	5	< 5	
Carbon tetrachloride	5	< 5	
Chlorobenzene	5	< 5	
Chlorodibromomethane	5	< 5	
Chloroethane	10	< 10	
2-Chloroethyl vinyl ether	10	< 10	
Chloroform	5	< 5	
Chloromethane	5	< 5	
1,2-Dibromoethane (EDB)	5	< 5	
Dibromomethane	5	< 5	
1,2-Dichlorobenzene	5	< 5	
1,3-Dichlorobenzene	5	< 5	
1,4-Dichlorobenzene	5	< 5	
1,4-Dichloro-2-butene	10	< 10	
Dichlorodifluoromethane	5	< 5	
1,1-Dichloroethane	5	< 5	
1,2-Dichloroethane	5	< 5	
1,1-Dichloroethene	5	< 5	
cis-1,2-Dichloroethene	5	< 5	
trans-1,2-Dichloroethene	5	< 5	
1,2-Dichloropropane	5	< 5	
cis-1,3-Dichloropropene	5	< 5	

date completed:	tech:	approved by:
5/6/93	LNT	Edward Theiert

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01413
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B3 6'-8'
4/27/93 08:40

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	287
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

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5/6/93	LNT	Edward Shuert

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01413
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B3 6'-8'
4/27/93 08:40

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	105%	70-121
Toluene-d8	89.7%	81-117
4-Bromofluorobenzene	97.2%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01414
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B4 4'-6'
4/27/93 10:20

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

date completed:	tech:	approved by:
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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01414
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B4 4'-6'
4/27/93 10:20

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

date completed	tech	approved by
5/6/93	LNT	Edward Flint

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01414
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B4 4'-6'
4/27/93 10:20

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	115%	70-121
Toluene-d8	102%	81-117
4-Bromofluorobenzene	99.4%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/6/93	LNT	Edward Shiner

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01447
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY **10% DUP.**
7121/7131 B4 4'-6' DUPLICATE OF 93C01414
4/27/93 1020

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

date completed	tech	approved by
5/6/93	LNT	Edward Shirey

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01447
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY **10% DUP.**
7121/7131 B4 4'-6' DUPLICATE OF 93C01414
4/27/93 1020

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

date completed	tech	approved by
5/6/93	LNT	Edward Shiner

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01447
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY **10% DUP.**
7121/7131 B4 4'-6' DUPLICATE OF 93C01414
4/27/93 1020

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	116%	70-121
Toluene-d8	102%	81-117
4-Bromofluorobenzene	101%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/6/93	LNT	Edward Shuert

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01415
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B4 6'-8'
4/27/93 10:25

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	19.4
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

date completed:	tech:	approved by:
5/6/93	LNT	Edward Shriver

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01415
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B4 6'-8'
4/27/93 10:25

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	16.8
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

date completed:	tech:	approved by:
5/6/93	LNT	Edward Shuert

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01415
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B4 6'-8'
4/27/93 10:25

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	114%	70-121
Toluene-d8	102%	81-117
4-Bromofluorobenzene	101%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01416
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B4 10'-12'
4/27/93 10:40

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

date completed	tech:	approved by:
5/6/93	LNT	Edward Shuert

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01416
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B4 10'-12'
4/27/93 10:40

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01416
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B4 10'-12'
4/27/93 10:40

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	114%	70-121
Toluene-d8	101%	81-117
4-Bromofluorobenzene	102%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/6/93	LNT	Edward Shirat

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01493
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-5 0'-2'
4/29/93 14:56

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

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5/10/93	LNT	

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01493
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-5 0'-2'
4/29/93 14:56

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

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5/10/93	LNT	Edward Shuert

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01493
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-5 0'-2'
4/29/93 14:56

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	113%	70-121
Toluene-d8	97.6%	81-117
4-Bromofluorobenzene	97.9%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01518
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY **10% DUP.**
7121/7131 - B-5 0'-2' DUPLICATE OF 93C01493
4/29/93 1456

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

date completed:	tech:	approved by:
5/10/93	LNT	Edward Kleinert

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01518
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY **10% DUP.**
7121/7131 - B-5 0'-2' DUPLICATE OF 93C01493
4/29/93 1456

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01518
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY **10% DUP.**
7121/7131 - B-5 0'-2' DUPLICATE OF 93C01493
4/29/93 1456

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	117%	70-121
Toluene-d8	100%	81-117
4-Bromofluorobenzene	97.9%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

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5/10/93	LNT	Edward Shiner

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01494
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-5 2'-4'
4/29/93 14:59

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

date completed:	tech:	approved by:
5/8/93	LNT	Edward Sheerer

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01494
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-5 2'-4'
4/29/93 14:59

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

date completed:	tech:	approved by:
5/8/93	LNT	Edward Shuerit

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01494
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-5 2'-4'
4/29/93 14:59

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	110%	70-121
Toluene-d8	105%	81-117
4-Bromofluorobenzene	107%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/8/93	LNT	Edward Shuert

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01481
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 - B-5 4'-6'
4/29/93 15:05

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	< 50
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

date completed	tech	approved by:
5/10/93	LNT	Edward Theiert

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01481
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 - B-5 4'-6'
4/29/93 15:05

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

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5/10/93	LNT	Edward Sheirt

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01481
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 - B-5 4'-6'
4/29/93 15:05

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	114%	70-121
Toluene-d8	98.8%	81-117
4-Bromofluorobenzene	119%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

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5/10/93	LNT	Edward Shriver

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01482
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-6 1'-3'
4/29/93 15:15

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
Acrolein	50	< 50
Acrylonitrile	50	< 50
Acetone	50	64.6
Benzene	5	< 5
Bromodichloromethane	5	< 5
Bromoform	5	< 5
Bromomethane	5	< 5
2-Butanone (MEK)	50	< 50
Carbon disulfide	5	< 5
Carbon tetrachloride	5	< 5
Chlorobenzene	5	< 5
Chlorodibromomethane	5	< 5
Chloroethane	10	< 10
2-Chloroethyl vinyl ether	10	< 10
Chloroform	5	< 5
Chloromethane	5	< 5
1,2-Dibromoethane (EDB)	5	< 5
Dibromomethane	5	< 5
1,2-Dichlorobenzene	5	< 5
1,3-Dichlorobenzene	5	< 5
1,4-Dichlorobenzene	5	< 5
1,4-Dichloro-2-butene	10	< 10
Dichlorodifluoromethane	5	< 5
1,1-Dichloroethane	5	< 5
1,2-Dichloroethane	5	< 5
1,1-Dichloroethene	5	< 5
cis-1,2-Dichloroethene	5	< 5
trans-1,2-Dichloroethene	5	< 5
1,2-Dichloropropane	5	< 5
cis-1,3-Dichloropropene	5	< 5

date completed:	tech:	approved by:
5/10/93	LNT	Edward Stewart

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01482
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-6 1'-3'
4/29/93 15:15

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

date completed:	tech:	approved by:
5/10/93	LNT	

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01482
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-6 1'-3'
4/29/93 15:15

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	80.2%	70-121
Toluene-d8	93.1%	81-117
4-Bromofluorobenzene	87.9%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/10/93	LNT	Edward Shiecut

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01483
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-6 3'-5'
4/29/93 15:20

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)	
Acrolein	10	< 10	
Acrylonitrile	10	< 10	
Acetone	10	106	
Benzene	1	< 1	
Bromodichloromethane	1	< 1	
Bromoform	1	< 1	
Bromomethane	1	< 1	
2-Butanone (MEK)	10	< 50	(39.5)
Carbon disulfide	1	< 1	
Carbon tetrachloride	1	< 1	
Chlorobenzene	1	< 1	
Chlorodibromomethane	1	< 1	
Chloroethane	2	< 2	
2-Chloroethyl vinyl ether	2	< 2	
Chloroform	1	< 1	
Chloromethane	1	< 1	
1,2-Dibromoethane (EDB)	1	< 1	
Dibromomethane	1	< 1	
1,2-Dichlorobenzene	1	< 1	
1,3-Dichlorobenzene	1	< 1	
1,4-Dichlorobenzene	1	< 1	
1,4-Dichloro-2-butene	2	< 2	
Dichlorodifluoromethane	1	< 1	
1,1-Dichloroethane	1	< 1	
1,2-Dichloroethane	1	< 1	
1,1-Dichloroethene	1	< 1	
cis-1,2-Dichloroethene	1	< 1	
trans-1,2-Dichloroethene	1	< 1	
1,2-Dichloropropane	1	< 1	
cis-1,3-Dichloropropene	1	< 1	

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5/10/93	LNT	Edward Shriner

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01483
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-6 3'-5'
4/29/93 15:20

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	< 5
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

date completed:	tech:	approved by:
5/10/93	LNT	Edward Shuert

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01483
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-6 3'-5'
4/29/93 15:20

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	80.7%	70-121
Toluene-d8	96.5%	81-117
4-Bromofluorobenzene	92.3%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/10/93	LNT	Edward Shirvit

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01484
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-6 5'-7'
4/29/93 15:25

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8240.

results:

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)	
Acrolein	50	< 50	
Acrylonitrile	50	< 50	
Acetone	50	< 50	
Benzene	5	< 5	
Bromodichloromethane	5	< 5	
Bromoform	5	< 5	
Bromomethane	5	< 5	
2-Butanone (MEK)	50	< 50	
Carbon disulfide	5	< 5	
Carbon tetrachloride	5	< 5	
Chlorobenzene	5	< 5	
Chlorodibromomethane	5	< 5	
Chloroethane	10	< 10	
2-Chloroethyl vinyl ether	10	< 10	
Chloroform	5	< 5	
Chloromethane	5	< 5	
1,2-Dibromoethane (EDB)	5	< 5	
Dibromomethane	5	< 5	
1,2-Dichlorobenzene	5	< 5	
1,3-Dichlorobenzene	5	< 5	
1,4-Dichlorobenzene	5	< 5	
1,4-Dichloro-2-butene	10	< 10	
Dichlorodifluoromethane	5	< 5	
1,1-Dichloroethane	5	< 5	
1,2-Dichloroethane	5	< 5	
1,1-Dichloroethene	5	< 5	(4.47)
cis-1,2-Dichloroethene	5	< 5	
trans-1,2-Dichloroethene	5	< 5	
1,2-Dichloropropane	5	< 5	
cis-1,3-Dichloropropene	5	< 5	

date completed:	tech:	approved by:
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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

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sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-6 5'-7'
4/29/93 15:25

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/Kg)	RESULT (µg/Kg)
trans-1,3-Dichloropropene	5	< 5
Ethyl acetate	10	< 10
Ethyl benzene	5	< 5
Ethyl ether	10	< 10
Ethyl methacrylate	5	< 5
2-Hexanone	10	< 10
Methylene chloride	5	< 5
Methyl iodide	5	< 5
4-Methyl-2-pentanone (MIBK)	50	< 50
Naphthalene	5	< 5
Styrene	5	< 5
1,1,1,2-Tetrachloroethane	5	< 5
1,1,2,2-Tetrachloroethane	5	< 5
Tetrachloroethene	5	< 5
Tetrahydrofuran	10	< 10
Toluene	5	< 5
1,1,1-Trichloroethane	5	65.2
1,1,2-Trichloroethane	5	< 5
Trichloroethene	5	< 5
Trichlorofluoromethane	5	< 5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5	< 5
1,2,3-Trichloropropane	5	< 5
Vinyl acetate	10	< 10
Vinyl chloride	5	< 5
m & p-Xylenes	5	< 5
o-Xylenes	5	< 5

date completed:	tech:	approved by:
5/10/93	LNT	Edward Shiest

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01484
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-6 5'-7'
4/29/93 15:25

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	78.4%	70-121
Toluene-d8	92.8%	81-117
4-Bromofluorobenzene	91.8%	74-121

1) A value reported as "less than" indicates the analyte was not detected. The number is the quantification limit for the sample.

2) A value in parenthesis following a "less than" value indicates the analyte was detectable but below the limit of quantification. The value is an estimate only.

date completed:	tech:	approved by:
5/10/93	LNT	Edward Thiebot

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MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01330
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 - B1/MW1 0-2 FT
4/23/93 0945

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	10 mg/Kg

date completed:	tech:	approved by:
4/29/93	MD	

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Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01331
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 - B1/MW1 2-4 FT
4/23/93 0945

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed:	tech:	approved by:
4/29/93	MD	

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Attn: Elise Allen
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615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01332
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 - B1/MW1 8-10 FT
4/23/93 0947

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	17 mg/Kg

date completed:	tech:	approved by:
4/29/93	MD	

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Attn: Elise Allen
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Cleveland, OH 44135

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615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01428
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-2 2'-4'
4/26/93 16:30

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	39 mg/Kg

date completed:	tech:	approved by:
4/30/93	MD	Edward Shirot

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615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01429
p.o. no. 2F2-4065-2935

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-2 6'-8'
4/26/93 16:35

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed: 5/3/93
tech: MD
approved by: Edward Shuist

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Attn: Elise Allen
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Cleveland, OH 44135

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toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01403
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-2 10'-12'
4/26/93 16:40

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed: 4/30/93
tech: MD
approved by: [signature]

All with original signature [illegible] whole or part is prohibited [illegible]

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Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

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toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01412
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B3 2'-4'
4/27/93 08:30

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed: 4/30/93
tech: MD
approved by: Edward Shuiet

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Cleveland, OH 44135

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toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01411
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B3 4'-6'
4/27/93 08:37

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed:	tech:	approved by:
4/30/93	MD	Edward Steiert

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Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01413
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B3 6'-8'
4/27/93 08:40

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed: 4/30/93
tech: MD
approved by: Edward Shiers

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Attn: Elise Allen
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Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01414
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B4 4'-6'
4/27/93 10:20

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed:	tech:	approved by:
4/30/93	MD	Edward Shurit

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615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01447
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY **10% DUP.**
7121/7131 B4 4'-6' DUPLICATE OF 93C01414
4/27/93 1020

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed	tech:	approved by:
5/3/93	MD	Edward Shriver

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Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01415
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B4 6'-8'
4/27/93 10:25

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed: 4/30/93
tech: MD
approved by:

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Attn: Elise Allen
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615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01416
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B4 10'-12'
4/27/93 10:40

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed	tech:	approved by:
4/30/93	MD	[illegible]

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Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01493
p.o. no. 2F2-4065-2935

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-5 0'-2'
4/29/93 14:56

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	8200 mg/Kg

date completed: 5/5/93
tech.: MD
approved by: Edward Hewitt

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Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

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615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01518
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY **10% DUP.**
7121/7131 B-5 0'-2' DUPLICATE OF 93C01493
4/29/93 1456

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	1700 mg/Kg

date completed:	tech:	approved by:
5/6/93	MD	Edward Fricke

[illegible] confidential [illegible]

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Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

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615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01494
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-5 2'-4'
4/29/93 14:59

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	36 mg/Kg

date completed:	tech:	approved by:
5/5/93	MD	Edward Fluid

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Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01481
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-5 4'-6'
4/29/93 15:05

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	130 mg/Kg

date completed	tech.	approved by:
5/4/93	MD	Edward Thurit

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Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01482
p.o. no. 2F2-4065-2935

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-6 1'-3'
4/29/93 15:15

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	27 mg/Kg

approved by:

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Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

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615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01483
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-6 3'-5'
4/29/93 15:20

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	34 mg/Kg

date completed:	tech:	approved by:
5/4/93	MD	Richard Hurst

MK-Ferguson
Nasa Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, OH 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

lab no. 93C01484
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
7121/7131 B-6 5'-7'
4/29/93 15:25

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed: | tech: | approved by: Richard Hewitt

APPENDIX C

Manifests

Print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039. Expires 9-30-87

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. 0H1910001537790 Manifest Document No. 000044

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
NASA - Plum Brook Station
1100 Columbus Ave Sandusky OH 44870

4. Generator's Phone (419) 621-3205

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name: CHEM FREIGHT

6. US EPA ID Number: 0H0986616610

C. State Transporter's ID

D. Transporter's Phone (216) 391-2500

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address
HUKILL CHEMICAL CORP
7013 KRICK RD.
BEDFORHTS, OH 44146

10. US EPA ID Number: 0H4000119261790

G. State Facility's ID

H. Facility's Phone (216) 232-9400

GENERATOR

11. US DOT Description (Including Proper Shipping Name, Hazard Class and ID Number)	RQ	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	Waste No.
a. X-RQ, 1000 (454) HAZARDOUS WASTE LIQUID N.O.S. ORM-E, NA9189 (D008-F002)		1	TT	454000G		F002 D008
b.						
c.						
d.						

J. Additional Descriptions for Materials Listed Above

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: Amy L. Bower | Signature: Amy L. Bower | Month Day Year: 09/18/89

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: KENNETH LACHABLE | Signature: Kenneth Lachable | Month Day Year: 09/18/89

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name: BOB LANG | Signature: Bob Lang | Month Day Year: 09/14/89

Style F15 REV-8 LABELMASTER, Div. of AMERICAN LABELMARK CO., CHICAGO, IL 60646

EPA Form 8700-22 (Rev. 9-86) Previous editions are obsolete.

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Form Approved. OMB No. 2050-0039. Expires 9-30-91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH3800011537 Manifest Document No. 000003

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
NASA- Plum Brook Station
6100 Columbus Ave, Sandusky OH 44870

4. Generator's Phone (419) 621-3205

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name
CHEM FREIGHT

6. US EPA ID Number
OHD986961190

C. State Transporter's ID

D. Transporter's Phone (216) 391-2500

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address
AVKILL CHEMICAL CORP.
7013 KRICK RD.
BEDFORD, OH 44146

10. US EPA ID Number
OHD000196716

G. State Facility's ID

H. Facility's Phone (216) 232-9400

11. US DOT Description (Including Proper Shipping Name, Hazard Class and ID Number)

	HM	11. US DOT Description	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	L. Waste No.
a.	X	RQ, 1000 (454) HAZARDOUS WASTE LIQUID N.O.S. ORM-E, NA9189 (0008- F002	1	TT	6000	G	F002 0008
b.							
c.							
d.							

J. Additional Descriptions for Materials Listed Above

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: Amy L. Bower | Signature: Amy L. Bower | Month Day Year: 09/15/89

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: William Gordon | Signature: William Gordon | Month Day Year: 09/15/89

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name: Delbert H Sykes | Signature: Delbert H Sykes | Month Day Year: 09/15/89

GENERATOR

TRANSPORTER

FACILITY

Style F15 REV-6 LABELMASTER, Div. of AMERICAN LABELMARK CO., CHICAGO, IL 60646

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

c. RQ =	EMERGENCY NUMBER OR LOCAL OPERATOR:	SEE SECTION 15
d. RQ =	EMERGENCY CONTACT: CHEMTREC (800) 424-9300	

Form Approved. OMB No. 2050-0039. Expires 9-30-91

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH3800015379 Manifest Document No. 001000

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
NASA - Plum Brook Station
6100 Columbus Avenue
Sandusky OH 44870

4. Generator's Phone (419) 621-3233

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name: CHEM FREIGHT

6. US EPA ID Number: OHD986961910

C. State Transporter's ID

D. Transporter's Phone 216 341 2500

7. Transporter 2 Company Name: SAME AS #1

8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address
Chem Tron Corporation
35850 Schneider Court
Avon OH 44011

10. US EPA ID Number: OHD066060609

G. State Facility's ID

H. Facility's Phone 216-871-8048

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. NA1993 Waste Combustible Liquid NOS F005 D001 F002	9	DM	495	G	F005 D001 F002
b. VA0021019-15					
c.					
d.					

J. Additional Descriptions for Materials Listed Above

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

AGENCY DISPLAY OF ESTIMATED BURDEN
"Public reporting burden for this collection of information is estimated to average: 37 minutes for generators, 15 minutes for transporters, and 10 minutes for treatment, storage and disposal facilities. This includes time for reviewing instructions, gathering data, and completing and reviewing the form. Send comments regarding the burden estimate, including suggestions for reducing this burden, to: Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503."

GENERATOR

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: Amy L. Bower | Signature: Amy L. Bower | Month Day Year: 10 21 1990

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: DAVE HAYDEN | Signature: Dave Hayden | Month Day Year: 10 21 1990

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name: STEVE JONES | Signature: Steve Jones | Month Day Year: 10 21 1990

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name: Lennie Hanchesky | Signature: Lennie Hanchesky | Month Day Year: 10 21 1990

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

#1 - GENERATOR ORIGINAL COPY

page 2 of 2

CHEMTRON CORPORATION
WASTE PROFILE DATA FORM

WASTE PROFILE NO. Q

A GENERATOR NAME: NASA - Plumbrook Station
B GENERATOR EPA ID NO.: OH380001537 9
C FACILITY ADDRESS: 6100 Columbus Avenue, Sandusky STATE: OH ZIP: 44870
BILLING ADDRESS: 1234 S. Cleveland-Massillon Road, Akron STATE: OH ZIP: 44321
D BUSINESS CONTACT: Robert P. Kozar TITLE: Chief, Mgnt. Office PHONE: (419) 621-3205
E TECHNICAL CONTACT: Amy L. Bower TITLE: Industrial Hygenist PHONE: (419) 621-3233

F GENERATOR'S COMMON NAME FOR THE WASTE	EPA HAZARDOUS WASTE NUMBER(S)
Waste Oil, Water and Combustible Solvents	F005, D001, F002

G DOT SHIPPING DESCRIPTION: Waste Comb. Liq. NOS DOT HAZARDOUS CLASS: Comb. Liquid UN/NA#: NA 1993
H PROCESS GENERATING WASTE: Sludge Material from Tank Cleaning
I ANNUAL QUANTITY: 9 Drums UNIT OF MEASURE: Gallon WILL BE SHIPPED PER:
☐ WEEK ☐ MONTH ☐ QUARTER ☐ YEAR ☒ ONE TIME ☐ OTHER, Specify

J CHEMICAL COMPOSITION

CONSTITUENT	ANALYSIS (%)	RANGE (%)
WATER	50%	
Oil	30%	
Mineral Spirits	15%	
Chlorinated Solv.	2%	

INORGANIC METALS: (Concentration in mg/kg, mg/l or ppm) ☐ Extraction Procedure (mg/l) ☐ Total (ppm)

BARIUM ___ SILVER ___
CADMIUM ___ ALUMINUM ___
CHROMIUM ___ BERYLLIUM ___
CHROMIUM (+6) ___ COPPER ___
MERCURY ___ NICKEL ___
LEAD ___ ZINC ___
SELENIUM ___ THALLIUM ___

NON-METALS: (Concentration in mg/kg, mg/l or ppm) ☐ Extraction Procedure (mg/l) ☐ Total (ppm)

ARSENIC ___ TOTAL PHOSPHOROUS ___
HALOGENS AS CHLORINE ___ TOTAL SULFUR ___
FLUORINE ___ SULFIDE ___
CYANIDE ___ ISO-CYANATES ___

K PHYSICAL PROPERTIES

COLOR: ___ ODOR: ☐ NONE ☐ STRONG ☐ MILD DESCRIBE:

PHYSICAL STATE AT 70°F: ☐ SOLID ☐ LIQUID ☐ SEMI-SOLID ☐ POWDER

PHASE LAYERING: ☐ NONE ☐ BILAYERED ☐ MULTILAYERED

pH: ☐ 0 ☐ 2-4 ☐ 7.1-9 ☐ > 12.5 ___ N/A ☐ < 2 ☐ 4.1-7 ☐ 9.1-12.5 ___ EXACT

FLASH POINT: ☐ 70°F-100°F ☒ 141°F-200°F ☐ < 70°F ☐ 101°F-140°F NO FLASH ☐ EXACT ___ ☐ CLOSED CUP ☐ OPEN CUP

SPECIFIC GRAVITY: ☐ < 0.8 ☒ 0.8-1.0 ☐ 1.1-1.2 ☐ 1.3-1.4 ☐ 1.5-1.8 ☐ > 1.8

HAZARDOUS CHARACTERISTICS
REACTIVITY: ☐ NONE ☐ PYROPHORIC ☐ SHOCK SENSITIVE ☐ EXPLOSIVE ☐ WATER REACTIVE ☐ OTHER ___

SOLIDS: ___ BY WEIGHT ___ BY VOLUME
BTU/GAL > 6000 BTU/LB

L. Does the waste contain any of the following: Halogenated Aromatics (e.g. PCB, PBB); Aromatic Amines; Pesticides; Urea; Thiourea's; Cyclic Nitrogen (e.g. Pyridine); Phenols; Quinones; Phosphorous Compounds; Polycyclic Organics; Asbestos; Radioactive Material; Biological Materials; Infectious Agents.
☐ YES ☒ NO
If YES Attach Detailed Analysis.
M Special Handling Procedures: ___

I hereby certify that I have personally examined and am familiar with the information submitted in this and all attached documents. Based upon my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete to the best of my knowledge and that all known and suspected hazards have been disclosed in accordance with 40 CFR 261.

Amy L. Bower — SIGNATURE
Industrial Hygenist — TITLE
16 Feb. 1990 — DATE

WHITE/OFFICE YELLOW/CUSTOMER PINK/LAB GOLD/CUSTOMER ACCEPTANCE COPY

a. RQ =	c. RQ =	EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT: CHEMTREC (800) 424-9300
b. RQ =	d. RQ =	

Estimated average burden hours for this collection of information is estimated to average 37 minutes for generators, 15 minutes for transporters, and 30 minutes for treatment, storage and disposal facilities. This includes time for reviewing instructions, searching data sources, completing and reviewing the form. Send comments regarding burden estimate, including suggestions for reducing this burden, to Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, DC 20460, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20640.

Please print or type. *(Form designed for use on elite (12-pitch) typewriter.)* *Form Approved. OMB No. 2050-0039. Expires 9-30-91*

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH3800015379 — Manifest Document No. 190009

2. Page 1 of 1

Information in the shaded areas is not required by Federal law

3. Generator's Name and Mailing Address: NASA - Plum Brook Station, 6100 Columbus Avenue, Sandusky OH 44870

4. Generator's Phone (419) 625-1123

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name: Myers Chemical Transport — 6. US EPA ID Number: PAD041235175

C. State Transporter's ID

D. Transporter's Phone: 419-758-5716

7. Transporter 2 Company Name — 8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address: Envirosafe, 876 Otter Creek Rd, Oregon OH 43616 — 10. US EPA ID Number: OHD045243706

G. State Facility's ID

H. Facility's Phone: 419-255-5100

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ Hazardous Waste Solid NA9189 NOS F002	001	CM	27500	P	F002
b.					
c.					
d.					

Additional Descriptions for Materials Listed Above: PCN 2123 AT

K. Handling Codes for Wastes Listed Above: D81

15. Special Handling Instructions and Additional Information: 13 62T 27240P

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; **OR**, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: Amy L. Beaver — Signature: [signature] — Month Day Year: 03 08 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Donnie Jenkins — Signature: [signature] — Month Day Year: 03 08 90

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name — Signature — Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19

Printed/Typed Name: Jerry Ricke — Signature: [signature] — Month Day Year: 3 8 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete. — GENERATOR FILE COPY

a. RQ =	c. RQ =	EMERGENCY NUMBER OR LOCAL OPERATOR EMERGENCY CONTACT:	SEE SECTION 15
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300	

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039. Expires 9-30-91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH3800015379 Manifest Document No. 900710

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address: NASA - Plum Brook Station, 6100 Columbus Avenue, Sandusky OH 44870

4. Generator's Phone: (419) 625-1123

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name: Myers Chemical Transport

6. US EPA ID Number: PAD041255175

C. State Transporter's ID

D. Transporter's Phone: 412-758-5606

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address: Envirosafe, 8716 Otter Creek Rd., Oregon OH 43616

10. US EPA ID Number: OHD045243706

G. State Facility's ID

H. Facility's Phone: 419-255-5100

GENERATOR

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ Hazardous Waste Solid NA9189 NOS F002	001	CM	27500	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above: PCN 2123 AT

K. Handling Codes for Wastes Listed Above: D81 SCUF cert

15. Special Handling Instructions and Additional Information: 58520 lb 1424T

AGENCY DISPLAY OF ESTIMATED BURDEN

"Public reporting burden for this collection of information is estimated to average: 37 minutes for generators, 15 minutes for transporters, and 10 minutes for treatment, storage and disposal facilities. This includes time for reviewing instructions, gathering data, and completing and reviewing the form. Send comments regarding the burden estimate, including suggestions for reducing this burden, to: Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503."

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 03 08 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Donnie Jenkins — Signature: Donnie Jenkins — Month Day Year: 03 08 90

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name — Signature — Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19

Printed/Typed Name: Dale McPertner — Signature: Dale McPertner — Month Day Year: 03 08 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

#1 - GENERATOR ORIGINAL COPY

a. RQ =	c. RQ =	EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT:	
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300	

SEE SECTION 15

DC 20460 and to the Office of Information and Regulatory, Office of Management and Budget, Washington, DC 20640

Please print or type. *(Form designed for use on elite (12-pitch) typewriter.)* *Form Approved. OMB No. 2050-0039. Expires 9-30-88*

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. 0H3800015379 Manifest Document No. 90011

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
NASA - Plum Brook Station
6100 Columbus Avenue
Sandusky OH 44870

A. State Manifest Document Number

B. State Generator's ID

4. Generator's Phone (419) 625-1123

5. Transporter 1 Company Name: Myers Chemical Transport
6. US EPA ID Number: PAD041255175

C. State Transporter's ID

D. Transporter's Phone 412-758-5606

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address
Envirosafe
876 Otter Creek Rd
Oregon OH 43616
10. US EPA ID Number: OHD045243706

G. State Facility's ID

H. Facility's Phone 419-255-5100

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ Hazardous Waste Solid NA9189 NOS F002	001	CM	27500	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
D81
S04
[illegible]

15. Special Handling Instructions and Additional Information
13720 11
C.8[illegible]

AGENCY DISPLAY OF ESTIMATED BURDEN
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Printed/Typed Name: Amy L. Bower
Signature: Amy L. Bower
Month Day Year: 03 08 90

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: X Donnie Jenkins
Signature: Donnie Jenkins
Month Day Year: 03 08 90

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

19. Discrepancy Indication Space
WEIGHTS ARE ESTIMATED Per Jim Parks Rep 3/9/90

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: Dale M Pertner
Signature: Dale M Pertner
Month Day Year: 03 09 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

1 - GENERATOR ORIGINAL COPY

a. RQ =	c. RQ =	EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT:	SEE SECTION 15
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300	

DC 20460, and to the Office of Information and Regulatory, Office of Management and Budget, Washington, DC 20640."

Please print or type. *(Form designed for use on elite (12-pitch) typewriter.)* *Form Approved OMB No. 2050-0039. Expires 9-30-88* 91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH3800015379 — Manifest Document No. 00012
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address: NASA - Plum Brook Station, 6100 Columbus Avenue, Sandusky OH 44870
4. Generator's Phone (419) 625-1123

A. State Manifest Document Number
B. State Generator's ID

5. Transporter 1 Company Name: Myers Chemical Transport
6. US EPA ID Number: PAD041255175
C. State Transporter's ID
D. Transporter's Phone: 412-758-9060

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID
F. Transporter's Phone

9. Designated Facility Name and Site Address: Envirosafe, 876 Otter Creek Rd., Oregon OH 43616
10. US EPA ID Number: OAD045243706
G. State Facility's ID
H. Facility's Phone: 419-255-5100

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ Hazardous Waste Solid NA9189 NOS F002	001	CM	27500	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above: PCN 2123 AT

K. Handling Codes for Wastes Listed Above: D81

15. Special Handling Instructions and Additional Information: 1141T 22820 P.

AGENCY DISPLAY OF ESTIMATED BURDEN
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GENERATOR

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name: Amy L. Beaver — Signature: Amy L. Beaver — Month Day Year: 03 08 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: X Richard M. Reiser — Signature: [signature] — Month Day Year: 03 08 90

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name — Signature — Month Day Year

FACILITY

19. Discrepancy Indication Space: WEIGHTS ARE ESTIMATED Per Jim Park 3/9/90 KLP

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: JERRY PICKLE — Signature: [signature] — Month Day Year: 3 9 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete. #1 - GENERATOR ORIGINAL COPY

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. 0H3800001579
Manifest Document No. 22790
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
NASA PLUM BROOK
6100 COLUMBUS AVE
SANDUSKY OHIO 44870

4. Generator's Phone ( )

A. State Manifest Document Number
B. State Generator's ID

5. Transporter 1 Company Name
MEYERS CHEMICAL TRANSPORT
6. US EPA ID Number
PA0041255175

C. State Transporter's ID
D. Transporter's Phone

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID
F. Transporter's Phone

9. Designated Facility Name and Site Address
ENVIORSAFE
876 OTTER CREEK ROAD
OREGON OHIO
10. US EPA ID Number
ONO045243706

G. State Facility's ID
H. Facility's Phone

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	HM		12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.		RQ HAZARDOUS WASTE SOLID NA9189 N.O.S. F002	001	CM		39,805	F002
b.							
c.							
d.							

J. Additional Descriptions for Materials Listed Above
PCN 423 A7

K. Handling Codes for Wastes Listed Above
Scq I D81

15. Special Handling Instructions and Additional Information
16.95 T 33900 P.

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national governmental regulations.

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Printed/Typed Name: Amy L. Bower
Signature: Amy L. Bower
Month Day Year: 10 28 90

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: DONNIE JINKINS
Signature: Donnie Jenkins
Month Day Year: 10 28 90

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

19. Discrepancy Indication Space
PCN Added for Bag Charges KLP 2-28-90

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name: JEFF HARDING
Signature: Jeff Harding
Month Day Year: 02 28 90

ORIGINAL - RETURN TO GENERATOR

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH3800015379
Manifest Document No. 22890
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
NASA PLUM BROOK
6100 COLUMBUS AVE
SANDUSKY OHIO 44870

4. Generator's Phone ( )

A. State Manifest Document Number
B. State Generator's ID

5. Transporter 1 Company Name: MEYERS CHEMICAL TRANSPORT
6. US EPA ID Number: PAD041251755
C. State Transporter's ID
D. Transporter's Phone

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID
F. Transporter's Phone

9. Designated Facility Name and Site Address
ENVIORSAFE
876 OTTER CREEK ROAD
OREGON OHIO
10. US EPA ID Number: ON0045241706
G. State Facility's ID
H. Facility's Phone

	HM	11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.		RQ HAZARDOUS WASTE SOLID NA9189 N.O.S. F002	001	CM		21,365	F002
b.							
c.							
d.							

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
S02 T D81

15. Special Handling Instructions and Additional Information
12.13 T 24260 P.

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national governmental regulations.

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Printed/Typed Name: Amy L. Bower
Signature: Amy L. Bower
Month Day Year: 02 28 90

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: BILL MCCORMICK
Signature: Bill McCormick
Month Day Year: 2 28 90

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

19. Discrepancy Indication Space
PCN Added Per Bob Chartes KP 2-28-90

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name: JEFF HARDING
Signature: Jeff Harding
Month Day Year: 02 28 90

ORIGINAL - RETURN TO GENERATOR

RQ =	RQ =	EMERGENCY CONTACT:	SEE SECTION 15
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300	DC 20460, and to the Office of Information and Regulatory, Office of Management and Budget, Washington, DC 20640

Please print or type. *(Form designed for use on elite (12-pitch) typewriter.)* *Form Approved OMB No 2050-0039 Expires 9-30-88* 91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. 0H3800015379 Manifest Document No. 00003
2. Page 1 of 1
Information in the shaded areas is not required by Federal law

3. Generator's Name and Mailing Address
NASA Plum Brook Station
6100 Columbus Avenue
Sandusky OH 44870

A. State Manifest Document Number

B. State Generator's ID

4. Generator's Phone (419) 625-1123

5. Transporter 1 Company Name: Meyers Chemical Trucking
6. US EPA ID Number: PAD041255175

C. State Transporter's ID

D. Transporter's Phone 412-758-5606

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address
Envirosafe
876 Otter Creek Rd.
Oregon OH 43616
10. US EPA ID Number: OHD045243706

G. State Facility's ID

H. Facility's Phone 419-255-5100

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ Hazardous Waste Solid NA9189 N.O.S. F002	001	CM	30450	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
S01 T01

15. Special Handling Instructions and Additional Information
14.54 T 29080

AGENCY DISPLAY OF ESTIMATED BURDEN
"Public reporting burden for this collection of information is estimated to average: 37 minutes for generators, 15 minutes for transporters, and 10 minutes for treatment, storage and disposal facilities. This includes time for reviewing instructions, gathering data, and completing and reviewing the form. Send comments regarding the burden estimate, including suggestions for reducing this burden, to: Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503."

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

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Printed/Typed Name	Signature	Month Day Year
Amy L. Bower	Amy L. Bower	10 30 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year
DONNIE JENKINS	Donnie Jenkins	10 30 90

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19

Printed/Typed Name	Signature	Month Day Year
JEFF HARDING	Jeff Harding	10 31 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete. #1 - GENERATOR ORIGINAL COPY

a. RQ =	c. RQ =	EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT:	SEE SECTION 15
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300	

DC 20460; and to the Office of Information and Regulatory, Office of Management and Budget, Washington, DC 20640.

Please print or type. *(Form designed for use on elite (12-pitch) typewriter.)* *Form Approved. OMB No. 2050-0039. Expires 9-30-91*

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. 0H3800015379 Manifest Document No. 90004

2. Page 1 of 1

Information in the shaded areas is not required by Federal law

3. Generator's Name and Mailing Address: NASA Plum Brook Station, 6100 Columbus Avenue, Sandusky OH 44870

4. Generator's Phone (419) 625-1123

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name: Meyers Chemical Trucking

6. US EPA ID Number: PAD041255175

C. State Transporter's ID

D. Transporter's Phone: 412-758-5606

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address: Envirosafe, 876 Otter Creek Rd., Oregon OH 43616

10. US EPA ID Number: OHD045243706

G. State Facility's ID

H. Facility's Phone: 419-255-5100

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ Hazardous Waste Solid NA 9189 N.O.S. F002	001	CM	30750	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above: PCN 2123AT

K. Handling Codes for Wastes Listed Above: S01 D81

15. Special Handling Instructions and Additional Information: 14.08 T 28160

AGENCY DISPLAY OF ESTIMATED BURDEN

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Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 03 01 90

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Bill McCormick — Signature: Bill McCormick — Month Day Year: 03 01 90

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name — Signature — Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19

Printed/Typed Name: JEFF HARDING — Signature: Jeff Harding — Month Day Year: 03 01 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete. #1 - GENERATOR ORIGINAL COPY

a. RQ =	c. RQ =	EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT:	SEE SECTION 15
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300	

DC 20460, and to the Office of Information and Regulatory, Office of Management and Budget, Washington, DC 20640

Please print or type. *(Form designed for use on elite (12-pitch) typewriter.)* *Form Approved OMB No. 2050-0039. Expires 9-30-91*

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No: OH3800015379 Manifest Document No: 0005
2. Page 1 of 1
Information in the shaded areas is not required by Federal law

3. Generator's Name and Mailing Address: NASA - Plum Brook Station, 6100 Columbus Avenue, Sandusky OH 44870
4. Generator's Phone (419) 625-1123

A. State Manifest Document Number
B. State Generator's ID

5. Transporter 1 Company Name: Meyers Chemical Trucking
6. US EPA ID Number: PAD041255175
C. State Transporter's ID
D. Transporter's Phone: 412-758-5606

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID
F. Transporter's Phone

9. Designated Facility Name and Site Address: Envirosafe, 876 Otter Creek Road, Oregon OH 43616
10. US EPA ID Number: OHD045243706
G. State Facility's ID
H. Facility's Phone: 419-255-5100

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ Hazardous Waste Solid NA9189 N.O.S. F002	001	CM	35465	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above: PCN 2123 AT

K. Handling Codes for Wastes Listed Above: S01 I081

15. Special Handling Instructions and Additional Information: 1172 T 35440

AGENCY DISPLAY OF ESTIMATED BURDEN
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Printed/Typed Name	Signature	Month Day Year
Amy L. Bower	Amy L. Bower	03 01 90

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year
Donnie Jenkins	Donnie Jenkins	03 01 90

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19

Printed/Typed Name	Signature	Month Day Year
JEFF HARDING	Jeff Harding	03 08 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete. #1-GENERATOR ORIGINAL COPY

a. RQ =	c. RQ =	EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT:	
b. ~~RQ =~~	d. RQ =	CHEMTREC (800) 424-9300	

SEE SECTION 15

DC 20460, and to the Office of Information and Regulatory Office of Management and Budget, Washington, DC 20640

Please print or type (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039. Expires 9-30-88 91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH3810015379 Manifest Document No. 00016

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address: NASA- Plum Brook Station, 6100 Columbus Avenue, Sandusky OH 44870

4. Generator's Phone (419) 625-1123

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name: Meyers Chemical Trucking

6. US EPA ID Number: PAD041255175

C. State Transporter's ID

D. Transporter's Phone 412-758-5606

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address: Envirosafe, 876 Otter Creek Rd., Oregon OH 43616

10. US EPA ID Number: OHD045243706

G. State Facility's ID

H. Facility's Phone 419-255-5700

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ Hazardous Waste Solid NA9189 NOS F002	001	CM	28220	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above: PCN 2123 AT

K. Handling Codes for Wastes Listed Above: Scd I D81

15. Special Handling Instructions and Additional Information: 14.27 T 28540

AGENCY DISPLAY OF ESTIMATED BURDEN

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Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 03 01 90

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Bill McCormick — Signature: Bill McCormick — Month Day Year: 03 01 90

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name — Signature — Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19

Printed/Typed Name: JEFF HARDING — Signature: Jeff Harding — Month Day Year: 09 02 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

#1 - GENERATOR ORIGINAL COPY

a. RQ =	c. RQ =	EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT: CHEMTREC (800) 424-9300	SEE SECTION 15
b. RQ =	d. RQ =		

Please print or type (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039. Expires 9-30-88

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No: OH 3 8 0 0 0 1 5 3 7 9 9 0 0 0 7
Manifest Document No.

2. Page 1 of 1

Information in the shaded areas is not required by Federal law

3. Generator's Name and Mailing Address: NASA - Plum Brook Station, 6100 Columbus Avenue, Sandusky OH 44870

4. Generator's Phone: (419) 625-1123

5. Transporter 1 Company Name: Myers Chemical Transport

6. US EPA ID Number: P A D 0 4 1 2 5 5 1 7 5

7. Transporter 2 Company Name:

8. US EPA ID Number:

9. Designated Facility Name and Site Address: Envirosafe, 876 Otter Creek Rd, Oregon OH 43616

10. US EPA ID Number: O H D 0 4 5 2 4 3 7 0 6

A. State Manifest Document Number

B. State Generator's ID

C. State Transporter's ID

D. Transporter's Phone: 412-758-5606

E. State Transporter's ID

F. Transporter's Phone

G. State Facility's ID

H. Facility's Phone: 419-255-5100

GENERATOR

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ Hazardous Waste Solid NA9189 NOS F002	001	CM	15985	P	F002
b.					
c.					
d.					

Additional Descriptions for Materials Listed Above: PCN 2123 AT

K. Handling Codes for Wastes Listed Above: Sec I D81

15. Special Handling Instructions and Additional Information: 7.83 T 15160

AGENCY DISPLAY OF ESTIMATED BURDEN

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Printed/Typed Name: Amy L. Bewer — Signature: Amy L. Bewer — Month Day Year: 0 3 0 2 9 0

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Bill McCormick — Signature: Bill McCormick — Month Day Year: 0 3 0 2 9 0

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name: — Signature: — Month Day Year:

FAC.

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name: JEFF HARDING — Signature: Jeff Harding — Month Day Year: 0 3 0 8 9 0

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

#1 - GENERATOR ORIGINAL COPY

a. RQ =	c. RQ =	EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT:	SEE SECTION 15
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300	DC 20460, and to the Office of Information and Regulatory, Office of Management and Budget, Washington, DC 20640"

Please print or type (Form designed for use on elite (12-pitch) typewriter.) Form Approved OMB No. 2050-0039 Expires 9-30-88

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH3800015379 Manifest Document No. 9100B
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
NASA - Plum Brook Station
6100 Columbus Avenue
Sandusky OH 44870

4. Generator's Phone (419) 625-1123

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name: Myers Chemical Transport
6. US EPA ID Number: PAD041255175

C. State Transporter's ID

D. Transporter's Phone 412-758-5600

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address
Envirosafe
876 Otter Creek Rd.
Oregon OH 43616
10. US EPA ID Number: OHD045243706

G. State Facility's ID

H. Facility's Phone 419-255-5100

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ Hazardous Waste Solid NA9189 NOS F002	001	CM	28235	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
Sec I D 91

15. Special Handling Instructions and Additional Information
14.44 T 29830 P

AGENCY DISPLAY OF ESTIMATED BURDEN
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Printed/Typed Name: Amy L. Bower
Signature: Amy L. Bower
Month Day Year: 03 02 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Ronnie Jenkins
Signature: Ronnie Jenkins
Month Day Year: 03 02 90

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name: JEFF HARDING
Signature: Jeff Harding
Month Day Year: 03 08 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

#1 - GENERATOR ORIGINAL COPY

a. RQ =	c. RQ =	EMERGENCY CONTACT:	SEE SECTION 15
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300	

Please print or type. *(Form designed for use on elite (12-pitch) typewriter.)* *Form Approved. OMB No 2050-0039 Expires 9-30-88* 91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH3800015379 Manifest Document No. 001100
2. Page 1 of 1
Information in the shaded areas is not required by Federal law

3. Generator's Name and Mailing Address
NASA - Plum Brook Station
6100 Columbus Avenue
Sandusky OH 44870
4. Generator's Phone (419) 621-3233

A. State Manifest Document Number
B. State Generator's ID

5. Transporter 1 Company Name: CHEM FREIGHT
6. US EPA ID Number: OKD986966190
C. State Transporter's ID
D. Transporter's Phone 216 341 2500

7. Transporter 2 Company Name: SAME AS #1
8. US EPA ID Number
E. State Transporter's ID
F. Transporter's Phone

9. Designated Facility Name and Site Address
ChemTron Corporation
35850 Schneider Court
Avon OH 44011
10. US EPA ID Number: OHD066060609
G. State Facility's ID
H. Facility's Phone 216-871-8048

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. NA1993 Waste Combustible Liquid NOS F005 D001 F002	9	DM	495	G	F005 D001 F002
b. VA0002190-15					
c.					
d.					

J. Additional Descriptions for Materials Listed Above

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

AGENCY DISPLAY OF ESTIMATED BURDEN
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GENERATOR

Printed/Typed Name	Signature	Month Day Year
Amy L. Bower	Amy L. Bower	02 16 90

17. Transporter 1 Acknowledgement of Receipt of Materials

TRANSPORTER

Printed/Typed Name	Signature	Month Day Year
DAVE HAYDEN	Dave Hayden	02 16 90

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year
STEVE JONES	Steve Jones	02 19 90

FACI

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19

Printed/Typed Name	Signature	Month Day Year
Lonnie Hanchesky	Lonnie Hanchesky	02 19 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

#1 - GENERATOR ORIGINAL COPY