Reactor Area
NASA Plum Brook Station
Sandusky, Ohio

Closure Work Plan

September 1995

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REACTOR AREA
NASA PLUM BROOK STATION
SANDUSKY, OHIO

CLOSURE WORK PLAN
TASK ORDER 7059-004

SEPTEMBER 1995

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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 Corporaton
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
PBS	Plum Brook Station
PCB	Polychlorinated Biphenyl

ABBREVIATIONS AND ACRONYMS-Continued

PARCC	Precision, Accuracy, Representativeness, Completeness and Comparability
PPE	Personal Protection Equipment
PQL	Practical Quantitation Limit
PTI	Permit To Install
PTO	Permit To Operate
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
SPF	Space Power Facility
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 Reactor Area (RA) complex 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 consisted of one underground storage tank (UST), #23, located adjacent to the south side of Building 1131, in the RA complex.

In 1989, UST #23 and two adjacent USTs, #21 and #22, were removed from the RA complex. UST #23 contained waste oil and solvents generated at the RA complex and was in use up to the time of removal. USTs #21 and #22 contained fuel oil and were out of service at the time of removal.

This Closure Work Plan addresses the following activities:

- Identification and complete delineation of the horizontal and vertical extent of soil and groundwater contamination at the RA complex 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.

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 any contamination at the RA complex as a result of waste storage operations at the site.

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 used for crop production. Plum Brook Station is generally undisturbed, forested land and is located in Perkins and Oxford townships. Small portions of the site along the eastern boundary 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 RA complex, in the northwest 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 intakes 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, and
- National Pollutant Discharge Elimination System (NPDES) Permit
- Air Permits
- National Environmental Policy Act 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 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. OH0001392) 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 informational 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.

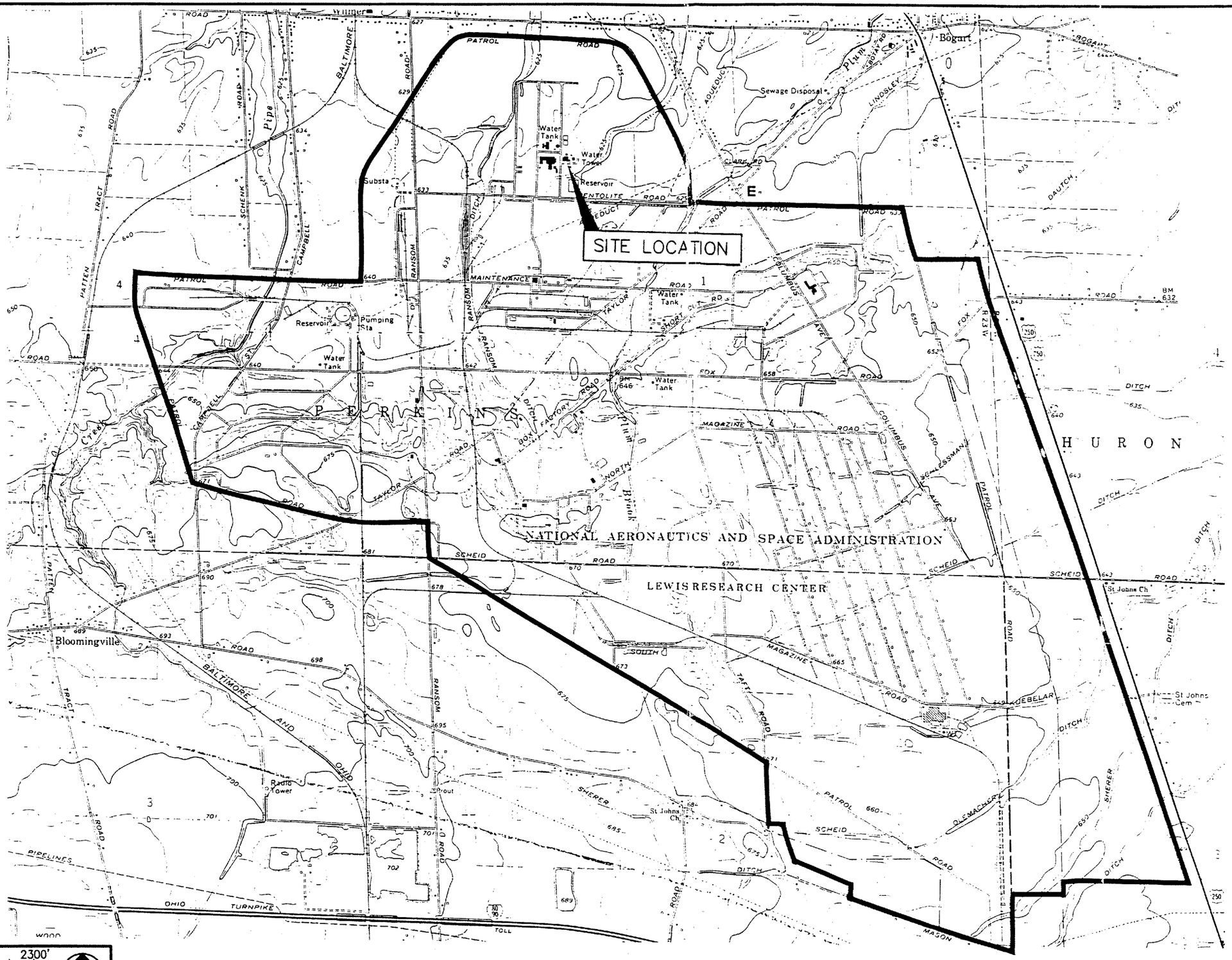
Following a 1989 assessment by EBASCO Environmental (EBASCO), 19 USTs used during various PBS operations were identified and earmarked for removal. The following list summarizes the removal of these USTs.

- 9 USTs at the Garage and Maintenance Area (Buildings 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 UST (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.



0 2300'
SCALE 1" = 2300'
0 276 552 828M
SCALE 1CM = 276M

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

M:\B705900\C\ \FIG2-1

NASA Lewis Research Center
Plum Brook Station
Reactor Area

Figure 2-1
Facility Location
Map

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3.0 THE REACTOR 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 northern boundary of Plum Brook Station which includes the Reactor Area (RA) complex. Figure 3-1 shows the Reactor Area and the location of the former UST pit adjacent to the south wall of Building 1131.

Building 1131 is currently used for storage of equipment. A battery backup system for high voltage switching gear is also housed in this building.

The area of study is the former UST area, containing 3 USTs, located adjacent to the south wall of Building 1131. Building 1131, titled Reactor Service Equipment Building in PBS records, was constructed in 1959 with a total floor area of 26,975 square feet. Its purpose was to house equipment such as the water treatment operations, the boiler/heating system for the reactor, large air compressors, emergency generators, and other equipment from various locations at PBS. A control room for a now demolished cooling tower and a small radiological laboratory were also housed in this building.

A dewatering sump located in the basement is used to collect water from floor drains and tunnel dewatering. The sump is situated north of the "Cold Pipe Tunnel", along the interior wall in the northwest quadrant of the basement. The sump receives groundwater from footer drains for the Building 1131 tunnel and is reported to receive inflow from the floor drains. Sump water is pumped to the Reactor Effluent Metering Station at Building 1192, located approximately 900 feet south of Building 1131. This building also receives sump discharges from 6 or 8 other sumps within the general Reactor area. Facility personnel estimate the combined flow to be approximately 200 to 250 gallons per hour. The major contributor to the combined flow is a sump, 25 feet deep, located at Building 1111, which is estimated to yield approximately 180 gallons per hour. Therefore, the sump serving the Building 1131 tunnel is estimated to produce approximately 5 to 10 gallons per hour.

The combined sump water is discharged to Pentolite Ditch and subsequently flows eastward along the south side of Pentolite Road for a distance of approximately 2500 feet to Plum Brook. Collected water is discharged into Pentolite Ditch. The reactor sump discharge is under a group outfall permit for Plum Brook (#003).

Pentolite Ditch has a channel width of approximately 6 feet, a typical flow depth of 6 to 8 inches, and low flow velocities. It flows year round. Most, if not all, of the flow is from the sump discharges. Plum Brook has a channel width of 12 to 15 feet, a typical flow depth of 3 feet, and a drainage area of approximately 1960 acres at the property boundary.

Building 1131 is connected to Building 1111 by means of an underground tunnel on the west side. Building 1131 has numerous floor drains leading to a collection sump in the basement. The only utility that traverses the south side of the building, where the USTs were located, is a buried power line from substation/Building 1161. Building 1131 is predominately sheet metal sided, with brick on the west side where the control rooms are located.

3.1.1 Topography

The RA complex is located on relatively flat land characterized by topography that slopes gently north and east toward 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 RA complex is 630 feet mean sea level (MSL).

3.1.2 Surficial Geology/Soil Conditions

Sixteen soil borings in the vicinity of the RA complex have identified surface soil to be predominantly a fine sand and grey mottled clayey silt. The overburden at the Reactor Area has an average thickness greater than 22 feet. Brown fine sand was found near the surface to a depth of 8 feet in all boreholes in the UST area. This brown fine sand was found in some areas to be underlain by 2-14 feet of grey fine sand, 1.5-8 feet of grey sandy clayey silt, >1.5 feet of grey clayey silt and grey silty clay. 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. Bedrock was not reached at this UST area, although the boreholes were drilled to a depth of auger refusal at 10-22 feet.

3.1.3 Bedrock Geology

Bedrock was not encountered in any of the borings at the RA complex. Bedrock in this area may be the Ohio Shale or Devonian Columbus and Delaware limestone. To the south of the site, at the Garage and Maintenance Area (GMA), soil borings at a depth of 27-29 feet encountered the Ohio Shale. The Ohio shale has also been encountered at shallow depths of 6-8 feet in the Space Power Facility (SPF) and in the GMA at PBS. It is likely that shale will be encountered at depths of greater than 29 feet, being that the general dip of the shale bedrock is to the north. A well which will be drilled in the bedrock at the RA will help to define the bedrock in the area.

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. The ODNR map also indicates the Devonian Columbus and Delaware limestone and dolomite aquifer occurs in the area at depths of less than 100 feet.

The zone map indicates the RA complex is in an area where bedrock yields of 5 to 25 gallons per minute may be developed. Development of cavernous porosity within this zone is highly erratic as indicated by a well located just outside of the Plum Brook Station boundary, which had a yield of 8 gpm in the same aquifer.

3.1.4 Surficial Groundwater

In the area of the excavated USTs, the groundwater table during the Phase I investigation was above the level where the removed USTs had been located. Figures 3-2 and 3-3 present the surficial groundwater aquifer elevation contours developed from the January 9, 1991 and May 9, 1991 groundwater level measurements, respectively. The groundwater flow direction indicated for both the January and May measurements was inward toward the buildings. The groundwater elevation contours for this area reflect the presence of the underground tunnel that connects Building Nos. 1134, 1131, and 1152 in this area. A dewatering operation is taking place at this tunnel in which

groundwater draining into the area around the tunnel is collected and pumped out. The dewatering in this area has a pronounced local effect on groundwater elevations and flow direction. The dewatering of the tunnel dominates the local groundwater flow pattern in the surrounding area, including the former location of the USTs. This local effect diminishes with distance from the dewatering point.

A regional groundwater elevation study under the Corrective Actions Remedial Investigations/Feasibility Study (RI/FS) Phase I indicates groundwater flow contours show the flow to be in a northwesterly direction (Figure 3-4). At the northernmost point of PBS, the regional flow at the RA complex appears to head in a northeasterly direction. After placement of the additional wells, more information will be available to determine the regional flow direction in the area.

Taking the maximum theoretical hydraulic conductivity for the various soil units observed at this UST area, the maximum horizontal groundwater flow velocities in the soils are 72 and 58 feet per year, calculated based on the January and May 1991 water elevation measurements, respectively. These calculated velocities are roughly a factor of 30 to 50 higher than the velocities calculated for the other areas. This calculation also highlighted the relative steepness of the gradients in this area. The slug test will offer more information regarding the hydraulic conductivities.

3.2 PAST WASTE MANAGEMENT ACTIVITIES

Figure 3-5 shows the area of waste and fuel management operations at the RA complex. Three USTs were located in a common excavation adjacent to the south side of the RA complex (Building 1131). Two of the USTs were 7,900 gallon steel fuel oil USTs (#21 and #22) and the third (UST #23) was a 500 gallon steel waste oil and solvent UST. All three USTs were installed in 1961. The three USTs were removed on December 28, 1989. USTs #21 and #22 were not in service at the time of removal and were empty; UST #23 was in service at the time of its removal. USTs #21 and #22, used to store gasoline and diesel fuel, were removed and closed under BUSTR regulations. 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 RA complex.

The USTs did not have secondary containment or release detection systems. 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.

It is estimated the maximum hazardous waste inventory in UST #23 is 250 gallons. Waste oil and solvents were allowed to accumulate in the UST until it was approximately half full. Contents of the UST was disposed of once a year. There are no manifests which document routine disposal of the UST contents. It is estimated the throughput of hazardous wastes over the life of the waste oil and solvent UST is 8400 gallons. Manifests from the shipment of hazardous waste solvents from the reactor area closure are included in Appendix D.

Records listing the identities and quantities of waste solvents stored in UST #23 could not be found, but discussions with facility personnel provided the following information: acetone, carbon tetrachloride, methylene chloride, 1,1,1-trichloroethane, and tetrachloroethene were known to have been used and are likely to have been placed in the UST.

Table 3-1 is a list of chemical solvents which are known to have been managed at UST #23. Table 3-2 shows the additional chemicals that were found at the site during past investigations and are potentially associated with UST #23 as either chemicals that were used or degradation products thereof. The combination of Tables 3-1 and 3-2 constitutes the list of the potential chemicals of concern for 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 RA complex.

3.3.1 Underground Storage Tank Removals

On December 28, 1989, the permanent removal of USTs #21, #22, and #23 was performed at the RA complex. These USTs were located adjacent to the southern side of Building 1131. The USTs were adjacent to one another, lying in a north-south direction. These USTs were installed in 1961 and were constructed of steel. Mr. Edwin Maglott of the State Fire Marshal's Office and Ms. Pamela Doerner of the Ohio Environmental Protection Agency were on site to oversee the removal of the USTs. Representatives of NASA Plum Brook Station, Warner/ Osborn/ Pardee and Turner Construction were also on site to monitor the removal of the USTs.

The tops of the USTs were approximately 6 feet below grade. The soil from the surface to a depth of approximately 13 feet was removed and placed in containment areas. These areas consisted of roll off boxes and in an area located approximately 100 yards east of the UST pit which was covered with plastic sheeting and bounded by hay bales. All soil excavation and UST removals were performed by Independence Excavating of Cleveland, Ohio, who was retained as a subcontractor to Turner Construction Company of Cleveland, Ohio.

The three USTs were cleaned prior to their removal. Before UST #23 was cleaned, approximately 250 gallons of waste oil was removed and placed in 55-gallon drums. The cleaning of the USTs was performed by Clean Harbors of Cleveland, Ohio. No as-built or engineering drawings were available for the USTs. A scaled drawing of the UST layout was obtained and is included in Appendix C.

Partial cleanup of the site has occurred in the form of UST removal and disposal of excavated soil. All waste residues from the USTs were removed and transported offsite for disposal. It is estimated that the following quantities of wastes were generated during the UST removal on December 28, 1989:

- Three USTs were cleaned prior to their removal by Clean Harbors of Cleveland, Ohio. Before UST #23 was cleaned, 250 gallons of liquid pumpable wastes were removed and drummed, and 190 gallons of rinseate was generated from the cleaning and drummed. A total of 400 gallons of waste was drummed and shipped by Clean Harbors of Kingston, Inc. and disposed of at Clean Harbors of Braintree, Inc. on February 19, 1990. A Uniform Hazardous Waste Manifest is included in Appendix D.

- From March 23 through March 28, 1990, soil generated from the removal of the UST, and solid residue within the UST #23 was transported by Myers Chemical Transport and disposed of at Envirosafe Landfill in Oregon, Ohio. Uniform Hazardous Waste Manifests which

document soil disposal are included in Appendix D. A total of 468 tons of soil was disposed of at Envirosafe.

- The underground storage USTs and ancillary piping were removed, cleaned, and transported offsite for disposal. Site personnel have stated that the storage USTs were cut open and rendered useless prior to removal from the site and disposal as scrap steel. There is no available documentation as to the final disposition of the USTs nor their ancillary piping.

- All excavations were backfilled with clean sand from a borrow pit within PBS.

In regard to health and safety during the 1989 UST removal, NASA requires a site-specific health and safety plan from each contractor that performs work on site. The health and safety plan was reviewed by NASA Health and Safety personnel. During this removal, 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, 1990

As part of the UST removal, an UST Site Closure Assessment for USTs #21, #22, and #23 was completed by EBASCO Environmental in December, 1989, and a report was generated dated May, 1990 that included soil sampling and analyses. A complete copy of the report including figures and laboratory data may be found in Appendices B-1 and B-2. A total of eleven soil samples from beneath the UST, the sidewalls of the excavation pit, and from excavated soils were collected from the UST cavity at the time of UST removal in order to determine if a release of UST contents had occurred during the active life of the UST. Two concrete slabs that ran an east-west direction beneath the USTs were removed after the USTs were removed. Soil samples were labelled PBS-1131-SS-1 through PBS-1131-SS-11. Soil samples SS-1 through SS-6 were taken from the pit excavation after the 3 USTs and the concrete slabs were removed. Soil samples SS-7 through SS-9 were taken from the excavated soils from above the USTs.

The closure assessment indicated that varying degrees of contamination were present. During the original excavation of the soils, the pit appeared to contain a water-oil mixture after the USTs were removed. An Hnu photoionization detector was used to determine if there were volatile organics emanating from the soil samples. The Hnu readings and visual contamination was the rationale for excavating an additional 3-4 feet beneath the concrete slabs. Soil samples SS-10 and SS-11 were taken from the bottom of the pit after the additional 3-4 feet of soil was removed.

The eleven soil samples were collected and analyzed for Volatile Organic Compounds (VOCs) (EPA method 524.2), EP Toxicity for lead (EPA method 200.7), Flash point (ASTM method D-93) and Total Petroleum Hydrocarbons (TPH) (EPA method 418.1). The samples were analyzed for EP toxicity because that was the accepted leachate test when the samples were analyzed. No groundwater samples were taken at the time.

A summary of chemicals identified in the soil listed with their highest detected concentrations is shown in Table 3-3. There were detectable levels of TPH in the area of UST #23. Eleven samples were analyzed for TPH and concentrations ranged from a low of 114 ppm to a high of 3570 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 characteristic or ignitability.

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

In November 1991, Phase I of a Corrective Action RI/FS was completed by EBASCO Environmental. A copy of the report including figures, well logs, data, etc. may be found in Appendices B-3 and B-4. During Phase I field investigation, six soil borings with depths ranging from 10-22 feet were completed and were finished as groundwater monitoring wells. Soil borings were labelled PBS-RA-SB-01 through PBS-RA-SB-06. Samples for volatile organics analysis were collected as discrete samples. All others were composited and collected over the depth of the borings and analyzed. The field activities involved in the Phase I field investigation included soil borings and sampling, well installation, and groundwater sampling. Two of the six monitoring wells were sampled; PBS-RA-GW-04 because it was presumed to be contaminated and PBS-RA-GW-01 because it was expected to be clean and used as background.

All of the field samples, duplicates and field blanks, were analyzed for the target compound list (TCL) volatiles, semivolatiles, pesticides/PCBs and target analyte list (TAL) metals and cyanide and total petroleum hydrocarbons (TPH). The TCL/TAL analyses were completed following USEPA contract laboratory protocols. The TPH analysis was performed in accordance with EPA method 418.1. Methods for the additional sample analysis were not specifically stated, however they are believed to be consistent with SW-846 methodology. Four VOCs (1,2-dichloroethane, 1,1,1-trichloroethane, trichloroethene, and tetrachloroethene) were detected in this set of soil samples. Methylene chloride, acetone, carbon disulfide, and bis(2-ethylhexyl)phthalate were also detected and were referred to as probable laboratory contaminants. Additional semivolatile compounds were also found in the soil samples. TPH was found in the soil samples up to a concentration of 159 mg/kg (SB03 0'-22' composite). Table 3-4 is a summary of maximum detected chemical contaminants in soil samples.

Groundwater wells range in depth from 10 to 22 feet. All screens used were 304 stainless steel .01" slot, and ranged in length from five to fifteen feet. Well #PBS-RA-GW-01 was drilled to a depth of 16 feet and the bottom 10 feet was screened. Well #PBS-RA-GW-02 was drilled to a depth of 18 feet and was screened across the bottom 10 feet. Well #PBS-RA-GW-03 was drilled to a depth of 22 feet and a 15 feet screen was utilized. Well #s PBS-RA-GW-04 through PBS-RA-GW-06 were each drilled to a depth of 10 feet and screened in the bottom five feet of the well. Copies of well logs and a geologic cross-section may be found included in the full report in Appendix B-3.

The groundwater samples indicated the presence of a pesticide endosulfan sulfate at 1.00 ug\L in PBS-RA-GW-04, 0.580 ug/L in PBS-RA-GW-01, and the analyte was also found in the associated blank. Beta-BHC, a chlorinated insecticide, was found at a concentration of 0.097 ug/L in PBS-RA-GW-01, which was expected to be clean. The result is an extremely low concentration and it is unknown whether the analytical procedure was performed using dual column confirmation, therefore indicating the potential for a false positive. Beta-BHC was never utilized in the area of the UST #23. The groundwater assessment for the Phase I was inadequate for determining rate and extent.

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

In April 1993, MK performed Site Assessments of the UST areas. A copy of the report, Preliminary Site Investigation, Phase I, can be found in Appendix B-5. The laboratory data are included in Appendix B-6. As part of the investigation, soil, groundwater and sediment samples were collected in and around the RA complex.

Four borings were drilled at the reactor area and labelled B-1 through B-4. B-1 through B-3 were drilled to a depth of 16 feet, and B-4 to 14 feet. B-1 was also converted into a monitoring well, MW-1. Three samples were collected from each boring. Samples were collected at depths of 2-4', 4-6', 6-8' or 14-16'. The soil samples were analyzed for TPH (Method 418.1), BTEX (Method 8020), Volatiles (Method 8240) and Polynuclear Aromatic Hydrocarbons (Method 8100). Well MW-1 was sampled along with six other previously installed monitoring wells.

During this investigation MK renamed the existing monitoring wells: PBS-RA-GW-01 was renamed EB-6 and PBS-RA-GW-02 through PBS-RA-GW-06 were renamed EB-1 through EB-5 respectively.

A sump area inside of the Building 1131 was also sampled. The sump collects water from the building foundation drain system and building floor drains. All of the groundwater samples were analyzed for volatiles (Method 8240) and polynuclear aromatic hydrocarbons (Method 8100).

Table 3-5 is a summary of chemicals detected in the soil during this round of sampling. Analytical results for the groundwater are found in Table 3-6.

3.3.5 Facility Wide Site Inspection, Morrison Knudsen Corporation, 1993

Water and sediment samples were collected in Plum Brook approximately 500 feet downstream from Pentolite Road on July 20, 1993, as part of a facility wide Site Inspection by MK. These samples were collected at a period of extreme low flow (approximately 100,000 gpd). The samples found no detectable hazardous waste constituents.

3.3.6 Decontamination and Cleaning of Cold Drains and of Sump, Morrison Knudsen Corporation, 1994

On August 8, 1994, Matt Construction Services, Inc. under contract to MK, mobilized equipment to clean the drains and associated piping in the Service Equipment Building #1131, rooms 13,15,18,20,21,25,26, and 27. A high pressure sewer cleaning unit was used to vacuum material from the drains at the point of entry to the sump. Air movement was audible in some of the drains, which showed that gross debris had been removed by the vacuuming process.

Cleaning of the drains continued on August 9, 1994. Alternate drains were temporarily plugged in order to increase the strength of the vacuum to effectively remove material in the drains. After all drains were audibly clear of debris, water was introduced under high pressure. Each drain location was flushed for three to five minutes and a sample of water collected at the point of entry to the sump. When the water exhibited no debris, odor, or sheen the drain was considered clean.

Air monitoring was performed on August 9, 1994, by MK for 1,1,1-trichloroethane using Drager gas measurement detector tubes. Areas around the drains as well as in the sump showed levels to be below detection levels (50 parts per million). Aries Environmental of Pittsburgh, Pennsylvania

performed personnel monitoring using detector badges on the same date. 1,1,1- Trichloroethane was not detected in the sample.

On August 10, 1994, the sump cleaning was completed. The majority of liquid and sludge removed from the drains and sump was transferred from the vacuum tanker to a storage tank (approximately 2,000 gallons). Three drums of sludge and water were containerized in 55-gallon drums.

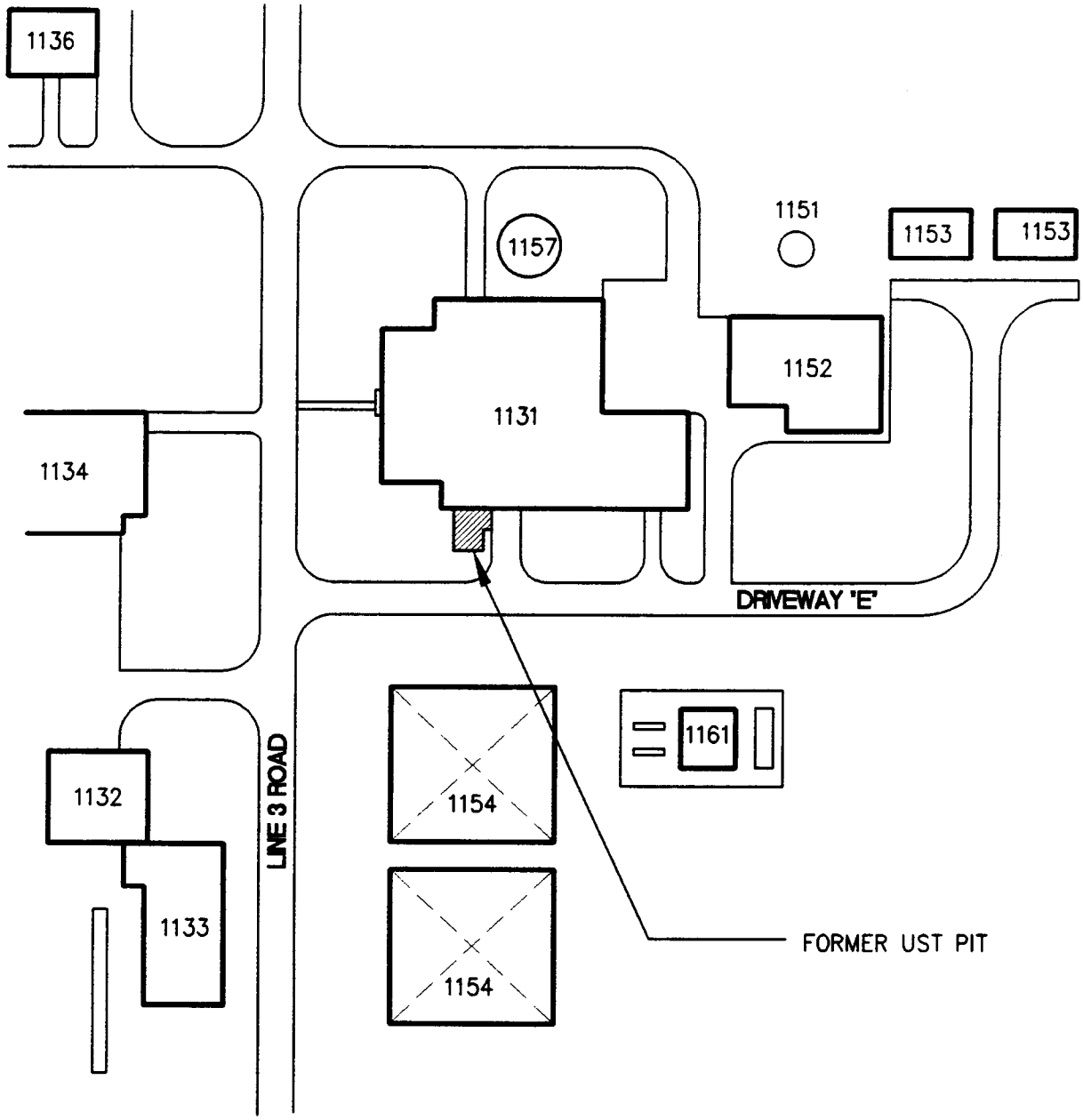
In addition, four 55-gallon drums of plastic, personnel protective equipment (PPE), and trash were generated during the cleaning process. Samples of wastewater from the drums and holding tank were submitted to B.E.C. Laboratories in Twinsburg, Ohio for analysis. Copies of the analyses, and drawings of the drains are in Appendix B-7.

Temporary plugs were placed in the drains after cleaning to prevent further contamination of the drains and sump. Equipment used in the cleaning process was screened for radiation contamination by NASA personnel after completion of the project. No radiation levels were found to exist above background levels. With the approval of NASA Office of Environmental Programs, seven drums of sludge, trash and PPE were disposed of at Laidlaw Environmental Services (TS), Inc. on November 9, 1994, under manifest number 94011, and 2,410 gallons of water was disposed of on November 10,1994 at Chem Met Services, Inc. under manifest document number 94012. Uniform Hazardous Waste Manifests from disposal of the sludge are found in Appendix D.

3.3.7 Summary of Previous Site Investigations at RA

Based on soil and groundwater sample analyses of the previous site investigations, it is apparent that soil contamination and groundwater contamination exists at the site as a result of waste and fuel management operations at the RA complex. Ohio EPA has commented on the above mentioned investigations used in a previous submittal (NASA Plum Brook Station, Closure Work Plan Reactor Area, May 20, 1994). After review and discussions with OEPA, NASA agrees that the RA complex has not been adequately characterized for extent and that much of the analytical data used to support the risk assessment may not have the required validation.

NASA intends to define the full vertical and horizontal extent of soil and groundwater contamination at the Reactor Area. The following Sampling and Analysis Plan 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.



0 40'
SCALE 1" = 40'
0 4 8 12M
SCALE 1CM = 4M

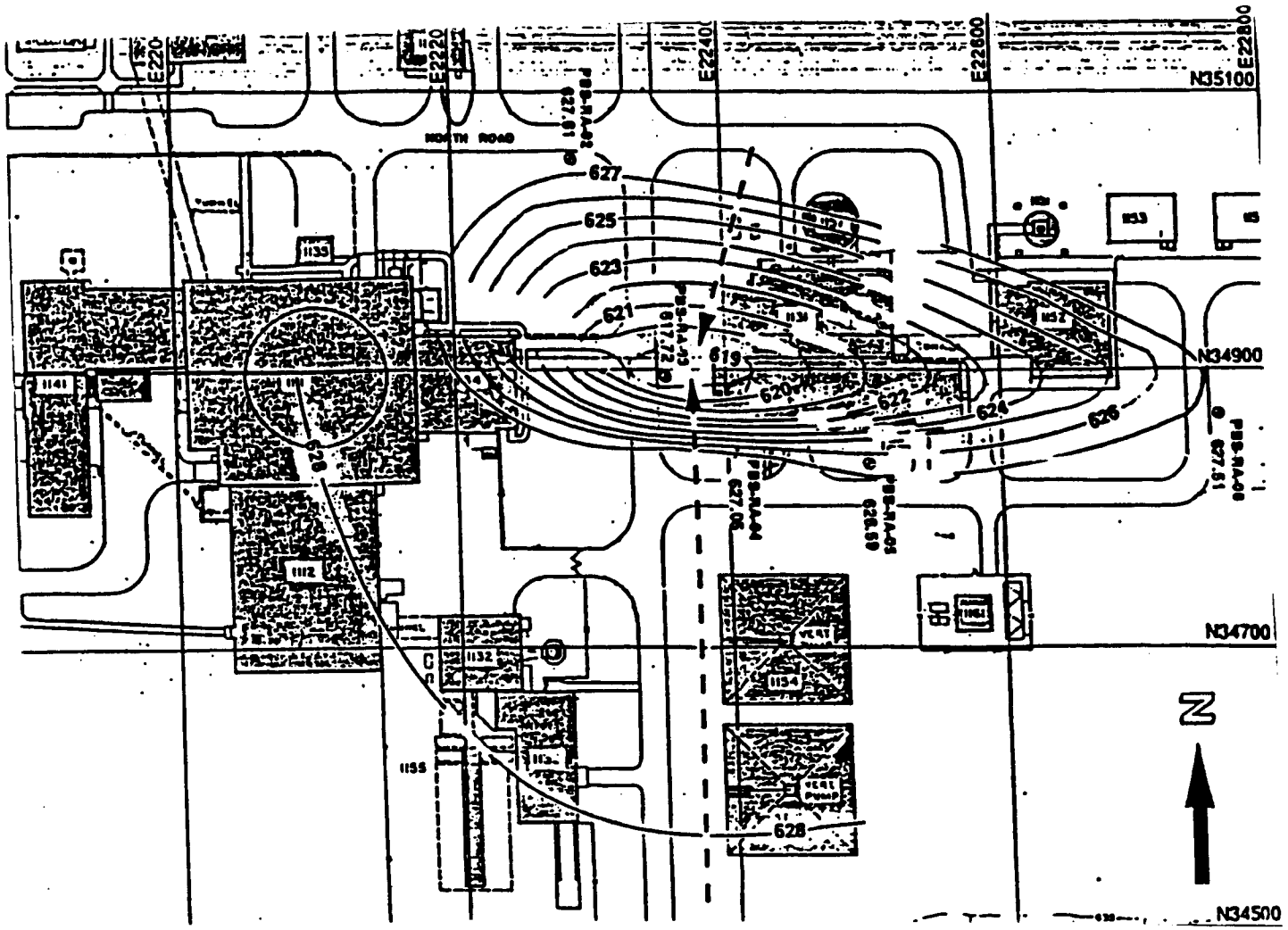
LEGEND:
7121 BUILDING/STRUCTURE AND NUMBER

NASA Lewis Research Center
Plum Brook Station
Reactor Area

Figure 3-1
Site Location Map

URS CONSULTANTS

M:\8705900\...TOR\FIG3-1

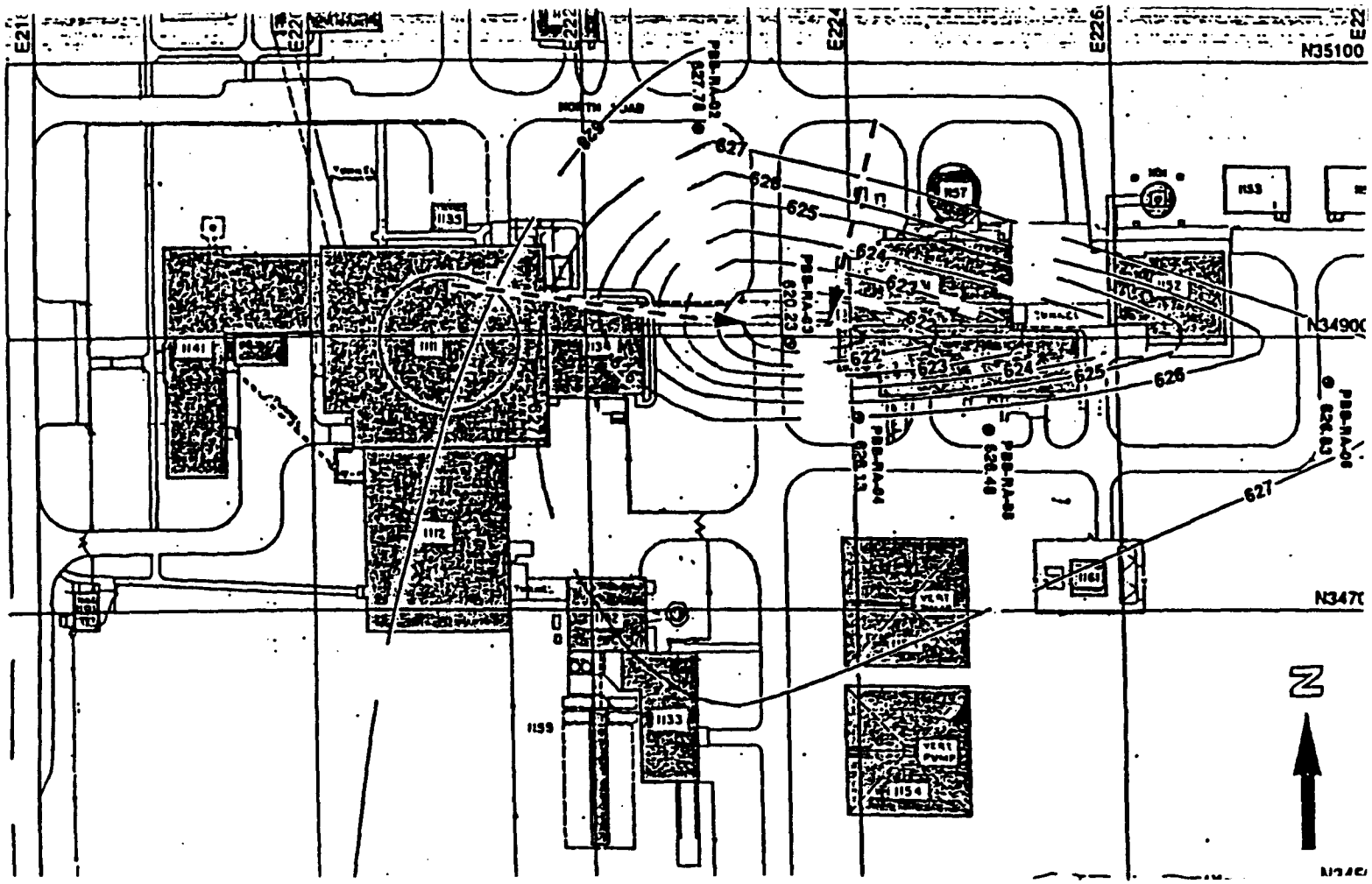


NASA Lewis Research Center
Plum Brook Station
Reactor Area

Figure 3-2
Groundwater Contour
Map - January 1991

URS CONSULTANTS

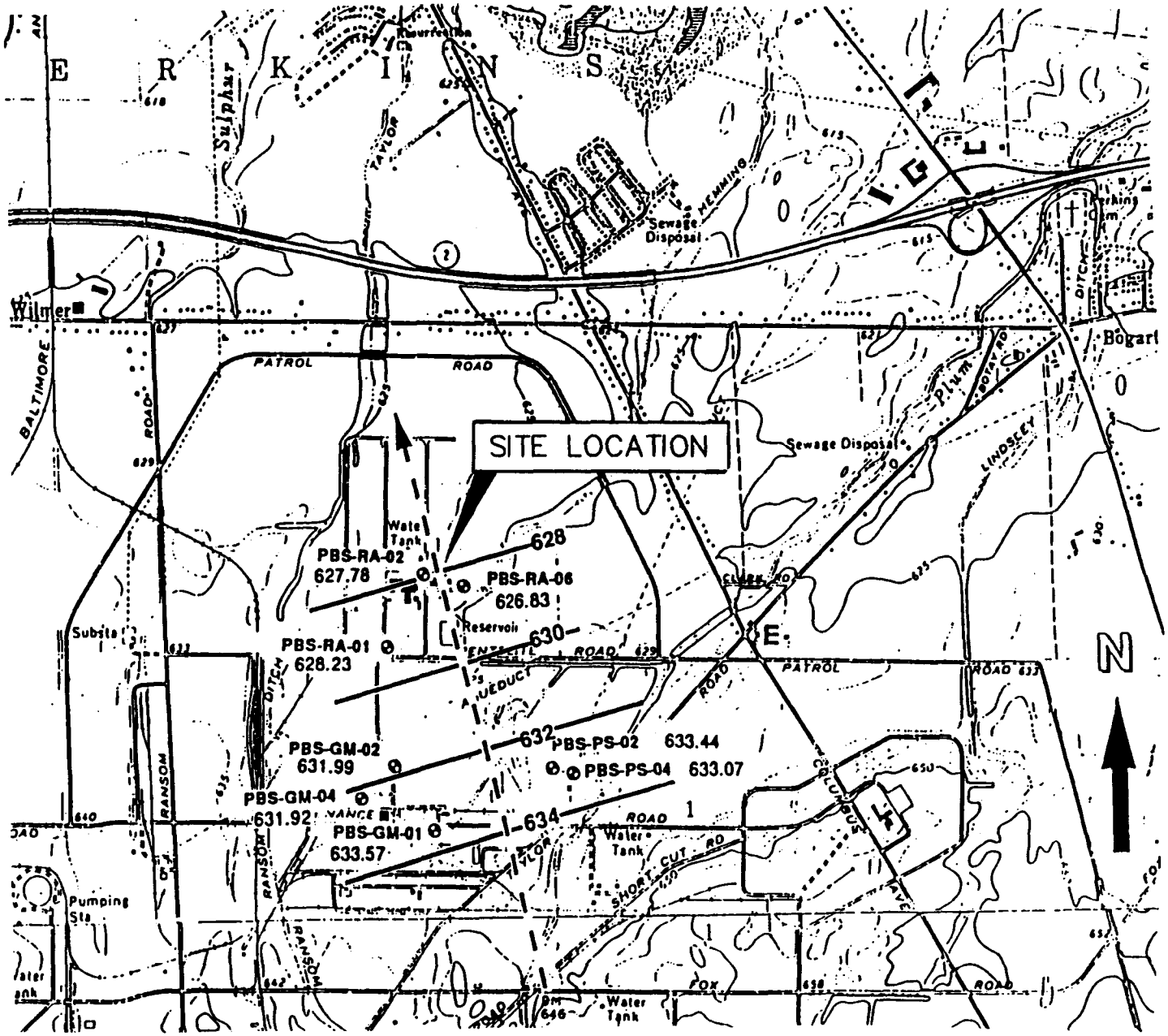
M:\8705900\C\REACTOR\FIG3-2



NASA Lewis Research Center
Plum Brook Station
Reactor Area

Figure 3-3
Groundwater Contour
Map - May 1991

URS CONSULTANTS



LEGEND

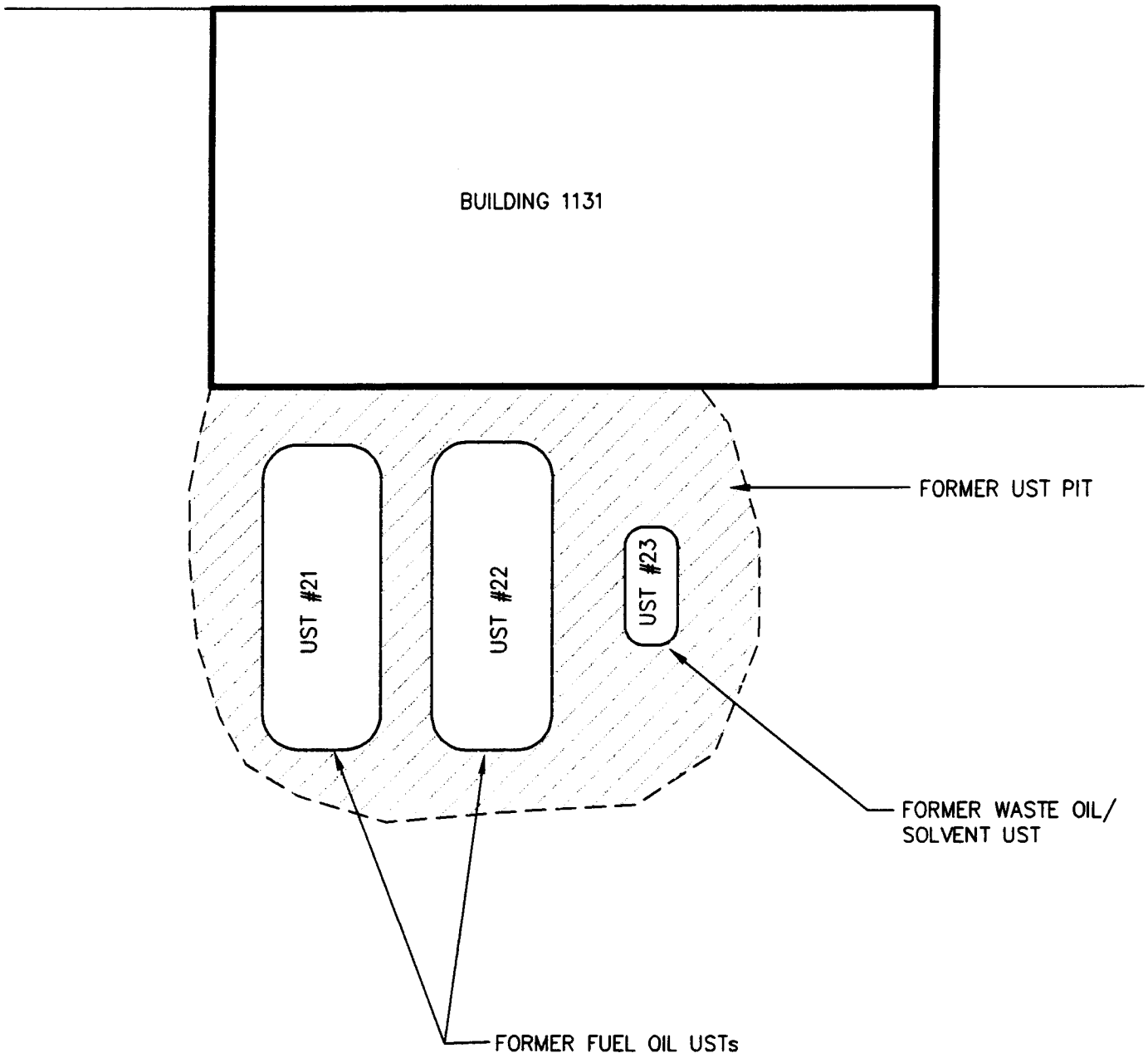
PBS-GM-01 633.87	Ground Water Monitoring Well Ground Water Elevation
634.0	Ground Water Elevation Contour
	Direction of Ground Water Flow

NASA Lewis Research Center
Plum Brook Station
Reactor Area

Figure 3-4
Regional Groundwater Contour Map - May 1991

URS CONSULTANTS

M:\8705900\C\REACTOR\FIG3-4



M:\8705900\CTOR\FIG3-5

0 20'
SCALE 1" = 20'
0 2.4 4.8 7.2M
SCALE 1CM = 2.4M

NASA Lewis Research Center
Plum Brook Station
Reactor Area

Figure 3-5
Extent Of
Operations

URS CONSULTANTS

Table 3-1

Chemicals Managed at UST #23
Reactor Area, Plum Brook Station

CHEMICAL	HAZARDOUS WASTE CODE
acetone	F003
carbon tetrachloride	F001,F002
methylene chloride	F001,F002
1,1,1-trichloroethane	F001,F002
tetrachloroethene	F001,F002

Table 3-2
Chemicals Potentially Managed at UST#23 - Reactor Area, Plum Brook Station

CHEMICAL
1,1-dichloroethane
cis-1,2-dichloroethene
trans-1,2-dichloroethene
1,2-dichlorobenzene
bromodichloromethane
1,2-dichloroethane
tert-butylbenzene
sec-butylbenzene
p-isopropyltoluene
1,3-dichlorobenzene
1,4-dichlorobenzene
dichlorodifluoromethane
chloroethane
naphthalene
trichloroethene
1,2,4-trimethylbenzene
1,3,5-trimethylbenzene
toluene
n-propylbenzene
chloroform
hexachlorobutadiene
isopropylbenzene
1,1,2-trichloroethane
1,1,1,2-tetrachloroethane
1,1,2,2-tetrachloroethane
1,2,3-trichloropropane
trichlorofluoromethane
1,2,4-trichlorobenzene
1,2,3-trichlorobenzene
xylenes

Table 3-3

Maximum Concentrations of Analytes in Soil, EBASCO Environmental, 1990 Reactor Area, Plum Brook Station

CHEMICAL	MAXIMUM CONCENTRATION IN SOIL (ug/kg)	SAMPLE LOCATION
dichlorodifluoromethane	61	SS-11
chloroethane	990	SS-10
trichlorofluoromethane	120 J	SS-2
methylene chloride	503	SS-5
trans-1,2-dichloroethene	17	SS-11
1,1-dichloroethane	6120	SS-10
cis-1,2-dichloroethene	165	SS-11
chloroform	1 J	SS-10
1,1,1-trichloroethane	891	SS-3
carbon tetrachloride	91 J	SS-3
1,2-dichloroethane	178	SS-10
benzene	32 J	SS-4
trichloroethene	1019	SS-9
bromodichloromethane	23 J	SS-4
toluene	41	SS-8
1,1,2-trichloroethane	143	SS-4
tetrachloroethene	1043	SS-3
ethylbenzene	1093	SS-4
1,1,1,2-tetrachloroethane	375	SS-8
m & p- xylenes	1115	SS-8
o-xylene	703	SS-8
1,1,2,2-tetrachloroethane	463	SS-6
isopropylbenzene	380	SS-8
1,2,3-trichloropropane	9	SS-10
n-propylbenzene	612	SS-8
1,3,5-trimethylbenzene	4365	SS-8

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Table 3-3 continued

Maximum Concentrations of Analytes in Soil, EBASCO Environmental, 1990 Reactor Area, Plum Brook Station

CHEMICAL	MAXIMUM CONCENTRATION IN SOIL (ug/kg)	SAMPLE LOCATION
tert-butylbenzene	645	SS-7
1,2,4-trimethylbenzene	4413	SS-8
sec-butylbenzene	858	SS-8
p-isopropyltoluene	1854	SS-8
1,3-dichlorobenzene	2 J	SS-10
1,4-dichlorobenzene	2 J	SS-10
1,2-dichlorobenzene	31 J	SS-8
1,2,4-trichlorobenzene	575	SS-1
hexachlorobutadiene	404	SS-1
naphthalene	13388	SS-8
1,2,3-trichlorobenzene	1025	SS-1

J Below Quantitation limits; Estimated Value

Table 3-4
Maximum Concentrations of Analytes in Soil, EBASCO Environmental, 1991
Reactor Area, Plum Brook Station

CHEMICAL	MAXIMUM CONCENTRATION DETECTED IN SOILS (ug/kg)	SAMPLE LOCATION
methylene chloride*	95	SB03 6'-8'
acetone*	320 BE	SB03 6'-8'
carbon disulfide*	31	SB03 6'-8'
1,2-dichloroethene	120	SB05 4'-6'
1,1,1-trichloroethane	22	SB04 4'-6'
trichloroethene	760 E	SB05 4'-6'
tetrachloroethene	19	SB05 4'-6'
SEMI-VOLATILE COMPOUNDS		
phenanthrene	290 J	SB05 COMP.0'-10'
anthracene	93 J	SB05 COMP.0'-10'
fluoranthene	270 J	SB05 COMP.0'-10'
pyrene	230 J	SBO4,SB05 COMP. 0'-10'
benzo(a)anthracene	130 J	SB05 COMP. 0'-10'
chrysene	130 J	SB05 COMP. 0'-10'
bis(2-ethylhexyl)phthalate*	590	SB01 COMP. 0'-16'
PESTICIDE/PCBs		
endosulfan sulfate	16 B	SB06 COMP. 0'-10'

* Probable Laboratory Contaminant
J Estimated, value below the Quantitation Limit
E Concentration exceeds calibration range of GC/MS Instrument
B Analyte Found in Associated Blank

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Table 3-5

Maximum Concentrations of Analytes in Soil, Morrison Knudsen Corporation, 1993 Reactor Area, Plum Brook Station

CHEMICAL	MAXIMUM CONCENTRATION (mg/kg)	SAMPLE LOCATION
1,1,1-trichloroethane	0.023	B2 6'-8'
toluene	0.003	B3 6'-8'
phenanthrene	1.16	B3 2'-4'
pyrene	0.343	B1 4'-6'
chrysene	1.26	B3 2'-4'
acenaphthene	0.159	B3 2'-4'
anthracene	0.378	B3 2'-4'
benzo(a)anthracene	1.28	B3 2'-4'
benzo(a)pyrene	1.45	B3 2'-4'
benzo(b)fluoroanthene	1.16	B3 2'-4'
benzo(k)fluoroanthene	1.02	B3 2'-4'
benzo(ghi)perylene	0.635	B3 2'-4'
dibenzo(a,h)anthracene	0.277	B3 2'-4'
fluoranthene	2.48	B3 2'-4'
indeno(1,2,3-cd)pyrene	0.775	B3 2'-4'
acenaphthylene	0.103	B3 2'-4'

Table 3-6

Maximum Concentrations of Analytes in Groundwater, Morrison Knudsen Corporation, 1993 Reactor Area, Plum Brook Station

CHEMICAL	MAXIMUM CONCENTRATION IN GROUNDWATER (ug/l)	SAMPLE LOCATION
dichlorodifluoromethane	1.70	GW-01 (1)
1,1,1-trichloroethane	2.90	GW-04
cis-1,2-dichloroethene	51.9	GW-05
trans-1,2-dichloroethene	1.93	GW-05
tetrachloroethene	1.85	GW-05
trichloroethene	483	GW-05
benzo(a)anthracene	1.30	MW1A (dup. sample of MW-1)
benzo(b)fluoranthene	4.02	GW-02
benzo(a)pyrene	9.20	GW-06
phenanthrene	1.05	GW-04
acenaphthene	414	SUMP
anthracene	215	SUMP
chrysene	17.6	SUMP
dibenz (a,h) anthracene	18.1	SUMP
chloroethane	3.56	SUMP2(2)
1,1-dichloroethane	9.36	SUMP2
1,1,1-trichloroethane	10.8	SUMP2
trichloroethene	1.43	SUMP2
fluoranthene	71.8	SUMP
fluorene	690	SUMP
pyrene	32.9	SUMP

(1) The method blank contained 0.903 ug/L of dichlorodifluoromethane. The approximately equivalent concentration, taking into account dilution factors, is 0.903 ug/L. This is considered to be a significant contribution to the reported value.

(2) A sump in Building 1131 was sampled twice, the lab accidentally destroying the first sample. Sump 2 is the second sample.

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4.0 SAMPLING AND ANALYSIS PLAN

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

- collection of soil samples to be used to establish background conditions for inorganics in the soil;
- collection of site soil samples which will determine the extent and concentration of potential contamination in the soil;
- installation of deeper groundwater monitoring wells;
- sampling of existing upgradient and downgradient monitoring wells to determine extent and concentration of potential contaminants in the groundwater.

NASA intends to sample and characterize the soil in and adjacent to the former UST cavity. NASA also intends to sample away from the UST excavation, circumscribing the waste management unit until the full extent of 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. The plan will include the requirement that everything leaving the RA complex (samples, equipment, etc.) will be screened for radiation.

4.1 SOIL SAMPLING

Soil samples will be collected at RA complex 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 location of 12 sample points that will be used to establish background conditions for naturally occurring compounds in the soil at the RA complex. Soil conditions at the RA complex are similar to those of the Garage and Maintenance Area; therefore, the same background sample 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 RA complex;
- background soil samples have not been affected by the RA complex 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 RA complex. 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 remediations 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. Sampling will proceed until the 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. A grid interval for soil sampling in a "Hot Spot" contamination scenario has been developed as follows:

Step 1: Determine the Potency of Carcinogens

CHEMICAL	POTENCY Slope Factor(mg/kg-d)$^{-1}$	SCORE
carbon tetrachloride	1.3E-01	2
1,4-dichlorobenzene	2.4E-02	1
1,2-dichloroethane	9.1E-02	2
methylene chloride	7.5E-03	1
tetrachloroethene	5.2E-02	1
bromodichloromethane	6.2E-02	1
1,1,1,2-tetrachloroethane	2.6E-02	1
1,1,2,2-tetrachloroethane	2.0E-01	2
chloroform	6.1E-03	1
hexachlorobutadiene	7.8E-02	1
1,1,2-trichloroethane	5.7E-02	1
trichloroethene	1.1E-02	1
12 chemical constituents	Total Score 15	
Average Score = Total Score/Chemical Constituents = 15/12=1.25		

Step 2: Determine the Potency of Systemic Toxicants

CHEMICAL	POTENCY RfD(mg/kg-d)	SCORE
acetone	1E-01	1
carbon tetrachloride	7E-04	3
cis-1,2-dichloroethane	1E-02	2
trichloroethene	6E-03	2
1,1-dichloroethane	1E-01	1
isopropylbenzene	4E-02	2
bromodichloromethane	2E-02	2
methylene chloride	6E-02	1
1,1,1,2-tetrachloroethane	3E-02	2
naphthalene	4E-02	2
chloroform	1E-02	2
1,1,1-trichloroethane	9E-02	1
1,2-dichlorobenzene	9E-02	1
hexachlorobutadiene	2E-04	3
1,2,4-trichlorobenzene	1E-02	2
toluene	2E-01	1
tetrachloroethene	1E-02	2
trichlorofluoromethane	3E-01	1
trans-1,2-dichloroethene	2E-02	2
1,1,2-trichloroethane	4E-03	2
xylene	2E+00	1
21 chemicals with RfDs	Total Score	36
Average= Total Score/Chemical constituents =36/21=1.71		

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 four to ten feet.	3
Soil Permeability is $>10^{-5}$ cm/sec.	3
Unit design had no secondary containment and is considered outdated.	2
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 = 2.28	Total Score = 16

Step 4: Determine the Soil Sampling Intensity Matrix

SOIL SAMPLING INTENSITY MATRIX	
CRITERION	**Sample Intensity Factor (SIF)**
Potency of Carcinogens	1.25
Potency of Systemic Toxicants	1.71
Average ROE	2.28
Composite SIF = (1.25 + 1.71 + 2.28) =	5.24

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 5.24 is computed. A composite SIF of 5.24 will require a 16-foot sampling grid to be used as a guide in defining the extent of soil contamination at the RA complex. 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 6-8 feet and from 10-12 feet. Intervals for soil sampling are based on the following criteria:

- The waste management unit at the RA complex was an UST. Surficial or shallow samples generally would not be taken to characterize a UST site because the waste is stored at a depth below the surface. Any surface spillage was removed with the excavation. A release of waste would be detected at depth, especially considering the fact that most of the chemicals suspected of being stored in the UST are heavier than water.

- It is proposed that samples be collected at a depth interval of 6-8 feet, near the top of the excavated UST. Samples will also be taken at a depth of 10-12 feet to characterize and define the vertical extent of potential waste solvents released from the UST.

The sample locations shown on Figure 4-2 are the minimum number of locations on the grid that will be sampled. The grid will be expanded outward and additional samples will be collected at grid intersections 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. 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

Figures 3-2 and 3-3 present the surficial groundwater aquifer elevation contours developed from the January 9, 1991 and May 9, 1991 groundwater level measurements, respectively. The groundwater flow direction indicated for both the January and May measurements was inward toward the buildings. The groundwater elevations contours for this area reflect the presence of the underground tunnel which connects Building Nos. 1134, 1131, and 1152 in this area. A dewatering operation is taking place at this tunnel in which groundwater draining into the area around the tunnel is collected and pumped out. The dewatering in this area has a pronounced local effect on groundwater elevations and flow direction. The dewatering of the tunnel dominates the local groundwater flow pattern in the surrounding area, including the former location of the USTs. This local effect diminishes with distance from the dewatering point.

Due to the steep gradient created by the dewatering, the maximum theoretical hydraulic conductivity for the soil unit at the RA was calculated to be approximately 65 feet/year based on 1991 water level measurements. This calculation is much higher than expected and greater than other areas at PBS. A slug test will further characterize the aquifer's hydraulic conductivity.

A regional groundwater elevation study under the Corrective Actions Remedial Investigations/Feasibility Study Phase I indicates groundwater flow contours show the flow to be in a northwesterly direction (Figure 3-4). At the northernmost point of PBS, the regional flow at the RA complex appears to head in a northeasterly direction. After placement of the additional wells, more information will be available to determine the regional flow direction in the area. In the area of the excavated USTs, the groundwater table during the Phase I investigation was above the level where the removed USTs had been located.

Seven wells were drilled to a depth of 10-22 feet, and were finished where the drill rig encountered auger refusal. Well logs are included in the UST Corrective Actions RI/FS, November, 1991 report in Appendix B-3. Based on ODNR groundwater zone maps, the bedrock in the area should be limestone and dolomite at a depth of 22-100 feet; however, shale was encountered at a depth of 27-29 feet at the GMA just south of the RA.

Seven shallow monitoring wells are located at the RA complex (Figure 4-3). Three monitoring wells are located at the south and southwest side of the building, RA-04, RA-05, and MW-1. Borings B-2, B-3 are also located at the south side of the building and were not developed into monitoring wells. Two monitoring wells, RA-02 and RA-03 are northwest/west of the building; boring B-4 was not made into a monitoring well. One monitoring well, RA-06 is to the east. Well RA-01 is approximately 1200 feet to the southwest of Building 1131 at the corner of Line 2 and Pentolite Roads. This well is too far away to the southwest to be of use in this study.

This site is unusual due to its localized concentric flow pattern. VOC contamination has been detected in wells RA-04 and RA-05. Horizontal extent of contamination may be determined by placement of wells near these two contaminated wells. Regional flow in a northern direction will also be taken into account with the placement of wells in a northerly direction.

MW-1 is an upgradient well for both the concentric localized flow and the regional flow. A new well, MW-2, at the same hydrostatic position as the current wells will serve as another upgradient well, and will also determine if any contamination has moved southeast. Well RA-06 to the east will intercept possible contaminants in that direction. Wells RA-02, RA-03, and RA-04 are in a regional downgradient position to intercept any possible contamination.

The extent of horizontal contamination will be defined as well by the placement of four shallow proposed wells, MW-2, MW-3, MW-4, and MW-6 (Figure 4-3). MW-3 to the west will define the horizontal extent of contamination from well RA-04, and will be downgradient of the concentric flow pattern as well. MW-4 and MW-6 will serve as additional downgradient wells to intercept a regional flow of groundwater to the north.

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 near the contaminated well RA-05 to determine if the bedrock has been compromised. This well will be referred to as MW-5. Drilling methods will utilize the double casing method to assure there will be no introduction of contaminants into the bedrock (Section 4.4.2).

This additional proposed groundwater monitoring will determine the rate, extent and concentration of contamination. If contamination is present in the new groundwater monitoring wells, the horizontal and vertical well locations will be expanded.

- Groundwater samples will be collected from each of the five proposed wells, MW-2, MW-3, MW-4, MW-5 and MW-6, and from existing wells RA-02 through RA-05, and MW-1.

- A sample will be extracted from the basin where the sump water collects prior to discharge.

- Groundwater elevations will be performed prior to sampling. These groundwater elevations must be performed seasonally.

4.2.2 Slug Tests

Slug tests will be performed at this site to determine the hydraulic conductivity of the unit. Monitoring wells RA-04, RA-05, MW-1 and MW-5(deep) will be used for the test. Slug test procedures are outlined in Section 4.4.7.

4.3 ANALYTICAL PARAMETERS

The potential chemicals of concern have been identified in Tables 3-1 and 3-2. 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 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 site 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:

- The drill stem and auger will be placed on the ground surface on the the sample grid intersection.

- The center plug will be attached to the drill stem, and the auger will be advanced to a depth of six to eight 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 center plug will be attached to the drill stem, and the auger will be advanced to a depth of 10 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, Field Operations.

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 the groundwater contamination, including dense non-aqueous phase liquids (DNAPLs), and characterize groundwater contamination near the bottom 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 RA complex is known to be very fine grained, and a 10-mm slot size will be used.

Four new shallow monitoring wells MW-2, MW-3, MW-4 and MW-6 will be drilled approximately 22-32 feet in depth to the bedrock. The top of the screen for MW-2, MW-3, MW-4 and MW-6 will be placed ten feet directly above the bedrock in the saturated zone. The rationale for determining

the depth of the wells and well screens is based on identifying a contiguous water bearing zone that could be monitored for contamination migration from the former UST. If the bedrock is saturated, the screen for MW-5 (deep) will be placed 10 feet into the top of the bedrock. If it is not saturated, drilling will continue until either the next saturated zone is encountered or sufficient depth is achieved to allow determination that the bedrock acts as an aquitard.

The monitoring well boreholes will be advanced one foot into the 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.

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 of the riser, and the riser will be notched at the point where the elevation is taken.

With the drilling of the deep well, MW-5, 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 that 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 viscosity of the bentonite will be 90% or higher and the mud weight will be 9.5 lbs/gallon or greater.

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

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

4.4.3. 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 of any Light Non-Aqueous Phase Liquid (LNAPL) or Dense Non-Aqueous Phase Liquid (DNAPL) will be measured with an electronic interface probe.

4.4.5 Groundwater Sampling

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 is slow to recharge (greater than 15 minutes), evacuation will be terminated. Purged water will be 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 waste water 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 (QA/QC) procedures. 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

A decontamination facility for large and small sampling equipment will be constructed in a paved area near Building 1131 during site mobilization. A scaled drawing of the decontamination facility is presented in Figure 4-4. 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 monitor 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 on 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 resulsts 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 the 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 monitor 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 when it was generated. Based on previous well development activity at the RA complex, 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 (non-liquid) 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 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 banks 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.

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

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 LCS, 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.

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

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.

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.

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

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, LCS, 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 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 Table 4-2.

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 these 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 PQL 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 general description of the contents (e.g. cuttings, 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, documentation, 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.

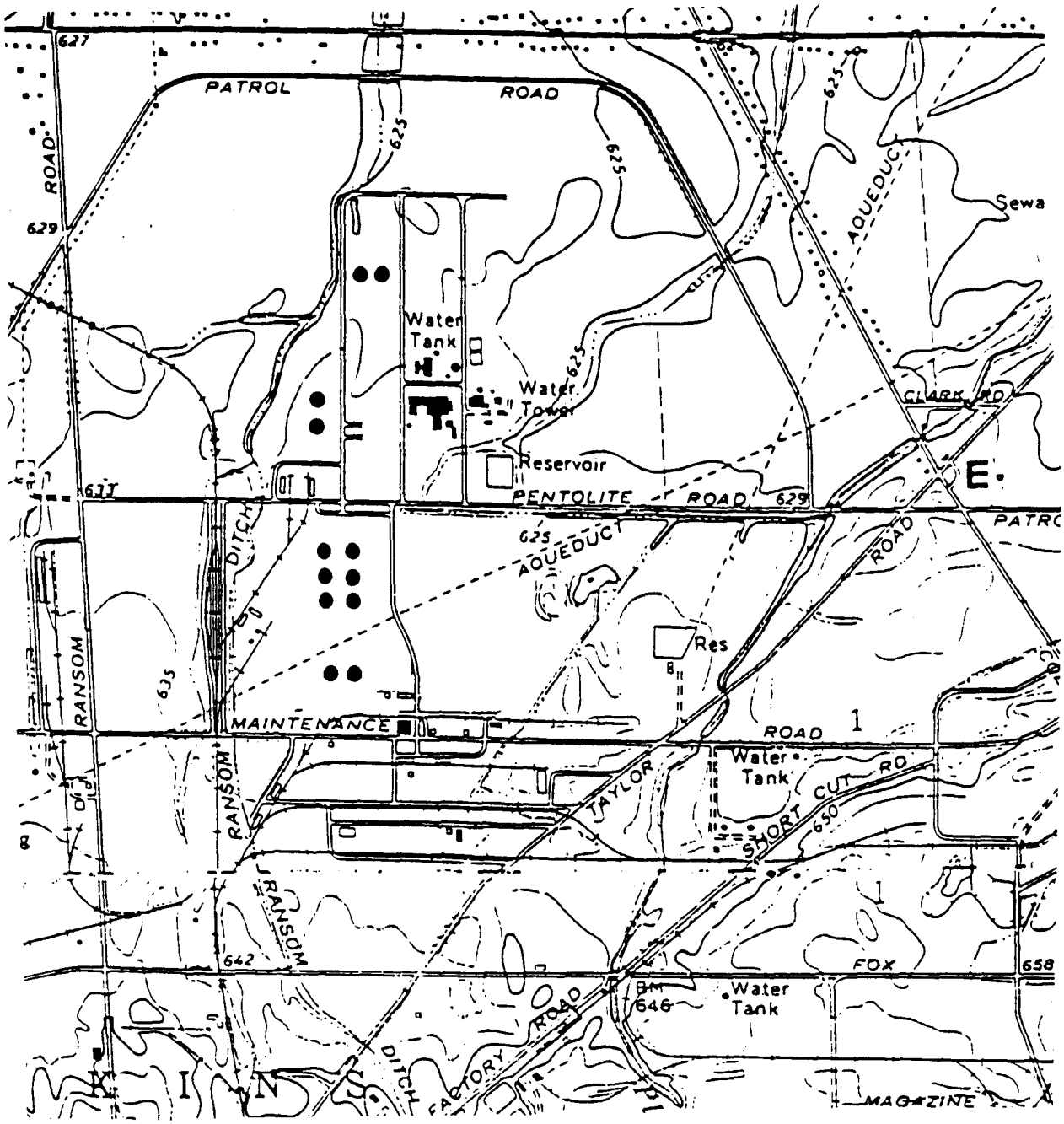
4.7.5.2.3 Sample Custody Records - All entries on the Laboratory chain-of-custody form must correspond to the Laboratory Sample Labels. The Laboratory is to maintain complete laboratory documentation measures to ensure the integrity and legal validity of all sample analytical results. These documentation 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.



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

LEGEND:

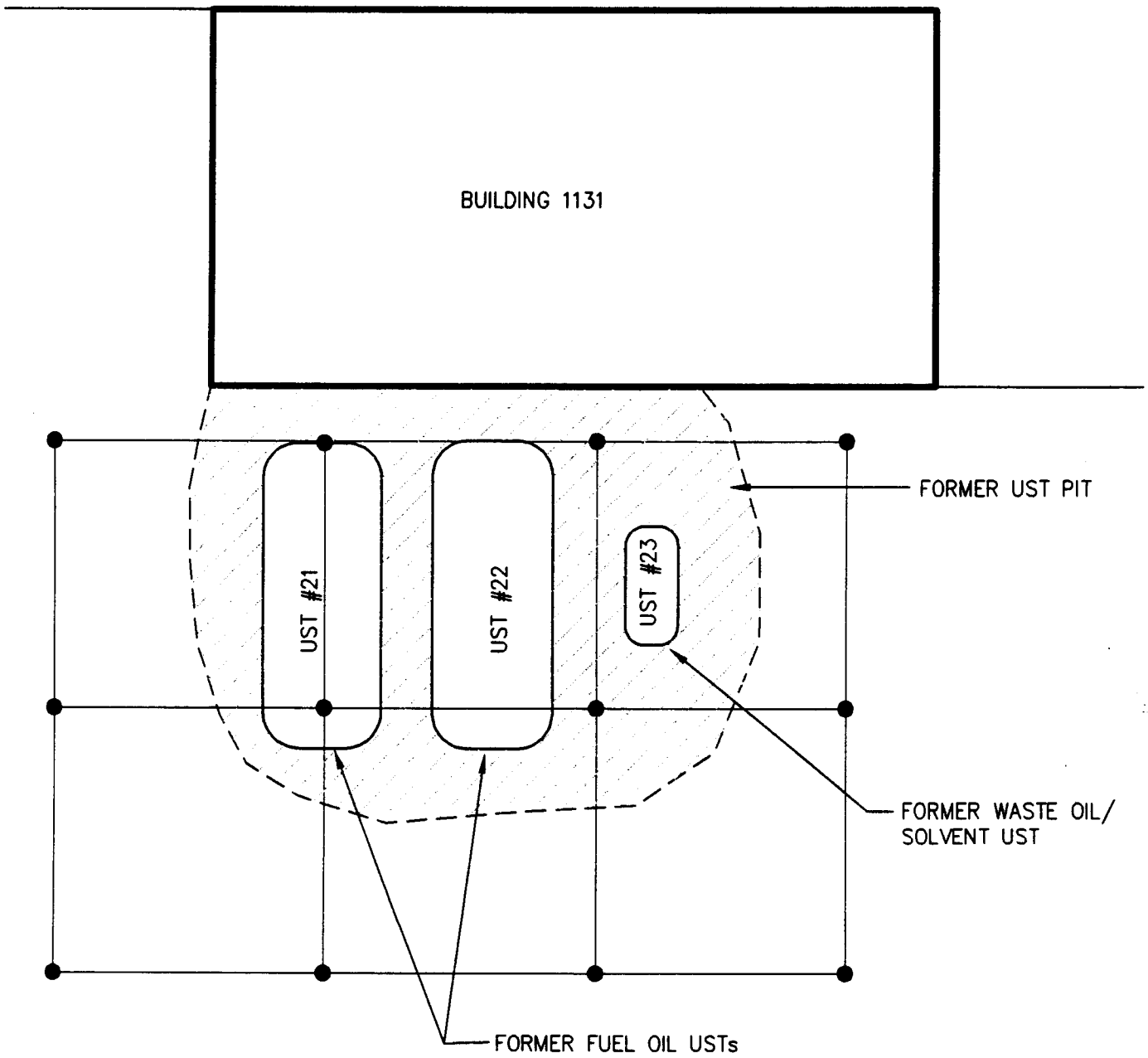
● SOIL SAMPLE LOCATION
SAMPLE INTERVAL 0-1'

NASA Lewis Research Center
Plum Brook Station
Reactor Area

Figure 4-1
Background Soil
Sampling Locations

URS CONSULTANTS

M:\8705900\C\ IOR\FIG4-1



LEGEND:

● SOIL SAMPLING LOCATION
SAMPLE COLLECTION INTERVALS
6-8' AND 10-12'

16' GRID

0 20'
SCALE 1" = 20'
0 2.4 4.8 7.2M
SCALE 1CM = 2.4M

NASA Lewis Research Center
Plum Brook Station
Reactor Area

Figure 4-2
Site Sample
Locations

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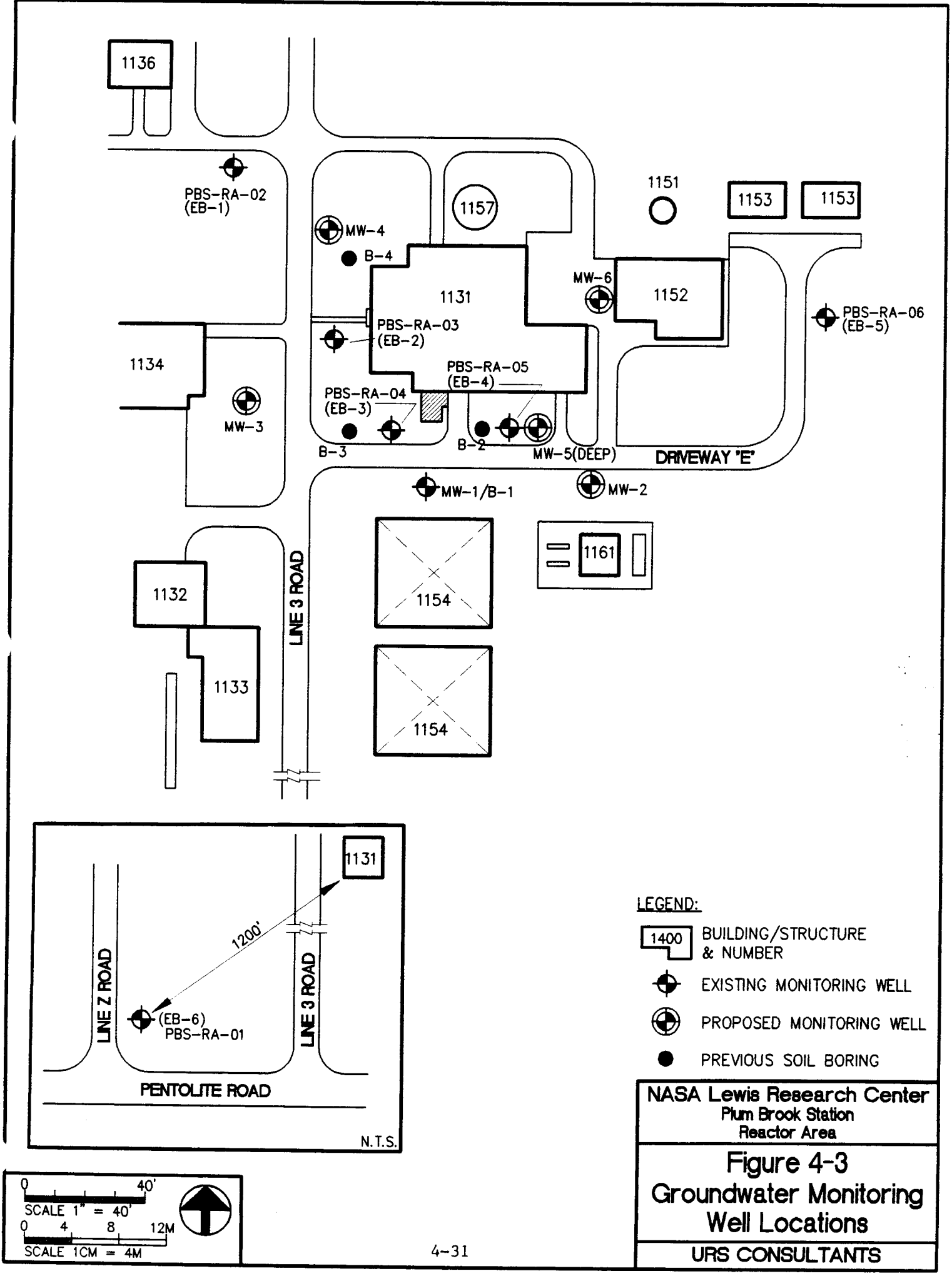
M:\8705900\ .CTOR\FIG4-2


1136
PBS-RA-02
(EB-1)
1157
1151
1153
1153
MW-4
B-4
1131
MW-6
1152
PBS-RA-06
(EB-5)
PBS-RA-03
(EB-2)
1134
PBS-RA-05
(EB-4)
PBS-RA-04
(EB-3)
MW-3
B-3
B-2
MW-5(DEEP)
DRIVEWAY "E"
MW-1/B-1
MW-2
1161
1132
LINE 3 ROAD
1154
1133
1154
1131
1200'
LINE Z ROAD
(EB-6)
PBS-RA-01
LINE 3 ROAD
PENTOLITE ROAD
N.T.S.
LEGEND:
1400
BUILDING/STRUCTURE
& NUMBER
EXISTING MONITORING WELL
PROPOSED MONITORING WELL
PREVIOUS SOIL BORING
0
40'
SCALE 1" = 40'
0
4
8
12M
SCALE 1CM = 4M
NASA Lewis Research Center
Plum Brook Station
Reactor Area
Figure 4-3
Groundwater Monitoring
Well Locations
URS CONSULTANTS
CTOR\FIG4-3
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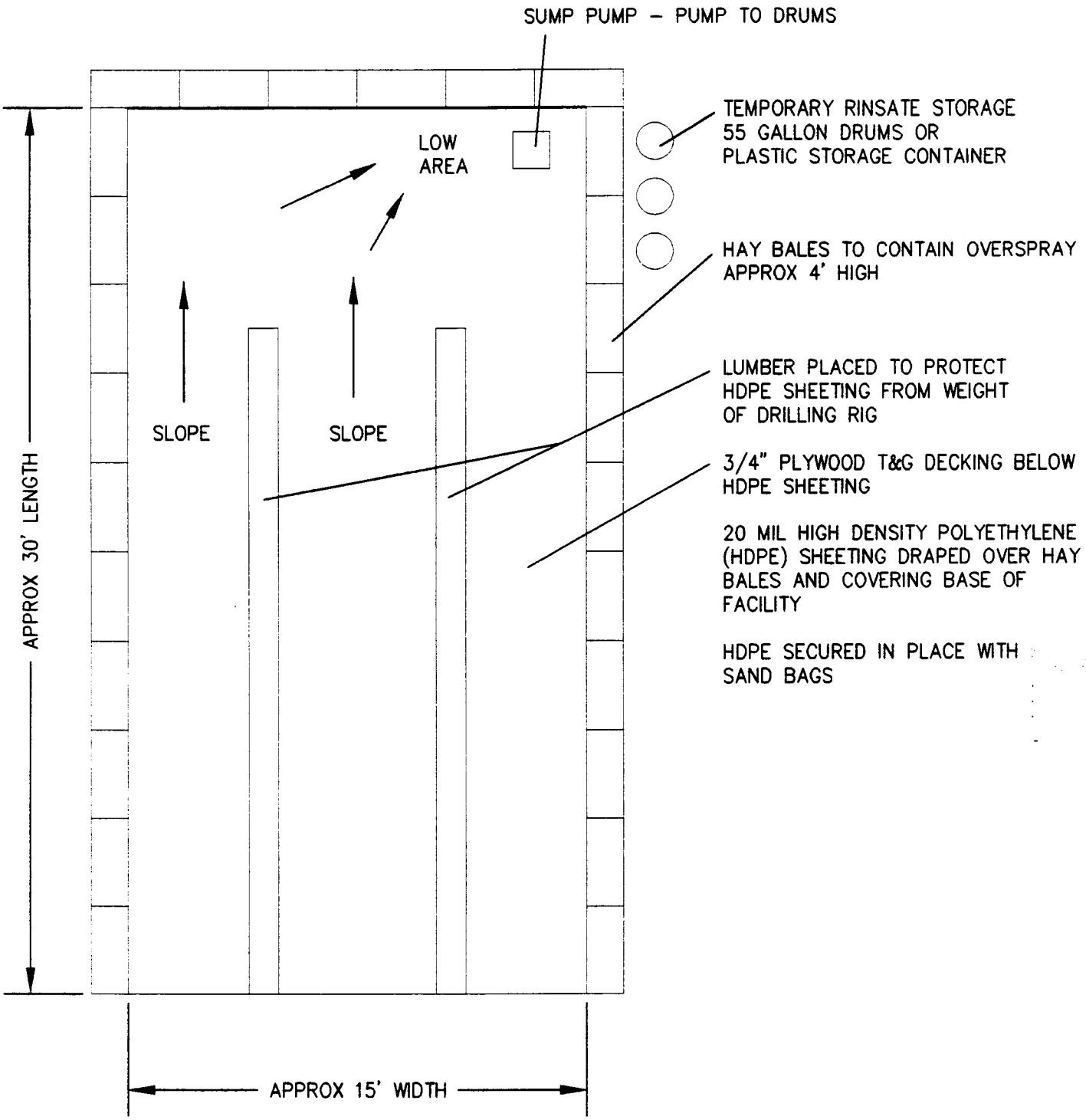

NASA Lewis Research Center
Plum Brook Station
Reactor Area

Figure 4-4
Decontamination
Facility

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

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Table 4-1

Summary of Laboratory Analysis
Reactor Area, Plum Brook Station

MEDIA TYPE	SAMPLE PARAMETER	SAMPLE METHOD[1,2]
Background Soil Samples	**RCRA Metals**	**RCRA Metals**
	arsenic	SW7060
	lead	SW6010
	barium	SW6010
	mercury	SW7471
	cadmium	SW6010
	selenium	SW7740
	chromium	SW6010
	silver	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 4-2

Summary of QA/QC Samples for Background and Site Samples
Reactor 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	10	1	1	1	1	14
	Semivolatiles	10	1	1	0	1	13
	Metals (8 RCRA)	10	1	1	0	1	13
	pH	10	1	1	0	1	13
Soil	Volatiles	24	3	3	3	4	37
	Semivolatiles	24	3	3	0	4	34
	Metals (8 RCRA)	36	4	4	0	4	48
	pH	36	0	4	0	0	40

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: Table 4-2 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.

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Table 4-3

Method Detection Limits (MDL)/Practical Quantitation Limits (PQL)
Volatiles by GC/MS
Reactor 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

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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)
Dichlorodifluoromethane	75-71-8	0.10	0.50	1	5
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

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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
Reactor 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

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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

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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

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Table 4-5

Method Detection Limits (MDL)/Practical Quantitation Limits (PQL)
Total Metals by ICP/AA
Reactor 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 QPL 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

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Table 4-6

Practical Quantitation Limits (PQL)
Miscellaneous Analytical Parameters
Reactor 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

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Table 4-7

F001-F005 Spent Solvents
Treatment Standards
Reactor 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
1,1,2-Trichloroethane	79-00-5	6.0

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Table 4-7 (Continued)

Target Analyte	CAS Number	Treatement Standard
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) Reactor 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

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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
Reactor 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

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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

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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

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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

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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 this site exceeds OEPA recommended risk levels. If the proposed sampling confirms the need for remediation, and 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 in this characterization process 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 Site: The risk assessment will include all organic chemicals which NASA has determined could reasonably have been managed in the waste tank plus those chemicals which Ohio EPA personnel indicated, during a meeting June 28, 1995, that they believe potentially could have been managed in the waste tank. 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 the tables in Section 5.0 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 tank 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 this site 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 volatile organic chemicals (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:

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

A roughness height (Z_0) of 0.1m based on the terrain at the site is assumed.

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). Table 5-1 summarizes 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 5-2.

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 this site are summarized in Table 5-3.

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-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. Table 5-4 provides the currently available toxicity values and weight-of-evidence classification for those chemicals preliminarily identified as chemicals of concern at this site.

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). Table 5-3 includes these values for potential chemicals of concern identified for this site.

Table 5-4 indicates 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 will also 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 the 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
Reactor 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	--	--
sec-Butylbenzene	135-98-8	1.14E-02	--	--
tert-Butylbenzene	98-06-6	1.17E-02	--	--
Carbon tetrachloride	56-23-5	2.41E-02	4.39E+02	9.45E-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
1,2-Dichlorobenzene	95-50-1	2.95E-03	1.70E+03	7.79E-02
1,3-Dichlorobenzene	541-73-1	3.24E-03	--	7.79E-02
1,4-Dichlorobenzene	106-46-7	4.30E-03	1.70E+03	7.79E-02
Dichlorodifluoromethane	75-71-8	2.77E+00	5.80E+01	9.91E-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
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
Dichlorofluoromethane	75-45-6	--	--	--
Hexachlorobutadiene	87-68-3	--	2.90E+04	--
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-01
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
1,2,3-Trichloropropane	96-18-4	3.39E-04	--	--
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 5-2

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 5-3

Summary of Dermal Values for Potential Chemicals of Concern
Reactor 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
sec-Butylbenzene	135-98-8	0.25	1.00E+00	--
tert-Butylbenzene	98-06-6	0.25	1.00E+00	--
Carbon tetrachloride	56-23-5	0.25	5.00E-01	2.24E-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
1,2-Dichlorobenzene	95-50-1	0.25	1.00E+00	6.10E-02
1,3-Dichlorobenzene	541-73-1	0.25	1.00E+00	8.70E-02
1,4-Dichlorobenzene	106-46-7	0.25	1.00E+00	6.20E-02
Dichlorodifluoromethane	75-71-8	0.25	5.00E-01	1.20E-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
Dichlorofluoromethane	75-45-6	0.25	1.00E+00	--
Hexachlorobutadiene	87-68-3	0.1	1.00E+00	1.21E-01
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
1,2,3-Trichloropropane	96-18-4	0.1	1.00E+00	--
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 5–4

Summary of Toxicity Values for Potential Chemicals of Concern
Reactor 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	--
sec–Butylbenzene	135–98–8	--	--	--	--	--	--	--
tert–Butylbenzene	98–06–6	--	--	--	--	--	--	--
Carbon tetrachloride	56–23–5	7.00E–04	7.00E–03(c)	--	--	B2	1.30E–01	5.30E–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
1,2–Dichlorobenzene	95–50–1	9.00E–02	9.00E–01(c)	5.70E–02	5.70E–01	D	--	--
1,3–Dichlorobenzene	541–73–1	--	--	--	--	D	--	--
1,4–Dichlorobenzene	106–46–7	--	--	2.30E–01	7.10E–01	B2	2.40E–02	--
Dichlorodifluoromethane	75–71–8	2.00E–01	9.00E–01	5.70E–02	5.70E–01	--	--	--
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
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	--	--	--	--	--
Dichlorofluoromethane	75–45–6	--	--	1.40E+01	--	--	--	--
Hexachlorobutadiene	87–68–3	2.00E–04	2.00E–03(c)	--	--	C	7.80E–02	7.80E–02
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
1,2,2–Tetrachloroethane	79–34–5	--	--	--	--	C	2.00E–01	2.00E–01
etrachloroethene	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–Trichlorobenzene	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	--	--
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	--	--	--
1,2,3–Trichloropropane	96–18–4	6.00E–03	6.00E–02	--	--	--	--	--
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 this site, 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 site. 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 this 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 soil is estimated to be 3000 cubic yards. Upon excavation, soils will be placed directly into

semi-dump trailers and transported for disposal or placed in roll-off boxes that are lined with at least 10 mil of seamless or seamed, leaktight polyethylene and accumulated on site prior to disposal. Soil in the roll-off boxes will be covered with a minimum 20 mil of polyethylene or an equivalent leaktight covering to prevent precipitation from infiltrating soils and to prevent wind dispersal. The roll offs will be labeled and dated in accordance with RCRA generator standards and will be kept covered. No containers of hazardous waste soil will be kept on site for greater than 90 days.

During demolition of asphalt and concrete surfaces and excavation of soil, some dust and particulate matter can be expected to be generated, but it is expected to be minimal. Appropriate dust control measures such as water sprays will be implemented as necessary. Additional controls may include the use of covers over the excavation areas and the use of other dust suppressors. As an added control measure, excavation activities would be stopped and the excavation area covered during periods of high wind.

The excavated soil will be removed from the site and may be landfilled (if it is not land banned) or it may be treated. For soils that are not excavated from hot spots and disposed off site in a permitted landfill, the most likely treatment options are thermal desorption or incineration. These treatment options are described below.

6.1.2.1.1 Thermal Desorption - Thermal desorption is a separation technology that removes volatile and semi-volatile organics from the soil matrix through low temperature (300 to 700 degrees F) heating. Many thermal desorption units are mobile and can be used on site. The excavated soil is fed to the unit, which is heated to the temperature necessary to volatilize the contaminants present. Pretreatment of the soil and post treatment of the vapors may be necessary.

Sizing or grinding of the soil particles may be necessary prior to thermal treatment. Also, large objects are screened out at this time. The soil is then fed to the thermal treatment component, which is usually a rotary kiln. Here the soil is heated to a temperature sufficient for volatilization but lower than the combustion temperature. The off-gasses are either incinerated in an after burner or condensed, concentrating the organics in a liquid phase for recovery or disposal. The treated soils can be backfilled into the original excavation if required treatment levels and land disposal restriction standards are reached. All soil handling will be conducted in a manner that minimizes generation of dust and prevents spillage.

The thermal desorption process can be used to treat soils contaminated with volatile and semi-volatile organics. High concentrations of oil and grease will decrease the processing rate. Metals are not treated in this process. This process is best suited to cohesionless soil such as gravel, sand and silt and is less applicable to high clay content or high water content soils. The soil at this site is sand and silt with low clay content making this technology possible.

6.1.2.1.2 Incineration - Incineration is the high temperature (greater than 1800 degrees F) destruction of organic constituents and the media via complete combustion. The incineration unit consists of the feed handling system, the primary and secondary combustion chambers, the air pollution control system and the ash handling system. The 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 help determine if this remediation option is feasible, approximately four of the site soil samples collected from the highest contaminated areas will be analyzed for physical characteristics and additional chemical parameters including nutrient concentrations. These parameters are listed in Table 4-1. To further evaluate the feasibility of the technology, a vapor extraction pilot study can be performed. The pilot test will determine the areal extent of influence of the vapor extraction well and estimate removal rates. This information will be used to design a full scale system and predict the length of the remediation effort. The need for air permits and effluent treatment will also be determined from the results of the pilot study. The pilot study will necessitate installing a vapor extraction well in the unsaturated zone along with sufficient monitoring points to collect monitoring data.

6.1.3 Conclusions

Currently, the extent of contamination at the site has not been defined. Based on current data, the most likely soil remediation techniques have been discussed in the previous section. If, after the extent of contamination has been defined, these options are still appropriate, a soil vapor extraction pilot study will be performed.

6.2 GROUNDWATER REMEDIATION

6.2.1 Introduction

Currently, very little is known about the presence or extent of groundwater contamination at this site. Also, very little is known about the hydrogeologic conditions of this aquifer. If it is determined that groundwater remediation is necessary, slug tests and pilot studies will be performed to determine the most feasible option. Based on current information, the following options are the most likely. However, other options may be considered.

6.2.2 Options

6.2.2.1 Air Sparging

Air sparging is the process of injection of air into the saturated zone. The injected air moves outward and upward from the point of injection through the pores of the saturated zone. VOCs will partition into the vapor phase from the groundwater or saturated soil. The VOCs are transported with the air to the unsaturated zone where they can be removed by a soil vapor extraction system. The injection of air also enhances any in-situ biodegradation by adding necessary oxygen. Multiple air sparging points can be installed to maximize treatment efficiency.

Air sparging is most applicable to VOCs but can also be effective on less volatile compounds if they can be aerobically biodegraded. Air sparging is most effective in highly permeable soils with no horizontal barriers, such as a clay layer, which would prevent upward migration of the volatilized compounds.

An air sparging pilot study can be performed to determine the feasibility of this remediation technique. The pilot study will determine the areal extent of influence of the sparging well and define the operating parameters and the equipment needs. This information will be used

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.

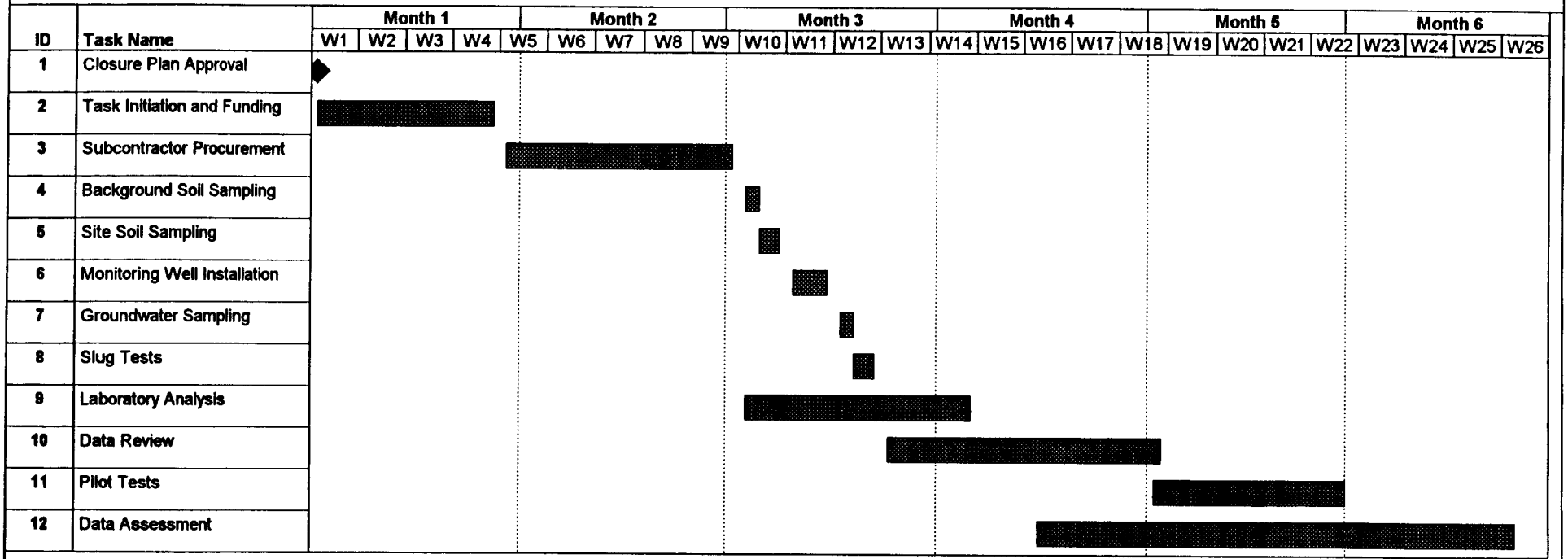
7.0 CLOSURE SCHEDULE

Implementation of this Work Plan for the Closure of the RA complex waste management unit is expected to commence upon Ohio EPA 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 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
Reactor Area, Plum Brook Station



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

Task Progress Milestone

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8.0 AMENDMENT OF WORK PLAN

NASA fully expects to implement this closure plan as described in Section 3.0 and in accordance with the schedule in Section 7.0. A number of issues may arise during the implementation of this Closure Work 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;
- If additional sampling reveals site conditions 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 unit at the RA complex 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/her 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 Reactor Area will not be utilized in the future for the storage of hazardous waste or fuels. The 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 Site Closure Assessment for Tanks 21, 22 and 23, EBASCO Environmental, 1990

CLOSURE ASSESSMENT FOR TANKS 21, 22, AND 23
AT PLUM BROOK STATION
SANDUSKY, OHIO

FOR

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LEWIS RESEARCH CENTER
CLEVELAND, OHIO

PREPARED BY:

EBASCO ENVIRONMENTAL
5000 BRADENTON AVENUE, SUITE 200
DUBLIN, OHIO 43017

MAY 1990

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1.0 Introduction

On December 28, 1989 the permanent closure by removal of three (3) underground storage tanks (USTs) was performed at the NASA Plum Brook Station near Sandusky, Ohio. The tanks removed were Tank 21, Tank 22, and Tank 23. These tanks were located adjacent to the southern side of Building 1131, which is in the Reactor Facility area. Figure 1 shows the location of the Reactor Area within the boundaries of the Plum Brook Station. The tanks were adjacent to one another, lying in a north-south direction. Figure 2 shows the locations of the removed tanks relative to Building 1131. Tank 21 and Tank 22 were 7900 gallon fuel oil tanks which were not in use prior to their removal. Tank 23 was a 500 gallon waste oil tank which had been in use until the time of removal. These tanks were installed in 1961 and were constructed of steel.

Mr. Edwin Maglott of the State Fire Marshall's Office and Ms. Pamela Doerner of the Ohio Environmental Protection Agency were on site to oversee the removal of the USTs. Representatives of NASA Plum Brook Station, Warner Osborn Pardee and Turner Construction were also on site to monitor the removal of the USTs.

2.0 Tank Removal

The tops of the tanks were approximately six feet below grade. The soil from the surface to a depth of approximately eight feet was removed and placed in containment areas. These areas consisted of two roll off boxes and an area located approximately 100 yards east of the tank pit which was covered with plastic sheeting and bounded by hay bails. All soil excavation and tank removals were performed by Independence Excavating of Cleveland, Ohio, who was retained as a subcontractor to Turner Construction Company of Cleveland, Ohio.

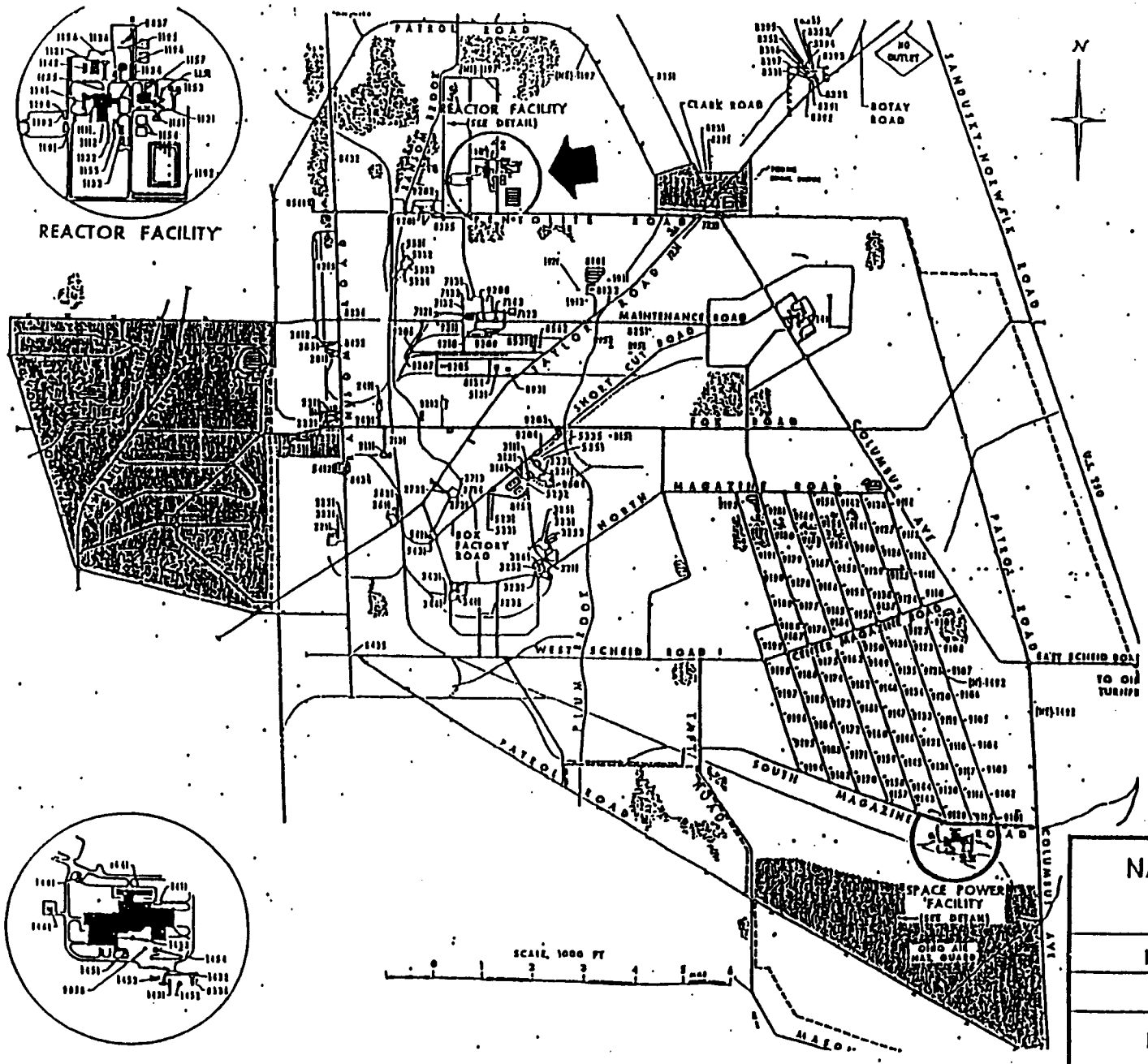
The three (3) USTs were cleaned prior to their removal. Before Tank No. 23 was cleaned, approximately 250 gallons of waste oil was removed and placed in 55 gallon drums. The cleaning of the USTs was performed by Clean Harbors of Cleveland, Ohio.

The three USTs were removed after the tank cleaning was completed. The pit appeared to contain a water-oil mixture after the tanks were removed. Two concrete slabs ran in an east-west direction beneath the tanks. These two concrete slabs were removed after the USTs were removed.

3.0 Sampling and Analysis

A total of eleven (11) soil samples were taken for this assessment. Eight (8) samples of the soils underlying the tanks were taken to detect the presence of any past or ongoing leaks. Three (3) samples of the tank cover soil were taken to determine if there had been appreciable surface spillage, overfilling or piping failures. An alphanumeric sample identification number encoded each sample's site location (Plum Brook Station), the building location (Building 1131), the sample medium (soil sample), and the sample number. Each sample was numbered sequentially, with the six samples taken from the pit bottom being samples PBS-1131-SS-1 through SS-6. Samples SS-7, SS-8 and SS-9 were taken from soil excavated prior to the removal of the USTs. Samples SS-10 and SS-11 were taken from the pit bottom after an additional 3-4 feet of soil was removed. Figure 2 shows the locations of the soil samples taken from the excavated area. The locations are shown relative to the locations of the three removed tanks.

The first set of samples (SS-1 through SS-6) was taken after the three (3) USTs and the concrete slabs were removed. Because the pit bottom soil was very unconsolidated after the removal of the tanks and concrete slabs direct sampling of the pit bottom was not possible. The soil samples

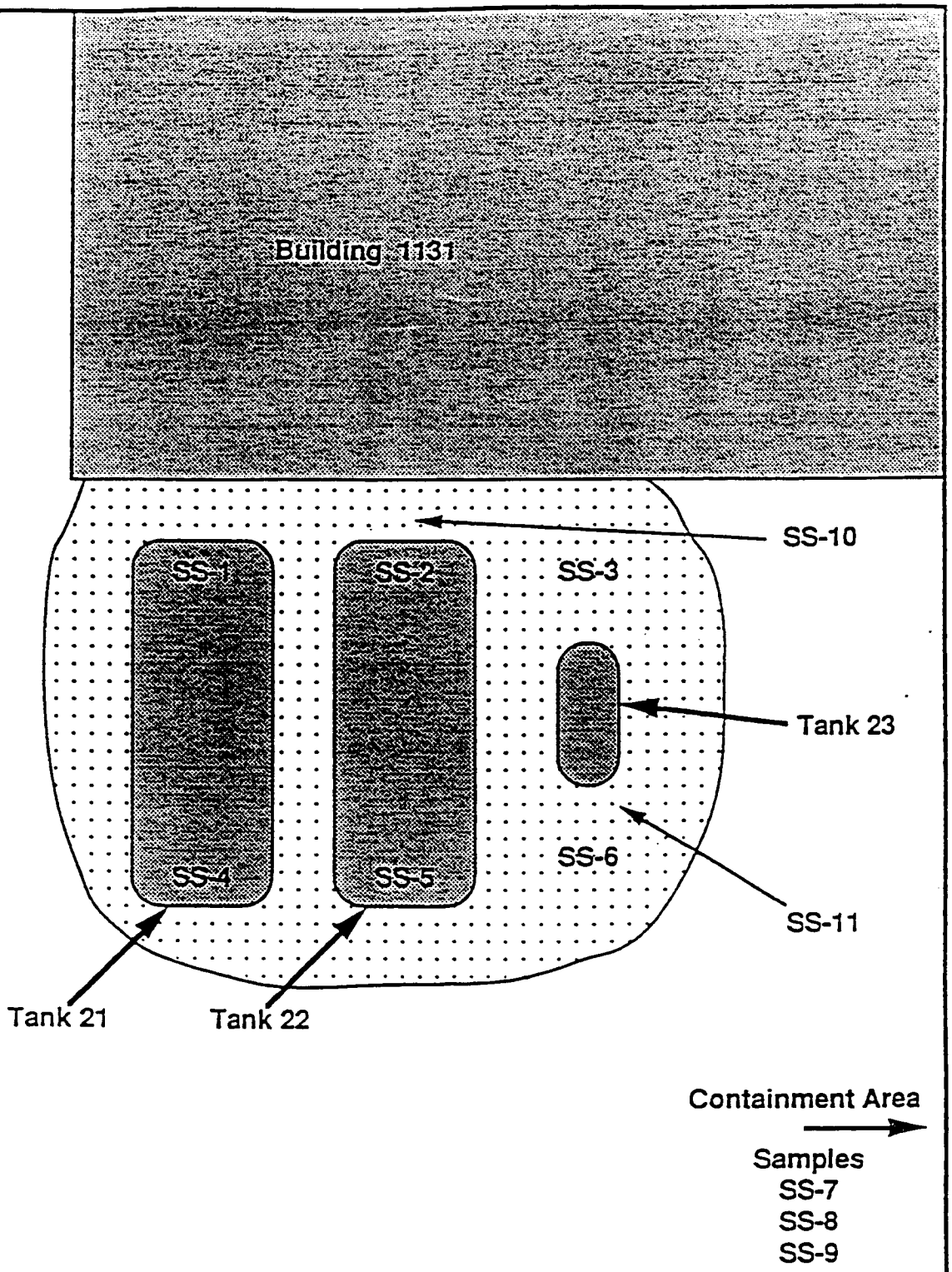


NASA Plum Brook Station
Building 1131

EBASCO ENVIRONMENTAL

FIGURE 1

Map of Plum Brook Station
Showing the Reactor Area



Buildings

Excavated Tank Pit

Locations of Excavated Tanks

SS-4 Soil Sample Locations

North

Not to Scale

NASA Plum Brook Station
Building 1131

EBASCO ENVIRONMENTAL

FIGURE 2

Locations of Removed Underground Storage Tanks and Soil Sampling Points

were taken using the backhoe bucket to remove soil from the appropriate area of the pit bottom. Samples SS-1 through SS-6 were taken in this manner. Samples SS-1 through SS-6 were analyzed for Total Petroleum Hydrocarbons (TPH) (EPA Method # 418.1), volatile organics (EPA Method # 524.2), EP Toxicity for lead (EPA Method # 200.7), and flashpoint (American Society for Testing Materials Method # D-93).

As the samples were taken from the pit bottom, they were screened with an HNu photoionization detector to determine if there were non-methane volatile organics emanating from the soil samples. Table 1 shows the HNu readings for the samples taken from the pit bottom.

Table 1

HNu Readings for Samples SS-1 through SS-6

Sample I.D. Number	HNu Reading (ppm)
PBS-1131-SS-1	Not Taken
PBS-1131-SS-2	2.0
PBS-1131-SS-3	0.6
PBS-1131-SS-4	0.6
PBS-1131-SS-5	3.0
PBS-1131-SS-6	1.8
Background Range	0.0-0.1

Although there is not a direct correlation between HNu readings and the laboratory analytical results with regard to the degree of contamination, the HNu is useful in that it gives an indication as to whether volatile contamination is present in the soil sample.

Samples SS-7, SS-8 and SS-9 were taken from the soil excavated prior to the removal of the USTs. These samples were taken from the containment area east of Building 1131. Samples SS-7 through SS-9 were analyzed for TPH, volatile organics, EP Toxicity for lead, and flashpoint. HNu readings for samples SS-7, SS-8 and SS-9 were measured at background levels. This soil had been excavated on the previous day and therefore some volatilization of this soil may have already occurred.

Due to the apparent contamination, indicated by both the HNu readings and visual inspection of the tank, it was determined that additional soil would be removed before the excavation was backfilled. However, no additional soil was removed on December 28th, due to a lack of sufficient containment capacity. On December 29th additional containment areas were set up. Approximately 3-4 feet of additional soil was removed from the pit bottom. The depth of the excavation was approximately 13 feet after the additional excavation was completed. The soil at this depth was a consistent, well consolidated gray clay.

Two samples (SS-10 and SS-11) were taken from the pit bottom after the additional soil was removed Figure 2 shows the sample locations. Sample SS-10 was taken along the northern side of the pit were it appeared that the excavated soils had been discolored, possibly due to contamination from the excavated USTs. Sample SS-11 was taken along the eastern side of the pit beneath the previous location of the waste oil tank. Both samples had background readings when screened with the HNu. Both samples were analyzed for TPH and volatile organics.

4.0 Laboratory Results

All eleven of the soil samples were analyzed for TPH and volatile organics. Samples PBS-1131-SS-1 through SS-9 were analyzed for flashpoint and EP Toxicity for lead. Appendix A contains the complete set of laboratory data. The extracted lead in each of the samples was below the detection limit of 500 micrograms per liter. The flashpoint of all of the samples exceeded 200° F. The TPH concentrations for the eleven soil samples are listed in Table 2.

Table 2

Total Petroleum Hydrocarbons Concentrations for Samples SS-1 through SS-11

Sample I.D. Number	TPH Concentration (mg/kg)
PBS-1131-SS-1	1980
PBS-1131-SS-2	293
PBS-1131-SS-3	190
PBS-1131-SS-4	U
PBS-1131-SS-5	3050
PBS-1131-SS-6	762
PBS-1131-SS-7	801
PBS-1131-SS-8	3570
PBS-1131-SS-9	1590
PBS-1131-SS-10	114
PBS-1131-SS-11	U

U: below detection limits

The concentrations of TPH in the excavated cover soil (SS-7, SS-8 and SS-9) and the pit bottom soil indicate that contamination of the surrounding soils has occurred. High concentrations of total petroleum hydrocarbons (801, 3570, 1590 ppm) were found in the soil which covered the tanks (SS-7, SS-8, SS-9). This would seem to indicate that at least a portion of the soil contamination was due to piping failures, overfilling and/or surface spills, and not leakage from the tanks themselves. Samples taken from the pit bottom (SS-1 through SS-6) also showed elevated levels of total petroleum hydrocarbons, although no petroleum hydrocarbons were detected in sample SS-4. Samples SS-10 and SS-11, which were taken after additional soil was removed from the tank pit, did not show elevated levels of TPH.

Volatile organics also were detected in the soil samples. These volatiles included both possible petroleum degradation products and other compounds such as chlorinated organics which could have been found in the waste oil tank. Table 3 lists the concentrations for the organic compounds which were detected in the soil samples. Thirty-six organics were detected in various samples and the concentrations ranged as high as 13,388 ug/kg for naphthalene in SS-8. Concentrations were also in the thousands of parts per billion for 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,1-dichloroethane, and total xylenes. The majority of the remaining chemicals were detected at concentrations in the hundreds of parts per billion. Most of these contaminants were detected in lower concentrations or not at all in the two soil samples which were taken after the additional soil was removed (SS-10, SS-11), although 1,1-dichloroethane, 1,2-dichloroethane, and chloroethane were detected in much higher concetrations in samples SS-10 and SS-11. Therefore, vertical contaminant migration may be limited to a few chlorinated organics.

TABLE 3
Page 1 of 2

Soil Sample Concentrations for Samples Taken at the NASA Plum Brook Station
Building 1131 (Reactor Facility) Underground Storage Tank Removals

Samples SS-1 through SS-6 were taken from the pit bottom, SS-7, SS-8, and SS-9 were taken from the excavated soils, and samples SS-10 and SS-11 were taken from the pit bottom after approximately 4 feet of additional soil was removed

Concentrations of TPH are in mg/kg and volatile concentrations are in micrograms/kg

	1131-SS-1	1131-SS-2	1131-SS-3	1131-SS-4	1131-SS-5	1131-SS-6	1131-SS-7	1131-SS-8	1131-SS-9	1131-SS-10	1131-SS-11
Total Petroleum Hydrocarbons (TPH) (mg/kg)	1980	293	190	u	3050	762	801	3570	1590	114	u
Volatile Organics (ug/kg)	**1131-SS-1**	**1131-SS-2**	**1131-SS-3**	**1131-SS-4**	**1131-SS-5**	**1131-SS-6**	**1131-SS-7**	**1131-SS-8**	**1131-SS-9**	**1131-SS-10**	**1131-SS-11**
Dichlorodiflouromethane	u	J 36	u	u	u	u	J 24	J 36	u	u	61
Chloromethane	u	u	u	u	u	u	u	u	u	u	u
Vinyl Chloride	u	u	u	u	u	u	u	u	u	u	u
Bromomethane	u	u	u	u	u	u	u	u	u	u	u
Chloroethane	u	u	u	u	u	u	u	u	u	990	105
Trichlorofluoromethane	u	J 120	u	u	u	u	J 112	u	u	u	20
1,1 Dichloroethene	u	u	u	u	u	u	u	u	u	u	u
Methylene Chloride	u	446	u	u	503	u	426	205	u	25	109
trans-1,2-Dichloroethene	u	u	u	u	u	u	u	u	u	u	17
1,1 Dichloroethane	482	4483	u	u	u	u	u	u	u	6120	673
cis-1,2 Dichloroethene	u	u	u	u	u	u	u	u	u	u	165
2,2 Dichloropropane	u	u	u	u	u	u	u	u	u	u	u
Chloroform	u	u	u	u	u	u	u	u	u	J 1	u
Bromochloromethane	u	u	u	u	u	u	u	u	u	u	u
1,1,1-Trichloroethane	197	423	891	u	u	u	u	u	J 123	u	u
1,1 Dichloropropene	u	u	u	u	u	u	u	u	u	u	u
Carbon Tetrachloride	u	u	J 91	u	u	u	u	u	u	u	u
1,2 Dichloroethane	u	u	u	u	u	u	u	u	u	178	u
Benzene	u	J 28	u	J 32	J 16	u	J 25	J 25	u	J 2	u
Trichloroethene	589	577	u	u	836	u	846	u	1019	u	997
1,2 Dichloropropane	u	u	u	u	u	u	u	u	u	u	u
Bromodichloromethane	u	u	u	J 23	u	u	u	u	u	u	u

u Undetected
J Below quantitation limits; Estimated Value

TABLE 3 Continued
Page 2 of 2

Soil Sample Concentrations for Samples Taken at the NASA Plum Brook Station
Building 1131 (Reactor Facility) Underground Storage Tank Removals

Volatile Organics (ug/kg)	1131-SS-1	1131-SS-2	1131-SS-3	1131-SS-4	1131-SS-5	1131-SS-6	1131-SS-7	1131-SS-8	1131-SS-9	1131-SS-10	1131-SS-11
Dibromomethane	u	u	u	u	u	u	u	u	u	u	u
Toluene	u	J 26	u	J 17	J 23	u	J 27	J 41	u	J 2	6
1,1,2-Trichloroethane	u	u	u	143	u	u	u	u	u	u	u
1,3 Dichloropropane	u	u	u	u	u	u	u	u	u	u	u
Tetrachloroethene	u	677	1043	u	u	u	u	u	u	u	u
Dibromochloromethane	u	u	u	u	u	u	u	u	u	u	u
1,2-Dibromomethane-EDB	u	u	u	u	u	u	u	u	u	u	u
Chlorobenzene	u	u	u	u	u	u	u	u	u	u	u
Ethylbenzene	311	431	u	1093	329	u	548	543	140	11	11
1,1,1,2-Tetrachloroethane	u	u	u	u	u	u	J 41	375	u	J 2	u
m & p -Xylenes	430	240	u	739	566	u	647	1115	J 38	19	4
o-Xylene	204	J 80	u	413	170	u	424	703	u	14	J 1
Styrene	u	u	u	u	u	u	u	u	u	u	u
1,1,2,2-Tetrachloroethane	u	u	u	194	u	463	231	283	u	5	12
Isopropylbenzene	J 84	u	u	u	128	u	176	380	u	10	u
Bromoform	u	u	u	u	u	u	u	u	u	u	u
1,2,3- Trichloropropane	u	u	u	u	u	u	u	u	u	9	u
n-Propylbenzene	235	J 71	u	u	289	u	369	612	u	12	u
Bromobenzene	u	u	u	u	u	u	u	u	u	u	u
1,3,5 Trimethylbenzene	1775	692	269	528	1685	166	2953	4365	178	106	u
4-Chlorotoluene	u	u	u	u	u	u	u	u	u	u	u
2-Chlorotoluene	u	u	u	u	u	u	u	u	u	u	u
tert-Butylbenzene	288	183	240	129	422	u	645	618	u	23	15
1,2,4 Trimethylbenzene	2470	1000	598	1122	2348	270	3909	4413	204	115	u
sec-Butylbenzene	290	125	J 67	u	430	u	682	858	u	11	u
p-Isopropyltoluene	639	337	u	u	806	u	1503	1854	u	27	u
1,3 Dichlorobenzene	u	u	u	u	u	u	u	u	u	J 2	u
1,4 Dichlorobenzene	u	u	u	u	u	u	u	u	u	J 2	u
n-Butylbenzene	u	u	u	u	u	u	u	u	u	u	u
1,2 Dichlorobenzene	u	u	u	u	u	u	u	J 31	u	u	u
Dibromo-3-Chloropropane	u	u	u	u	u	u	u	u	u	u	u
1,2,4 Trichlorobenzene	575	185	218	u	u	u	u	u	193	3	u
Hexachlorobutadiene	404	J 82	u	u	u	u	u	u	u	u	u
Naphthalene	4550	3070	3523	4935	6332	1743	7801	13388	1255	548	223
1,2,3 Trichlorobenzene	1025	143	490	385	J 45	178	J 115	198	u	5	6

u Undetected
J Below quantitation limits; Estimated Value

5.0 Discussion and Recommendations

The results of the laboratory analyses indicated that contamination of the surrounding soils has occurred. High concentrations of total petroleum hydrocarbons (TPH) were found in the majority of the soil samples, and elevated concentrations of volatile organic compounds were found in all of the soil samples. The tanks were visually inspected by the EBASCO engineer after their removal and were found to be in good condition structurally. There were no apparent holes or cracks in the tanks and there was very little visible corrosion. This would indicate that the cause of the leakage was from piping failures or overfilling. The concentrations of organics and TPH found in the soil samples were among the highest encountered at any of the tank areas sampled at Plum Brook Station.

At present, no state or federal standards are available for TPH and organic compounds in soils. Guidelines from the Ohio EPA concerning soil remediation levels have not been promulgated because of a delay in the release of similar federal standards. Although there are no soil standards at this time, representatives of both the State Fire Marshall's Bureau of Underground Storage Tank Regulation (BUSTR) and the Ohio EPA have indicated that acceptable levels of TPH in soil range from 50 - 100 mg/kg. Concentrations of TPH exceeded 700 mg/kg in 6 of the 11 samples. The analyses also indicated that numerous chlorinated organic compounds were present in the surrounding soil.

Because of the degree of contamination encountered in the soil samples taken, and also the apparent visible contamination of the tank pit bottom, additional investigation of the area surrounding this tank area is warranted. This area has been included under the scope of work for the UST Corrective Actions Remedial Investigation / Feasibility Study of the previously assessed tank areas at Plum Brook Station, being performed under Task Order 028 of NASA/Ebasco Contract Number NASW-4301.

APPENDIX B-2

Laboratory Data, UST Site Closure Assessment for Tanks 21, 22 and 23, EBASCO Environmental, 1990

HITTMAN EBASCO ASSOCIATES, INC.
ANALYTICAL REPORT
SAMPLE RESULTS

CLIENT: NASA PLUMBROOK

CONTRACT NO: ESI-7019-006

REPORTING DATE: 24-Jan-90

REPORT PREPARED BY LP

DATA RELEASED BY EAP

CLIENT ID	HEAI ID	LEAD(ug/l in leachate)	FLASHPOINT(°F)
PBS.1131.SS.1	8692	<500	NO FLASH @ <200°
PBS.1131.SS.2	8693	<500	NO FLASH @ <200°
PBS.1131.SS.3	8694	<500	NO FLASH @ <200°
PBS.1131.SS.4	8695	<500	NO FLASH @ <200°
PBS.1131.SS.5	8696	<500	NO FLASH @ <200°
PBS.1131.SS.6	8697	<500	NO FLASH @ <200°

HITTMAN EBASCO ASSOCIATES, INC.
ANALYTICAL REPORT
SAMPLE RESULTS

CLIENT: NASA PLUMBROOK

REPORT PREPARED BY KH

CONTRACT NO: ESI-7019-006

DATA RELEASED BY EAP

REPORTING DATE: 05-Jan-90

UNITS: ug/l in Leachate

CLIENT ID	HEAI ID	EPTOX LEAD	FLASHPOINT (°F)
PBS.1131.SS.7	8689	<500	NO FLASH AT <200°
PBS.1131.SS.8	8690	<500	NO FLASH AT <200°
PBS.1131.SS.9	8691	<500	NO FLASH AT <200°

HITTMAN EBASCO ASSOCIATES, INC.
ANALYTICAL REPORT
SAMPLE RESULTS

CLIENT: NASA PLUMBROOK

REPORT PREPARED BY KH

CONTRACT NO: ESI-7019-006

DATA RELEASED BY EAD

REPORTING DATE: 05-Jan-90

UNITS: mg/Kg

CLIENT ID	HEAI ID	TPH	% SOLIDS
PBS.1131.SS.1	8692	1980	82.4
PBS.1131.SS.2	8693	293	80.2
PBS.1131.SS.3	8694	190	80.1
PBS.1131.SS.4	8695	<39	83.3
PBS.1131.SS.5	8696	3050	82.8
PBS.1131.SS.6	8697	762	81.5
PBS.1131.SS.7	8698	801	84.0
PBS.1131.SS.8	8699	3570	81.0
PBS.1131.SS.9	8700	1590	78.2

HITTMAN EBASCO ASSOCIATES, INC.
ANALYTICAL REPORT
SAMPLE RESULTS

CLIENT: NASA PLUMBROOK

REPORT PREPARED BY KH

CONTRACT NO: ESI-7019-006

DATA RELEASED BY EAP

REPORTING DATE: 10-Jan-90

UNITS: mg/Kg

CLIENT ID	HEAI ID	TPH	% SOLIDS
PBS.1131.SS.10	27	114	79.2
PBS.1131.SS.11	28	<40	80.6

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

Lab Data File:	>AA063	Method Number:	524.2M
Lab Sample Name:	HEAI#8680 PBS1131SS1	Date Analyzed:	900110
Matrix:	Soil	Date Collected:	891228
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul 524.2,4gm/100 UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit
Dichlorodifluoromethane		125. U
Chloromethane		125. U
Vinyl Chloride		125. U
Bromomethane		125. U
Chloroethane		125. U
Trichlorofluoromethane		125. U
1,1-Dichloroethene		125. U
Methylene Chloride		125. U
trans-1,2-Dichloroethene		125. U
1,1-Dichloroethane	482.	
cis-1,2-Dichloroethene		125. U
2,2-Dichloropropane		125. U
Chloroform		125. U
Bromochloromethane		125. U
1,1,1-Trichloroethane	197.	
1,1-Dichloropropene		125. U
Carbon Tetrachloride		125. U
1,2-Dichloroethane		125. U
Benzene		125. U
Trichloroethene	589.	
1,2-Dichloropropane		125. U
Bromodichloromethane		125. U
Dibromomethane		125. U
Toluene		125. U
1,1,2-Trichloroethane		125. U
1,3-Dichloropropane		125. U
Tetrachloroethene		125. U
Dibromochloromethane		125. U
1,2-Dibromoethane - EDB		125. U
Chlorobenzene		125. U
Ethylbenzene	311.	
1,1,1,2-Tetrachloroethane		125. U
m + p-Xylenes	430.	

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

Lab Data File:	>AA063	Method Number:	524.2M
Lab Sample Name:	HEAI#8680 PBS1131SS1	Date Analyzed:	900110
Matrix:	Soil	Date Collected:	891228
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul 524.2,4gm/100 UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene	204.		
Styrene		125.	U
1,1,2,2-Tetrachloroethane		125.	U
Isopropylbenzene	84.		J
Bromoform		125.	U
1,2,3-Trichloropropane		125.	U
n-Propylbenzene	235.		
Bromobenzene		125.	U
1,3,5-Trimethylbenzene	1775.		
4-Chlorotoluene		125.	U
2-Chlorotoluene		125.	U
tert-Butylbenzene	288.		
1,2,4-Trimethylbenzene	2470.		
sec-Butylbenzene	290.		
p-Isopropyltoluene	639.		
1,3-Dichlorobenzene		125.	U
1,4-Dichlorobenzene		125.	U
n-Butylbenzene		125.	U
1,2-Dichlorobenzene		125.	U
1,2-Dibromo-3-Chloropropane		125.	U
1,2,4-Trichlorobenzene	575.		
Hexachlorobutadiene	404.		
Naphthalene	4550.		
1,2,3-Trichlorobenzene	1025.		

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

Lab Data File:	>AA050	Method Number:	524.2M
Lab Sample Name:	HEAI#8681 PBS1131SS2	Date Analyzed:	900109
Matrix:	Soil	Date Collected:	891223
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul 524.2,4gm/100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane	36.		J
Chloromethane		125.	U
Vinyl Chloride		125.	U
Bromomethane		125.	U
Chloroethane		125.	U
Trichlorofluoromethane	120.		J
1,1-Dichloroethene		125.	U
Methylene Chloride	446.		
trans-1,2-Dichloroethene		125.	U
1,1-Dichloroethane	4483.		
cis-1,2-Dichloroethene		125.	U
2,2-Dichloropropane		125.	U
Chloroform		125.	U
Bromochloromethane		125.	U
1,1,1-Trichloroethane	423.		
1,1-Dichloropropene		125.	U
Carbon Tetrachloride		125.	U
1,2-Dichloroethane		125.	U
Benzene	28.		J
Trichloroethene	577.		
1,2-Dichloropropane		125.	U
Bromodichloromethane		125.	U
Dibromomethane		125.	U
Toluene	26.		J
1,1,2-Trichloroethane		125.	U
1,3-Dichloropropane		125.	U
Tetrachloroethene	677.		
Dibromochloromethane		125.	U
1,2-Dibromoethane -- EDB		125.	U
Chlorobenzene		125.	U
Ethylbenzene	431.		
1,1,1,2-Tetrachloroethane		125.	U
m + p-Xylenes	240.		

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

Lab Data File:	>AA050	Method Number:	524.2M
Lab Sample Name:	HEAI#8681 PBS1131SS2	Date Analyzed:	500109
Matrix:	Soil	Date Collected:	891228
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul 524.2,4gm/100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene	80.		J
Styrene		125.	U
1,1,2,2-Tetrachloroethane		125.	U
Isopropylbenzene		125.	U
Bromoform		125.	U
1,2,3-Trichloropropane		125.	U
n-Propylbenzene	71.		J
Bromobenzene		125.	U
1,3,5-Trimethylbenzene	692.		
4-Chlorotoluene		125.	U
2-Chlorotoluene		125.	U
tert-Butylbenzene	183.		
1,2,4-Trimethylbenzene	1000.		
sec-Butylbenzene	125.		
p-Isopropyltoluene	337.		
1,3-Dichlorobenzene		125.	U
1,4-Dichlorobenzene		125.	U
n-Butylbenzene		125.	U
1,2-Dichlorobenzene		125.	U
1,2-Dibromo-3-Chloropropane		125.	U
1,2,4-Trichlorobenzene	185.		
Hexachlorobutadiene	82.		J
Naphthalene	3070.		
1,2,3-Trichlorobenzene	143.		

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

Lab Data File:	>AA064	Method Number:	S24.2M
Lab Sample Name:	HEAI#8682 PBS1131SS3	Date Analyzed:	900110
Matrix:	Soil	Date Collected:	891228
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul S24.2,4gm,100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		125.	U
Chloromethane		125.	U
Vinyl Chloride		125.	U
Bromomethane		125.	U
Chloroethane		125.	U
Trichlorofluoromethane		125.	U
1,1-Dichloroethene		125.	U
Methylene Chloride		125.	U
trans-1,2-Dichloroethene		125.	U
1,1-Dichloroethane		125.	U
cis-1,2-Dichloroethene		125.	U
2,2-Dichloropropane		125.	U
Chloroform		125.	U
Bromochloromethane		125.	U
1,1,1-Trichloroethane	891.		
1,1-Dichloropropene		125.	U
Carbon Tetrachloride	91.		J
1,2-Dichloroethane		125.	U
Benzene		125.	U
Trichloroethene		125.	U
1,2-Dichloropropane		125.	U
Bromodichloromethane		125.	U
Dibromomethane		125.	U
Toluene		125.	U
1,1,2-Trichloroethane		125.	U
1,3-Dichloropropane		125.	U
Tetrachloroethene	1043.		
Dibromochloromethane		125.	U
1,2-Dibromoethane - EDB		125.	U
Chlorobenzene		125.	U
Ethylbenzene		125.	U
1,1,1,2-Tetrachloroethane		125.	U
m + p-Xylenes		125.	U

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

Lab Data File:	>AA064	Method Number:	524.2M
Lab Sample Name:	HEAI#8682 PBS1131SS3	Date Analyzed:	900110
Matrix:	Soil	Date Collected:	891228
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul 524.2,4gm,100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		125.	U
Styrene		125.	U
1,1,2,2-Tetrachloroethane		125.	U
Isopropylbenzene		125.	U
Bromoform		125.	U
1,2,3-Trichloropropane		125.	U
n-Propylbenzene		125.	U
Bromobenzene		125.	U
1,3,5-Trimethylbenzene	269.		
4-Chlorotoluene		125.	U
2-Chlorotoluene		125.	U
tert-Butylbenzene	240.		
1,2,4-Trimethylbenzene	598.		
sec-Butylbenzene	67.		J
p-Isopropyltoluene		125.	U
1,3-Dichlorobenzene		125.	U
1,4-Dichlorobenzene		125.	U
n-Butylbenzene		125.	U
1,2-Dichlorobenzene		125.	U
1,2-Dibromo-3-Chloropropane		125.	U
1,2,4-Trichlorobenzene	218.		
Hexachlorobutadiene		125.	U
Naphthalene	3523.		
1,2,3-Trichlorobenzene	430.		

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

Lab Data File:	>AA065	Method Number:	524.2M
Lab Sample Name:	HEAI#8683 PBS1131SS4	Date Analyzed:	900110
Matrix:	Soil	Date Collected:	891228
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul 524.2,4gm,100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		125.	U
Chloromethane		125.	U
Vinyl Chloride		125.	U
Bromomethane		125.	U
Chloroethane		125.	U
Trichlorofluoromethane		125.	U
1,1-Dichloroethene		125.	U
Methylene Chloride		125.	U
trans-1,2-Dichloroethene		125.	U
1,1-Dichloroethane		125.	U
cis-1,2-Dichloroethene		125.	U
2,2-Dichloropropane		125.	U
Chloroform		125.	U
Bromochloromethane		125.	U
1,1,1-Trichloroethane		125.	U
1,1-Dichloropropene		125.	U
Carbon Tetrachloride		125.	U
1,2-Dichloroethane		125.	U
Benzene	32.		J
Trichloroethene		125.	U
1,2-Dichloropropane		125.	U
Bromodichloromethane	23.		J
Dibromomethane		125.	U
Toluene	17.		J
1,1,2-Trichloroethane	143.		
1,3-Dichloropropane		125.	U
Tetrachloroethene		125.	U
Dibromochloromethane		125.	U
1,2-Dibromoethane - EDB		125.	U
Chlorobenzene		125.	U
Ethylbenzene	1093.		
1,1,1,2-Tetrachloroethane		125.	U
m + p-Xylenes	739.		

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

Lab Data File:	>AA065	Method Number:	524.2M
Lab Sample Name:	HEAI$8683 PBS1131SS4	Date Analyzed:	900110
Matrix:	Soil	Date Collected:	891228
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul 524.2,4gm,100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit
o-Xylene	413.	
Styrene		125. U
1,1,2,2-Tetrachloroethane	194.	
Isopropylbenzene		125. U
Bromoform		125. U
1,2,3-Trichloropropane		125. U
n-Propylbenzene		125. U
Bromobenzene		125. U
1,3,5-Trimethylbenzene	528.	
4-Chlorotoluene		125. U
2-Chlorotoluene		125. U
tert-Butylbenzene	129.	
1,2,4-Trimethylbenzene	1122.	
sec-Butylbenzene		125. U
p-Isopropyltoluene		125. U
1,3-Dichlorobenzene		125. U
1,4-Dichlorobenzene		125. U
n-Butylbenzene		125. U
1,2-Dichlorobenzene		125. U
1,2-Dibromo-3-Chloropropane		125. U
1,2,4-Trichlorobenzene		125. U
Hexachlorobutadiene		125. U
Naphthalene	4935.	
1,2,3-Trichlorobenzene	385.	

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

Lab Data File:	>AA053	Method Number:	524.2M
Lab Sample Name:	HEAI#8684 PBS1131555	Date Analyzed:	900109
Matrix:	Soil	Date Collected:	891229
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul 524.2,4gm,100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		125.	U
Chloromethane		125.	U
Vinyl Chloride		125.	U
Bromomethane		125.	U
Chloroethane		125.	U
Trichlorofluoromethane		125.	U
1,1-Dichloroethene		125.	U
Methylene Chloride	503.		
trans-1,2-Dichloroethene		125.	U
1,1-Dichloroethane		125.	U
cis-1,2-Dichloroethene		125.	U
2,2-Dichloropropane		125.	U
Chloroform		125.	U
Bromochloromethane		125.	U
1,1,1-Trichloroethane		125.	U
1,1-Dichloropropene		125.	U
Carbon Tetrachloride		125.	U
1,2-Dichloroethane		125.	U
Benzene	16.		J
Trichloroethene	836.		
1,2-Dichloropropane		125.	U
Bromodichloromethane		125.	U
Dibromomethane		125.	U
Toluene	23.		J
1,1,2-Trichloroethane		125.	U
1,3-Dichloropropane		125.	U
Tetrachloroethene		125.	U
Dibromochloromethane		125.	U
1,2-Dibromoethane - EDB		125.	U
Chlorobenzene		125.	U
Ethylbenzene	329.		
1,1,1,2-Tetrachloroethane		125.	U
m + p-Xylenes	566.		

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

Lab Data File:	>AA053	Method Number:	524.2M
Lab Sample Name:	HEAI#8684 P851131555	Date Analyzed:	900109
Matrix:	Soil	Date Collected:	891228
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul 524.2,4gm,100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit
o-Xylene	170.	
Styrene		125. U
1,1,2,2-Tetrachloroethane		125. U
Isopropylbenzene	128.	
Bromoform		125. U
1,2,3-Trichloropropane		125. U
n-Propylbenzene	269.	
Bromobenzene		125. U
1,3,5-Trimethylbenzene	1685.	
4-Chlorotoluene		125. U
2-Chlorotoluene		125. U
tert-Butylbenzene	422.	
1,2,4-Trimethylbenzene	2348.	
sec-Butylbenzene	430.	
p-Isopropyltoluene	606.	
1,3-Dichlorobenzene		125. U
1,4-Dichlorobenzene		125. U
n-Butylbenzene		125. U
1,2-Dichlorobenzene		125. U
1,2-Dibromo-3-Chloropropane		125. U
1,2,4-Trichlorobenzene		125. U
Hexachlorobutadiene		125. U
Naphthalene	6332.	
1,2,3-Trichlorobenzene	45.	J

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

Lab Data File:	>AA066	Method Number:	524.2M
Lab Sample Name:	HEAI#8685 PBS1131SS6	Date Analyzed:	900110
Matrix:	Soil	Date Collected:	891229
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul 524.2,4gm,100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		125.	U
Chloromethane		125.	U
Vinyl Chloride		125.	U
Bromomethane		125.	U
Chloroethane		125.	U
Trichlorofluoromethane		125.	U
1,1-Dichloroethene		125.	U
Methylene Chloride		125.	U
trans-1,2-Dichloroethene		125.	U
1,1-Dichloroethane		125.	U
cis-1,2-Dichloroethene		125.	U
2,2-Dichloropropane		125.	U
Chloroform		125.	U
Bromochloromethane		125.	U
1,1,1-Trichloroethane		125.	U
1,1-Dichloropropene		125.	U
Carbon Tetrachloride		125.	U
1,2-Dichloroethane		125.	U
Benzene		125.	U
Trichloroethene		125.	U
1,2-Dichloropropane		125.	U
Bromodichloromethane		125.	U
Dibromomethane		125.	U
Toluene		125.	U
1,1,2-Trichloroethane		125.	U
1,3-Dichloropropane		125.	U
Tetrachloroethene		125.	U
Dibromochloromethane		125.	U
1,2-Dibromoethane - EDB		125.	U
Chlorobenzene		125.	U
Ethylbenzene		125.	U
1,1,1,2-Tetrachloroethane		125.	U
m + p-Xylenes		125.	U

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

Lab Data File:	>AA066	Method Number:	524.2M
Lab Sample Name:	HEAI#8685 PBS1131556	Date Analyzed:	900110
Matrix:	Soil	Date Collected:	891228
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,5ul 524.2,4gm,100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit
o-Xylene		125. U
Styrene		125. U
1,1,2,2-Tetrachloroethane	463.	
Isopropylbenzene		125. U
Bromoform		125. U
1,2,3-Trichloropropane		125. U
n-Propylbenzene		125. U
Bromobenzene		125. U
1,3,5-Trimethylbenzene	166.	
4-Chlorotoluene		125. U
2-Chlorotoluene		125. U
tert-Butylbenzene		125. U
1,2,4-Trimethylbenzene	270.	
sec-Butylbenzene		125. U
p-Isopropyltoluene		125. U
1,3-Dichlorobenzene		125. U
1,4-Dichlorobenzene		125. U
n-Butylbenzene		125. U
1,2-Dichlorobenzene		125. U
1,2-Dibromo-3-Chloropropane		125. U
1,2,4-Trichlorobenzene		125. U
Hexachlorobutadiene		125. U
Naphthalene	1743.	
1,2,3-Trichlorobenzene	178.	

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

Lab Data File:	>AA055	Method Number:	524.2M
Lab Sample Name:	HEAI#8686 PBS1131557	Date Analyzed:	900109
Matrix:	Soil	Date Collected:	891228
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,5ul 524.2,4gm,100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane	24.		J
Chloromethane		125.	U
Vinyl Chloride		125.	U
Bromomethane		125.	U
Chloroethane		125.	U
Trichlorofluoromethane	112.		J
1,1-Dichloroethene		125.	U
Methylene Chloride	426.		
trans-1,2-Dichloroethene		125.	U
1,1-Dichloroethane		125.	U
cis-1,2-Dichloroethene		125.	U
2,2-Dichloropropane		125.	U
Chloroform		125.	U
Bromochloromethane		125.	U
1,1,1-Trichloroethane		125.	U
1,1-Dichloropropene		125.	U
Carbon Tetrachloride		125.	U
1,2-Dichloroethane		125.	U
Benzene	25.		J
Trichloroethene	846.		
1,2-Dichloropropane		125.	U
Bromodichloromethane		125.	U
Dibromomethane		125.	U
Toluene	27.		J
1,1,2-Trichloroethane		125.	U
1,3-Dichloropropane		125.	U
Tetrachloroethene		125.	U
Dibromochloromethane		125.	U
1,2-Dibromoethane - EDB		125.	U
Chlorobenzene		125.	U
Ethylbenzene	548.		
1,1,1,2-Tetrachloroethane	41.		J
m + p-Xylenes	647.		

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

Lab Data File:	>AA055	Method Number:	524.2M
Lab Sample Name:	HEAI#8686 PBS1131557	Date Analyzed:	900109
Matrix:	Soil	Date Collected:	891228
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul 524.2,4gm,100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene	424.		
Styrene		125.	U
1,1,2,2-Tetrachloroethane	231.		
Isopropylbenzene	176.		
Bromoform		125.	U
1,2,3-Trichloropropane		125.	U
n-Propylbenzene	369.		
Bromobenzene		125.	U
1,3,5-Trimethylbenzene	2953.		
4-Chlorotoluene		125.	U
2-Chlorotoluene		125.	U
tert-Butylbenzene	645.		
1,2,4-Trimethylbenzene	3909.		
sec-Butylbenzene	682.		
p-Isopropyltoluene	1503.		
1,3-Dichlorobenzene		125.	U
1,4-Dichlorobenzene		125.	U
n-Butylbenzene		125.	U
1,2-Dichlorobenzene		125.	U
1,2-Dibromo-3-Chloropropane		125.	U
1,2,4-Trichlorobenzene		125.	U
Hexachlorobutadiene		125.	U
Naphthalene	7901.		
1,2,3-Trichlorobenzene	115.		J

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VOLATILE ORGANIC ANALYSIS - TABULATED REPORT

Lab Data File:	>AA056	Method Number:	524.2M
Lab Sample Name:	HEAI#8687 PBS1131SS8	Date Analyzed:	900109
Matrix:	Soil	Date Collected:	891228
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,5ul 524.2,4gm,100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane	36.		J
Chloromethane		125.	U
Vinyl Chloride		125.	U
Bromomethane		125.	U
Chloroethane		125.	U
Trichlorofluoromethane		125.	U
1,1-Dichloroethene		125.	U
Methylene Chloride	205.		
trans-1,2-Dichloroethene		125.	U
1,1-Dichloroethane		125.	U
cis-1,2-Dichloroethene		125.	U
2,2-Dichloropropane		125.	U
Chloroform		125.	U
Bromochloromethane		125.	U
1,1,1-Trichloroethane		125.	U
1,1-Dichloropropene		125.	U
Carbon Tetrachloride		125.	U
1,2-Dichloroethane		125.	U
Benzene	25.		J
Trichloroethene		125.	U
1,2-Dichloropropane		125.	U
Bromodichloromethane		125.	U
Dibromomethane		125.	U
Toluene	41.		J
1,1,2-Trichloroethane		125.	U
1,3-Dichloropropane		125.	U
Tetrachloroethene		125.	U
Dibromochloromethane		125.	U
1,2-Dibromoethane - EDB		125.	U
Chlorobenzene		125.	U
Ethylbenzene	543.		
1,1,1,2-Tetrachloroethane	375.		
m + p-Xylenes	1115.		

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

Lab Data File:	>AA056	Method Number:	524.2M
Lab Sample Name:	HEAI#8687 PBS1131SS8	Date Analyzed:	900109
Matrix:	Soil	Date Collected:	891228
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul 524.2,4gm,100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene	703.		
Styrene		125.	U
1,1,2,2-Tetrachloroethane	283.		
Isopropylbenzene	380.		
Bromoform		125.	U
1,2,3-Trichloropropane		125.	U
n-Propylbenzene	612.		
Bromobenzene		125.	U
1,3,5-Trimethylbenzene	4365.		
4-Chlorotoluene		125.	U
2-Chlorotoluene		125.	U
tert-Butylbenzene	618.		
1,2,4-Trimethylbenzene	4413.		
sec-Butylbenzene	358.		
p-Isopropyltoluene	1854.		
1,3-Dichlorobenzene		125.	U
1,4-Dichlorobenzene		125.	U
n-Butylbenzene		125.	U
1,2-Dichlorobenzene	31.		J
1,2-Dibromo-3-Chloropropane		125.	U
1,2,4-Trichlorobenzene		125.	U
Hexachlorobutadiene		125.	U
Naphthalene	13388.		
1,2,3-Trichlorobenzene	198.		

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

Lab Data File:	>AA067	Method Number:	524.2M
Lab Sample Name:	HEAI#8683 PBS1131SS9	Date Analyzed:	900110
Matrix:	Soil	Date Collected:	891223
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul 524.2,4gm,100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
Dichlorodifluoromethane		125.	U
Chloromethane		125.	U
Vinyl Chloride		125.	U
Bromomethane		125.	U
Chloroethane		125.	U
Trichlorofluoromethane		125.	U
1,1-Dichloroethene		125.	U
Methylene Chloride		125.	U
trans-1,2-Dichloroethene		125.	U
1,1-Dichloroethane		125.	U
cis-1,2-Dichloroethene		125.	U
2,2-Dichloropropane		125.	U
Chloroform		125.	U
Bromochloromethane		125.	U
1,1,1-Trichloroethane	123.		J
1,1-Dichloropropene		125.	U
Carbon Tetrachloride		125.	U
1,2-Dichloroethane		125.	U
Benzene		125.	U
Trichloroethene	1019.		
1,2-Dichloropropane		125.	U
Bromodichloromethane		125.	U
Dibromomethane		125.	U
Toluene		125.	U
1,1,2-Trichloroethane		125.	U
1,3-Dichloropropane		125.	U
Tetrachloroethene		125.	U
Dibromochloromethane		125.	U
1,2-Dibromoethane - EDB		125.	U
Chlorobenzene		125.	U
Ethylbenzene	140.		
1,1,1,2-Tetrachloroethane		125.	U
m + p-Xylenes	38.		J

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

Lab Data File:	>AA067	Method Number:	524.2M
Lab Sample Name:	HEAI#8688 PBS1131SS9	Date Analyzed:	900110
Matrix:	Soil	Date Collected:	891223
Dilution Factor:	125.0	Date Received:	891229

Sample Info.: GC/MS A,TN,ESI7019,Sul 524.2,4gm,100UL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene		125.	U
Styrene		125.	U
1,1,2,2-Tetrachloroethane		125.	U
Isopropylbenzene		125.	U
Bromoform		125.	U
1,2,3-Trichloropropane		125.	U
n-Propylbenzene		125.	U
Bromobenzene		125.	U
1,3,5-Trimethylbenzene	178.		
4-Chlorotoluene		125.	U
2-Chlorotoluene		125.	U
tert-Butylbenzene		125.	U
1,2,4-Trimethylbenzene	204.		
sec-Butylbenzene		125.	U
p-Isopropyltoluene		125.	U
1,3-Dichlorobenzene		125.	U
1,4-Dichlorobenzene		125.	U
n-Butylbenzene		125.	U
1,2-Dichlorobenzene		125.	U
1,2-Dibromo-3-Chloropropane		125.	U
1,2,4-Trichlorobenzene	193.		
Hexachlorobutadiene		125.	U
Naphthalene	1255.		
1,2,3-Trichlorobenzene		125.	U

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

Lab Data File:	>AA044	Method Number:	524.2M
Lab Sample Name:	HEAI# 30 FBS11315511	Date Analyzed:	900105
Matrix:	Soil	Date Collected:	122989
Dilution Factor:	2.5	Date Received:	010390

Sample Info.: GC/MS A,TN,ESI7015,SUI 524.2,25gm,LL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit
Dichlorodifluoromethane	61.	
Chloromethane		3. U
Vinyl Chloride		3. U
Bromomethane		3. U
Chloroethane	105.	
Trichlorofluoromethane	29.	
1,1-Dichloroethene		3. U
Methylene Chloride	109.	
trans-1,2-Dichloroethene	17.	
1,1-Dichloroethane	673.	
cis-1,2-Dichloroethene	165.	
2,2-Dichloropropane		3. U
Chloroform		3. U
Bromochloromethane		3. U
1,1,1-Trichloroethane		3. U
1,1-Dichloropropene		3. U
Carbon Tetrachloride		3. U
1,2-Dichloroethane		3. U
Benzene		3. U
Trichloroethene	997.	
1,2-Dichloropropane		3. U
Bromodichloromethane		3. U
Dibromomethane		3. U
Toluene	6.	
1,1,2-Trichloroethane		3. U
1,3-Dichloropropane		3. U
Tetrachloroethene		3. U
Dibromochloromethane		3. U
1,2-Dibromoethane - EDB		3. U
Chlorobenzene		3. U
Ethylbenzene	11.	
1,1,1,2-Tetrachloroethane		3. U
m + p-Xylenes	4.	

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

Lab Data File:	XAA044	Method Number:	524.2M
Lab Sample Name:	HEAI# 30 FBS1131SS11	Date Analyzed:	900105
Matrix:	Soil	Date Collected:	122989
Dilution Factor:	2.5	Date Received:	010390

Sample Info.: GC/MS A,TN,ESI7019,SUI 524.2,25gm,LL/5ML

U = not detected
J = estimated value, below detection limit
MS = MS/MSD compound

Compound	Concentration ug/Kg	Detection Limit	
o-Xylene	1.		J.
Styrene		3.	U
1,1,2,2-Tetrachloroethane	12.		
Isopropylbenzene		3.	U
Bromoform		3.	U
1,2,3-Trichloropropane		3.	U
n-Propylbenzene		3.	U
Bromobenzene		3.	U
1,3,5-Trimethylbenzene		3.	U
4-Chlorotoluene		3.	U
2-Chlorotoluene		3.	U
tert-Butylbenzene	15.		
1,2,4-Trimethylbenzene		3.	U
sec-Butylbenzene		3.	U
p-Isopropyltoluene		3.	U
1,3-Dichlorobenzene		3.	U
1,4-Dichlorobenzene		3.	U
n-Butylbenzene		3.	U
1,2-Dichlorobenzene		3.	U
1,2-Dibromo-3-Chloropropane		3.	U
1,2,4-Trichlorobenzene		3.	U
Hexachlorobutadiene		3.	U
Naphthalene	223.		
1,2,3-Trichlorobenzene	6.		

APPENDIX B-3

UST Corrective Actions RI/FS Report, EBASCO Environmental, 1991

NASA PLUM BROOK STATION

UNDERGROUND STORAGE TANK
CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY

- PHASE I REPORT -
November 1991

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F	LOGS FOR THE PHASE I GROUND WATER MONITORING WELLS

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 are 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 storage 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 1-1
Summary of PBS UST Activities and Related Events

DATE	ACTIVITY/EVENT
1988, May	New Ohio State UST Regulations Promulgated - O.A.C. 1301:7-7-28 [Ohio Fire Code Article 28, Flammable and Combustible Liquids]
1988, December 22	New Federal UST Regulations Promulgated - 40 CFR Part 280 [Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks]
1989, June 13	NASA Meets with Ohio State Fire Marshal's Office, Bureau of Underground Storage Tank Regulation (BUSTR) to Discuss Compliance with State and Federal UST Regulations
1989, June	NASA Receives Permit from BUSTR to Remove Three USTs at the PBS
1989, June 28 - July 5	Underground Storage Tanks 7132-1 (#33), 7132-2 (#34), 7132-3 (#35) are Removed from the Garage and Maintenance Area - Closure assessment (including soil, ground water and surface water sampling and analysis) performed
1989, July	UST Compliance Program Developed for PBS - Program outlined the UST removal and/or replacement options available to NASA to comply with the new regulations over a 3-year period
1989, August	Monitoring wells installed at the Garage and Maintenance Area
1989, August	Closure Assessment Report for PBS USTs #33, #34 and #35 is Finalized
1989, September	Underground Storage Tanks 7121-1 (#28), 7121-2 (#29), 7121-3 (#30), 7121-4 (#31), 7131-1 (#32) are Removed from the Garage and Maintenance Area - Closure assessment (including soil sampling and analysis) performed

TABLE 1-1 (continued)

DATE	ACTIVITY/EVENT
1989, September	Underground Storage Tank 8133-1 (#39) is Removed from the Pump Station Area - Closure assessment (including soil sampling and analysis) performed
1989, September	Underground Storage Tanks 1411-1 (#24) and 1411-2 (#25) are Removed from the Space Power Facility - Closure assessment (including soil sampling and analysis) performed
1989, September	Preliminary Remediation Effort Undertaken at the Garage and Maintenance Area - 1,320 cubic yards of soil removed
1989, October	BUSTR Directs Further Removal of Soil from the Tank Pit at the Garage and Maintenance Area - 18 additional inches of soil is removed
1989, October 18 - 25	Soil Gas Surveys are Conducted at the Garage and Maintenance Area, the Pump Station Area and the Space Power Facility Area
1989, December	Closure Assessment Report for PBS USTs #24, #25, #28, #29, #30, #31, #32 and #39 is Finalized
1989, December	Underground Storage Tanks 1131-1 (#21), 1131-2 (#22) and 1131-3 (#23) are Removed from the Reactor Building Area - Closure assessment (including soil sampling and analysis) performed
1990, January	Revised NASA UST Compliance Program is Finalized
1990, May	Regulatory Jurisdiction for the PBS USTs is Turned Over to the OEPA Northwest District Office by BUSTR Because of Evidence of Hazardous Waste Contamination From Some of the USTs Removed

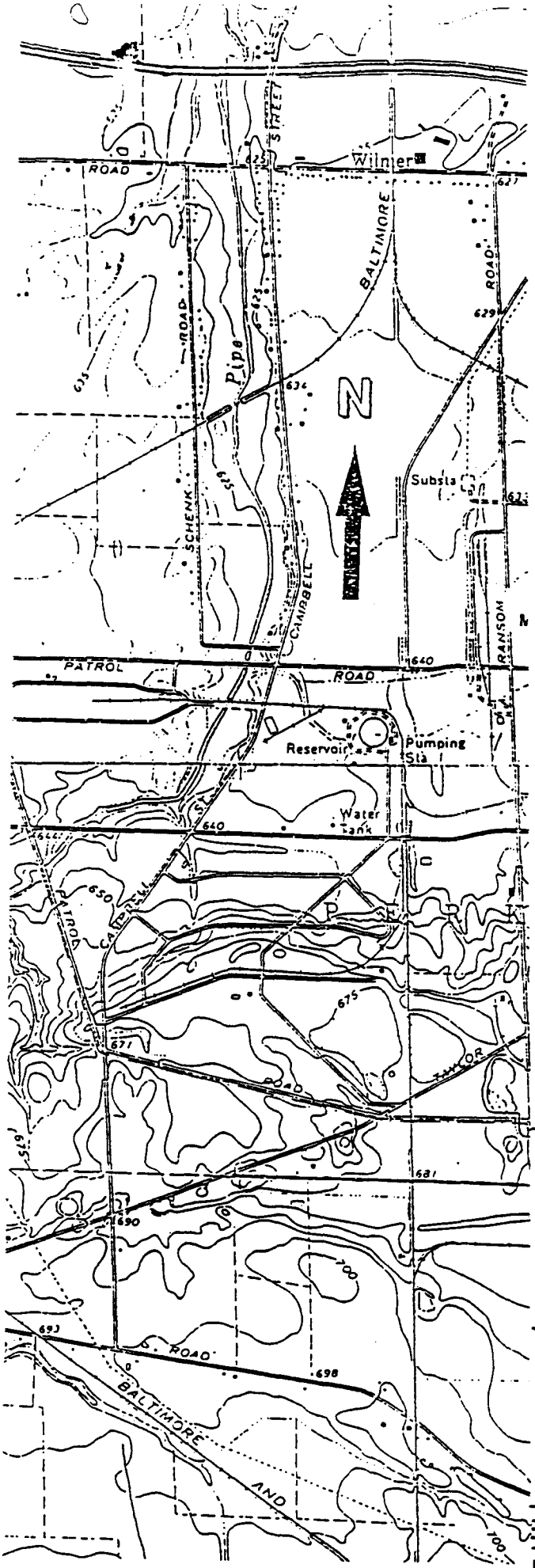
TABLE 1-1 (continued)

DATE	ACTIVITY/EVENT
1990, May	Closure Assessment Report for PBS USTs #21, #22 and #23 is Finalized
1990, June 12	Ebasco Submits Draft Work Plan for the PBS UST Corrective Actions RI/FS to NASA for Review
1990, August 9	Ebasco Submits Final Work Plan for the PBS UST Corrective Actions RI/FS to NASA
1990, September 25	NASA Submits Work Plan for the PBS UST Corrective Actions RI/FS to the Ohio EPA for Review and Concurrence
1990, October 5	Ebasco Begins Work on the First Phase of the Corrective Actions RI/FS Project to Characterize the Current Conditions at the Former UST Areas - Monitoring wells installed at all areas - Soil, ground water and sediment samples analyzed

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



NASA PLUM BROOK STATION

UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY: PHASE I

Locations of the Four Former Underground Storage Tank Areas at the NASA Plum Brook Station

EBASCO ENVIRONMENTAL | SCALE: 1"=2000'

FROM USGS SANDUSKY & KIMBALL, OHIO 7.5 MINUTE QUADRANGLE TOPO MAPS

FIGURE 1-1

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 can be found in Appendix F. As the final part of the well installation and prior to the ground 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 the 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 Jersey Soil Cleanup Criteria(1) (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	NA
Manganese (N)	590	478	5.145	3049.31	NA	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.

3.4 Reactor Area

The Reactor Area consists of a number of buildings, roads, tunnels, open areas, structures. Figure 3-1 shows the location of the Reactor Area at the Plum Brook Station. On December 28, 1989, the permanent closure by removal of three (3) USTs was performed.

The USTs were lying adjacent to each other in a north-south direction, south of Building No. 1311. Two (2) of the tanks, 1311-1 (#21) and 1311-2 (#22) were 7,900 gallon steel fuel oil tanks that were not in use at the time of their removal. Tank 1311-3 (#23) was a 500 gallon steel waste oil tank which was in use until its removal. All three tanks were installed in 1961.

3.4.1 Previous Investigations and Results

3.4.1.1 UST Closure Assessment

A UST closure assessment was performed as part of the tank removal operation. The study consisted of a visual inspection of the tanks during and after removal, environmental sampling, and air monitoring. Mr. Edwin Maglott of the State Fire Marshall's Office, and Ms. Pamela Doerner of the Ohio EPA, along with the Ebasco field representative, were onsite to oversee the removal of the USTs, and to inspect the tanks. After the tanks were removed, they were visually inspected and found to be in good condition structurally. There were no apparent holes or cracks in the tanks, and there was very little visible corrosion.

Environmental sampling consisted of the collection of eleven (11) soil samples. Soil samples were screened with an HNu photoionization meter to gain an indication of whether volatile organic compounds were present in the samples. Three (3) samples were taken from the tank cover soil to determine if there had been appreciable surface spillage, overfilling or piping failures. Six (6) samples were taken from the soil underlying the tanks, to detect the presence of any past or ongoing leaks.

Soil samples 1131-SS-1 through 1131-SS-6 were collected from beneath the tanks as shown in Figure 3-35 and were analyzed for TPH, VOCs, EP Toxicity lead, and ignitability. Samples 1131-SS-7, 1131-SS-8 and 1131-SS-9 were taken from the cover soil prior to the removal of the USTs. These samples were taken from the soil containment area which was set up east of Building No. 1131. The cover soil samples were analyzed for TPH, VOCs, EP Toxicity lead, and ignitability.

Due to the apparent contamination, indicated by both the HNu readings and visual inspection of the pit, it was determined that additional soil would be removed before the tank pit was backfilled. However, no additional soil was removed on December 28th, due to a lack of sufficient soil containment capacity. On December 29th, additional containment areas were set up. Approximately 3 to 4 feet of additional soil was removed from the pit bottom. The depth of the excavation was approximately 13 feet after the additional excavation was completed. The soil at this depth was a hard, homogeneous grey clay.

Two additional samples (1131-SS-10 and 1131-SS-11) were taken from the pit bottom after the additional soil was removed. Figure 3-35 shows the sample locations. Sample 1131-SS-10 was taken along the northern side of the pit where it appeared that the excavated soils had been discolored, possibly due to contamination from the excavated USTs. Sample 1131-SS-11 was taken along the eastern side of the pit beneath the previous location of the waste oil tank. Both samples had background readings when screened with the HNu. Both samples were analyzed for TPH and VOCs. The results

of these analyses are summarized in Table 3-15.

Samples 1131-SS-1 through 1131-SS-9 had lead concentrations below the detection limit, and Flashpoints above 200°F. The concentrations of TPH in the excavated cover soil and the pit bottom indicated that contamination of the surrounding soils has occurred. As high concentrations of TPH were found in the soil which covered the tanks, it would seem that at least a portion of the soil contamination was due to piping failures, overfilling or surface spills. Five of the samples from the pit bottom also showed elevated levels of TPH. Samples 1131-SS-10 and 1131-SS-11, taken after an additional 3-4 feet of soil was removed, did not show elevated levels of TPH.

Volatile organics were also detected in the soil samples. They included both possible petroleum degradation products and other compounds such as chlorinated organics which could have been found in the waste oil tank. Thirty-seven (37) organics were detected in various samples and the concentrations ranged as high as 13,388 ug/kg for naphthalene in 1131-SS-8. Ten VOCs were detected at ppm levels.

3.4.1.2 Soil Gas Survey

No soil gas survey was conducted at this location.

3.4.2 Current Investigation and Results

The field activities at the Reactor Area associated with the current investigation were conducted on the following dates:

Soil Sampling: 12/4/90, 12/13/90, 12/14/90 and 12/17/90
Ground Water Sampling: 1/15/91 and 1/16/91
Ground Water Level Measurements: 1/9/91, 5/9/91

The results of these sampling and analysis activities, are presented below.

3.4.2.1 Soil Sampling and Analyses

Six soil borings were completed around the Reactor Area. These borings were completed to depths ranging from 10' to 22'. PBS-RA-01 and PBS-RA-06 were planned to be background locations, while the remaining locations, PBS-RA-02 through PBS-RA-05 had been selected to characterize the contaminated area.

All of the soil borings in the Reactor Area were completed as ground water monitoring wells. These locations are shown on Figure 3-36.

3.4.2.1.1 Physical and General Stratigraphic Characteristics

Based on the six boreholes made at the Reactor Area as part of the current investigation, the overburden material at the Reactor Area has an average thickness greater than 22 feet. Figure 3-37 presents the generalized stratigraphic section for the Reactor Area showing the types of soils and the order of occurrence of the soil units encountered. The surface soil in this area is brown fine sand, with a mean thickness of 6 to 7 feet. In some places, this unit is underlain by grey fine sand which varies in thickness from 2.5 to more than 14 ft. The grey fine sand is followed by grey sandy-clayey silt, which has a maximum thickness of 4 feet and overlies the grey silty clay. At PBS-RA-01, the brown fine sand is underlain by grey sandy-clayey silt with a thickness of 8 feet. This unit was followed by grey clayey silt. The bedrock was not encountered by any boring at this area. The overburden does not appear, to the extent that it has been investigated, to be a water bearing unit. The monitoring wells exhibit low yield as was seen during well the development effort. Following the purging of about 6 gallons of water, the wells were unable to sustain enough water to continue purging.

3.4.2.1.2 Nature and Extent of Contamination

The samples collected from the boreholes at the Reactor Area were composited over the total depth of the boring except for the volatiles samples which were ranging from 4 to 10 feet below the ground surface. The complete results of the chemical analyses of these samples are presented in Table A-4 in Appendix A. A summary of the detected organic compounds is presented in Table 3-16. Excluding the probable laboratory contaminants, four (4) different volatile organic compounds were detected in this set of samples. These four volatiles (1,2-Dichloroethene (Total) at 120 ppb, 1,1,1-Trichloroethane at 22 ppb, Trichloroethene at 760 ppb, and Tetrachloroethene - 19 ppb) were all detected only in one of the six samples, PBS-RA-SB-05. This sample was taken approximately 70 feet east of the former UST location. The distribution of the organics detected in the soils at this Tank Area is presented in Figure 3-38. Table 3-16 and Figure 3-38 also indicate that five or six non-lab contaminant semivolatile organic compounds belonging to the PAH family also were reported by the laboratory for the two samples just south of the Building. As is noted, the laboratory reported estimated concentrations for these compounds at levels associated with 20% to 65% of the sample detection limit. Consequently, the listed semivolatiles may practically be considered not detected. TPH was detected at 3 of the 6 sampling locations. The highest measured value of 159 ppm, was associated with the sampling location due west of Building No. 1131 next to the roadway. The other two concentrations, for the two soil samples taken south of Building No. 1131, were approximately at the detection limit. Using the inorganics comparison methodology and criteria described earlier, no inorganics are indicated to be of concern in the soils at the Reactor Area. Two inorganics (Calcium and Magnesium) were detected at levels

exceeding their calculated UCLs indicating signicant difference from background, but these inorganics are not generally of concern with respect to toxic health hazard.

3.4.2.2 Ground Water Sampling and Analysis

3.4.2.2.1 Nature and Extent of Contamination

Two ground water samples were taken at the Reactor Area as part of the current investigation, one from a well expected to be heavily contaminated (PBS-RA-04) and one from a well expected to be clean (PBS-RA-01). The complete results of the chemical analyses of these samples are presented in Table B-4 in Appendix B. A summary of the detected organic compounds is presented in Table 3-16. As can be seen, no volatile or semivolatile organics, PCBs, or TPH were detected in either of these two samples. A very trace amount (0.097 ppb) of the insecticide Beta-BHC was detected in the presumed background well (see Figure 3-39). Because insecticides were not stored in the USTs, the presence of the Beta-BHC in ground water is not associated with the former USTs.

3.4.2.2.2 Ground Water Flow

Figures 3-40 and 3-41 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 elevation contours for this area reflect the presence of the underground tunnel which connects Building Nos. 1134, 1131 and 1152 in this area. A dewatering operation is taking place at this tunnel in which ground water draining into the area around the tunnel is collected and pumped out. The dewatering in this area has a pronounced local effect on ground water elevations and flow direction. The dewatering of the tunnel dominates the local ground water flow pattern in the surrounding area, including the former location of the USTs. This local effect diminishes with distance from the dewatering point, and the overall site ground water level contours shown in Figure 3-15 become more representative. In the area of the excavated tanks the ground water table during the Phase I investigation was above the level were the removed tanks had been located.

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 72 and 58 feet per year, respectively. These calculated velocities are roughly a factor of 30 to 50 higher than the velocities calculated for the other areas. This calculation also highlighted the relative steepness of the gradients in this area.

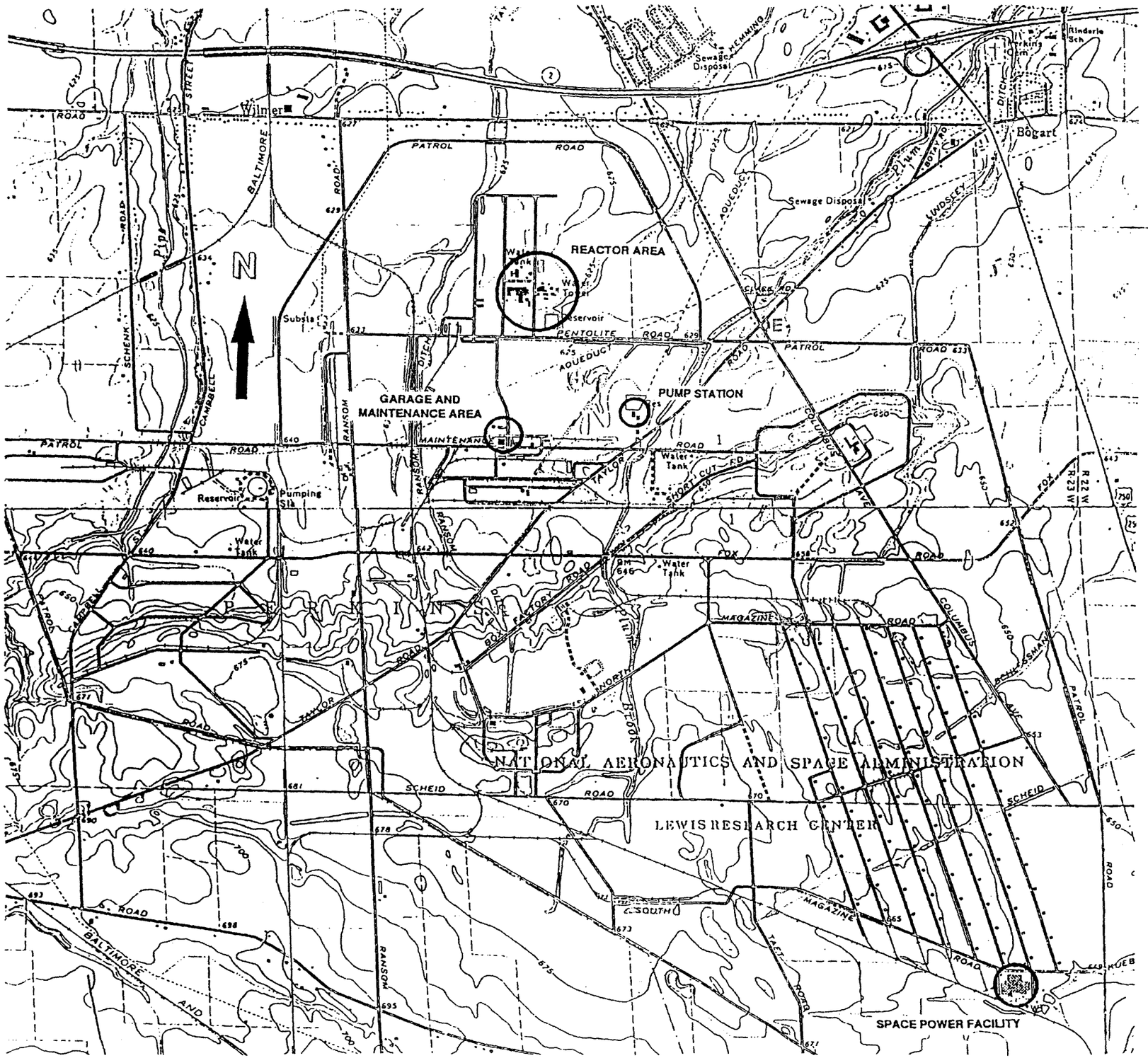
3.4.2.3 Sediment Sampling and Analysis

No sediment sampling or analysis was performed at the Reactor Area as part of the current investigation.

3.4.3 Conclusions for Reactor Area

Although the USTs removed at the Reactor Area appeared to be in good condition structurally, with no holes or cracks, initial soil sampling identified significantly elevated levels of a variety of fuel products and solvent compounds in the soil beneath and surrounding the tanks. The most recent sampling confirmed the presence of solvents in the soils from the sampling locations next to the south side of Building No. 1131. Trace or low levels of TPH were found in the three soil samples taken adjacent to the south or west sides of the Building. Trace levels of a number of semivolatile PAH compounds were also found in the samples closest to the former UST location. It is not clear at this time that the source of the PAHs is the former USTs, given the low concentrations of these compounds reported by the laboratory. No inorganics were highlighted to be of possible concern based on the current investigation. No PCBs were detected in any soil or ground water sample and a trace level of an insecticide was detected in the intended "background" location ground water sample for this Tank Area.

Transport and migration of contamination from the former UST locations at the Reactor Area would appear to be dictated by the movement of ground water and the apparent tunnel dewatering operation. This activity, as reflected in the local ground water level contours constructed for this Tank Area, would appear to be drawing the contamination away from the former UST locations toward the northwest. As the collected ground water is not treated before being discharged into Pentolite Ditch, any contaminated ground water collected at the tunnel would be transported directly to the surface water and sediments in the Ditch.



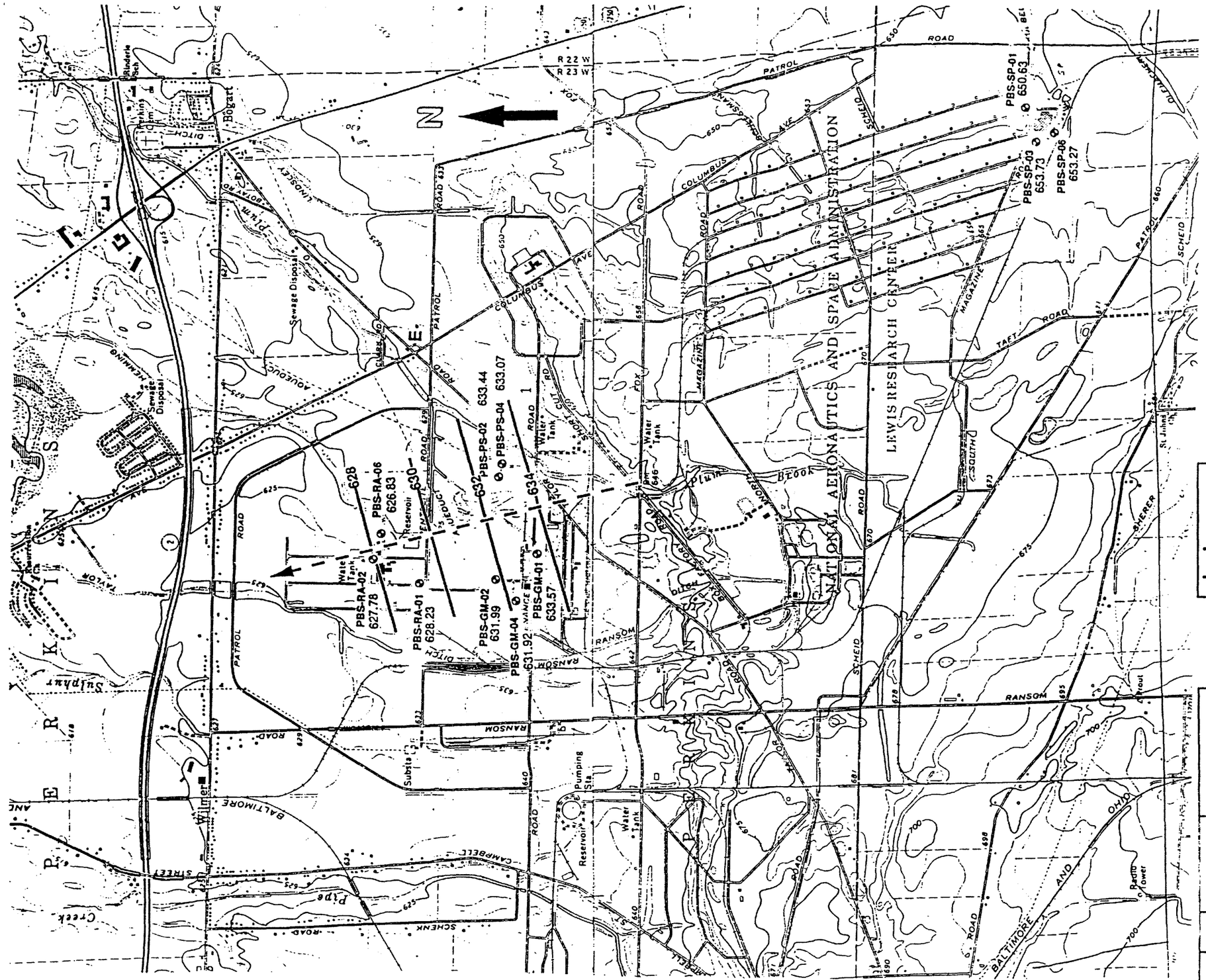
NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY: PHASE I

Locations of the Four Former Underground Storage Tank Areas at the NASA Plum Brook Station

EBASCO ENVIRONMENTAL | SCALE: 1"=200

FROM USGS SANDUSKY & KIMBALL, OHIO 7.5 MINUTE QUADRANGLE TOPO MAPS

FIGURE 3-1



LEGEND

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

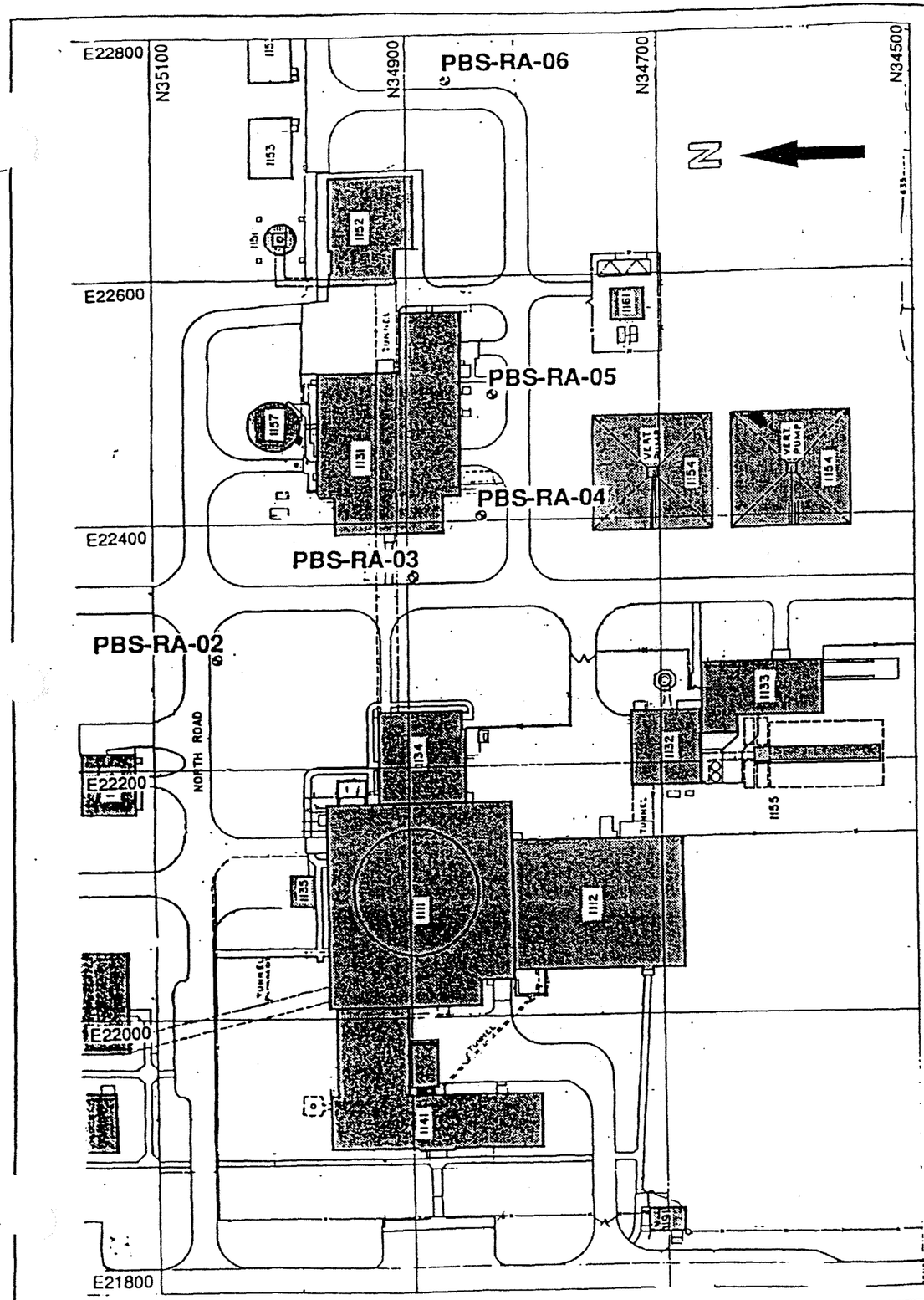
NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATIONS/FEASIBILITY STUDY: PHASE I

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-RA-01

LEGEND

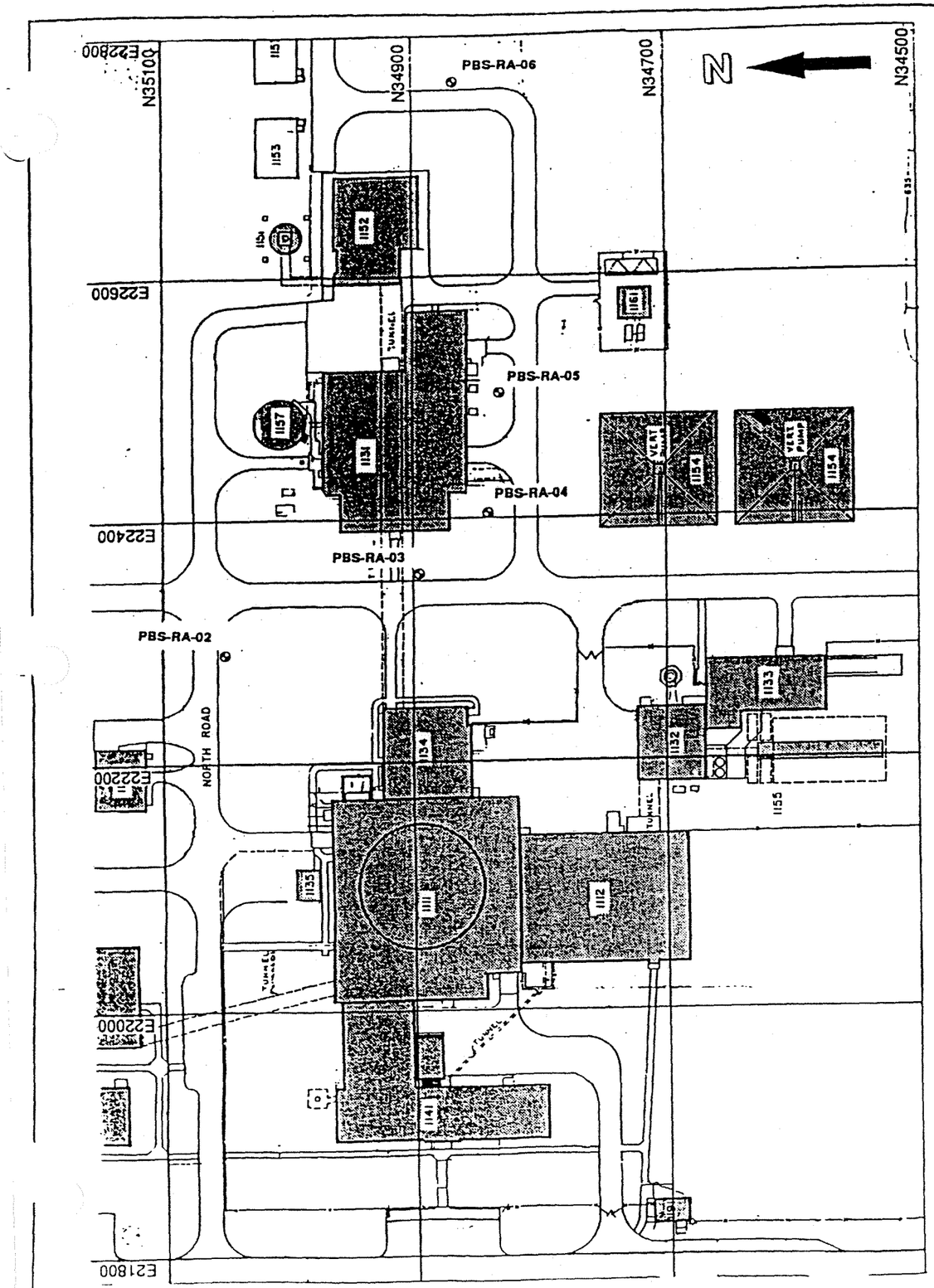
Ground Water Monitoring Well Location

NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK
CORRECTIVE ACTIONS REMEDIAL
INVESTIGATION/FEASIBILITY STUDY:
PHASE I

Locations of Soil Borings and Ground Water Monitoring Wells

REACTOR AREA

EBASCO ENVIRONMENTAL	SCALE: 1"=100'
FROM NASA DWG. NO. PF-65156	FIGURE 3-36



PBS-RA-GW-01	Conc.
Beta-BHC	0.1 ug/L

PBS-RA-01

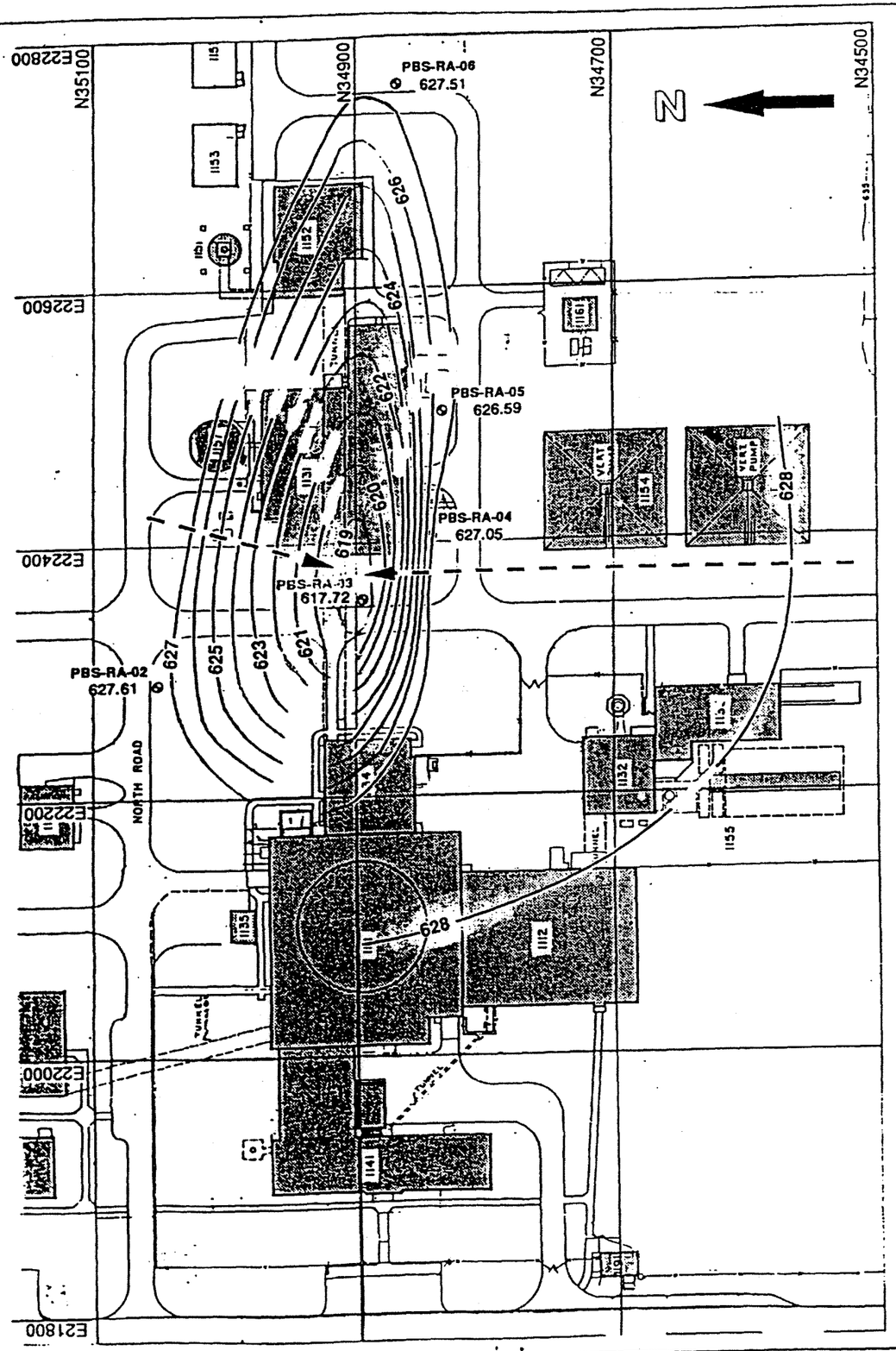
NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK
CORRECTIVE ACTIONS REMEDIAL
INVESTIGATIONS/FEASIBILITY STUDY:
PHASE I

Organic Contaminant Concentrations in Ground Water

REACTOR AREA

EBASCO ENVIRONMENTAL | SCALE: 1"=100'

FROM NASA DWG. NO. PF-65156 | FIGURE 3-39



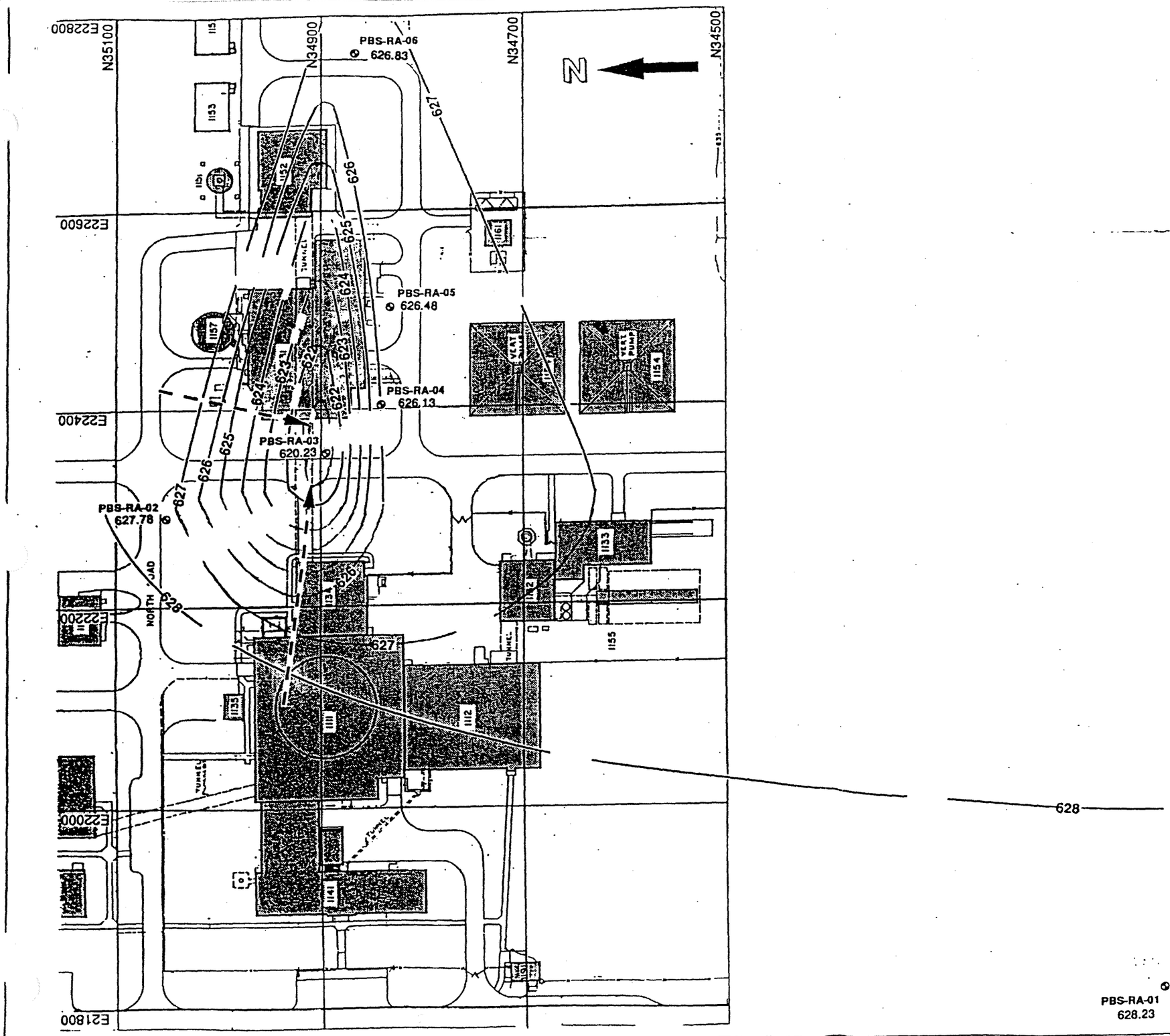
LEGEND	
PBS-RA-01 628.88	Ground Water Monitoring Well Ground Water Elevation
628	Ground Water Elevation Contour
→	Direction of Ground Water Flow

NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATIONS/FEASIBILITY STUDY: PHASE I

Ground Water Elevation Contours for 01/10/91

REACTOR AREA

EBASCO ENVIRONMENTAL	SCALE: 1"=100'
FROMNASA DWG. NO. PF-65156	FIGURE 3-40



LEGEND

PBS-RA-01 628.23	Ground Water Monitoring Well Ground Water Elevation
628	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 05/09/91

REACTOR AREA

EBASCO ENVIRONMENTAL	SCALE: 1"=100'
FROM NASA DWG. NO. PF-65156	FIGURE 3-41

TABLE 3-15
Results of Soil Analyses for the Building 1131 Tank Area
at the Reactor Area

	Maximum Concentration Detected in Soil	
	Building 1131 Tanks #21, 22, 23	
Volatile Organic Compounds	ug/Kg	Frequency
Dichlorodifluoromethane	61	4 / 11
Chloromethane	ND	-
Vinyl Chloride	ND	-
Bromomethane	ND	-
Chloroethane	990	2 / 11
Trichlorofluoromethane	120	3 / 11
1,1 Dichloroethene	ND	-
Methylene Chloride	503	6 / 11
trans-1,2-Dichloroethene	17	1 / 11
1,1 Dichloroethane	6120	4 / 11
cis-1,2 Dichloroethene	165	1 / 11
2,2 Dichloropropane	ND	-
Chloroform	1	1 / 11
Bromochloromethane	ND	-
1,1,1-Trichloroethane	891	4 / 11
1,1 Dichloropropene	ND	-
Carbon Tetrachloride	91	1 / 11
1,2 Dichloroethane	178	1 / 11
Benzene	32	6 / 11
Trichloroethene	1019	6 / 11
1,2 Dichloropropane	ND	-
Bromodichloromethane	23	1 / 11
Dibromomethane	ND	-
Toluene	41	7 / 11
1,1,2-Trichloroethane	143	1 / 11
1,3 Dichloropropane	ND	-
Tetrachloroethene	1043	2 / 11
Dibromochloromethane	ND	-
1,2-Dibromomethane-EDB	ND	-
Chlorobenzene	ND	-
Ethylbenzene	1093	9 / 11
1,1,1,2-Tetrachloroethane	375	3 / 11
m & p -Xylenes	1115	9 / 11
o-Xylene	703	8 / 11
Styrene	ND	-
1,1,2,2-Tetrachloroethane	463	6 / 11
Isopropylbenzene	380	5 / 11
Bromoform	ND	-
1,2,3- Trichloropropane	9	1 / 11
n-Propylbenzene	612	6 / 11
Bromobenzene	ND	-
1,3,5 Trimethylbenzene	4365	10 / 11

ND Not Detected

TABLE 3-15 Continued
Results of Soil Analyses for the Building 1131 Tank Area
at the Reactor Area

	Maximum Concentration Detected in Soil	
	Building 1131 Tanks #21, 22, 23	
Volatile Organic Compounds	ug/Kg	Frequency
4-Chlorotoluene	ND	-
2-Chlorotoluene	ND	-
tert-Butylbenzene	645	9 / 11
1,2,4 Trimethylbenzene	4413	10 / 11
sec-Butylbenzene	858	7 / 11
p-Isopropyltoluene	1854	6 / 11
1,3 Dichlorobenzene	2	1 / 11
1,4 Dichlorobenzene	2	1 / 11
n-Butylbenzene	ND	-
1,2 Dichlorobenzene	31	1 / 11
Dibromo-3-Chloropropane	ND	-
1,2,4 Trichlorobenzene	575	5 / 11
Hexachlorobutadiene	404	2 / 11
Naphthalene	13388	11 / 11
1,2,3 Trichlorobenzene	1025	10 / 11
TPH (mg/Kg)	3570	9 / 11

ND Not Detected

TABLE 3-15
Results of Soil Analyses for the Building 1131 Tank Area
at the Reactor Area

	Maximum Concentration Detected in Soil	
	Building 1131 Tanks #21, 22, 23	
Volatile Organic Compounds	ug/Kg	Frequency
Dichlorodifluoromethane	61	4 / 11
Chloromethane	ND	-
Vinyl Chloride	ND	-
Bromomethane	ND	-
Chloroethane	990	2 / 11
Trichlorofluoromethane	120	3 / 11
1,1 Dichloroethene	ND	-
Methylene Chloride	503	6 / 11
trans-1,2-Dichloroethene	17	1 / 11
1,1 Dichloroethane	6120	4 / 11
cis-1,2 Dichloroethene	165	1 / 11
2,2 Dichloropropane	ND	-
Chloroform	1	1 / 11
Bromochloromethane	ND	-
1,1,1-Trichloroethane	891	4 / 11
1,1 Dichloropropene	ND	-
Carbon Tetrachloride	91	1 / 11
1,2 Dichloroethane	178	1 / 11
Benzene	32	6 / 11
Trichloroethene	1019	6 / 11
1,2 Dichloropropane	ND	-
Bromodichloromethane	23	1 / 11
Dibromomethane	ND	-
Toluene	41	7 / 11
1,1,2-Trichloroethane	143	1 / 11
1,3 Dichloropropane	ND	-
Tetrachloroethene	1043	2 / 11
Dibromochloromethane	ND	-
1,2-Dibromomethane-EDB	ND	-
Chlorobenzene	ND	-
Ethylbenzene	1093	9 / 11
1,1,1,2-Tetrachloroethane	375	3 / 11
m & p -Xylenes	1115	9 / 11
o-Xylene	703	8 / 11
Styrene	ND	-
1,1,2,2-Tetrachloroethane	463	6 / 11
Isopropylbenzene	380	5 / 11
Bromoform	ND	-
1,2,3- Trichloropropane	9	1 / 11
n-Propylbenzene	612	6 / 11
Bromobenzene	ND	-
1,3,5 Trimethylbenzene	4365	10 / 11

ND Not Detected

TABLE 3-15 Continued
Results of Soil Analyses for the Building 1131 Tank Area
at the Reactor Area

	Maximum Concentration Detected in Soil	
	Building 1131 Tanks #21, 22, 23	
Volatile Organic Compounds	ug/Kg	Frequency
4-Chlorotoluene	ND	-
2-Chlorotoluene	ND	-
tert-Butylbenzene	645	9 / 11
1,2,4 Trimethylbenzene	4413	10 / 11
sec-Butylbenzene	858	7 / 11
p-Isopropyltoluene	1854	6 / 11
1,3 Dichlorobenzene	2	1 / 11
1,4 Dichlorobenzene	2	1 / 11
n-Butylbenzene	ND	-
1,2 Dichlorobenzene	31	1 / 11
Dibromo-3-Chloropropane	ND	-
1,2,4 Trichlorobenzene	575	5 / 11
Hexachlorobutadiene	404	2 / 11
Naphthalene	13388	11 / 11
1,2,3 Trichlorobenzene	1025	10 / 11
TPH (mg/Kg)	3570	9 / 11

ND Not Detected

Soil Unit	Range of Unit Thickness at the Tank Area
Brown Fine Sand	6' - 8'
* Grey Fine Sand	2.5' - >14'
* Grey Sandy Clayey Silt	1.5' - 8'
* Grey Clayey Silt	>1.5'
Grey Silty Clay	

OVERBURDEN

* Unit not encountered at all borehole locations

NOTE Bedrock was not reached at this Tank Area; Drilling was completed in the first confining layer encountered

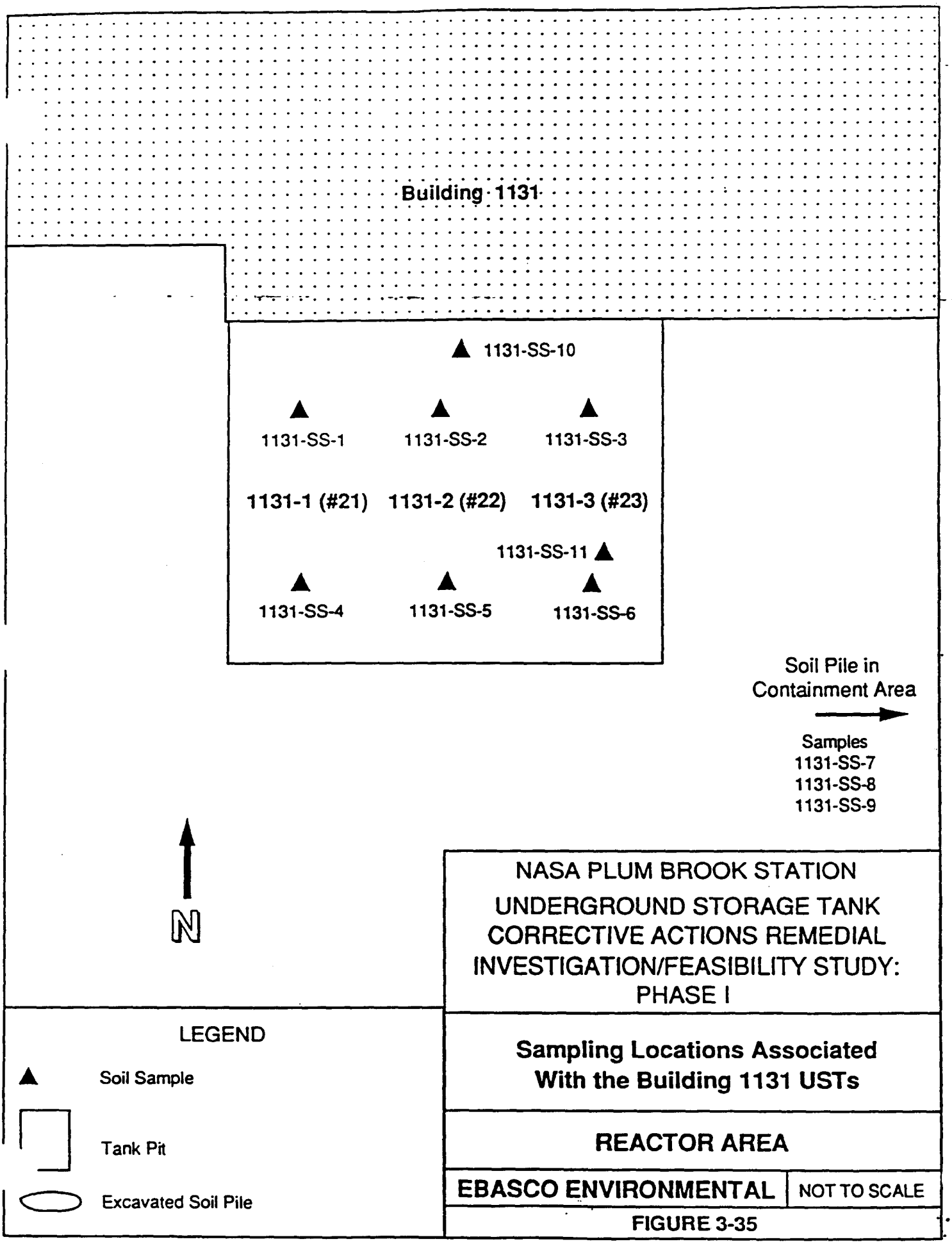
NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY: PHASE I

Generalized Stratigraphic Section

REACTOR AREA

EBASCO ENVIRONMENTAL | NOT TO SCALE

FIGURE 3-37



NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY: PHASE I

Sampling Locations Associated With the Building 1131 USTs

REACTOR AREA

EBASCO ENVIRONMENTAL | NOT TO SCALE

FIGURE 3-35

TABLE 3-16
SUMMARY OF ORGANIC CONTAMINANTS DETECTED AT THE REACTOR AREA

REACTOR AREA	MAXIMUM CONCENTRATION DETECTED IN			
	SOIL		GROUND WATER	
VOLATILE ORGANIC COMPOUNDS	ug/Kg	Freq.	ug/L	Freq.
Methylene Chloride *	95	5/6	ND	
Acetone *	320 BE	4/6	ND	
Carbon Disulfide *	31	3/6	ND	
1,2-Dichloroethene (Total)	120	1/6	ND	
1,1,1-Trichloroethane	22	1/6	ND	
Trichloroethene	760 E	1/6	ND	
Tetrachloroethene	19	1/6	ND	
SEMIVOLATILE ORGANIC COMPOUNDS	ug/Kg	Freq.	ug/L	Freq.
Phenanthrene	290 J	2/6	ND	
Anthracene	93 J	1/6	ND	
Fluoranthene	270 J	2/6	ND	
Pyrene	230 J	2/6	ND	
Benzo(a)anthracene	130 J	2/6	ND	
Chrysene	130 J	2/6	ND	
bis(2-Ethylhexyl)phthalate *	590	1/6	ND	
PESTICIDE / PCBs COMPOUNDS	ug/Kg	Freq.	ug/L	Freq.
Beta-BHC	ND		0.097	1/2
TOTAL PETROLEUM HYDROCARBONS	mg/Kg	Freq.	mg/L	Freq.
TPH	159	3/6	ND	

NOTES : * Probable Laboratory Contaminants (See Text)
J Estimated, Value Below the Quantitation Limit
E Concentration Exceeds Calibration Range of GC/MS Instrument
B Analyte Found in Associated Blank
ND Not Detected

APPENDIX B-4

Laboratory Data, UST Corrective Actions RI/FS EBASCO Environmental, 1991

SAMPLE IDENTIFICATION	RA-SB01	(RA-SB01)	RA-SB02	(RA-SB02)	RA-SB03	(RA-SB03)	RA-SB04	(RA-SB04)
Sample Type	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Sample Depth Below Surface	8'-10'	8'-10'	6'-8'	6'-8'	6'-8'	6'-8'	4'-6'	4'-6'
Date Sampled	12-4-90	12-4-90	12-13-90	12-13-90	12-13-90	12-13-90	12-14-90	12-14-90
VOLATILE ORGANIC COMPOUNDS (ug/Kg)	RA-SB01	(RA-SB01)	RA-SB02	(RA-SB02)	RA-SB03	(RA-SB03)	RA-SB04	(RA-SB04)
Chloromethane	13 U	13 U	12 U	12 U	12 U	12 U	12 U	12 U
Bromomethane	13 U	13 U	12 U	12 U	12 U	12 U	12 U	12 U
Vinyl Chloride	13 U	13 U	12 U	12 U	12 U	12 U	12 U	12 U
Chloroethane	13 U	13 U	12 U	12 U	12 U	12 U	12 U	12 U
Methylene Chloride	7 U	18	6 U	82	6 U	95	6 U	21
Acetone	32	98	12 U	69	12 U	320 BE	12 U	12 U
Carbon Disulfide	31	7 U	3 J	12	6 U	31	6 U	6 U
1,1-Dichloroethene	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
1,1-Dichloroethane	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloroethene (total)	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
Chloroform	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloroethane	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
2-Butanone	13 U	13 U	12 U	12 U	12 U	12 U	12 U	12 U
1,1,1-Trichloroethane	7 U	7 U	6 U	6 U	6 U	6 U	22	6 U
Carbon Tetrachloride	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
Vinyl Acetate	13 U	13 U	12 U	12 U	12 U	12 U	12 U	12 U
Bromodichloromethane	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloropropane	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
cis-1,3-Dichloropropene	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
Trichloroethene	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
Dibromochloromethane	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U

Notes
( ) Denote Sample Reanalysis

Qualifiers
U Undetected
J Estimated, Value is below Quantitation Limit
B Analyte found in associated blank
E Concentration exceeds calibration range of GC/MS

SAMPLE IDENTIFICATION	RA-SB01	(RA-SB01)	RA-SB02	(RA-SB02)	RA-SB03	(RA-SB03)	RA-SB04	(RA-SB04)
Sample Type	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Sample Depth Below Surface	8'-10'	8'-10'	6'-8'	6'-8'	6'-8'	6'-8'	4'-6'	4'-6'
Date Sampled	12-4-90	12-4-90	12-13-90	12-13-90	12-13-90	12-13-90	12-14-90	12-14-90
VOLATILE ORGANIC COMPOUNDS (ug/Kg)	RA-SB01	(RA-SB01)	RA-SB02	(RA-SB02)	RA-SB03	(RA-SB03)	RA-SB04	(RA-SB04)
1,1,2-Trichloroethane	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
Benzene	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
trans-1,3-Dichloropropene	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
Bromoform	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
4-Methyl-2-Pentanone	13 U	13 U	12 U	12 U	12 U	12 U	12 U	12 U
2-Hexanone	13 U	13 U	12 U	12 U	12 U	12 U	12 U	12 U
Tetrachloroethene	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
1,1,2,2-Tetrachloroethane	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
Toluene	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
Chlorobenzene	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
Ethylbenzene	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
Styrene	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U
Xylenes (Total)	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U

Notes
( ) Denote Sample Reanalysis

Qualifiers
U Undetected
J Estimated, Value is below Quantitation Limit
B Analyte found in associated blank
E Concentration exceeds calibration range of GC/MS

SAMPLE IDENTIFICATION	RA-SB05	(RA-SB05)	RA-SB06	(RA-SB06)
Sample Type	Grab	Grab	Grab	Grab
Sample Depth Below Surface	4'-6'	4'-6'	4'-6'	4'-6'
Date Sampled	12-14-90	12-14-90	12-17-90	12-17-90
VOLATILE ORGANIC COMPOUNDS (ug/Kg)	RA-SB05	(RA-SB05)	RA-SB06	(RA-SB06)
Chloromethane	12 U	63 U	13 U	13 U
Bromomethane	12 U	63 U	13 U	13 U
Vinyl Chloride	12 U	63 U	13 U	13 U
Chloroethane	12 U	63 U	13 U	13 U
Methylene Chloride	6 U	31 U	6 U	31
Acetone	12 U	63 U	13 U	63
Carbon Disulfide	6 U	31 U	6 U	6 U
1,1-Dichloroethene	6 U	31 U	6 U	6 U
1,1-Dichloroethane	6 U	31 U	6 U	6 U
1,2-Dichloroethene (Total)	120	31 U	6 U	6 U
Chloroform	6 U	31 U	6 U	6 U
1,2-Dichloroethane	6 U	31 U	6 U	6 U
2-Butanone	12 U	63 U	13 U	13 U
1,1,1-Trichloroethane	6 U	31 U	6 U	6 U
Carbon Tetrachloride	6 U	31 U	6 U	6 U
Vinyl Acetate	12 U	63 U	13 U	13 U
Bromodichloromethane	6 U	31 U	6 U	6 U
1,2-Dichloropropane	6 U	31 U	6 U	6 U
cis-1,3-Dichloropropene	6 U	31 U	6 U	6 U
Trichloroethene	760 E	460	6 U	6 U
Dibromochloromethane	6 U	31 U	6 U	6 U

Notes
( ) Denote Sample Reanalysis

Qualifiers
U Undetected
J Estimated, Value is below Quantitation Limit
B Analyte found in associated blank
E Concentration exceeds calibration range of GC/MS

SAMPLE IDENTIFICATION	RA-SB05	(RA-SB05)	RA-SB06	(RA-SB06)
Sample Type	Grab	Grab	Grab	Grab
Sample Depth Below Surface	4'-6'	4'-6'	4'-6'	4'-6'
Date Sampled	12-14-90	12-14-90	12-17-90	12-17-90
VOLATILE ORGANIC COMPOUNDS (ug/Kg)	RA-SB05	(RA-SB05)	RA-SB06	(RA-SB06)
1,1,2-Trichloroethane	6 U	31 U	6 U	6 U
Benzene	6 U	31 U	6 U	6 U
trans-1,3-Dichloropropene	6 U	31 U	6 U	6 U
Bromoform	6 U	31 U	6 U	6 U
4-Methyl-2-Pentanone	12 U	63 U	13 U	13 U
2-Hexanone	12 U	63 U	13 U	13 U
Tetrachloroethene	19	31 U	6 U	6 U
1,1,2,2-Tetrachloroethane	6 U	31 U	6 U	6 U
Toluene	6 U	31 U	6 U	6 U
Chlorobenzene	6 U	31 U	6 U	6 U
Ethylbenzene	6 U	31 U	6 U	6 U
Styrene	6 U	31 U	6 U	6 U
Xylenes (Total)	6 U	31 U	6 U	6 U

Notes
( ) Denote Sample Reanalysis

Qualifiers
U Undetected
J Estimated, Value is below Quantitation Limit
B Analyte found in associated blank
E Concentration exceeds calibration range of GC/MS

SAMPLE IDENTIFICATION	RA-SB01	(RA-SB01)	RA-SB02	RA-SB03	RA-SB04	RA-SB05	RA-SB06
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-16'	0'-16'	0'-20'	0'-22'	0'-10'	0'-10'	0'-10'
Date Sampled	12-4-90	12-4-90	12-13-90	12-13-90	12-14-90	12-14-90	12-17-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	RA-SB01	(RA-SB01)	RA-SB02	RA-SB03	RA-SB04	RA-SB05	RA-SB06
Phenol	450 U	500 U	430 U	440 U	440 U	440 U	440 U
bis(-2-Chloroethyl) Ether	450 U	500 U	430 U	440 U	440 U	440 U	440 U
2-Chlorophenol	450 U	500 U	430 U	440 U	440 U	440 U	440 U
1,3-Dichlorobenzene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
1,4-Dichlorobenzene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Benzyl alcohol	450 U	500 U	430 U	440 U	440 U	440 U	440 U
1,2-Dichlorobenzene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
2-Methylphenol	450 U	500 U	430 U	440 U	440 U	440 U	440 U
bis(-2-Chloroisopropyl) Ether	450 U	500 U	430 U	440 U	440 U	440 U	440 U
4-Methylphenol	450 U	500 U	430 U	440 U	440 U	440 U	440 U
N-Nitroso-Di-n-propylamine	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Hexachloroethane	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Nitrobenzene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Isophorone	450 U	500 U	430 U	440 U	440 U	440 U	440 U
2-Nitrophenol	450 U	500 U	430 U	440 U	440 U	440 U	440 U
2,4-Dimethylphenol	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Benzoic acid	2300 U	2500 U	2100 U	2200 U	2200 U	2200 U	2200 U
bis(-2-Chloroethoxy) methane	450 U	500 U	430 U	440 U	440 U	440 U	440 U
2,4-Dichlorophenol	450 U	500 U	430 U	440 U	440 U	440 U	440 U
1,2,4-Trichlorobenzene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Naphthalene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
4-Chloroaniline	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Hexachlorobutadiene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
4-Chloro-3-methylphenol	450 U	500 U	430 U	440 U	440 U	440 U	440 U
2-Methylnaphthalene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Hexachlorocyclopentadiene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
2,4,6-Trichlorophenol	450 U	500 U	430 U	440 U	440 U	440 U	440 U
2,4,5-Trichlorophenol	2300 U	2500 U	2100 U	2200 U	2200 U	2200 U	2200 U

Notes
( ) Denotes Sample Reanalysis

Qualifiers
U Undetected
J Estimated, Value is below the Quantitation Limit

SOIL SAMPLE RESULTS FOR THE REACTOR AREA

SAMPLE IDENTIFICATION	RA-SB01	(RA-SB01)	RA-SB02	RA-SB03	RA-SB04	RA-SB05	RA-SB06
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-16'	0'-16'	0'-20'	0'-22'	0'-10'	0'-10'	0'-10'
Date Sampled	12-4-90	12-4-90	12-13-90	12-13-90	12-14-90	12-14-90	12-17-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	RA-SB01	(RA-SB01)	RA-SB02	RA-SB03	RA-SB04	RA-SB05	RA-SB06
2-Chloronaphthalene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
2-Nitroaniline	2300 U	2500 U	2100 U	2200 U	2200 U	2200 U	2200 U
Dimethyl Phthalate	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Acenaphthylene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
2,6-Dinitrotoluene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
3-Nitroaniline	2300 U	2500 U	2100 U	2200 U	2200 U	2200 U	2200 U
Acenaphthene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
2,4-Dinitrophenol	2300 U	2500 U	2100 U	2200 U	2200 U	2200 U	2200 U
4-Nitrophenol	2300 U	2500 U	2100 U	2200 U	2200 U	2200 U	2200 U
Dibenzofuran	450 U	500 U	430 U	440 U	440 U	440 U	440 U
2,4-Dinitrotoluene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Diethylphthalate	450 U	500 U	430 U	440 U	440 U	440 U	440 U
4-Chlorophenyl-phenylether	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Fluorene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
4-Nitroaniline	2300 U	2500 U	2100 U	2200 U	2200 U	2200 U	2200 U
4,6-Dinitro-2-methylphenol	2300 U	2500 U	2100 U	2200 U	2200 U	2200 U	2200 U
N-Nitrosodiphenylamine	450 U	500 U	430 U	440 U	440 U	440 U	440 U
4-Bromophenyl-phenylether	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Hexachlorobenzene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Pentachlorophenol	2300 U	2500 U	2100 U	2200 U	2200 U	2200 U	2200 U
Phenanthrene	450 U	500 U	430 U	440 U	150 J	290 J	440 U
Anthracene	450 U	500 U	430 U	440 U	440 U	93 J	440 U
Di-n-butylphthalate	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Fluoranthene	450 U	500 U	430 U	440 U	210 J	270 J	440 U
Pyrene	450 U	500 U	430 U	440 U	230 J	230 J	440 U
Butylbenzylphthalate	450 U	500 U	430 U	440 U	440 U	440 U	440 U
3,3'-Dichlorobenzidine	450 U	990 U	850 U	880 U	880 U	870 U	440 U
Benzo(a)anthracene	450 U	500 U	430 U	440 U	110 J	130 J	440 U

Notes
( ) Denotes Sample Reanalysis

Qualifiers
U Undetected
J Estimated, Value is below the Quantitation Limit

SAMPLE IDENTIFICATION	RA-SB01	(RA-SB01)	RA-SB02	RA-SB03	RA-SB04	RA-SB05	RA-SB06
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-16'	0'-16'	0'-20'	0'-22'	0'-10'	0'-10'	0'-10'
Date Sampled	12-4-90	12-4-90	12-13-90	12-13-90	12-14-90	12-14-90	12-17-90
SEMIVOLATILE ORGANIC COMPOUNDS (ug/Kg)	RA-SB01	(RA-SB01)	RA-SB02	RA-SB03	RA-SB04	RA-SB05	RA-SB06
Chrysene	450 U	500 U	430 U	440 U	120 J	130 J	440 U
bis(2-Ethylhexyl)phthalate	500	590	430 U	440 U	440 U	440 U	440 U
Di-n-octyl Phthalate	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Benzo(b)fluoranthene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Benzo(k)fluoranthene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Benzo(a)pyrene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Indeno(1,2,3-cd)pyrene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Dibenzo(a,h)anthracene	450 U	500 U	430 U	440 U	440 U	440 U	440 U
Benzo(g,h,i)perylene	450 U	500 U	430 U	440 U	440 U	440 U	440 U

Notes
( ) Denotes Sample Reanalysis

Qualifiers
U Undetected
J Estimated, Value is below the Quantitation Limit

SAMPLE IDENTIFICATION	RA-SB01	RA-SB02	RA-SB03	RA-SB04	RA-SB05	RA-SB06
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-16'	0'-20'	0'-22'	0'-10'	0'-10'	0'-10'
Date Sampled	12-4-90	12-13-90	12-13-90	12-14-90	12-14-90	12-17-90
PESTICIDE/PCBs (ug/Kg)	RA-SB01	RA-SB02	RA-SB03	RA-SB04	RA-SB05	RA-SB06
Alpha-BHC	10.0 U	9.7 U	10.0 U	10.0 U	10.0 U	6.3 U
Beta-BHC	10.0 U	9.7 U	10.0 U	10.0 U	10.0 U	6.3 U
Delta-BHC	10.0 U	9.7 U	10.0 U	10.0 U	10.0 U	6.3 U
Gamma-BHC(Lindane)	10.0 U	9.7 U	10.0 U	10.0 U	10.0 U	6.3 U
Heptachlor	10.0 U	9.7 U	10.0 U	10.0 U	10.0 U	6.3 U
Aldrin	10.0 U	9.7 U	10.0 U	10.0 U	10.0 U	6.3 U
Heptachlor Epoxide	10.0 U	9.7 U	10.0 U	10.0 U	10.0 U	6.3 U
Endosulfan I	10.0 U	9.7 U	10.0 U	10.0 U	10.0 U	6.3 U
Dieldrin	21.0 U	19.0 U	20.0 U	20.0 U	20.0 U	13.0 U
4,4-DDE	21.0 U	19.0 U	20.0 U	20.0 U	20.0 U	13.0 U
Endrin	21.0 U	19.0 U	20.0 U	20.0 U	20.0 U	13.0 U
Endosulfan II	21.0 U	19.0 U	20.0 U	20.0 U	20.0 U	13.0 U
4,4-DDD	21.0 U	19.0 U	20.0 U	20.0 U	20.0 U	13.0 U
Endosulfan Sulfate	21.0 U	19.0 U	20.0 U	20.0 U	20.0 U	16.0 B
4,4-DDT	21.0 U	19.0 U	20.0 U	20.0 U	20.0 U	13.0 U
Methoxychlor	100.0 U	97.0 U	100.0 U	100.0 U	100.0 U	63.0 U
Endrin Ketone	21.0 U	19.0 U	20.0 U	20.0 U	20.0 U	13.0 U
Chlordane	100.0 U	97.0 U	100.0 U	100.0 U	100.0 U	63.0 U
Toxaphene	210.0 U	190.0 U	200.0 U	200.0 U	200.0 U	130.0 U
Aroclor-1016	100.0 U	97.0 U	100.0 U	100.0 U	100.0 U	63.0 U
Aroclor-1221	100.0 U	97.0 U	100.0 U	100.0 U	100.0 U	63.0 U
Aroclor-1232	100.0 U	97.0 U	100.0 U	100.0 U	100.0 U	63.0 U
Aroclor-1242	100.0 U	97.0 U	100.0 U	100.0 U	100.0 U	63.0 U
Aroclor-1248	100.0 U	97.0 U	100.0 U	100.0 U	100.0 U	63.0 U
Aroclor-1254	210.0 U	190.0 U	200.0 U	200.0 U	200.0 U	130.0 U
Aroclor-1260	210.0 U	190.0 U	200.0 U	200.0 U	200.0 U	130.0 U

Qualifiers
U Undetected
B Analyte found in associated blank

SOIL SAMPLE RESULTS FOR THE REACTOR AREA

SAMPLE IDENTIFICATION	RA-SB01	RA-SB02	RA-SB03	RA-SB04	RA-SB05	RA-SB06
Sample Type	Composite	Composite	Composite	Composite	Composite	Composite
Sample Depth Below Surface	0'-16'	0'-20'	0'-22'	0'-10'	0'-10'	0'-10'
Date Sampled	12-4-90	12-13-90	12-13-90	12-14-90	12-14-90	12-17-90
METALS/CYANIDE/TPH (mg/Kg)	RA-SB01	RA-SB02	RA-SB03	RA-SB04	RA-SB05	RA-SB06
Aluminum	13500.00	7410.00	4730.00	4750.00	6720.00	3780.00
Antimony	1.90 U	1.90 U	1.80 U	2.00 U	2.10 U	1.90 U
Arsenic	5.40	7.00	5.80	5.60	5.80	4.10
Barium	73.00	50.00	78.00	49.00	55.00	31.00
Beryllium	0.50	0.50	0.40 U	0.40 U	0.60	0.40 U
Cadmium	1.80 U	1.20 U	1.20 U	1.30 U	1.70	1.30 U
Calcium	17200.00	84600.00	36700.00	61600.00	72300.00	27700.00
Chromium	19.00	11.00	9.20	10.00	13.00	9.20
Cobalt	9.10	7.60	5.60	4.60	8.30	2.20 U
Copper	21.00	17.00	9.90	10.00	13.00	8.90
Iron	33200.00	22900.00	14500.00	18100.00	20100.00	10500.00
Lead	14.00	13.00	7.20	8.10	13.00	6.30
Magnesium	6680.00	26700.00	8690.00	22500.00	27000.00	7100.00
Manganese	468.00	479.00	672.00	353.00	484.00	189.00
Mercury	0.11 U	0.10 U	0.10	0.10 U	0.10 U	0.10 U
Nickel	24.00	16.00	10.00	9.70	20.00	11.00
Potassium	707.00	1280.00	459.00	1040.00	1150.00	312.00
Selenium	13.00 U	0.90 U	0.90 U	0.90 U	0.90 U	0.90 U
Silver	0.63 U	0.70 U	0.70 U	0.70 U	0.70 U	0.70 U
Sodium	747.00	128.00	24.00	70.00	97.00	9.20 U
Thallium	0.88 U	0.90 U	0.90 U	1.00 U	0.90 U	0.90 U
Vanadium	35.00	16.00	12.00	19.00	19.00	8.90
Zinc	51.00	45.00	30.00	32.00	44.00	23.00
CYANIDE	1.30 U	1.20 U	1.20 U	1.20 U	1.20 U	1.30 U
TOTAL PETROLEUM HYDROCARBONS (TPH)	37.00 U	37.00 U	159.00	36.00	37.00	38.00 U

Qualifiers
U Undetected

SAMPLE IDENTIFICATION	PBS-RA-GW-01	PBS-RA-GW-04
Date Sampled	1-15-91	1-16-91
VOLATILE ORGANIC COMPOUNDS (ug/L)	PBS-RA-GW-01	PBS-RA-GW-04
Chloromethane	10 U	10 U
Bromomethane	10 U	10 U
Vinyl Chloride	10 U	10 U
Chloroethane	10 U	10 U
Methylene Chloride	5 U	5 U
Acetone	10 U	10 U
Carbon Disulfide	5 U	5 U
1,1-Dichloroethene	5 U	5 U
1,1-Dichloroethane	5 U	5 U
1,2-Dichloroethene (Total)	5 U	5 U
Chloroform	5 U	5 U
1,2-Dichloroethane	5 U	5 U
2-Butanone	10 U	10 U
1,1,1-Trichloroethane	5 U	5 U
Carbon Tetrachloride	5 U	5 U
Vinyl Acetate	10 U	10 U
Bromodichloromethane	5 U	5 U
1,2-Dichloropropane	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U
Trichloroethene	5 U	5 U
Dibromochloromethane	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U
Benzene	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U
Bromoform	5 U	5 U
4-Methyl-2-Pentanone	10 U	10 U
2-Hexanone	10 U	10 U
Tetrachloroethene	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U
Toluene	5 U	5 U
Chlorobenzene	5 U	5 U
Ethylbenzene	5 U	5 U
Styrene	5 U	5 U
Xylenes (Total)	5 U	5 U

Qualifiers
U Undetected

SAMPLE IDENTIFICATION	PBS-RA-GW-01	PBS-RA-GW-04
Date Sampled	1-15-91	1-16-91
SEMIVOLATILE ORGANIC COMPOUNDS (ug/L)	PBS-RA-GW-01	PBS-RA-GW-04
Phenol	10 U	10 U
bis(-2-Chloroethyl) Ether	10 U	10 U
2-Chlorophenol	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U
Benzyl alcohol	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U
2-Methylphenol	10 U	10 U
bis(-2-Chloroisopropyl) Ether	10 U	10 U
4-Methylphenol	10 U	10 U
N-Nitroso-Di-n-propylamine	10 U	10 U
Hexachloroethane	10 U	10 U
Nitrobenzene	10 U	10 U
Isophorone	10 U	10 U
2-Nitrophenol	10 U	10 U
2,4-Dimethylphenol	10 U	10 U
Benzoic acid	50 U	50 U
bis(-2-Chloroethoxy) methane	10 U	10 U
2,4-Dichlorophenol	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U
Naphthalene	10 U	10 U
4-Chloroaniline	10 U	10 U
Hexachlorobutadiene	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U
2-Methylnaphthalene	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U
2,4,5-Trichlorophenol	50 U	50 U
2-Chloronaphthalene	10 U	10 U
2-Nitroaniline	50 U	50 U
Dimethyl Phthalate	10 U	10 U
Acenaphthylene	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U
3-Nitroaniline	50 U	50 U
Acenaphthene	10 U	10 U
2,4-Dinitrophenol	50 U	50 U
4-Nitrophenol	50 U	50 U
Dibenzofuran	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U
Diethylphthalate	10 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U

Qualifiers
U Undetected

SAMPLE IDENTIFICATION	PBS-RA-GW-01	PBS-RA-GW-04
Date Sampled	1-15-91	1-16-91
SEMIVOLATILE ORGANIC COMPOUNDS (ug/L)	PBS-RA-GW-01	PBS-RA-GW-04
Fluorene	10 U	10 U
4-Nitroaniline	50 U	50 U
4,6-Dinitro-2-methylphenol	50 U	50 U
N-Nitrosodiphenylamine	10 U	10 U
4-Bromophenyl-phenylether	10 U	10 U
Hexachlorobenzene	10 U	10 U
Pentachlorophenol	50 U	50 U
Phenanthrene	10 U	10 U
Anthracene	10 U	10 U
Di-n-butylphthalate	10 U	10 U
Fluoranthene	10 U	10 U
Pyrene	10 U	10 U
Butylbenzylphthalate	10 U	10 U
3,3'-Dichlorobenzidine	20 U	10 U
Benzo(a)anthracene	10 U	10 U
Chrysene	10 U	10 U
bis(2-Ethylhexyl)phthalate	10 U	10 U
Di-n-octyl Phthalate	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U
Benzo(a)pyrene	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U
Dibenzo(a,h)anthracene	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U

Qualifiers
U Undetected

SAMPLE IDENTIFICATION	PBS-RA-GW-01	PBS-RA-GW-04
Date Sampled	1-15-91	1-16-91
PESTICIDE/PCBs (ug/L)	PBS-RA-GW-01	PBS-RA-GW-04
Alpha-BHC	0.053 U	0.052 U
Beta-BHC	0.097	0.052 U
Delta-BHC	0.053 U	0.052 U
Gamma-BHC(Lindane)	0.053 U	0.052 U
Heptachlor	0.053 U	0.052 U
Aldrin	0.053 U	0.052 U
Heptachlor Epoxide	0.053 U	0.052 U
Endosulfan I	0.053 U	0.052 U
Dieldrin	0.110 U	0.100 U
4,4-DDE	0.110 U	0.100 U
Endrin	0.110 U	0.100 U
Endosulfan II	0.110 U	0.100 U
4,4-DDD	0.110 U	0.100 U
Endosulfan Sulfate	0.580 B	1.000
4,4-DDT	0.110 U	0.100 U
Methoxychlor	0.530 U	0.520 U
Endrin Ketone	0.110 U	0.100 U
Chlordane	0.530 U	0.520 U
Toxaphene	1.100 U	1.000 U
Aroclor-1016	0.530 U	0.520 U
Aroclor-1221	0.530 U	0.520 U
Aroclor-1232	0.530 U	0.520 U
Aroclor-1242	0.530 U	0.520 U
Aroclor-1248	0.530 U	0.520 U
Aroclor-1254	1.100 U	1.000 U
Aroclor-1260	1.100 U	1.000 U

Qualifiers
U Undetected
B Analyte found in associated blank

TABLE B-4 GROUND WATER SAMPLE RESULTS FOR THE REACTOR AREA

SAMPLE IDENTIFICATION	PBS-RA-GW-01		PBS-RA-GW-04	
Date Sampled	1-15-91		1-16-91	
METALS/CYANIDE (ug/L) TPH (mg/L)	PBS-RA-GW-01		PBS-RA-GW-04	
Aluminum	124		181	
Antimony	3.4	U	3.4	U
Arsenic	3	U	3.6	
Barium	3.2	U	21	
Beryllium	1.6	U	1.6	U
Cadmium	5	U	5	U
Calcium	78200		169000	
Chromium	2.2	U	2.2	U
Cobalt	8.7	U	8.7	U
Copper	11	U	11	U
Iron	81		445	
Lead	1.5	U	1.5	U
Magnesium	16200		26200	
Manganese	802		122	
Mercury	0.2	U	0.2	U
Nickel	25		22	U
Potassium	410		34	U
Selenium	3.3	U	3.3	U
Silver	2.5	U	2.5	U
Sodium	30400		2850	
Thallium	2.4	U	2.4	U
Vanadium	9.2	U	9.2	U
Zinc	12		8	
CYANIDE	10	U	10	U
TOTAL PETROLEUM HYDROCARBONS (TPH)	1	U	1	U

Qualifiers
U Undetected

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-RA-SB-01

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 34061 E- 21813

TOTAL DEPTH: 16'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 632.300 MSL

GROUND WATER LEVEL & DATE TAKEN: 628.88 MSL 1/8/91

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
		2-6-8-10	VOA Sample RA-SB-01 RA-SB-01 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH sample composited over totaldepth	33	Brown fine SAND, some to little silt, little to trace cobbles, little to trace clay	
		4-6-5-5		88		
5		2-4-4-8		79		
		2-2-3-4		83	Greyish sandy clayey SILT 1/8" SAND lenses from 6'6" - 8'	Saturated VOA sample taken from 8'-10'
		1-1-3-5		75		
10		2-3-3-4		83		
		2-3-5-6		88		
15		3-5-8-9		83	Grey clayey SILT	
20					End of boring at 16'	
25						

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-RA-SB-02

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 35053 E- 22289

TOTAL DEPTH: 20'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 632.060 MSL

GROUND WATER LEVEL & DATE TAKEN: 627.61 MSL 1/10/91

DATE STARTED: 12-13-90

DATE COMPLETED: 12-13-90

LOGGED BY: S. STOWE

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		1-4-12-7	VOA Sample RA-SB-02 RA-SB-02 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH sample composited over total depth	67	Brown fine SAND, little silt	
		2-3-5-7		75		
5		5-10-12-13		67		
		6-12-12-8		71	Grey fine SAND, some to trace silt	Saturated VOA sample taken from 6'-8'
		1-6-7-12		83		
10		2-3-4-6		83		
		1-2-5-4		67		
15		2-3-3-5		83	Grey fine SAND, little to trace silt, little to trace clay	
		2-3-3-4		100		
		2-3-4-4		100	Layers of saturated fine sand 1/8' - 1/4" thick	
20					Split Spoons taken to 20', augering stopped at 18'	
25						

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-RA-SB-03

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 34898 E- 22357

TOTAL DEPTH: 22'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 631.735 MSL

GROUND WATER LEVEL & DATE TAKEN: 617.72 MSL 1/10/91

DATE STARTED: 12-13-90

DATE COMPLETED: 12-13-90

LOGGED BY: S. STOWE

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		2-5-7-8	VOA Sample RA-SB-03 RA-SB-03 B/N/A, Pesticides & PCBs, Metals & Cyanide and TPH sample composited over total depth	83	Brown fine SAND, little silt mottled from 2' - 4'	
		2-3-4-4		79		
5		2-5-9-10		75		
		3-3-3-4		71	Grey fine SAND, some to little silt, trace clay	Saturated VOA sample taken from 6'-8'
		3-4-9-7		83		
10		1-4-4-5		100		
		2-2-4-4		83		
15		2-3-3-5		75		
		2-3-2-4		100	Grey sandy clayey SILT	
		2-2-2-3		100		
20		1-1-1-1		100	Grey silty CLAY	
25					End of boring at 22'	

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-RA-SB-04

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 34842 E- 22402

TOTAL DEPTH: 10'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 631.655 MSL

GROUND WATER LEVEL & DATE TAKEN: 627.05 MSL 1/10/91

DATE STARTED: 12-14-90

DATE COMPLETED: 12-14-90

LOGGED BY: E. ZAENGLE

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		2-6-12-16	VOA Sample RA-SB-04 RA-SB-04 B/N/A, Pest. & PCBs, Metals & CN and TPH sample composited over depth	79	Brown fine SAND, some to trace silt	
		5-5-6-3		92		
5		4-10-12-11		83	Grey 1/8" thick clay lenses	Saturated VOA sample taken from 4'-6'
		2-2-3-7		92	Grey silty CLAY	
		3-6-6-5		92		
10					End of boring at 10'	
15						
20						
25						

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-RA-SB-05

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 34831 E- 22504

TOTAL DEPTH: 10'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 631.410 MSL

GROUND WATER LEVEL & DATE TAKEN: 626.59 MSL 1/10/91

DATE STARTED: 12-14-90

DATE COMPLETED: 12-14-90

LOGGED BY: E. ZAENGLE

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		1-3-6-4	VOA Sample RA-SB-05 RA-SB-05 B/N/A, Pest. & PCBs, Metals & CN and TPH sample composited over depth	88	Brown fine SAND, little to trace silt	
		5-5-5-5		83		
5		2-1-1-2		88		Saturated VOA sample taken from 4'-6'
		1-1-1-4		83		
		3-5-6-7		96	Grey silty CLAY	
10					End of boring at 10'	
15						
20						
25						

EBASCO SERVICES INCORPORATED

BOREHOLE LOG

BORING NO. PBS-RA-SB-06

SHEET 1 OF 1

PROJECT: NASA PBS CORRECTIVE ACTIONS RI/FS -PHASE 1 EFFORT-

DRILLER: R. FISHER / BELASCO DRILLING

COORDINATES: N- 34868 E- 22761

TOTAL DEPTH: 10'

TYPE OF BORING: HOLLOW STEM AUGER

ELEVATION: 630.720 MSL

GROUND WATER LEVEL & DATE TAKEN: 627.51 MSL 1/10/91

DATE STARTED: 12-17-90

DATE COMPLETED: 12-17-90

LOGGED BY: S. STOWE

DEPTH (FEET)	ELEVATION (FEET)	BLOWS 6"	SAMPLE NO. AND TYPE	PERCENT RECOVERY	DESCRIPTION	VERTICAL BOREHOLE REMARKS
		1-3-6-4	VOA Sample RA-SB-06 RA-SB-06 B/N/A, Pest. & PCBs, Metals & CN and TPH sample composited over depth	79	Brown fine SAND, little to trace silt	
		5-5-5-5		75		
5		2-1-1-2		83		Saturated VOA sample taken from 4'-6'
		1-1-1-4		88	Grey fine SAND and SILT, little to trace clay	
		3-5-6-7		83	Grey fine SAND, trace silt Grey sandy clayey SILT (10) 1/8" Sand layers from 9' - 10'	
10					Split spoons taken to 10' Boring completed at 9'	
15						
20						
25						

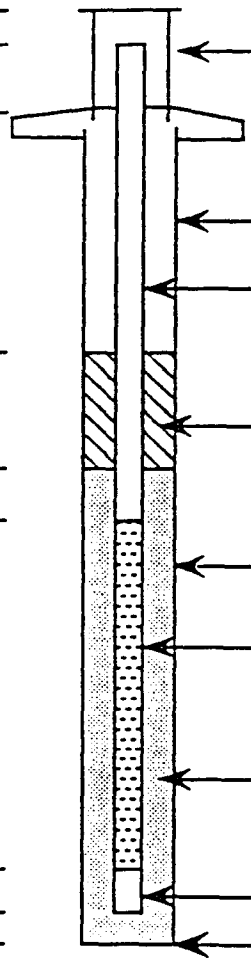
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

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-RA-01
DATE OF WELL INSTALLATION: 12-4-90
DATE OF WELL DEVELOPMENT: 1-8-91
ENGINEER: T. Roller

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE	
635.180	2.88'	
634.875	2.575'	I.D. OF SURFACE CASING: 4"
632.300	0'	
		TYPE OF SURFACE SEAL: Concrete
		I.D. OF RISER PIPE: 2"
	2'	TYPE OF RISER PIPE: 304 Stainless St.
		TYPE OF SEAL: Bentonite
	4'	EMPLACEMENT METHOD: Poured
626.8	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
616.8	15.5'	
	15.75'	LENGTH OF TAILPIPE: 3"
616.3	16'	BOTTOM OF BORING



WATER LEVEL MEASUREMENTS

DATE	1-8-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	6.00	6.65								
ELEVATION	628.88	628.23								

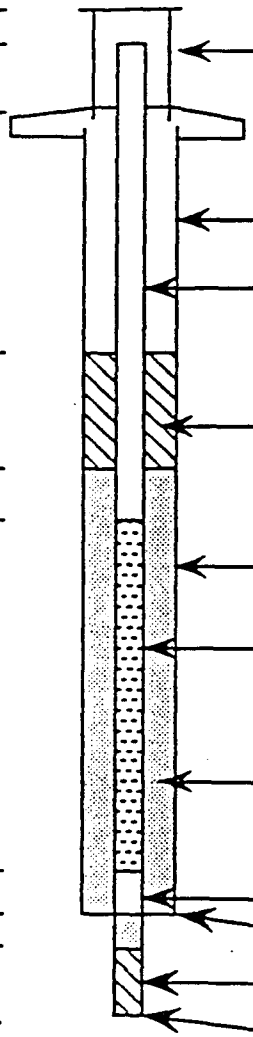
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

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-RA-02
DATE OF WELL INSTALLATION: 12-13-90
DATE OF WELL DEVELOPMENT: 1-10-91
GEOLOGIST: S. Stowe

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE
634.890	2.83'
634.760	2.7'
632.060	0'
	4'
	6'
624.3	7.75'
614.3	17.75'
614.1	18'
	18.25'
612.1	20'



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	
TYPE OF SEAL	Bentonite
END OF SPLIT SPOON SAMPLES	

WATER LEVEL MEASUREMENTS

DATE	1-10-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	7.15	6.98								
ELEVATION	627.61	627.78								

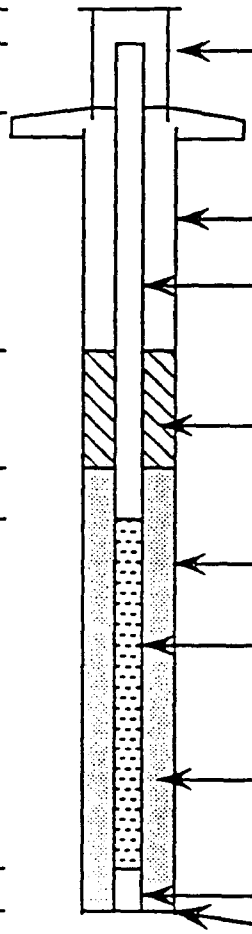
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

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-RA-03
DATE OF WELL INSTALLATION: 12-13-90
DATE OF WELL DEVELOPMENT: 1-10-91
GEOLOGIST: S. Stowe

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE	
634.455	2.72'	
634.355	2.62'	I.D. OF SURFACE CASING: 4"
631.735	0'	
		TYPE OF SURFACE SEAL: Concrete
		I.D. OF RISER PIPE: 2"
	3'	TYPE OF RISER PIPE: 304 Stainless St.
		TYPE OF SEAL: Bentonite
	5'	EMPLACEMENT METHOD: Poured
625	6.75'	
		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
610	21.75'	
609.7	22'	LENGTH OF TAILPIPE: 3"
		BOTTOM OF BORING



WATER LEVEL MEASUREMENTS

DATE	1-10-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	16.64	14.13								
ELEVATION	617.72	620.23								

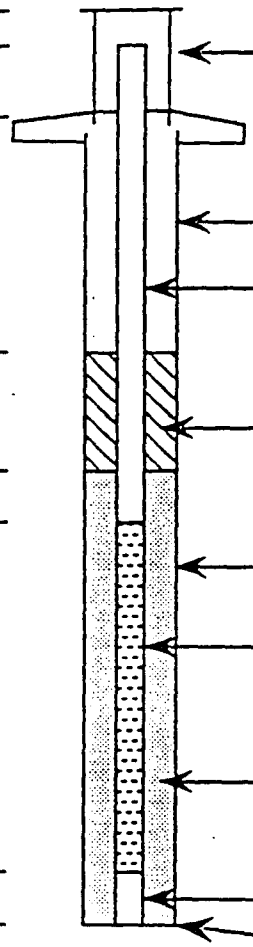
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

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-RA-04
DATE OF WELL INSTALLATION: 12-14-90
DATE OF WELL DEVELOPMENT: 1-10-91
GEOLOGIST: E. Zaengle

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE	
634.525	2.87'	
634.400	2.745'	I.D. OF SURFACE CASING: 4"
631.655	0'	
		TYPE OF SURFACE SEAL: Concrete
		I.D. OF RISER PIPE: 2"
	1.75'	TYPE OF RISER PIPE: 304 Stainless St.
		TYPE OF SEAL: Bentonite
	2.75'	EMPLACEMENT METHOD: Poured
626.9	4.75'	
		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
621.9	9.75'	
621.7	10'	LENGTH OF TAILPIPE: 3"
		BOTTOM OF BORING



WATER LEVEL MEASUREMENTS

DATE	1-10-91	5-9-91								
DEPTH FROM TOP OF OUTER PROTECTIVE CASING	7.35	8.27								
ELEVATION	627.05	626.13								

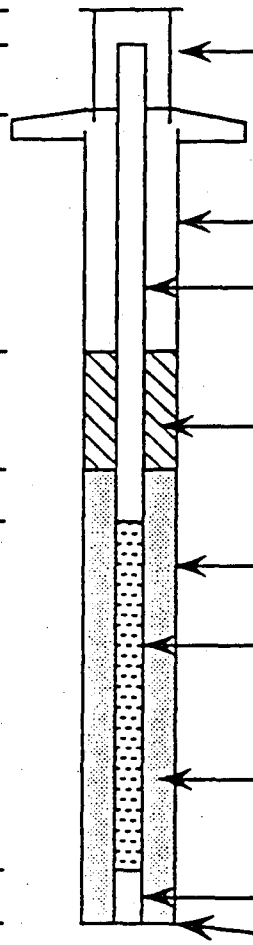
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

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-RA-05
DATE OF WELL INSTALLATION: 12-14-90
DATE OF WELL DEVELOPMENT: 1-10-91
GEOLOGIST: E. Zaengle

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE
634.195	2.785'
633.995	2.585'
631.410	0'
	1.75'
	2.75'
626.7	4.75'
621.7	9.75'
621.4	10'



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	1-10-91	5-9-91								
DEPTH FROM TOP OF OUTER PROTECTIVE CASING	7.41	7.52								
ELEVATION	626.59	626.48								

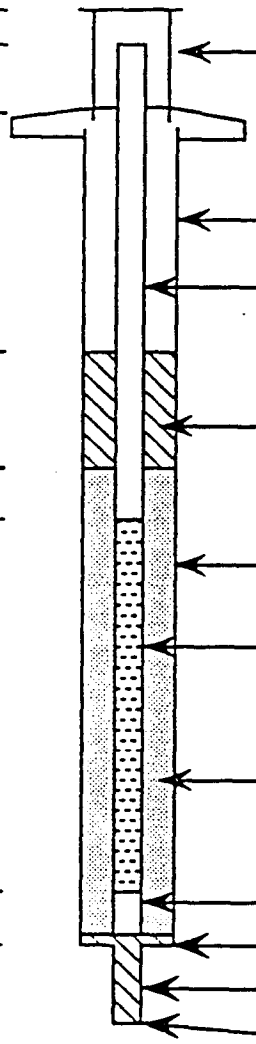
UNCONSOLIDATED MONITORING WELL INSTALLATION SKETCH

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-RA-06
DATE OF WELL INSTALLATION: 12-17-90
DATE OF WELL DEVELOPMENT: 1-10-91
GEOLOGIST: S. Stowe

ELEVATION (M.S.L.)	DEPTH OR HEIGHT FROM GROUND SURFACE	
633.625	2.905'	
633.470	2.75'	I.D. OF SURFACE CASING: 4"
630.720	0'	
		TYPE OF SURFACE SEAL: Concrete
		I.D. OF RISER PIPE: 2"
	2.4'	TYPE OF RISER PIPE: 304 Stainless St.
		TYPE OF SEAL: Bentonite
	3.4'	EMPLACEMENT METHOD: Poured
627	3.7'	
		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
622	8.7'	LENGTH OF TAILPIPE: 3"
621.7	9'	BOTTOM OF BORING
620.7	10'	TYPE OF SEAL: Bentonite
		END OF SPLIT SPOON SAMPLES



WATER LEVEL MEASUREMENTS

DATE	1-10-91	5-9-91								
DEPTH FROM TOP OF WELL CASING	5.96	6.64								
ELEVATION	627.51	626.83								

APPENDIX B-5

Preliminary Site Investigation Report, Phase I, Morrison Knudsen Corporation, 1993

PRELIMINARY SITE INVESTIGATION REPORT

100% SUBMITTAL

PHASE I

REMEDIATION OF CONTAMINATED
UNDERGROUND STORAGE TANK SITES

TASK ORDER 6105-004

PLUM BROOK STATION
6100 COLUMBUS AVENUE
SANDUSKY, OHIO 44870

JANUARY 28, 1993

PREPARED BY:

MORRISON KNUDSEN FERGUSON GROUP
21000 BROOKPARK ROAD
CLEVELAND, OHIO 44135

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TABLE 3.....Summary of Detected Soil Contamination (Ebasco 1991)

INTRODUCTION

NASA requested Morrison Knudsen (MK) to submit a report to characterize the Underground Storage Tank (UST) sites at the Plum Brook Station (PBS) in Sandusky, Ohio. The report will prioritize, characterize and determine appropriate regulatory guidance, discuss potential remediation techniques, and provide a sampling and analysis plan for each site.

The UST sites at PBS consisted of the Garage and Maintenance Area (Buildings 7132, 7121, and 7131), the Space Power Facility (SPF) (Building 1411), the Pump Station (Building 8133), and the Reactor Area (Building 1131) (Figure 1). The associated buildings and USTs, tank composition and contents, and site comments are listed in Table 1.

Upon review of the data available, it would be beneficial to separate the Garage and Maintenance Area into two sites. One site would be the Building 7132 Area, which consisted of four petroleum USTs, 7132-1(33), 7132-2(34), 7132-3(35), and 7132-4(36) and has a history with the Bureau of Underground Storage Tank Regulations (BUSTR) for the UST removals. This site could be closed under the new BUSTR regulations. The second site would be the Building 7121 and 7131 areas which consisted of USTs 7121-1(28), 7121-2(29), 7121-3(30), 7121-4(31), and 7131-1(32). These sites have a history of volatile organic compound (VOC) contamination and should follow the Resource Conservation and Recovery Act (RCRA) guidance for closure.

Each of the UST sites have had a history of UST removal and soil sampling. The Building 7132 Area and the Pump Station (Building 8133) sites have petroleum contamination; the levels are shown in Table 2. The Building 7121 and 7131 Area, SPF (Building 1411), and the Reactor Area (Building 1131) have contamination from VOC in addition to petroleum; the levels are shown in Table 3.

SITE PRIORITIZATION

Each site has been prioritized according to potential environmental hazards. The sites are listed in order from most critical to least critical, with the rationale for prioritization following.

1. Building 7121 and 7131 Area - (RCRA)
2. Reactor Area (Building 1131) - (RCRA)
3. Space Power Facility (Building 1411) - (RCRA)
4. Building 7132 Area - (BUSTR)
5. Pump Station (Building 8133) - (BUSTR)

The USTs associated with Building 7121 and 7131 were 7121-1(28) which contained waste oil and solvents (VOC), 7121-2(29) which contained acetone (VOC), 7121-3(30) which contained trichloroethene (TCE) (VOC), 7121-4(31) which contained 1,1,1-trichloroethane (TCA) (VOC), and 7131-1(32) which contained waste oil and solvents (VOC). Building 7121 and 7131 Area is the most critical because past studies have shown VOC contamination throughout the soils and groundwater of the site. These results indicate that contamination from the USTs has spread beyond the UST site. This site had the highest levels of contamination in the soils and groundwater and the furthest spread of contamination across the site. This UST site should be remediated to prevent the potential migration of contamination through the soils and groundwater.

The USTs associated with the Reactor Area (Building 1131) were 1131-1(21) which contained fuel oil, 1131-2(22) which contained fuel oil, and 1131-3(23) which contained waste oil and solvents. This area has VOC contamination in the soils but no contamination has been found in the groundwater. This site is listed as priority #2 because soil contamination exists outside the UST excavation area. Footer tiles, associated with an underground utility tunnel west of Building 1131, collect and discharge water to a sump in the basement of Building 1131. The sump discharges water to a ditch, eventually discharging to Plum Brook. This water collection may affect the local groundwater flow direction, drawing contamination from the excavation area through the soil to the footer tiles. The site should be remediated to prevent the further migration of contamination through the soils.

The USTs associated with the SPF (Building 1411) were 1411-1(24) which contained waste oil and solvents, and 1411-2(25) which contained fuel oil. This area had levels of VOC found in the UST cavity soils after excavation. This site is listed as priority #3 because less VOC contamination was detected than in the priority #2 site (Reactor Area) and no contamination was detected in the groundwater.

The USTs associated with Building 7132, near the Garage and Maintenance area, were 7132-1(33) which contained gasoline, 7132-2(34) which contained gasoline, 7132-3(35) which contained diesel fuel, and 7132-4(36) which contained diesel fuel. This area had soil sample results indicating the presence of benzene. This site is listed as priority #4 because a groundwater sample from near the UST excavation indicated benzene contamination. The soils in the contaminated area should be resampled and the groundwater should be sampled. The site should be categorized according to the BUSTR regulations. Levels in the area may be low enough to allow closure of the site.

The UST associated with the Pump Station Area (Building 8133) was 8133-1(39) which contained gasoline. This area is listed as priority #5. Total Petroleum Hydrocarbons (TPH) levels were found in the UST cavity soil after excavation. No contamination was found in the groundwater. The site does not appear to be a threat to the environment. The site should be categorized according to the BUSTR regulations. Levels in the area may be low enough to allow closure of the site.

UST SITE CHARACTERIZATIONS

Building 7121 and 7131 Areas (Priority #1)

There were four USTs located east of Building 7121 (Figure 2). They were UST 7121-1 which contained waste oil and solvents (VOC), 7121-2 which contained acetone (VOC), 7121-3 which contained TCE (VOC), and 7121-4 which contained TCA (VOC). USTs 7121-2, 7121-3, and 7121-4 were in a common excavation, while UST 7121-1 was located east of the common excavation. UST 7131-1 contained waste oil and solvents (VOC) and was located north of Building 7131. All of these USTs were removed in September of 1989. The closure report indicated levels of VOC in the soils, so the sites were placed under the Ohio Environmental Protection Agency (OEPA) jurisdiction. Ebasco was contracted by NASA to complete a site assessment to define areas of contamination.

Soils

The excavated soils from around USTs 7121-2, 7121-3, and 7121-4 had results indicating the presence of VOC contamination. The contaminated excavated soil was removed from the site. Two soil samples were taken from the north and south sidewalls of the UST excavation. These two UST excavation samples detected the presence of VOC contamination. No depth was given for the sample areas so it is not known at what depth this contamination may exist.

The analytical data from the UST 7121-1 excavation indicated the presence of VOC contamination. The depths from which the excavation samples were obtained were not presented in the Ebasco assessment report, so it cannot be determined at what depth the contamination occurs.

Four soil borings were installed east of Building 7121. Analytical results of the four borings, (PBS-GM-SB01, PBS-GM-SB05, PBS-GM-SB06, and PBS-GM-SB07) indicated VOC contamination present in the soils. The depths at which contamination occurred cannot be determined as the soil boring samples were composited over the

entire length of each boring. Thus, contamination could have been from the surface or deeper within the soils.

Underground storage tank 7131-1, north of Building 7131 had soil sample results from its excavation which showed the presence of TPH and VOC contamination. Depth of the samples are not known.

Two soil borings, (PBS-GM-SB02 and PBS-GM-SB03) were completed north of Building 7131. The analytical results of the soil samples obtained from PBS-GM-SB02 indicated TPH and VOC contamination. The analytical results of soil samples from PBS-GM-SB03 indicated no VOC were present. The depths at which contamination occurred cannot be determined as the soil boring samples were composited over the entire length of each boring. Thus, contamination could have been from the surface or deeper within the soils.

A soil gas study was conducted around the entire area. The sampling methods produced results from the 0-4 foot soil interval. Levels of benzene, toluene, xylene (BTX), and TCA (VOC) were detected in the samples around USTs 7121-2, 7121-3, and 7121-4. No contamination was found in the samples collected from the area around UST 7131-1.

Groundwater

Six borings were completed as monitoring wells. Groundwater samples were collected from two wells, PBS-GM-02 and PBS-GM-06. The analytical results for both wells indicated the presence of VOC. PBS-GM-06 was near an outside door of Building 7121 where surface spillage could have occurred contaminating soils and groundwater in the immediate area. The other wells in the area should be tested to determine the extent of groundwater contamination over the entire area.

Closure of the 7121 and 7131 Areas

The UST excavation areas near Buildings 7121 and 7131 had VOC contamination. The USTs 7121-1 and 7131-1, containing waste oils and solvents (VOC), were in service until their removal in 1989. This area should follow the RCRA Closure Guidance.

It cannot be determined from existing data whether the contamination is restricted to the surface soils or exists at a deeper depth. There is not enough groundwater analytical data in the area to show spread of contamination through this medium. Before remedial technologies for this area can be determined, the full spread of possible contamination in the groundwater and soils should be identified.

It is recommended that the existing groundwater monitoring wells be sampled and analyzed for VOC and that additional borings and wells be installed on the site. The additional monitoring wells will also give the opportunity for further soil testing to determine depth of contamination. It is also recommended that soil permeability and transmissivity parameters be tested for, in field or laboratory tests, to determine groundwater flow and soil vapor transport. This information will be necessary for the remedial technology selection.

Reactor Area (Building 1131) (Priority #2)

The Reactor Area (Building 1131) contained three USTs, 1131-1 which contained fuel oil, 1131-2 which contained fuel oil, and 1131-3 which contained waste oil and solvents. These USTs were located in a common excavation adjacent to the south side of Building 1131 (Figure 3). The USTs were removed in December of 1989.

Soils

Soil samples were collected during the UST removals. These samples revealed levels of TPH and VOC. Additional soil was removed from the excavation and two additional samples were collected from the bottom of the excavation. The additional soil samples indicated no TPH results but they did detect VOC.

Six soil borings were placed around the site and were completed as monitoring wells. The borings (PBS-RA-01 through PBS-RA-06) were sampled. The laboratory analysis for these borings detected semi-volatile organic compounds and VOC present in the soils. The soils for each boring were composited over the entire length of the boring so specific depths of contamination cannot be determined.

Groundwater

Two groundwater samples were collected from monitoring wells PBS-RA-01 and PBS-RA-04 which were installed around the site. No VOC or TPH contamination was detected in the groundwater samples.

Closure of the Reactor Area (Building 1131)

Review of the soil and groundwater data in the area revealed the presence of VOC in the soils. UST 1131-3 was in service until removal. Because of these facts, this site cannot be closed under the BUSTR regulations and should be closed under RCRA guidance. Further soil sampling is recommended in the area to determine the horizontal and vertical extent of contamination.

It is recommended that the existing groundwater monitoring wells be sampled and analyzed for VOC and that additional borings and wells be installed on the site. The additional monitoring wells will also give the opportunity for further soil testing to determine depth of contamination. This information will be necessary for the remedial technology selection.

Space Power Facility (Building 1411) (Priority #3)

The two SPF USTs 1411-1 and 1411-2 were located in a common excavation adjacent to the south foundation of Building 1411 (Figure 4). The USTs were removed in September of 1989. UST 1411-1 had contained waste oil and solvents and UST 1411-2 had contained fuel oil.

Soils

During the UST removal, the UST excavation was advanced to 12 feet in depth, where shale bedrock was encountered. Analytical results of the soil samples collected from the excavation during the UST removal indicated the presence of TPH and VOC.

A soil gas survey was completed in the SPF area in October of 1989. The survey tested the soil gas for the 0-4 foot interval. Results of this survey showed the presence of BTX outside the excavation area and one occurrence of VOC, isolated from the excavation, on the southeast side of the building.

Six soil borings (PBS-SP-SB-01 through PBS-SP-SB-06) were completed at the SPF. Analytical results of soil samples indicated the presence of VOC contamination in PBS-SP-SB-06 at the edge of the UST excavation. Levels of TPH were found in PBS-SP-SB-01, PBS-SP-SB-04, and PBS-SP-SB-06.

Groundwater

Two of the groundwater monitoring wells (PBS-SP-06 and PBS-SP-01) were sampled. Groundwater samples from the wells were analyzed for VOC, semi-volatiles, pesticides, PCBs, and TPH. There was no contamination detected in the groundwater samples.

Closure of the Space Power Facility (Building 1411)

Review of the soil and groundwater analytical data show that VOC were found in the UST excavation. In addition, UST 1411-2 contained waste oil and solvents and was in service until its removal in 1989. Because of the above facts, the area should be closed under RCRA guidance.

The soil gas survey, soil borings, and the monitoring well samples indicated BTX in the soil gas, VOC and TPH in the soil and no indication of contamination in the groundwater samples.

Four soil borings are recommended upgradient and downgradient of the UST excavation and existing monitor wells should be resampled. Soil and groundwater should be analyzed for VOC in order to comply with RCRA closure guidance.

Building 7132 USTs (Priority #4)

Three petroleum USTs were removed from a common excavation in the Building 7132 area in July of 1989 (Figure 5). The USTs were 7132-1 which contained gasoline, 7132-2 which contained gasoline, and 7132-3 which contained diesel fuel. A fourth UST, 7132-4 which contained diesel fuel, was located south of Building 7132.

Soils

During the removal of USTs 7132-1, 7132-2, and 7132-3 visibly contaminated soil was observed. Soil samples were collected and the laboratory analytical results detected benzene, toluene, ethylbenzene, and xylenes (BTEX); therefore, additional soil was removed from the excavation. Analytical results of soil samples collected after the additional excavation showed the contaminated soils had been removed. One sampling location in the excavation had a benzene concentration of 0.420 ppm. The range of permissible benzene concentrations for soils under the new BUSTR regulations is 0.006 ppm to 0.500 ppm. Categorization of the area is required under the new BUSTR regulations.

UST 7132-4, south of Building 7132, contained diesel fuel and was removed in July of 1990. There was no contamination found in this excavation.

As part of the Ebasco work, a soil gas survey was conducted around the entire site. Two samples west of the site indicated low levels of benzene and one sample east of the site indicated dichlorethene. The soil gas survey methods described in the Ebasco report show that the samples were most likely obtained from the 0-4 foot soil depth and were most likely indicative of surface contamination.

During the Ebasco work a soil boring/monitoring well (PBS-GM -04) was completed west of the site. The soils from the boring were analyzed for VOC and TPH. The only result for the soil was a TPH level of 129 ppm. The permissible level for TPH in soils according to BUSTR is 380 ppm or less.

Groundwater

Four monitoring wells 7132-GW-1, 7132-GW-2, 7132-GW-3, and 7132-GW-4 were placed around the Building 7132 Area in August of 1989. All groundwater tested from the wells was free of contamination except for monitoring well 7132-GW-1 which had a result of 0.058 ppm benzene.

Closure of Building 7132 USTs

Review of the soil and groundwater data for the Building 7132 Area show that the site can be closed under the BUSTR regulations. According to the new BUSTR regulations, the site must be categorized. In order to close this site under BUSTR regulations it is recommended that a water sample be collected from monitoring well PBS-GM-04 and that three soil samples are collected from the area surrounding the site.

Pump Station Area (Building 8133) (Priority #5)

The UST 8133-1 was located on the west side of Building 8133 (Figure 6). The UST was a 250 gallon steel gasoline tank that was removed in September of 1989. At the time of removal, the UST was out of service.

Soils

The soils sampled from the walls of the UST excavation were tested for BTEX and TPH. Results of the samples were below BUSTR action levels.

Fourteen soil gas survey samples were collected around the site. Low BTEX results were indicated in five of the samples.

Four soil borings (PBS-PS-01, PBS-PS-02, PBS-PS-03, PBS-PS-04) were placed around the site. Three borings were completed as monitoring wells. Levels of TPH were found in all four borings. VOC were found in PBS-PS-04 and PBS-PS-01. Neither of these borings, however, were in the immediate vicinity of the UST area, and therefore are likely to be unrelated to the USTs.

Groundwater

Groundwater samples were collected from PBS-PS-02 and PBS-PS-04. There was no contamination found in the water samples.

Closure of Pump Station Area (Building 8133)

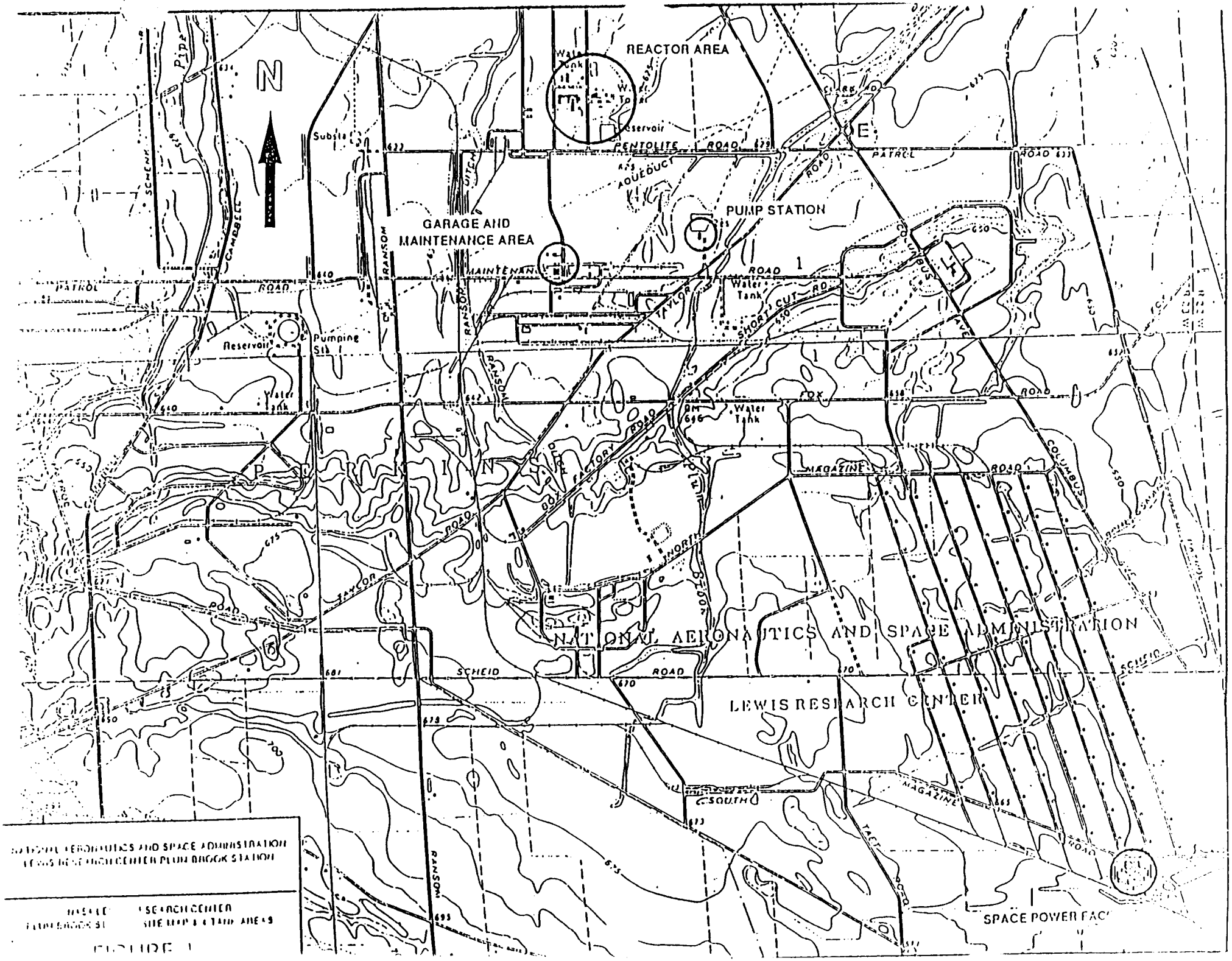
The Pump Station Area can be closed in accordance with the new BUSTR regulations. The site should be categorized according to the BUSTR regulations. Three soil samples should be collected from the surrounding area and existing monitor wells should be resampled to prove clean closure.

REVIEW OF EXISTING MATERIAL

A review of the Ebasco report submitted in November of 1991 revealed that much of the data collected during the study may be incomplete. The soil gas survey samples were collected in a manner which would have produced results from the 0-4 foot interval of soil. The manner in which the probes were advanced may have resulted in readings being produced from surface sediments which were transported down to the sampling level during installation of the probes. The asphalt in the parking lot at Building 7132 may have contributed to the contamination concentrations detected in the soil gas survey.

The soil samples collected from borings give an indication of the type of contamination in the area, but since samples were not consistently collected over the same depths and samples were composited, specific depth of contamination cannot be determined.

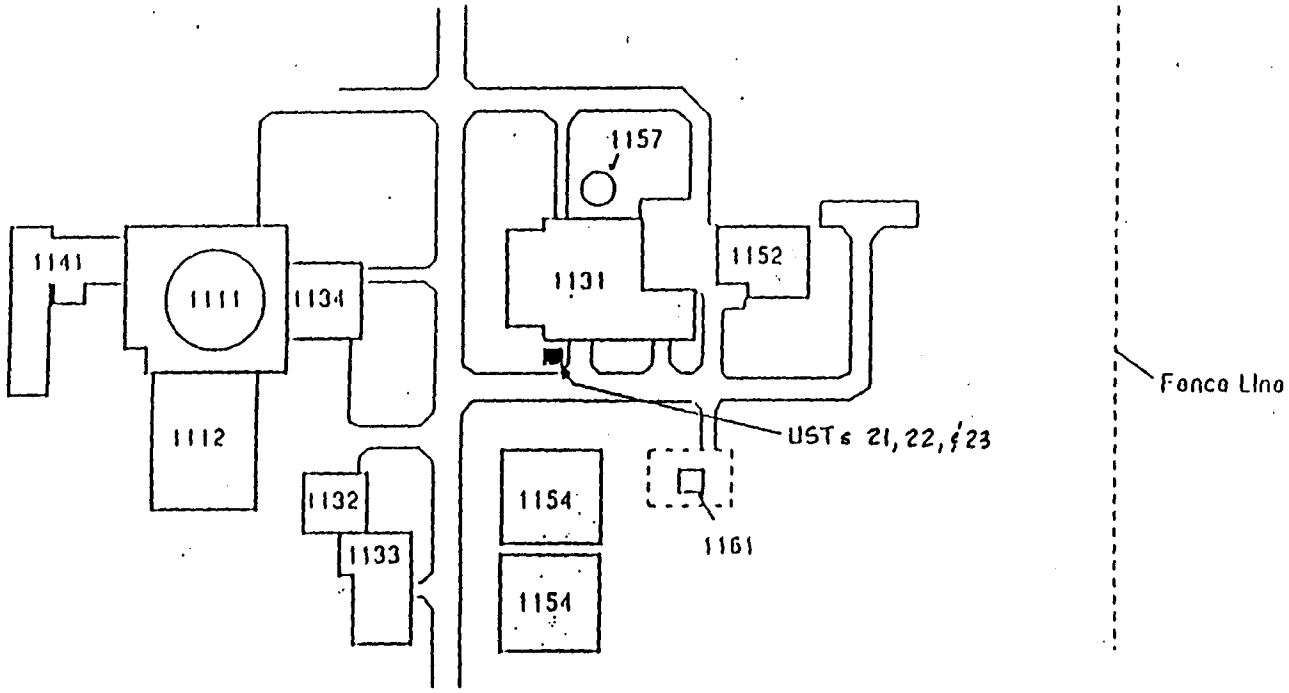
FIGURES



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LEWIS RESEARCH CENTER PLUM BROOK STATION

LEWIS RESEARCH CENTER
PLUM BROOK ST SITE MAP & TANK AREAS

FIGURE 1



Legend

Buildings

UST Location

Fence

Approximate Scale 1" = 200'

North

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
TEXAS RESEARCH CENTER PRAIRIE VIEW STATION

RESEARCH FACILITY

FIGURE 3

TABLES

SUMMARY OF DETECTED SOIL CONTAMINATION AT SITES FOR BUSTR CLOSURE

Soils Sampled from UST Excavation (Building 7132)

Sample Location	Benzene ug/kg	Toluene ug/kg	Ethylbenzene ug/kg	Xylene ug/kg	TPH mg/kg
7132-SS-1	BDL	1.10	BDL	0.35	166.0
7132-SS-2	420.0	8.90	0.79	4.00	132.0
7132-SS-3	3.0	0.85	BDL	0.27	159.0
7132-SS-4	3.0	3.80	0.59	2.70	190.0
7132-SS-5	BDL	1.60	BDL	BDL	121.0
7132-SS-6	BDL	1.10	BDL	BDL	118.0
7132-PI-1	BDL	1.20	BDL	1.70	79.0
7132-PI-2	0.95	9.50	2.30	5.60	BDL
7132-PI-3	0.46	7.70	BDL	BDL	BDL
7132-PI-4	0.60	3.00	0.37	0.94	BDL
7132-PI-5	1.30	0.64	BDL	BDL	81.0
7132-PI-6	0.30	1.80	BDL	BDL	BDL
BUSTR Action Level	335.0	900.0	14,000.0	67,000.0	904.0

Groundwater Samples (Building 7132)

Monitoring Well	Benzene ug/kg	Toluene ug/kg	Ethylbenzene ug/kg	Xylene ug/kg	TPH mg/kg
7132-GW-1	58.0	1.6	0.4	6.1	BDL
7132-GW-2	BDL	0.18	BDL	BDL	BDL
7132-GW-3	BDL	BDL	BDL	BDL	BDL
7132-GW-4	BDL	BDL	BDL	BDL	BDL
BUSTR Action Level	5.0	100.0	700.0	10,000.0	

Soil Samples from UST Excavation (Building 8133)

Sample Location	Benzene ug/kg	Toluene ug/kg	Ethylbenzene ug/kg	Xylene ug/kg	TPH mg/kg
8133-SS-3	0.19	0.77	0.27	0.94	BDL
BUSTR Action Level	350.0	900.0	14,000.0	67,000.0	904.0

BDL - Below Detection Levels

TABLE 3

SUMMARY OF DETECTED SOIL CONTAMINATION AT RCRA CLOSURE SITES (EBASCO 1991)
SOILS SAMPLED FROM UST EXCAVATION

COMPOUND	USEPA MAXIMUM CONTAMINANT LEVEL ug/kg	BLDG.7121 7121-1 ug/kg	BLDG.7121 7121-2,3,4 ug/kg	BLDG.7131 7131-1 ug/kg	BLDG.1411 1411-1,2 ug/kg	BLDG.1131 1131-1,2,3 ug/kg
Chloroethane	6.9	10.0	34.0	ND (1)	ND	ND
Trichloroflouromethane	1.8	28.0	4.0	17.0	93.0	120.0
1,1 Dichloroethane	1.2	44.0	13.0	ND	22.0	ND
Methylene Chloride	2.4	249.0	4.0	70.0	164.0	503.0
Trans1,2Dichloroethane	2.0	2.0	ND	ND	17.0	17.0
1,1Dichloroethane	0.53	1214.0	70.0	ND	228.0	6120.0
Chloroform	0.35	1.0	ND	ND	ND	1.0
1,1,1Trichloroethane	3.0	7770.0	610.0	23.0	1254.0	891.0
Carbon Tetrachloride	3.4	431.0	94.0	2.0	213.0	91.0
1,2Dichloroethane	0.53	96.0	3.0	370.0	5.0	178.0
Benzene	1.0	14.0	ND	ND	11.0	32.0
Trichloroethene	2.6	21142.0	200.0	728.0	1432.0	1019.0
Toluene	.60	1101.0	2.0	1.0	16.0	41.0
1,1,2Trichloroethane	3.2	212.0	1.0	ND	11.0	143.0
Tetrachloroethene	1.7	10048.0	8.0	17.0	342.0	1043.0
Ethylbenzene	0.50	411.0	1.0	2.0	45.0	1093.0
Xylenes	0.50	395.0	2.0	2.0	43.0	115.0
1,1,2,2Tetrachloroethane	1.0	4.0	ND	ND	ND	463.0
Isopropylbenzene	1.0	10.0	ND	ND	31.0	380.0
Tert-Butylbenzene	2.0	40.0	ND	ND	70.0	645.0
1,2,4Trimethylbenzene	2.0	479.0	ND	349.0	541.0	4413.0
Sec-Butylbenzene	2.0	8.0	ND	ND	37.0	ND
p-Isopropyltoluene	1.0	22.0	ND	ND	74.0	1854.0
Naphthalene	250.0	268.0	ND	159.0	1094.0	13388.0
1,2,3Trichlorobenzene	3.0	55.0	ND	18.0	40.0	1025.0

(1) ND - Not Detected

REACTOR AREA
TASK ORDER 6105-006

The Reactor Area contained three (3) USTs. Two (2) contained fuel oil and one (1) contained waste oil and solvents. The USTs were removed in December 1989 with the waste oil/solvent tank in service until removal.

In April 1993, four (4) borings were drilled at the Reactor Area and labeled B-1 through B-4 (Figure 2). B-1 was also converted into a monitoring well. Auger refusal depths are indicated in Table 2.

Three (3) samples were collected from each boring. The soil samples were analyzed for:

TPH (Method 418.1)
BTEX (Method 8020)
Volatiles (Method 8240)
Polynuclear Aromatic Hydrocarbons (Method 8100)

A summary of the results are attached.

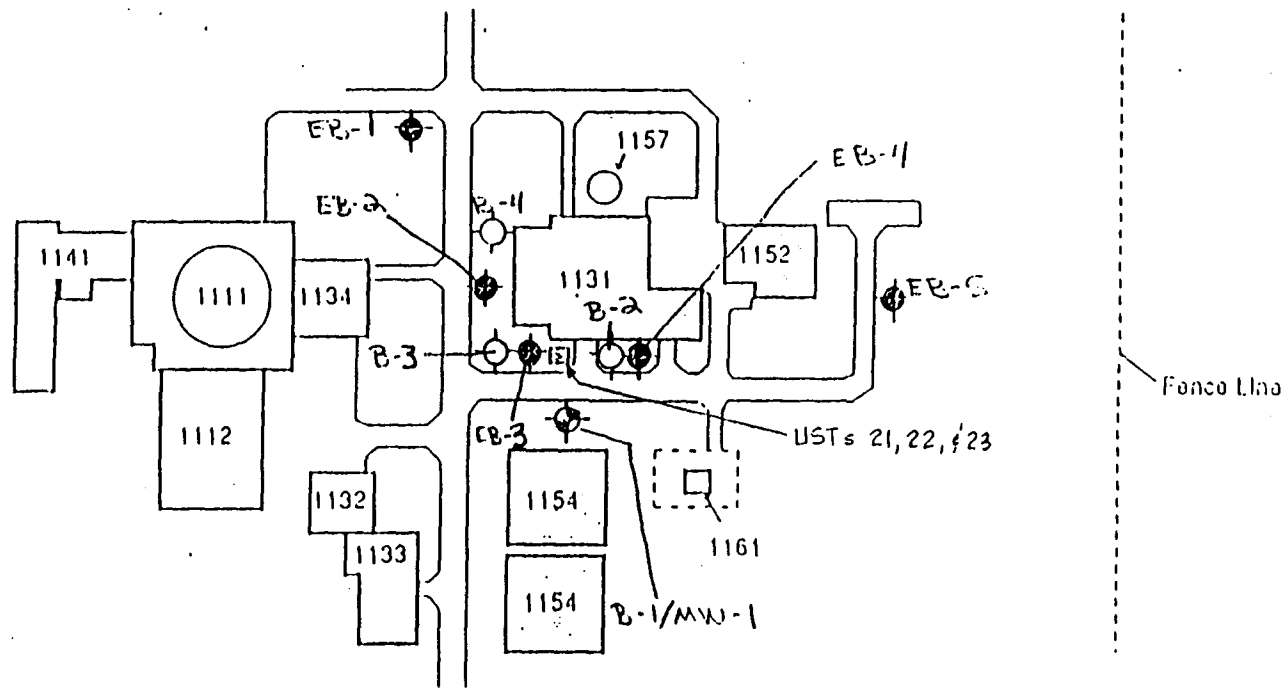
Boring B-1/MW-1 was developed into a monitoring well. This well was sampled along with six (6) other wells previously installed. A sump area inside of the Reactor Building was also sampled. The sump collects water from the building foundation drain system. All of the groundwater was analyzed for:

Volatiles (Method 8240)
Polynuclear Aromatic Hydrocarbons (Method 8100)

The sump was resampled because the original sample bottle was broken at the laboratory.

TABLE 2

LOCATION NO.	BORING NO.	BORING DEPTH (FEET)
MKB-55	B-1/MW-1	16
MKB-56	B-2	16
MKB-57	B-3	16
MKB-58	B-4	14



Legend

Buildings

UST Location

Fence

Approximate Scale 1" = 200'

North

EXISTING MONITOR WELLS (EB-)

PROPOSED MONITOR WELLS (MW-)

PROPOSED BORINGS (B-)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LEWIS RESEARCH CENTER PLUM BROOK STATION

REACTOR FACILITY

FIGURE 2

TPH AND BTEX RESULTS FOR SOIL

REACTOR AREA
TASK NO. 6105-006

BORING NUMBER	SAMPLE DEPTH	TPH (418.1) (mg/kg)[1]	BENZENE (ug/kg)[2]	TOLUENE (ug/kg)	ETHYLBENZENE (ug/kg)	M&P XYLENES (ug/kg)	O XYLENE (ug/kg)
B1	2'-4'	17	< 2	< 2	< 2	< 2	< 2
B1	4'-6'	26	< 2	< 2	< 2	< 2	< 2
B1	14'-16'	19	< 2	< 2	< 2	< 2	< 2
B2	2'-4'	12	< 2	< 2	< 2	< 2	< 2
B2	4'-6'	< 10	< 2	< 2	< 2	< 2	< 2
B2[D(3)]	4'-6'	< 10	< 2	< 2	< 2	< 2	< 2
B2	6'-8'	< 10	< 2	< 2	< 2	< 2	< 2
B3	2'-4'	10	< 2	< 2	< 2	< 2	< 2
B3	4'-6'	< 10	< 2	< 2	< 2	< 2	< 2
B3	6'-8'	10	< 2	3.14	< 2	< 2	< 2
B4	2'-4'	< 10	< 2	2.77	< 2	< 2	< 2
B4	4'-6'	< 10	< 2	2.86	< 2	< 2	< 2
B4	6'-8'	19	< 2	2.26	< 2	< 2	< 2

(1) mg/kg = parts per million
(2) ug/kg = parts per billion
(3) D = Duplicate Sample

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS IN SOIL

REACTOR AREA
TASK NO. 6105-006

BORING NUMBER	SAMPLE DEPTH	COMPOUND	RESULT (ug/kg)[1]	PQL (ug/kg)[2]
B1	2'-4'	---	---[3]	---
B1	4'-6'	---	---	---
B1	14'-16'	---	---	---
B2	2'-4'	---	---	---
B2	4'-6'	---	---	---
B2[D(4)]	4'-6'	---	---	---
B2	6'-8'	1,1,1-TRICHLOROETHANE	23.0	5
B3	2'-4'	---	---	---
B3	4'-6'	---	---	---
B3	6'-8'	---	---	---
B4	2'-4'	---	---	---
B4	4'-6'	---	---	---
B4	6'-8'	---	---	---

(1) ug/kg = ppb
(2) PQL = Practical Quantification Limit
(3) --- = Compound/Concentrations Below PQL
(4) D = Duplicate Sample

POLYNUCLEAR AROI IC HYDROCARBONS IN SOIL

REACTOR AREA
TASK NO. 6105-006

BORING NUMBER	SAMPLE DEPTH	COMPOUND	RESULT (mg/kg)[1]	PQL (mg/kg)[2]
B1	2'-4'	PHENANTHRENE	0.121	< 0.1
B1	2'-4'	PYRENE	0.177	< 0.1
B1	4'-6'	CHRYSENE	0.118	< 0.1
B1	4'-6'	FLUORANTHENE	0.304	< 0.1
B1	4'-6'	PYRENE	0.343	< 0.1
B1	14'-16'	PYRENE	0.151	< 0.1
B2	2'-4'	FLUORANTHENE	0.105	< 0.1
B2	2'-4'	PYRENE	0.185	< 0.1
B2	4'-6'	ACENAPHTHENE	0.141	< 0.1
B2[D(3)]	4'-6'	ACENAPHTHENE	0.132	< 0.1
B2	6'-8'	---	---[4]	---
B3	2'-4'	ACENAPHTHENE	0.159	< 0.1
B3	2'-4'	ACENAPHTHYLENE	0.103	< 0.1
B3	2'-4'	ANTHRACENE	0.378	< 0.1
B3	2'-4'	BENZO (a) ANTHRACENE	1.28	< 0.1
B3	2'-4'	BENZO (a) PYRENE	1.45	< 0.1
B3	2'-4'	BENZO (b) FLUOROANTHENE	1.16	< 0.1
B3	2'-4'	BENZO (k) FLUOROANTHENE	1.02	< 0.1
B3	2'-4'	BENZO (ghi) PERYLENE	0.635	< 0.1
B3	2'-4'	CHRYSENE	1.26	< 0.1

POLYNUCLEAR AROMATIC HYDROCARBONS IN SOIL

REACTOR AREA
TASK NO. 6105-006

BORING NUMBER	SAMPLE DEPTH	COMPOUND	RESULT (mg/kg)[1]	PQL (mg/kg)[2]
B3	2'-4'	DIBENZO (a,h) ANTHRACENE	0.277	< 0.1
B3	2'-4'	FLUORANTHENE	2.48	< 0.1
B3	2'-4'	INDENO (1,2,3-cd) PYRENE	0.775	< 0.1
B3	2'-4'	PHENANTHRENE	1.16	< 0.1
B3	2'-4'	PYRENE	0.220	< 0.1
B3	4'-6'	ACENAPHTHENE	0.124	< 0.1
B3	6'-8'	PYRENE	0.185	< 0.1
B4	2'-4'	PYRENE	0.106	< 0.1
B4	4'-6'	---	---[4]	---
B4	6'-8'	PYRENE	0.152	< 0.1

(1) mg/kg = ppm
(2) PQL = Practical Quantification Limit
(3) D = Duplicate Sample
(4) --- = Compound/Concentrations Below PQL

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS IN WATER

REACTOR AREA
TASK NO. 6105-006

MONITOR WELL	COMPOUND	RESULT (ug/L)[1]	PQL (ug/L)[2]
MW1[3]	---	---[4]	---
MW1A[5]	---	---	---
EB1[6]	DICHLORODIFLUORO-METHANE[7]	1.03	1
EB2	---	---	---
EB3	1,1,1-TRICHLOROETHANE	2.90	1
EB4	CIS-1,2-DICHLOROETHENE	51.9	1
EB4	TRANS-1,2-DICHLOROETHENE	1.93	1
EB4	TETRACHLOROETHENE	1.85	1
EB4	TRICHLOROETHENE	483	1
EB5	---	---	---
EB6	DICHLORODIFLUORO-METHANE[8]	1.70[4]	1
SUMP 2[9]	CHLOROETHANE	3.56	2
SUMP 2	1,1-DICHLOROETHANE	9.36	1
SUMP 2	1,1,1-TRICHLOROETHANE	10.8	1
SUMP 2	TRICHLOROETHENE	1.43	1

(1) ug/L = ppb

(2) PQL = Practical Quantification Limit

(3) MW1 = MK/NASA Installed Well

(4) --- = Concentrations Below PQL

(5) MW1A = Duplicate Sample of MW1

(6) EB1 = Ebasco Installed Well

(7) The method blank contained 0.384 ug/L of Dichlorodifluoromethane. The approximately equivalent concentration, taking into account dilution factors, is amplified to 0.384 ug/L. This is considered to be a significant contribution to the reported value.

(8) The method blank contained 0.903 ug/L of Dichlorodifluoromethane. The approximately equivalent concentration, taking into account dilution factors, is 0.903 ug/L. This is considered to be a significant contribution to the reported value.

(9) A sump in Building 1131 was sampled twice, the lab accidentally destroying the first sample. Sump 2 is the second sample.

POLYNUCLEAR AROMATIC HYDROCARBONS IN WATER

REACTOR AREA
TASK NO. 6105-006

MONITOR WELL	COMPOUND	RESULT (ug/L)[1]	PQL (ug/L)[2]
MW1[3]	---	---[4]	---
MW1A[5]	BENZO (a) ANTHRACENE	1.30	< 1.0
EB1[6]	BENZO (b) FLUOROANTHENE	4.02	< 1.0
EB2	---	---	---
EB3	BENZO (a) PYRENE	1.94	< 1.0
EB3	PHENANTHRENE	1.05	< 1.0
EB4	---	---	---
EB5	BENZO (a) PYRENE	9.20	< 1.0
EB6	---	---	---
SUMP	ACENAPHTHENE	163	< 1.0
SUMP	ACENAPHTHYLENE	414	< 1.0
SUMP	ANTHRACENE	215	< 1.0
SUMP	BENZO (a) ANTHRACENE	4.82	< 1.0
SUMP	CHRYSENE	17.6	< 1.0
SUMP	DIBENZO (a,h) ANTHRACENE	18.1	< 1.0

POLYNUCLEAR AROMATIC HYDROCARBONS IN WATER

REACTOR AREA
TASK NO. 6105-006

MONITOR WELL	COMPOUND	RESULT (ug/L)[1]	PQL (ug/L)[2]
SUMP	FLUORANTHENE	71.8	< 1.0
SUMP	FLUORENE	690	< 1.0
SUMP	PYRENE	32.9	< 1.0

(1) ug/L = ppb
(2) PQL = Practical Quantification Limit
(3) MW1 = MK/NASA Installed Well
(4) --- = Compound/Concentrations Below PQL
(5) MW1A = Duplicate Sample of MW1
(6) EB1 = Ebasco Installed Well

APPENDIX B-6

Laboratory Data, Preliminary Site Investigation, Phase I, Morrison Knudsen Corporation, 1993

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lab no. 93C01506
p.o. no. 2F2-4065-2935

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 2'-4'
4/28/93 14:22

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:
5/7/93	LNT	Edward Shiner

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lab no.: 93C01506
p.o. no.: 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 2'-4'
4/28/93 14:22

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	107%	70-121
Toluene-d8	93.7%	81-117
4-Bromofluorobenzene	89.5%	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:
5/7/93	LNT	Edward Shuert

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lab no: 93C01507
p.o. no: 2F2-4065-2935

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 4'-6'
4/28/93 14:26

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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sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 4'-6'
4/28/93 14:26

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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lab no: 93C01507
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 4'-6'
4/28/93 14:26

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	98.5%	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:
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lab no. 93C01519
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY **10% DUP.**
REACTOR AREA B-2 4'-6' DUPLICATE OF 93C01507
4/28/93 1426

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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lab no. 93C01519
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY **10% DUP.**
REACTOR AREA B-2 4'-6' DUPLICATE OF 93C01507
4/28/93 1426

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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(216) 425-8200

lab no. 93C01519
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY **10% DUP.**
REACTOR AREA B-2 4'-6' DUPLICATE OF 93C01507
4/28/93 1426

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	103%	81-117
4-Bromofluorobenzene	108%	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	

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lab no. 93C0150B
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 6'-8'
4/28/93 14:30

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:
5/7/93	LNT	Edward [illegible]

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lab no. 93C0150B
p.o. no. 2F2-4065-2935

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 6'-8'
4/28/93 14:30

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (ug/Kg)	RESULT (ug/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	23.0
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:
5/7/93	LNT	Edward Shirt

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lab no. 93C01508
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 6'-8'
4/28/93 14:30

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	111%	70-121
Toluene-d8	95.2%	81-117
4-Bromofluorobenzene	92.7%	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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lab no. 93C01509
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 2'-4'
4/28/93 15:11

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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lab no. 93C01509
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 2'-4'
4/28/93 15:11

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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lab no: 93C01509
p.o. no: 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 2'-4'
4/28/93 15:11

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	100%	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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lab no. 93C01510
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 4'-6'
4/28/93 15:12

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 Shiek

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lab no. 93C01510
p.o. no. 2F2-4065-2535

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 4'-6'
4/28/93 15:12

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: 5/8/93 | tech: LNT | approved by: Edward Shuert

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lab no. 93C01510
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sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 4'-6'
4/28/93 15:12

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	102%	81-117
4-Bromofluorobenzene	106%	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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lab no. 93C01495
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 6'-8'
4/28/93 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	< 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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lab no. 93C01495
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 6'-8'
4/28/93 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:
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lab no. 93C01495
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 6'-8'
4/28/93 15:15

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	113%	70-121
Toluene-d8	96.7%	81-117
4-Bromofluorobenzene	96.5%	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:
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lab no. 93C01496
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 2'-4'
4/28/93 15:54

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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lab no. 93C01496
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 2'-4'
4/28/93 15:54

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:
5/7/93	LNT	[signature]

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lab no. 93C01496
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 2'-4'
4/28/93 15:54

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	101%	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:
5/7/93	LNT	Edward Shirmt

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lab no. 93C01497
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 4'-6'
4/28/93 15:55

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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lab no. 93C01497
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 4'-6'
4/28/93 15:55

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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sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 4'-6'
4/28/93 15:55

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	98.6%	81-117
4-Bromofluorobenzene	93.9%	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:
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lab no. 93C01498
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 6'-8'
4/28/93 16:00

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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sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 6'-8'
4/28/93 16:00

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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sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 6'-8'
4/28/93 16:00

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	90.5%	81-117
4-Bromofluorobenzene	75.9%	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:
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lab no. 93C01676
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - MW1
5/6/93 1400

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:
5/19/93	JM	Edward Shriner

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lab no. 93C01676
p.o. no. 2F2-4065-2435

sample description: 4065-6106-006 PLUM BROOK UST STUDY
REACTOR - MW1
5/6/93 1400

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

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lab no. 93D01676
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - MW1
5/6/93 1400

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	102%	76-114
Toluene-d8	101%	88-110
4-Bromofluorobenzene	107%	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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lab no. 93001677
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - MW1-A
5/6/93 1400

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

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lab no. 93C01677
p.o. no. 2F2-4065-2435

sample description: 4065-6106-006 PLUM BROOK UST STUDY
REACTOR - MW1-A
5/6/93 1400

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:
5/19/93	JM	Edward J. Lisiet

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lab no. 93C01677
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - MW1-A
5/6/93 1400

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	105%	76-114
Toluene-d8	102%	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.

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lab no. 93C016B2
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB1
5/6/93 1515

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	1.03	See note 3
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:
5/19/93	JM	

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lab no. 93C01682
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB1
5/6/93 1515

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:
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lab no. 93C01682
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB1
5/6/93 1515

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	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.

3) The method blank contained 0.384 ug/L of Dichlorodifluoromethane. The approximate equivalent concentration, taking into account dilution factors, is amplified to 0.384 ug/L. This is considered to be a significant contribution to the reported value.

date completed:	tech:	approved by:
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lab no.
93G01681
p.o. no.
2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB2
5/6/93 1500

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:
5/19/93	JM	Edward Shiewt

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lab no. 93C016B1
p.o. no. 2F2-4065-2435

sample description: 4065-6106-006 PLUM BROOK UST STUDY
REACTOR - EB2
5/6/93 1500

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:
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lab no. 93C01681
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB2
5/6/93 1500

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	108%	76-114
Toluene-d8	103%	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.

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lab no. 93C016B0
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB3
5/6/93 1445

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

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lab no. 93C01680
p.o. no. 2F2-4065-2435

sample description: 4065-6106-006 PLUM BROOK UST STUDY
REACTOR - EB3
5/6/93 1445

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	2.90
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

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lab no. 93C01680
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB3
5/6/93 1445

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	101%	76-114
Toluene-d8	101%	88-110
4-Bromofluorobenzene	99.2%	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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lab no. 2293C01679
p.o.no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB4
5/6/93 1430

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	51.9
trans-1,2-Dichloroethene	1	1.93
1,2-Dichloropropane	1	< 1
cis-1,3-Dichloropropene	1	< 1

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lab no. 93C01679
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB4
5/6/93 1430

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	1.85	
Tetrahydrofuran	2	< 2	
Toluene	1	< 1	
1,1,1-Trichloroethane	1	< 1	(0.780)
1,1,2-Trichloroethane	1	< 1	
Trichloroethene	1	483	
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:
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lab no: 93C01579-Y
p.o. no: 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB4
5/6/93 1430

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	97.1%	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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lab no. 93C01678
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB5
5/6/93 1415

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:
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lab no. 93C01678
p.o. no. 2F2-4065-2435

sample description: 4065-6106-006 PLUM BROOK UST STUDY
REACTOR - EB5
5/6/93 1415

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:
5/19/93	JM	

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lab no: 93C01678
p.o. no: 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB5
5/6/93 1415

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	106%	76-114
Toluene-d8	102%	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:
5/19/93	JM	Edward Thiel

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lab no. 93C01684
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB6
5/7/93 0730

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	1.70	See note 3
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	

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lab no. 93C01684
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB6
5/7/93 0730

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 Hunt

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lab no. 93C01684
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB6
5/7/93 0730

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	101%	76-114
Toluene-d8	99.5%	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.

3) The method blank contained 0.903 ug/L of Dichlorodifluoromethane. The approximate equivalent concentration, taking into account dilution factors, is 0.903 ug/L. This is considered to be a significant contribution to the reported value.

date completed:	tech:	approved by:
5/17/93	JM	Edward Kleinot

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lab no. 93C01683
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - SUMP
5/6/93 1300

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.

* The VOC analysis could not be performed due to breakage in storage.

date completed:	tech:	approved by:
6/4/93	ELT	Edward Shirst

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lab no. 93C01914
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PBS UST STUDY
REACTOR-SUMP-2
5/25/93 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	3.56	
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	9.36	
1,2-Dichloroethane	1	< 1	
1,1-Dichloroethene	1	< 1	
cis-1,2-Dichloroethene	1	< 1	(0.715)
trans-1,2-Dichloroethene	1	< 1	
1,2-Dichloropropane	1	< 1	
cis-1,3-Dichloropropene	1	< 1	

date completed:	tech:	approved by:
6/1/93	LNT	Edward Stuart

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lab no. 93C01914
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PBS UST STUDY
REACTOR-SUMP-2
5/25/93 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	10.8
1,1,2-Trichloroethane	1	< 1
Trichloroethene	1	1.43
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:
6/1/93	LNT	Edward Frient

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lab no. 93C01914
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PBS UST STUDY
REACTOR-SUMP-2
5/25/93 0815

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	93.9%	76-114
Toluene-d8	90.6%	88-110
4-Bromofluorobenzene	90.9%	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:
6/1/93	LNT	Edward Shiner

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lab no. 93C01503
p.o. no. 12F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 2'-4'
4/28/93 13:01

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	17 mg/Kg

date completed: 5/6/93
tech: MD
approved by: Edward Sheet

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lab no. 93C01503
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 2'-4'
4/28/93 13:01

analysis: BTEX

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 8020.

results:

Benzene	less than	2	µg/Kg
Toluene	less than	2	µg/Kg
Ethylbenzene	less than	2	µg/Kg
m & p-Xylenes	less than	2	µg/Kg
o-Xylene	less than	2	µg/Kg

SURROGATE RECOVERY

a,a,a-Trifluorotoluene 78.2%

date completed:	tech:	approved by:
5/14/93	ELT	Edward Shiner

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lab no. 93C01504
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 4'-6'
4/28/93 13:03

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	26 mg/Kg

date completed:	tech:	approved by:
5/6/93	MD	Edward Shuert

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lab no. 93C01504
p.o. no. 2F2-4065-2455

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 4'-6'
4/28/93 13:03

analysis: BTEX

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 8020.

results:

Benzene	less than	2	µg/Kg
Toluene	less than	2	µg/Kg
Ethylbenzene	less than	2	µg/Kg
m & p-Xylenes	less than	2	µg/Kg
o-Xylene	less than	2	µg/Kg

SURROGATE RECOVERY

a,a,a-Trifluorotoluene 73.1%

date completed:	tech:	approved by:
5/14/93	ELT	Edward Kruit

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lab no. 93C01505
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 14'-16'
4/28/93 13:20

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	19 mg/Kg

date completed:	tech:	approved by:
5/6/93	MD	Edward Shuvit

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lab no. 93C01505
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 14'-16'
4/28/93 13:20

analysis: BTEX

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 8020.

results:

Benzene	less than	2	µg/Kg
Toluene	less than	2	µg/Kg
Ethylbenzene	less than	2	µg/Kg
m & p-Xylenes	less than	2	µg/Kg
o-Xylene	less than	2	µg/Kg

SURROGATE RECOVERY

a,a,a-Trifluorotoluene 76.6%

date completed:	tech:	approved by:
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lab no. 93C01506
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 2'-4'
4/28/93 14:22

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	12 mg/Kg

date completed:	tech:	approved by:
5/6/93	MD	Edward Shuert

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lab no. 93C01506
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 2'-4'
4/28/93 14:22

analysis: BTEX

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 8020.

results:

Benzene	less than	2	µg/Kg
Toluene	less than	2	µg/Kg
Ethylbenzene	less than	2	µg/Kg
m & p-Xylenes	less than	2	µg/Kg
o-Xylene	less than	2	µg/Kg

SURROGATE RECOVERY

a,a,a-Trifluorotoluene 82.4%

date completed:	tech:	approved by:
5/14/93	ELT	Edward Shuert

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lab no. 93C01507
p.o. no. 2F2-4065-2335

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 4'-6'
4/28/93 14:26

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed:	tech:	approved by:
5/6/93	MD	Edward Shuert

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lab no. [illegible]
93C01507
p.o. no. [illegible]
252-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 4'-6'
4/28/93 14:26

analysis: BTEX

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 8020.

results:

Benzene	less than	2	µg/Kg
Toluene	less than	2	µg/Kg
Ethylbenzene	less than	2	µg/Kg
m & p-Xylenes	less than	2	µg/Kg
o-Xylene	less than	2	µg/Kg

SURROGATE RECOVERY

a,a,a-Trifluorotoluene 95.1%

date completed:	tech:	approved by:
5/14/93	ELT	Edward Shriver

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lab no. 93C01519
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY **10% DUP.**
REACTOR AREA B-2 4'-6' DUPLICATE OF 93C01507
4/28/93 1426

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed	tech	approved by
5/6/93	MD	Edward Shiner

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lab no. 93C01519
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY **10% DUP**
REACTOR AREA B-2 4'-6' DUPLICATE OF 93C01507
4/28/93 1426

analysis: BTEX

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 8020.

results:

Benzene	less than	2	µg/Kg
Toluene	less than	2	µg/Kg
Ethylbenzene	less than	2	µg/Kg
m & p-Xylenes	less than	2	µg/Kg
o-Xylene	less than	2	µg/Kg

SURROGATE RECOVERY

a,a,a-Trifluorotoluene 95.1%

date completed:	tech:	approved by:
5/14/93	ELT	Edward Skwiot

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lab no. 93C01508
p.o. no. 12F2-4065-2455

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 6'-8'
4/28/93 14:30

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed:	tech:	approved by:
5/6/93	MD	Edward Shuert

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lab no/ 93C01508
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 6'-8'
4/28/93 14:30

analysis: BTEX

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 8020.

results:

Benzene	less than	2	µg/Kg
Toluene	less than	2	µg/Kg
Ethylbenzene	less than	2	µg/Kg
m & p-Xylenes	less than	2	µg/Kg
o-Xylene	less than	2	µg/Kg

SURROGATE RECOVERY

a,a,a-Trifluorotoluene 77.6%

date completed:	tech:	approved by:
5/14/93	ELT	Edward Sheirt

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lab no. 93C01509
p.o. no. 7F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 2'-4'
4/28/93 15:11

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	10 mg/Kg

date completed:	tech:	approved by:
5/6/93	MD	Edward Sheerit

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lab no. 93C01509
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 2'-4'
4/28/93 15:11

analysis: BTEX

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 8020.

results:

Benzene	less than	2	µg/Kg
Toluene	less than	2	µg/Kg
Ethylbenzene	less than	2	µg/Kg
m & p-Xylenes	less than	2	µg/Kg
o-Xylene	less than	2	µg/Kg

SURROGATE RECOVERY

a,a,a-Trifluorotoluene 86.6%

date completed:	tech:	approved by:
5/14/93	ELT	Edward Shuert

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lab no. 93C01510
p.o. no. 2F2-4065-2935

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 4'-6'
4/28/93 15:12

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed:	tech:	approved by:
5/6/93	MD	Edward Jewett

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lab no: 93C01510
p.o. no: CF2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 4'-6'
4/28/93 15:12

analysis: BTEX

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 8020.

results:

Benzene	less than	2	µg/Kg
Toluene	less than	2	µg/Kg
Ethylbenzene	less than	2	µg/Kg
m & p-Xylenes	less than	2	µg/Kg
o-Xylene	less than	2	µg/Kg

SURROGATE RECOVERY

a,a,a-Trifluorotoluene 95.4%

date completed:	tech:	approved by:
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lab no. 93C01495
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 6'-8'
4/28/93 15:15

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	10 mg/Kg

date completed: 5/5/93
tech: MD
approved by: Edward Skurot

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lab no. 93C01495
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 6'-8'
4/28/93 15:15

analysis: BTEX

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 8020.

results:

Benzene	less than	2	µg/Kg
Toluene		3.14	µg/Kg
Ethylbenzene	less than	2	µg/Kg
m & p-Xylenes	less than	2	µg/Kg
o-Xylene	less than	2	µg/Kg

SURROGATE RECOVERY

a,a,a-Trifluorotoluene 87.6%

date completed:	tech:	approved by:
5/13/93	ELT	Edward Stuart

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lab no. 93C01496
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 2'-4'
4/28/93 15:54

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed: 5/5/93
tech: MD
approved by: Edward Elliott

[illegible] as confidential communications. Authorization [illegible] in whole or part [illegible] our written approval [illegible]

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lab no. 93C01496
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 2'-4'
4/28/93 15:54

analysis: BTEX

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 8020.

results:

Benzene	less than	2	µg/Kg
Toluene		2.77	µg/Kg
Ethylbenzene	less than	2	µg/Kg
m & p-Xylenes	less than	2	µg/Kg
o-Xylene	less than	2	µg/Kg

SURROGATE RECOVERY

a,a,a-Trifluorotoluene 87.7%

date completed:	tech:	approved by:
5/13/93	ELT	Edward Shiest

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lab no. 93C01497
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 4'-6'
4/28/93 15:55

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	less than 10 mg/Kg

date completed	tech.	approved by:
5/6/93	MD	Edward Shivit

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lab no. 93C01497
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 4'-6'
4/28/93 15:55

analysis: BTEX

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 8020.

results:

Benzene	less than	2	µg/Kg
Toluene		2.86	µg/Kg
Ethylbenzene	less than	2	µg/Kg
m & p-Xylenes	less than	2	µg/Kg
o-Xylene	less than	2	µg/Kg

SURROGATE RECOVERY

a,a,a-Trifluorotoluene	76.7%

date completed:	tech:	approved by:
5/13/93	ELT	Edward Hurst

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lab no. 93C01498
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 6'-8'
4/28/93 16:00

ANALYTE	METHOD	RESULT
Total Petroleum Hydrocarbons - soil	SW-846, 9071 EPA 600, 418.1	19 mg/Kg

date completed:	tech:	approved by:
5/6/93	MD	Edward Shuert

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lab no. 93C01498
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 6'-8'
4/28/93 16:00

analysis: BTEX

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 8020.

results:

Benzene	less than	2	µg/Kg
Toluene		2.26	µg/Kg
Ethylbenzene	less than	2	µg/Kg
m & p-Xylenes	less than	2	µg/Kg
o-Xylene	less than	2	µg/Kg

SURROGATE RECOVERY

a,a,a-Trifluorotoluene 81.0%

date completed:	tech:	approved by:
5/13/93	ELT	Edward Kriest

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lab no. 93001689
2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - MW1
5/6/93 1400

analysis: Polynuclear Aromatic Hydrocarbons

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8100.

results:

COMPOUND	METHOD PQL (µg/L)	RESULTS (µg/L)
Acenaphthene	less than 1.0	less than 1.0
Acenaphthylene	less than 1.0	less than 1.0
Anthracene	less than 1.0	less than 1.0
Benzo (a) anthracene	less than 1.0	less than 1.0
Benzo (a) pyrene	less than 1.0	less than 1.0
Benzo (b) fluoroanthene	less than 1.0	less than 1.0
Benzo (k) fluoroanthene	less than 1.0	less than 1.0
Benzo (ghi) perylene	less than 1.0	less than 1.0
Chrysene	less than 1.0	less than 1.0
Dibenzo(a,h)anthracene	less than 1.0	less than 1.0
Fluoranthene	less than 1.0	less than 1.0
Fluorene	less than 1.0	less than 1.0
Indeno(1,2,3-cd)pyrene	less than 1.0	less than 1.0
Naphthalene	less than 1.0	less than 1.0
Phenanthrene	less than 1.0	less than 1.0
Pyrene	less than 1.0	less than 1.0

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	57.1%
p-Terphenyl-d14	76.1%

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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lab no. 93C01690
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - MW1-A
5/6/93 1400

analysis: Polynuclear Aromatic Hydrocarbons

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8100.

results:

COMPOUND	METHOD PQL (µg/L)	RESULTS (µg/L)
Acenaphthene	less than 1.0	less than 1.0
Acenaphthylene	less than 1.0	less than 1.0
Anthracene	less than 1.0	less than 1.0
Benzo (a) anthracene	less than 1.0	less than 1.0
Benzo (a) pyrene	less than 1.0	1.30
Benzo (b) fluoroanthene	less than 1.0	less than 1.0
Benzo (k) fluoroanthene	less than 1.0	less than 1.0
Benzo (ghi) perylene	less than 1.0	less than 1.0
Chrysene	less than 1.0	less than 1.0
Dibenzo(a,h)anthracene	less than 1.0	less than 1.0
Fluoranthene	less than 1.0	less than 1.0
Fluorene	less than 1.0	less than 1.0
Indeno(1,2,3-cd)pyrene	less than 1.0	less than 1.0
Naphthalene	less than 1.0	less than 1.0
Phenanthrene	less than 1.0	less than 1.0
Pyrene	less than 1.0	less than 1.0

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	61.0%
p-Terphenyl-d14	74.2%

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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

date completed:	tech:	approved by:
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lab no. 93C01695
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB1
5/6/93 1515

analysis: Polynuclear Aromatic Hydrocarbons

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8100.

results:

COMPOUND	METHOD PQL (µg/L)	RESULTS (µg/L)
Acenaphthene	less than 1.0	less than 1.0
Acenaphthylene	less than 1.0	less than 1.0
Anthracene	less than 1.0	less than 1.0
Benzo (a) anthracene	less than 1.0	less than 1.0
Benzo (a) pyrene	less than 1.0	less than 1.0
Benzo (b) fluoroanthene	less than 1.0	4.02
Benzo (k) fluoroanthene	less than 1.0	less than 1.0
Benzo (ghi) perylene	less than 1.0	less than 1.0
Chrysene	less than 1.0	less than 1.0
Dibenzo(a,h)anthracene	less than 1.0	less than 1.0
Fluoranthene	less than 1.0	less than 1.0
Fluorene	less than 1.0	less than 1.0
Indeno(1,2,3-cd)pyrene	less than 1.0	less than 1.0
Naphthalene	less than 1.0	less than 1.0
Phenanthrene	less than 1.0	less than 1.0
Pyrene	less than 1.0	less than 1.0

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	71.7%
p-Terphenyl-d14	92.6%

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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

date completed:	tech:	approved by:
5/24/93	GJB	

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lab no.
93C01694
p.o. no.
2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB2
5/6/93 1500

analysis: Polynuclear Aromatic Hydrocarbons

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8100.

results:

COMPOUND	METHOD PQL (µg/L)	RESULTS (µg/L)
Acenaphthene	less than 1.0	less than 1.0
Acenaphthylene	less than 1.0	less than 1.0
Anthracene	less than 1.0	less than 1.0
Benzo (a) anthracene	less than 1.0	less than 1.0
Benzo (a) pyrene	less than 1.0	less than 1.0
Benzo (b) fluoroanthene	less than 1.0	less than 1.0
Benzo (k) fluoroanthene	less than 1.0	less than 1.0
Benzo (ghi) perylene	less than 1.0	less than 1.0
Chrysene	less than 1.0	less than 1.0
Dibenzo(a,h)anthracene	less than 1.0	less than 1.0
Fluoranthene	less than 1.0	less than 1.0
Fluorene	less than 1.0	less than 1.0
Indeno(1,2,3-cd)pyrene	less than 1.0	less than 1.0
Naphthalene	less than 1.0	less than 1.0
Phenanthrene	less than 1.0	less than 1.0
Pyrene	less than 1.0	less than 1.0

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	79.2%
p-Terphenyl-d14	102%

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:
5/24/93	GJB	Howard Shirk

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lab no: 93C0265
2E2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB3
5/6/93 1445

analysis: Polynuclear Aromatic Hydrocarbons

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8100.

results:

COMPOUND	METHOD PQL (µg/L)	RESULTS (µg/L)
Acenaphthene	less than 1.0	less than 1.0
Acenaphthylene	less than 1.0	less than 1.0
Anthracene	less than 1.0	less than 1.0
Benzo (a) anthracene	less than 1.0	less than 1.0
Benzo (a) pyrene	less than 1.0	1.94
Benzo (b) fluoroanthene	less than 1.0	less than 1.0
Benzo (k) fluoroanthene	less than 1.0	less than 1.0
Benzo (ghi) perylene	less than 1.0	less than 1.0
Chrysene	less than 1.0	less than 1.0
Dibenzo(a,h)anthracene	less than 1.0	less than 1.0
Fluoranthene	less than 1.0	less than 1.0
Fluorene	less than 1.0	less than 1.0
Indeno(1,2,3-cd)pyrene	less than 1.0	less than 1.0
Naphthalene	less than 1.0	less than 1.0
Phenanthrene	less than 1.0	1.05
Pyrene	less than 1.0	less than 1.0

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	76.2%
p-Terphenyl-d14	96%

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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

date completed:	tech:	approved by:
5/24/93	GJB	

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lab no.
93C01692
p.o. no.
2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB4
5/6/93 1430

analysis: Polynuclear Aromatic Hydrocarbons

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8100.

results:

COMPOUND	METHOD PQL (µg/L)	RESULTS (µg/L)
Acenaphthene	less than 1.0	less than 1.0
Acenaphthylene	less than 1.0	less than 1.0
Anthracene	less than 1.0	less than 1.0
Benzo (a) anthracene	less than 1.0	less than 1.0
Benzo (a) pyrene	less than 1.0	less than 1.0
Benzo (b) fluoroanthene	less than 1.0	less than 1.0
Benzo (k) fluoroanthene	less than 1.0	less than 1.0
Benzo (ghi) perylene	less than 1.0	less than 1.0
Chrysene	less than 1.0	less than 1.0
Dibenzo(a,h)anthracene	less than 1.0	less than 1.0
Fluoranthene	less than 1.0	less than 1.0
Fluorene	less than 1.0	less than 1.0
Indeno(1,2,3-cd)pyrene	less than 1.0	less than 1.0
Naphthalene	less than 1.0	less than 1.0
Phenanthrene	less than 1.0	less than 1.0
Pyrene	less than 1.0	less than 1.0

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	65.4%
p-Terphenyl-d14	80.9%

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:
5/24/93	GJB	

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lab no: 93C01691
p.o. no: 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB5
5/6/93 1415

analysis: Polynuclear Aromatic Hydrocarbons

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8100.

results:

COMPOUND	METHOD PQL (µg/L)	RESULTS (µg/L)
Acenaphthene	less than 1.0	less than 1.0
Acenaphthylene	less than 1.0	less than 1.0
Anthracene	less than 1.0	less than 1.0
Benzo (a) anthracene	less than 1.0	less than 1.0
Benzo (a) pyrene	less than 1.0	9.20
Benzo (b) fluoroanthene	less than 1.0	less than 1.0
Benzo (k) fluoroanthene	less than 1.0	less than 1.0
Benzo (ghi) perylene	less than 1.0	less than 1.0
Chrysene	less than 1.0	less than 1.0
Dibenzo(a,h)anthracene	less than 1.0	less than 1.0
Fluoranthene	less than 1.0	less than 1.0
Fluorene	less than 1.0	less than 1.0
Indeno(1,2,3-cd)pyrene	less than 1.0	less than 1.0
Naphthalene	less than 1.0	less than 1.0
Phenanthrene	less than 1.0	less than 1.0
Pyrene	less than 1.0	less than 1.0

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	67.2%
p-Terphenyl-d14	83.1%

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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

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lab no. 93C01684
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EB6
5/7/93 0730

analysis: Polynuclear Aromatic Hydrocarbons

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8100.

results:

COMPOUND	METHOD PQL (µg/L)	RESULTS (µg/L)
Acenaphthene	less than 1.0	less than 1.0
Acenaphthylene	less than 1.0	less than 1.0
Anthracene	less than 1.0	less than 1.0
Benzo (a) anthracene	less than 1.0	less than 1.0
Benzo (a) pyrene	less than 1.0	less than 1.0
Benzo (b) fluoroanthene	less than 1.0	less than 1.0
Benzo (k) fluoroanthene	less than 1.0	less than 1.0
Benzo (ghi) perylene	less than 1.0	less than 1.0
Chrysene	less than 1.0	less than 1.0
Dibenzo(a,h)anthracene	less than 1.0	less than 1.0
Fluoranthene	less than 1.0	less than 1.0
Fluorene	less than 1.0	less than 1.0
Indeno(1,2,3-cd)pyrene	less than 1.0	less than 1.0
Naphthalene	less than 1.0	less than 1.0
Phenanthrene	less than 1.0	less than 1.0
Pyrene	less than 1.0	less than 1.0

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	64.9%
p-Terphenyl-d14	80.8%

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:
5/20/93	GJB	Edward Shuert

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Lab Number: 93G01688
P.O. or Contract Number: 2F-2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - SUMP
5/6/93 1300

analysis: Polynuclear Aromatic Hydrocarbons

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8100.

results:

COMPOUND	METHOD PQL (µg/L)	RESULTS (µg/L)
Acenaphthene	less than 1.0	163
Acenaphthylene	less than 1.0	414
Anthracene	less than 1.0	215
Benzo (a) anthracene	less than 1.0	4.82
Benzo (a) pyrene	less than 1.0	less than 1.0
Benzo (b) fluoroanthene	less than 1.0	less than 1.0
Benzo (k) fluoroanthene	less than 1.0	less than 1.0
Benzo (ghi) perylene	less than 1.0	less than 1.0
Chrysene	less than 1.0	17.6
Dibenzo(a,h)anthracene	less than 1.0	18.1
Fluoranthene	less than 1.0	71.8
Fluorene	less than 1.0	690
Indeno(1,2,3-cd)pyrene	less than 1.0	less than 1.0
Naphthalene	less than 1.0	less than 1.0
Phenanthrene	less than 1.0	less than 1.0
Pyrene	less than 1.0	32.9

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	100%
p-Terphenyl-d14	169% See note 4

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.
3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.
4) High surrogate recovery due to matrix interference.

date completed:	tech:	approved by:
5/24/93	GJB	Edward Hunt

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lab no. 93D01503
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 2'-4'
4/28/93 13:01

analysis: Polynuclear Aromatic Hydrocarbons

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 8100.

results:

COMPOUND	METHOD PQL (mg/Kg)	RESULTS (mg/Kg)
Acenaphthene	less than 0.1	less than 0.1
Acenaphthylene	less than 0.1	less than 0.1
Anthracene	less than 0.1	less than 0.1
Benzo (a) anthracene	less than 0.1	less than 0.1
Benzo (a) pyrene	less than 0.1	less than 0.1
Benzo (b) fluoroanthene	less than 0.1	less than 0.1
Benzo (k) fluoroanthene	less than 0.1	less than 0.1
Benzo (ghi) perylene	less than 0.1	less than 0.1
Chrysene	less than 0.1	less than 0.1
Dibenzo(a,h)anthracene	less than 0.1	less than 0.1
Fluoranthene	less than 0.1	less than 0.1
Fluorene	less than 0.1	less than 0.1
Indeno(1,2,3-cd)pyrene	less than 0.1	less than 0.1
Naphthalene	less than 0.1	less than 0.1
Phenanthrene	less than 0.1	0.121
Pyrene	less than 0.1	0.177

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	64.2%
p-Terphenyl-d14	90.1%

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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

date completed: 5/12/93 | tech: AMG/RJS/GJB | approved by: Edward Shuck

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lab no. 93C01504
p.o. no. 2F2-4065-2335

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 4'-6'
4/28/93 13:03

analysis: Polynuclear Aromatic Hydrocarbons

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 8100.

results:

COMPOUND	METHOD PQL (mg/Kg)	RESULTS (mg/Kg)
Acenaphthene	less than 0.1	less than 0.1
Acenaphthylene	less than 0.1	less than 0.1
Anthracene	less than 0.1	less than 0.1
Benzo (a) anthracene	less than 0.1	less than 0.1
Benzo (a) pyrene	less than 0.1	less than 0.1
Benzo (b) fluoroanthene	less than 0.1	less than 0.1
Benzo (k) fluoroanthene	less than 0.1	less than 0.1
Benzo (ghi) perylene	less than 0.1	less than 0.1
Chrysene	less than 0.1	0.118
Dibenzo(a,h)anthracene	less than 0.1	less than 0.1
Fluoranthene	less than 0.1	0.304
Fluorene	less than 0.1	less than 0.1
Indeno(1,2,3-cd)pyrene	less than 0.1	less than 0.1
Naphthalene	less than 0.1	less than 0.1
Phenanthrene	less than 0.1	less than 0.1
Pyrene	less than 0.1	0.343

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	59.9%
p-Terphenyl-d14	86.0%

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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

date completed:	tech:	approved by:
5/12/93	AMG/RJS/GJB	Edward Shirt

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job no: 93C01505
p.o. no: 2F2-4065-2455

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 14'-16'
4/28/93 13:20

analysis: Polynuclear Aromatic Hydrocarbons

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 8100.

results:

COMPOUND	METHOD PQL (mg/Kg)	RESULTS (mg/Kg)
Acenaphthene	less than 0.1	less than 0.1
Acenaphthylene	less than 0.1	less than 0.1
Anthracene	less than 0.1	less than 0.1
Benzo (a) anthracene	less than 0.1	less than 0.1
Benzo (a) pyrene	less than 0.1	less than 0.1
Benzo (b) fluoroanthene	less than 0.1	less than 0.1
Benzo (k) fluoroanthene	less than 0.1	less than 0.1
Benzo (ghi) perylene	less than 0.1	less than 0.1
Chrysene	less than 0.1	less than 0.1
Dibenzo(a,h)anthracene	less than 0.1	less than 0.1
Fluoranthene	less than 0.1	less than 0.1
Fluorene	less than 0.1	less than 0.1
Indeno(1,2,3-cd)pyrene	less than 0.1	less than 0.1
Naphthalene	less than 0.1	less than 0.1
Phenanthrene	less than 0.1	less than 0.1
Pyrene	less than 0.1	0.151

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	49.4%
p-Terphenyl-d14	71.6%

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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

date completed: 5/12/93 | tech: AMG/RJS/GJB | approved by: Edward Shuck

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lab no: 93C01506
p.o. no: 2F2-4065-2935

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 2'-4'
4/28/93 14:22

analysis: Polynuclear Aromatic Hydrocarbons

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 8100.

results:

COMPOUND	METHOD PQL (mg/Kg)	RESULTS (mg/Kg)
Acenaphthene	less than 0.1	less than 0.1
Acenaphthylene	less than 0.1	less than 0.1
Anthracene	less than 0.1	less than 0.1
Benzo (a) anthracene	less than 0.1	less than 0.1
Benzo (a) pyrene	less than 0.1	less than 0.1
Benzo (b) fluoroanthene	less than 0.1	less than 0.1
Benzo (k) fluoroanthene	less than 0.1	less than 0.1
Benzo (ghi) perylene	less than 0.1	less than 0.1
Chrysene	less than 0.1	less than 0.1
Dibenzo(a,h)anthracene	less than 0.1	less than 0.1
Fluoranthene	less than 0.1	0.105
Fluorene	less than 0.1	less than 0.1
Indeno(1,2,3-cd)pyrene	less than 0.1	less than 0.1
Naphthalene	less than 0.1	less than 0.1
Phenanthrene	less than 0.1	less than 0.1
Pyrene	less than 0.1	0.185

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	63.0%
p-Terphenyl-d14	87.1%

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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

date completed:	tech:	approved by:
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lab no. 93C01507
p.o. no. 2F2-4065-2935

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 4'-6'
4/28/93 14:26

analysis: Polynuclear Aromatic Hydrocarbons

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 8100.

results:

COMPOUND	METHOD PQL (mg/Kg)	RESULTS (mg/Kg)
Acenaphthene	less than 0.1	0.141
Acenaphthylene	less than 0.1	less than 0.1
Anthracene	less than 0.1	less than 0.1
Benzo (a) anthracene	less than 0.1	less than 0.1
Benzo (a) pyrene	less than 0.1	less than 0.1
Benzo (b) fluoroanthene	less than 0.1	less than 0.1
Benzo (k) fluoroanthene	less than 0.1	less than 0.1
Benzo (ghi) perylene	less than 0.1	less than 0.1
Chrysene	less than 0.1	less than 0.1
Dibenzo(a,h)anthracene	less than 0.1	less than 0.1
Fluoranthene	less than 0.1	less than 0.1
Fluorene	less than 0.1	less than 0.1
Indeno(1,2,3-cd)pyrene	less than 0.1	less than 0.1
Naphthalene	less than 0.1	less than 0.1
Phenanthrene	less than 0.1	less than 0.1
Pyrene	less than 0.1	less than 0.1

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	70.1%
p-Terphenyl-d14	93.7%

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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

date completed:	tech:	approved by:
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lab no. 93C01519
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY **10% DUP.**
REACTOR AREA B-2 4'-6' DUPLICATE OF 93C01507
4/28/93 1426

analysis: Polynuclear Aromatic Hydrocarbons

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 8100.

results:

COMPOUND	METHOD PQL (mg/Kg)	RESULTS (mg/Kg)
Acenaphthene	less than 0.1	0.132
Acenaphthylene	less than 0.1	less than 0.1
Anthracene	less than 0.1	less than 0.1
Benzo (a) anthracene	less than 0.1	less than 0.1
Benzo (a) pyrene	less than 0.1	less than 0.1
Benzo (b) fluoroanthene	less than 0.1	less than 0.1
Benzo (k) fluoroanthene	less than 0.1	less than 0.1
Benzo (ghi) perylene	less than 0.1	less than 0.1
Chrysene	less than 0.1	less than 0.1
Dibenzo(a,h)anthracene	less than 0.1	less than 0.1
Fluoranthene	less than 0.1	less than 0.1
Fluorene	less than 0.1	less than 0.1
Indeno(1,2,3-cd)pyrene	less than 0.1	less than 0.1
Naphthalene	less than 0.1	less than 0.1
Phenanthrene	less than 0.1	less than 0.1
Pyrene	less than 0.1	less than 0.1

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	77.9%
p-Terphenyl-d14	93.6%

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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

date completed:	tech:	approved by:
5/13/93	GJB	Edward Schuert

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lab no. 93C01508
p.o. no. 2F2-4065-2455

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 6'-8'
4/28/93 14:30

analysis: Polynuclear Aromatic Hydrocarbons

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 8100.

results:

COMPOUND	METHOD PQL (mg/Kg)	RESULTS (mg/Kg)
Acenaphthene	less than 0.1	less than 0.1
Acenaphthylene	less than 0.1	less than 0.1
Anthracene	less than 0.1	less than 0.1
Benzo (a) anthracene	less than 0.1	less than 0.1
Benzo (a) pyrene	less than 0.1	less than 0.1
Benzo (b) fluoroanthene	less than 0.1	less than 0.1
Benzo (k) fluoroanthene	less than 0.1	less than 0.1
Benzo (ghi) perylene	less than 0.1	less than 0.1
Chrysene	less than 0.1	less than 0.1
Dibenzo(a,h)anthracene	less than 0.1	less than 0.1
Fluoranthene	less than 0.1	less than 0.1
Fluorene	less than 0.1	less than 0.1
Indeno(1,2,3-cd)pyrene	less than 0.1	less than 0.1
Naphthalene	less than 0.1	less than 0.1
Phenanthrene	less than 0.1	less than 0.1
Pyrene	less than 0.1	less than 0.1

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	76.4%
p-Terphenyl-d14	103%

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:
5/12/93	AMG/RJS/GJB	Edward Shurk

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lab no. S93C01509
P.O. [illegible]
S 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 2'-4'
4/28/93 15:11

analysis: Polynuclear Aromatic Hydrocarbons

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 8100.

results:

COMPOUND	METHOD PQL (mg/Kg)	RESULTS (mg/Kg)
Acenaphthene	less than 0.1	0.159
Acenaphthylene	less than 0.1	0.103
Anthracene	less than 0.1	0.378
Benzo (a) anthracene	less than 0.1	1.28
Benzo (a) pyrene	less than 0.1	1.45
Benzo (b) fluoroanthene	less than 0.1	1.16
Benzo (k) fluoroanthene	less than 0.1	1.02
Benzo (ghi) perylene	less than 0.1	0.635
Chrysene	less than 0.1	1.26
Dibenzo(a,h)anthracene	less than 0.1	0.277
Fluoranthene	less than 0.1	2.48
Fluorene	less than 0.1	less than 0.1
Indeno(1,2,3-cd)pyrene	less than 0.1	0.775
Naphthalene	less than 0.1	less than 0.1
Phenanthrene	less than 0.1	1.16
Pyrene	less than 0.1	0.220

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	70.3%
p-Terphenyl-d14	87.4%

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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

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lab no: 93D01510
p.o. no: 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 4'-6'
4/28/93 15:12

analysis: Polynuclear Aromatic Hydrocarbons

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 8100.

results:

COMPOUND	METHOD PQL (mg/Kg)	RESULTS (mg/Kg)
Acenaphthene	less than 0.1	0.124
Acenaphthylene	less than 0.1	less than 0.1
Anthracene	less than 0.1	less than 0.1
Benzo (a) anthracene	less than 0.1	less than 0.1
Benzo (a) pyrene	less than 0.1	less than 0.1
Benzo (b) fluoroanthene	less than 0.1	less than 0.1
Benzo (k) fluoroanthene	less than 0.1	less than 0.1
Benzo (ghi) perylene	less than 0.1	less than 0.1
Chrysene	less than 0.1	less than 0.1
Dibenzo(a,h)anthracene	less than 0.1	less than 0.1
Fluoranthene	less than 0.1	less than 0.1
Fluorene	less than 0.1	less than 0.1
Indeno(1,2,3-cd)pyrene	less than 0.1	less than 0.1
Naphthalene	less than 0.1	less than 0.1
Phenanthrene	less than 0.1	less than 0.1
Pyrene	less than 0.1	less than 0.1

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	72.9%
p-Terphenyl-d14	88.7%

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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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

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lab no. 93C01495
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-3 6'-8'
4/28/93 15:15

analysis: Polynuclear Aromatic Hydrocarbons

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 8100.

results:

COMPOUND	METHOD PQL (mg/Kg)	RESULTS (mg/Kg)
Acenaphthene	less than 0.1	less than 0.1
Acenaphthylene	less than 0.1	less than 0.1
Anthracene	less than 0.1	less than 0.1
Benzo (a) anthracene	less than 0.1	less than 0.1
Benzo (a) pyrene	less than 0.1	less than 0.1
Benzo (b) fluoroanthene	less than 0.1	less than 0.1
Benzo (k) fluoroanthene	less than 0.1	less than 0.1
Benzo (ghi) perylene	less than 0.1	less than 0.1
Chrysene	less than 0.1	less than 0.1
Dibenzo(a,h)anthracene	less than 0.1	less than 0.1
Fluoranthene	less than 0.1	less than 0.1
Fluorene	less than 0.1	less than 0.1
Indeno(1,2,3-cd)pyrene	less than 0.1	less than 0.1
Naphthalene	less than 0.1	less than 0.1
Phenanthrene	less than 0.1	less than 0.1
Pyrene	less than 0.1	0.185

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	66.1%
p-Terphenyl-d14	92.7%

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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

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lab no. 93C01496
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 2'-4'
4/28/93 15:54

analysis: Polynuclear Aromatic Hydrocarbons

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 8100.

results:

COMPOUND	METHOD PQL (mg/Kg)	RESULTS (mg/Kg)
Acenaphthene	less than 0.1	less than 0.1
Acenaphthylene	less than 0.1	less than 0.1
Anthracene	less than 0.1	less than 0.1
Benzo (a) anthracene	less than 0.1	less than 0.1
Benzo (a) pyrene	less than 0.1	less than 0.1
Benzo (b) fluoroanthene	less than 0.1	less than 0.1
Benzo (k) fluoroanthene	less than 0.1	less than 0.1
Benzo (ghi) perylene	less than 0.1	less than 0.1
Chrysene	less than 0.1	less than 0.1
Dibenzo(a,h)anthracene	less than 0.1	less than 0.1
Fluoranthene	less than 0.1	less than 0.1
Fluorene	less than 0.1	less than 0.1
Indeno(1,2,3-cd)pyrene	less than 0.1	less than 0.1
Naphthalene	less than 0.1	less than 0.1
Phenanthrene	less than 0.1	less than 0.1
Pyrene	less than 0.1	0.106

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	74.9%
p-Terphenyl-d14	102%

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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

date completed:	tech:	approved by:
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lab no. 93C01497
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 4'-6'
4/28/93 15:55

analysis: Polynuclear Aromatic Hydrocarbons

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 8100.

results:

COMPOUND	METHOD PQL (mg/Kg)	RESULTS (mg/Kg)
Acenaphthene	less than 0.1	less than 0.1
Acenaphthylene	less than 0.1	less than 0.1
Anthracene	less than 0.1	less than 0.1
Benzo (a) anthracene	less than 0.1	less than 0.1
Benzo (a) pyrene	less than 0.1	less than 0.1
Benzo (b) fluoroanthene	less than 0.1	less than 0.1
Benzo (k) fluoroanthene	less than 0.1	less than 0.1
Benzo (ghi) perylene	less than 0.1	less than 0.1
Chrysene	less than 0.1	less than 0.1
Dibenzo(a,h)anthracene	less than 0.1	less than 0.1
Fluoranthene	less than 0.1	less than 0.1
Fluorene	less than 0.1	less than 0.1
Indeno(1,2,3-cd)pyrene	less than 0.1	less than 0.1
Naphthalene	less than 0.1	less than 0.1
Phenanthrene	less than 0.1	less than 0.1
Pyrene	less than 0.1	less than 0.1

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	64.1%
p-Terphenyl-d14	92.1%

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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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lab no. 93C01498
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-4 6'-8'
4/28/93 16:00

analysis: Polynuclear Aromatic Hydrocarbons

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 8100.

results:

COMPOUND	METHOD PQL (mg/Kg)	RESULTS (mg/Kg)
Acenaphthene	less than 0.1	less than 0.1
Acenaphthylene	less than 0.1	less than 0.1
Anthracene	less than 0.1	less than 0.1
Benzo (a) anthracene	less than 0.1	less than 0.1
Benzo (a) pyrene	less than 0.1	less than 0.1
Benzo (b) fluoroanthene	less than 0.1	less than 0.1
Benzo (k) fluoroanthene	less than 0.1	less than 0.1
Benzo (ghi) perylene	less than 0.1	less than 0.1
Chrysene	less than 0.1	less than 0.1
Dibenzo(a,h)anthracene	less than 0.1	less than 0.1
Fluoranthene	less than 0.1	less than 0.1
Fluorene	less than 0.1	less than 0.1
Indeno(1,2,3-cd)pyrene	less than 0.1	less than 0.1
Naphthalene	less than 0.1	less than 0.1
Phenanthrene	less than 0.1	less than 0.1
Pyrene	less than 0.1	0.152

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	55.8%
p-Terphenyl-d14	91.0%

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3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

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lab no. 93C01503
p.o. no. 2F2-4065-2935

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 2'-4'
4/28/93 13:01

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:
5/7/93	LNT	Edward Shirat

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lab no. 93C01503
p.o. no. 42-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 2'-4'
4/28/93 13:01

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:
5/7/93	LNT	Edward Shuck

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lab no. 93C01503
p.o. no. 2F2-4065-2935

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 2'-4'
4/28/93 13:01

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	97.1%	81-117
4-Bromofluorobenzene	95.2%	74-121

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date completed:	tech:	approved by:
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lab no. 93C01504
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 4'-6'
4/28/93 13:03

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:
5/7/93	LNT	Edward Shuck

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lab no. 93C01504
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 4'-6'
4/28/93 13:03

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:
5/7/93	LNT	Edward Shuert

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lab no. 93C01504
p.o. no. 2F2-4065-235

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 4'-6'
4/28/93 13:03

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	107%	70-121
Toluene-d8	97.3%	81-117
4-Bromofluorobenzene	94.0%	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:
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lab no. 93C01505
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 14'-16'
4/28/93 13:20

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:
5/8/93	LNT	Edward Shuck

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p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 14'-16'
4/28/93 13:20

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:
5/8/93	LNT	Edward Shuert

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p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-1 14'-16'
4/28/93 13:20

analysis: GAS CHROMOTOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatile Organics

Compound	% Recovery		Acceptable Range
1,2-Dichloroethane-d4	106%		70-121
Toluene-d8	90.4%	See note 3	81-117
4-Bromofluorobenzene	86.5%	See note 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.

3) Internal standards out of acceptable range due to sample matrix.

date completed:	tech:	approved by:
5/8/93	LNT	Edward Shuert

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lab no. 93C01506
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA B-2 2'-4'
4/28/93 14:22

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:
5/7/93	LNT	

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BTEX RESULTS FOR WATER - BLANKS

REACTOR AREA
TASK NO. 6105-006

BLANK NO.	DATE	BENZENE (ug/L)[1]	TOLUENE (ug/L)	ETHYLBENZENE (ug/L)	M&P XYLENES (ug/L)	O XYLENE (ug/L)
EQUIP. #1	4-28-93	< 0.5	0.639	< 0.5	< 0.5	< 0.5
FIELD #1	4-28-93	< 0.5	0.699	< 0.5	< 0.5	< 0.5

[1] ug/L = ppb

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lab no. 93C01488
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA EQUIP BLANK #1
4/28/93 16:30

analysis: BTEX

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 8020.

results:

Benzene	less than	0.5	µg/L
Toluene		0.639	µg/L
Ethylbenzene	less than	0.5	µg/L
m & p-Xylenes	less than	0.5	µg/L
o-Xylene	less than	0.5	µg/L

SURROGATE RECOVERY

a,a,a-Trifluorotoluene	102%

date completed:	tech:	approved by:
5/11/93	ELT	Edward Shuert

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lab no. 93C01501
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA FIELD BLANK #1
4/28/93 16:32

analysis: BTEX

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 8020.

results:

Benzene	less than	0.5	µg/L
Toluene		0.699	µg/L
Ethylbenzene	less than	0.5	µg/L
m & p-Xylenes	less than	0.5	µg/L
o-Xylene	less than	0.5	µg/L

SURROGATE RECOVERY

a,a,a-Trifluorotoluene 99.0%

date completed:	tech:	approved by:
5/14/93	ELT	Edward Shuert

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RCRA DRUM DISPOSAL
TASK NO. 6105-006

DRUM NO.	COMPOUND/TEST	RESULT (mg/kg)[1]	PQL (mg/kg)[2]
DNO 08/10/14	PAINT FILTER TEST	PASSED	SW-846,9095
DNO 08/10/14	pH 10% SOLUTION	9.10	SW-846,9040
DNO 08/10/14	REACTIVE CYANIDE	< 0.5	SW-846, 7.3.3.2
DNO 08/10/14	REACTIVE SULFIDE	12	SW-846,7.3.4.1
DNO 08/10/14	TOTAL CYANIDE	< 0.2	SW-846, 9010
DNO 08/10/14	TOTAL SULFIDES	38	SW-846,9030

(1) mg/kg = parts per million
(2) PQL = Practical Quantification Limit

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lab no. 93C01670
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
RCRA - DISPOSAL - MK-DNO - 08/10/14
1630

ANALYTE	METHOD	RESULT		
Paint Filter Test	SW-846, 9095	PASSES TEST		
pH 10% Solution	SW-846, 9040		9.10	
Reactive Cyanide	SW-846, 7.3.3.2	less than	0.5	mg/Kg
Reactive Sulfide	SW-846, 7.3.4.1		12	mg/Kg
Total Cyanide	SW-846, 9010	less than	0.2	mg/Kg
Total Sulfides	SW-846, 9030		38	mg/Kg

date completed: 5/28/93 | tech: SK/SR | approved by: Edward Shent

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TEST METHODS FOR EVALUATING SOLID WASTE, PHYSICAL/CHEMICAL METHODS

RCRA DRUM DISPOSAL
TASK NO. 6105-006

DRUM NO.	COMPOUND	RESULT (mg/kg)[1]	PQL (mg/kg)[2]
DNO 08/10/14	AROCLOR 1260	< 0.033	
DNO 08/10/14	AROCLOR 1254	< 0.033	
DNO 08/10/14	AROCLOR 1248	< 0.033	
DNO 08/10/14	AROCLOR 1242	< 0.033	
DNO 08/10/14	AROCLOR 1232	< 0.033	
DNO 08/10/14	AROCLOR 1221	< 0.033	
DNO 08/10/14	AROCLOR 1016	< 0.033	

(1) mg/kg = parts per million
(2) PQL = Practical Quantification Limit

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lab no. 93C01670
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
RCRA - DISPOSAL - MK-DNO - 08/10/14
1630

procedure: This sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, November, 1986, Method 8080.

ANALYTE	RESULT		
Aroclor 1260	less than	0.033	mg/Kg
Aroclor 1254	less than	0.033	mg/Kg
Aroclor 1248	less than	0.033	mg/Kg
Aroclor 1242	less than	0.033	mg/Kg
Aroclor 1232	less than	0.033	mg/Kg
Aroclor 1221	less than	0.033	mg/Kg
Aroclor 1016	less than	0.033	mg/Kg

PCB SURROGATE RECOVERY

2,4,5,6-Tetrachloro-meta-xylene	86%
Decachlorobiphenyl	87%

date completed:	tech:	approved by:
5/19/93	PDB/DGH/MMM	Edward Shiner

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GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS IN WATER

RCRA - DISPOSAL
TASK NO. 6105-006

DRUM NUMBER	COMPOUND	RESULT (ug/L) [1]	PQL (ug/L) [2]
DNO 15, 27, 31[3]	CHLOROETHANE	12.1	2
DNO 15, 27, 31	CHLOROFORM	1.51	1
DNO 15, 27, 31	1,1-DICHLOROETHANE	13.3	1
DNO 15, 27, 31	ETHYL BENZENE	6.53	1
DNO 15, 27, 31	4-METHYL-2-PENTANONE (MIBK)	19.6	10
DNO 15, 27, 31	TOLUENE	12.7	1
DNO 15, 27, 31	M & P XYLENES	7.72	1
DNO 15, 27, 31	O XYLENE	7.78	1

(1) ug/L = ppb

(2) PQL = Practical Quantification Limit

(3) DNO 15, 27, 31 = Drum Numbers 15, 27, and 31 which contain monitor well development water and purge water from 7121/7131, Reactor Area and Space Power Facility (RCRA sites).

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lab no.
93C01673
p.o. no.
2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
RCRA - DISPOSAL - MK-DNO-15,27,31
5/10/93 1645

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	12.1
2-Chloroethyl vinyl ether	2	< 2
Chloroform	1	1.51
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	13.3
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:
5/21/93	LNT	Edward Shuler

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lab no. 93C01673
p.o. no. 2F2-4065-235

sample description: 4065-6105-006 PLUM BROOK UST STUDY
RCRA - DISPOSAL - MK-DNO-15,27,31
5/10/93 1645

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	6.53	
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	19.6	
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	12.7	
1,1,1-Trichloroethane	1	< 1	
1,1,2-Trichloroethane	1	< 1	
Trichloroethene	1	< 1	(0.580)
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	7.72	
o-Xylene	1	7.78	

date completed:	tech:	approved by:
5/21/93	LNT	

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p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
RCRA - DISPOSAL - MK-DNO-15,27,31
5/10/93 1645

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	131% See note 3	76-114
Toluene-d8	99.8%	88-110
4-Bromofluorobenzene	107%	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.

3) Recovery out of range due to sample matrix.

date completed:	tech:	approved by:
5/21/93	LNT	

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GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS IN WATER EQUIPMENT/FIELD BLANKS - REACTOR AREA TASK NO. 6105-006

BLANK NUMBER	DATE	COMPOUND	RESULT (ug/L)[1]	PQL (ug/L)[2]
EQUIP. GW	5-7-93	TOLUENE	1.54	1
EQUIP. #1	4-28-93	2-BUTANONE (MEK)	115[3]	10
EQUIP. #1	4-28-93	TETRAHYDROFURAN	298[3]	2
FIELD GW	5-7-93	DICHLORODIFLUORO-METHANE	1.40[4]	1
FIELD GW	5-7-93	TOLUENE	2.01	1
FIELD #1	4-28-93	2-BUTONE (MEK)	134[3]	10
FIELD #1	4-28-93	TETRAHYDROFURAN	241[3]	2
FIELD #1	4-28-93	TOLUENE	1.04	1

(1) ug/L = ppb

(2) PQL = Practical Quantification Limit

(3) These values exceed the curve and are semi-quantitative. These values may be due to contaminated deionized water. This data should be evaluated for its impact on the actual samples.

(4) The method blank contained 0.903 ug/L of Dichlorodifluoromethane. The approximate equivalent concentration, taking into account dilution factors, is 0.903 ug/L. This is considered to be a significant contribution to the reported value.

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lab no. 93C01685
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EQUIPMENT BLANK - GW
5/7/93 0745

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:
5/19/93	JM	Edward J. Kiest

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lab no. 93C01685
p.o. no. 2F2-4065-2435

sample description: 4065-6106-006 PLUM BROOK UST STUDY
REACTOR - EQUIPMENT BLANK - GW
5/7/93 0745

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	1.54
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:
5/19/93	JM	

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lab no. 93C01685
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EQUIPMENT BLANK - GW
5/7/93 0745

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	101%	76-114
Toluene-d8	99.4%	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:
5/19/93	JM	Edward Skeet

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lab no. 93C01488
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA EQUIP BLANK #1
4/28/93 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 (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	115	See note 3
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: 5/7/93
tech: LNT
approved by: Edward Shuist

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lab no. 93C01488
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA EQUIP BLANK #1
4/28/93 16:30

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	298	See note 3
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:
5/7/93	LNT	Edward Thurst

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lab no. 93C01488
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA EQUIP BLANK #1
4/28/93 16:30

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	96.2%	76-114
Toluene-d8	92.6%	88-110
4-Bromofluorobenzene	96.2%	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.

3) These values exceed the curve and are semi-quantitative. These values may be due to contaminated deionized water. This data should be evaluated for its impact on the actual samples.

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lab no. 93C01686
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - FIELD BLANK - GW
5/7/93 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	1.40	See note 3
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	

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lab no: 93C01686
p.o. no: 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - FIELD BLANK - GW
5/7/93 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	2.01
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 Hiscott

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lab no. 93C01686
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - FIELD BLANK - GW
5/7/93 0800

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	102%	76-114
Toluene-d8	101%	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.

3) The method blank contained 0.903 ug/L of Dichlorodifluoromethane. The approximate equivalent concentration, taking into account dilution factors, is 0.903 ug/L. This is considered to be a significant contribution to the reported value.

date completed:	tech:	approved by:
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lab no. 93C01502
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA FIELD BLANK #1
4/28/93 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 (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	134	See note 3
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:
5/8/93	LNT	Edward Shiert

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lab no. 93C01502
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA FIELD BLANK #1
4/28/93 16:30

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	241	See note 3
Toluene	1	1.04	
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: 5/8/93
tech: LNT
approved by: [signature]

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lab no. 93C01502
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA FIELD BLANK #1
4/28/93 16:30

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	109%	76-114
Toluene-d8	103%	88-110
4-Bromofluorobenzene	109%	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.

3) These values exceed the curve and are semi-quantitative. These values may be due to contaminated deionized water. This data should be evaluated for its impact on the actual samples.

date completed:	tech:	approved by:
5/8/93	LNT	Edward Shuist

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GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS IN WATER

BUSTR - DISPOSAL
TASK NO. 6105-006

DRUM NUMBER	COMPOUND	RESULT (ug/L)[1]	PQL (ug/L)[2]
DNO 24[3]	ACROLEIN	< 2,000[4]	10
DNO 24	ACRYLONITRILE	< 2,000	10
DNO 24	ACETONE	< 2,000	10
DNO 24	BENZENE	< 200	1
DNO 24	BROMODICHLOROMETHANE	< 200	1
DNO 24	BROMOFORM	< 200	1
DNO 24	BROMOMETHANE	< 200	1
DNO 24	2-BUTANONE (MEK)	< 2,000	10
DNO 24	CARBON DISULFIDE	< 200	1
DNO 24	CARBON TETRACHLORIDE	< 200	1
DNO 24	CHLOROBENZENE	< 200	1
DNO 24	CHLORODIBROMOMETHANE	< 200	1
DNO 24	CHLOROETHANE	< 400	2
DNO 24	2-CHLOROETHYL VINYL ETHER	< 400	2
DNO 24	CHLOROFORM	< 200	1
DNO 24	CHLOROMETHANE	< 200	1
DNO 24	1,2-DIBROMOETHANE (EDB)	< 200	1
DNO 24	DIBROMOETHANE	< 200	1
DNO 24	1,2-DICHLOROBENZENE	< 200	1
DNO 24	1,3-DICHLOROBENZENE	< 200	1
DNO 24	1,4-DICHLOROBENZENE	< 200	1
DNO 24	1,4-DICHLORO-2-BUTENE	< 400	2
DNO 24	DICHLORODIFLUORO-METHANE	< 200	1

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS IN WATER

BUSTR - DISPOSAL
TASK NO. 6105-006

DRUM NUMBER	COMPOUND	RESULT (ug/L) [1]	PQL (ug/L) [2]
DNO 24[3]	1,1-DICHLOROETHANE	< 200	1
DNO 24	1,2-DICHLOROETHANE	< 200	1
DNO 24	1,1-DICHLOROETHENE	< 200	1
DNO 24	1,1-DICHLOROETHENE	< 200	1
DNO 24	TRANS-1,2-DICHLOROETHENE	< 200	1
DNO 24	1,2-DICHLOROPROPANE	< 200	1
DNO 24	CIS-1,3-DICHLOROPROPENE	< 200	1
DNO 24	TRANS-1,3-DICHLOROPROPENE	< 200	1
DNO 24	ETHYL ACETATE	< 400	2
DNO 24	ETHYL BENZENE	< 200	1
DNO 24	ETHYL ETHER	< 400	2
DNO 24	ETHYL METHACRYLATE	< 200	1
DNO 24	2-HEXANONE	< 400	2
DNO 24	METHYLENE CHLORIDE	< 200	1
DNO 24	METHYL IODIDE	< 200	1
DNO 24	4-METHYL-2-PENTANONE (MIBK)	< 2,000	10
DNO 24	NAPHTHALENE	< 200	1
DNO 24	STYRENE	< 200	1
DNO 24	1,1,1,2-TETRACHLOROETHANE	< 200	1
DNO 24	1,1,2,2-TETRACHLOROETHANE	< 200	1
DNO 24	TETRACHLOROETHENE	<200	1
DNO 24	TETRAHYDROFURAN	< 400	2

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS IN WATER

BUSTR - DISPOSAL
TASK NO. 6105-006

DRUM NUMBER	COMPOUND	RESULT (ug/L) [1]	PQL (ug/L) [2]
DNO 24[3]	TOLUENE	< 200	1
DNO 24	1,1,1-TRICHLOROETHANE	< 200	1
DNO 24	1,1,2-TRICHLOROETHANE	< 200	1
DNO 24	TRICHLOROETHENE	< 200	1
DNO 24	TRICHLOROFLUORO-METHANE	< 200	1
DNO 24	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	< 200	1
DNO 24	1,2,3-TRICHLOROPROPANE	< 200	1
DNO 24	VINYL ACETATE	< 400	2
DNO 24	VINYL CHLORIDE	< 200	1
DNO 24	M & P XYLENES	< 200	1
DNO 24	O XYLENE	< 200	1

(1) ug/L = ppb

(2) PQL = Practical Quantification Limit

(3) DNO 24 = Drum Number 24 which contains monitor well purge water from the Pump Station Area (BUSTR site).

(4) Elevated result is due to dilution required by the foaming nature of the sample.

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lab no. 93C01675
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
BUSTR - DISPOSAL - MK-DNO-24
5/10/93 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	<2,000
Acrylonitrile	10	<2,000
Acetone	10	<2,000
Benzene	1	< 200
Bromodichloromethane	1	< 200
Bromoform	1	< 200
Bromomethane	1	< 200
2-Butanone (MEK)	10	<2,000
Carbon disulfide	1	< 200
Carbon tetrachloride	1	< 200
Chlorobenzene	1	< 200
Chlorodibromomethane	1	< 200
Chloroethane	2	< 400
2-Chloroethyl vinyl ether	2	< 400
Chloroform	1	< 200
Chloromethane	1	< 200
1,2-Dibromoethane (EDB)	1	< 200
Dibromomethane	1	< 200
1,2-Dichlorobenzene	1	< 200
1,3-Dichlorobenzene	1	< 200
1,4-Dichlorobenzene	1	< 200
1,4-Dichloro-2-butene	2	< 400
Dichlorodifluoromethane	1	< 200
1,1-Dichloroethane	1	< 200
1,2-Dichloroethane	1	< 200
1,1-Dichloroethene	1	< 200
cis-1,2-Dichloroethene	1	< 200
trans-1,2-Dichloroethene	1	< 200
1,2-Dichloropropane	1	< 200
cis-1,3-Dichloropropene	1	< 200

date completed:	tech:	approved by:
5/24/93	LNT	

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lab no. 93C01675
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
BUSTR - DISPOSAL - MK-DNO-24
5/10/93 1700

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)
trans-1,3-Dichloropropene	1	< 200
Ethyl acetate	2	< 400
Ethyl benzene	1	< 200
Ethyl ether	2	< 400
Ethyl methacrylate	1	< 200
2-Hexanone	2	< 400
Methylene chloride	1	< 200
Methyl iodide	1	< 200
4-Methyl-2-pentanone (MIBK)	10	< 2,000
Naphthalene	1	< 200
Styrene	1	< 200
1,1,1,2-Tetrachloroethane	1	< 200
1,1,2,2-Tetrachloroethane	1	< 200
Tetrachloroethene	1	< 200
Tetrahydrofuran	2	< 400
Toluene	1	< 200
1,1,1-Trichloroethane	1	< 200
1,1,2-Trichloroethane	1	< 200
Trichloroethene	1	< 200
Trichlorofluoromethane	1	< 200
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1	< 200
1,2,3-Trichloropropane	1	< 200
Vinyl acetate	2	< 400
Vinyl chloride	1	< 200
m & p-Xylenes	1	< 200
o-Xylene	1	< 200

date completed:	tech:	approved by:
5/24/93	LNT	

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lab no. 93C01675
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
BUSTR - DISPOSAL - MK-DNO-24
5/10/93 1700

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	91.2%	76-114
Toluene-d8	91.0%	88-110
4-Bromofluorobenzene	90.1%	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.

3) Elevated detection limit due to dilution required by the foaming nature of the sample.

date completed:	tech:	approved by:
5/24/93	LNT	

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POLYNUCLEAR AROMATIC HYDROCARBONS IN WATER - BLANKS

REACTOR AREA
TASK NO. 6105-006

BLANK NUMBER	COMPOUND	RESULT (ug/L) [1]	PQL (ug/L) [1]
EQUIP. GW	BENZO (b) FLUOROANTHENE	2.75	< 1.0
EQUIP. #1	---	---[3]	---
EQUIP. #1	---	---	---
FIELD GW	---	---	---
FIELD #1	---	---	---

(1) ug/L = ppb
(2) PQL = Practical Quantification Limit
(3) --- = Compound/Concentrations Below PQL

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lab no: 93C01698
p.o. no: 2E2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - EQUIP BLANK - GW
5/7/93 0745

analysis: Polynuclear Aromatic Hydrocarbons

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8100.

results:

COMPOUND	METHOD PQL (µg/L)	RESULTS (µg/L)
Acenaphthene	less than 1.0	less than 1.0
Acenaphthylene	less than 1.0	less than 1.0
Anthracene	less than 1.0	less than 1.0
Benzo (a) anthracene	less than 1.0	less than 1.0
Benzo (a) pyrene	less than 1.0	less than 1.0
Benzo (b) fluoroanthene	less than 1.0	2.75
Benzo (k) fluoroanthene	less than 1.0	less than 1.0
Benzo (ghi) perylene	less than 1.0	less than 1.0
Chrysene	less than 1.0	less than 1.0
Dibenzo(a,h)anthracene	less than 1.0	less than 1.0
Fluoranthene	less than 1.0	less than 1.0
Fluorene	less than 1.0	less than 1.0
Indeno(1,2,3-cd)pyrene	less than 1.0	less than 1.0
Naphthalene	less than 1.0	less than 1.0
Phenanthrene	less than 1.0	less than 1.0
Pyrene	less than 1.0	less than 1.0

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	80.9%
p-Terphenyl-d14	105%

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.

3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.

date completed:	tech:	approved by:
5/24/93	GJB	Edward Shiner

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lab no. 93C01500
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA EQUIP BLANK #1
4/28/93 16:30

analysis: Polynuclear Aromatic Hydrocarbons

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8100.

results:

COMPOUND	METHOD PQL (µg/L)	RESULTS (µg/L)
Acenaphthene	less than 1.0	less than 1.0
Acenaphthylene	less than 1.0	less than 1.0
Anthracene	less than 1.0	less than 1.0
Benzo (a) anthracene	less than 1.0	less than 1.0
Benzo (a) pyrene	less than 1.0	less than 1.0
Benzo (b) fluoroanthene	less than 1.0	less than 1.0
Benzo (k) fluoroanthene	less than 1.0	less than 1.0
Benzo (ghi) perylene	less than 1.0	less than 1.0
Chrysene	less than 1.0	less than 1.0
Dibenzo(a,h)anthracene	less than 1.0	less than 1.0
Fluoranthene	less than 1.0	less than 1.0
Fluorene	less than 1.0	less than 1.0
Indeno(1,2,3-cd)pyrene	less than 1.0	less than 1.0
Naphthalene	less than 1.0	less than 1.0
Phenanthrene	less than 1.0	less than 1.0
Pyrene	less than 1.0	less than 1.0

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	57.3%
p-Terphenyl-d14	73.1%

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:
5/13/93	RJS/GJB/AMG	

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lab no. 93C01686
p.o. no. 2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - FIELD BLANK - GW
5/7/93 0800

analysis: Polynuclear Aromatic Hydrocarbons

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8100.

results:

COMPOUND	METHOD PQL (µg/L)	RESULTS (µg/L)
Acenaphthene	less than 1.0	less than 1.0
Acenaphthylene	less than 1.0	less than 1.0
Anthracene	less than 1.0	less than 1.0
Benzo (a) anthracene	less than 1.0	less than 1.0
Benzo (a) pyrene	less than 1.0	less than 1.0
Benzo (b) fluoroanthene	less than 1.0	less than 1.0
Benzo (k) fluoroanthene	less than 1.0	less than 1.0
Benzo (ghi) perylene	less than 1.0	less than 1.0
Chrysene	less than 1.0	less than 1.0
Dibenzo(a,h)anthracene	less than 1.0	less than 1.0
Fluoranthene	less than 1.0	less than 1.0
Fluorene	less than 1.0	less than 1.0
Indeno(1,2,3-cd)pyrene	less than 1.0	less than 1.0
Naphthalene	less than 1.0	less than 1.0
Phenanthrene	less than 1.0	less than 1.0
Pyrene	less than 1.0	less than 1.0

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	49.5%
p-Terphenyl-d14	62.4%

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:
5/20/93	GJB	Edward Shiner

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lab no.
93C01499
p.o. no.
2F2-4065-2435

sample description: 4065-6105-006 PHASE II UST STUDY
REACTOR AREA FIELD BLANK #1
4/28/93 16:40

analysis: Polynuclear Aromatic Hydrocarbons

procedure: The sample was analyzed as outlined in US EPA 600, Method 610.

results:

COMPOUND	METHOD PQL (µg/L)	RESULTS (µg/L)
Acenaphthene	less than 1.0	less than 1.0
Acenaphthylene	less than 1.0	less than 1.0
Anthracene	less than 1.0	less than 1.0
Benzo (a) anthracene	less than 1.0	less than 1.0
Benzo (a) pyrene	less than 1.0	less than 1.0
Benzo (b) fluoroanthene	less than 1.0	less than 1.0
Benzo (k) fluoroanthene	less than 1.0	less than 1.0
Benzo (ghi) perylene	less than 1.0	less than 1.0
Chrysene	less than 1.0	less than 1.0
Dibenzo(a,h)anthracene	less than 1.0	less than 1.0
Fluoranthene	less than 1.0	less than 1.0
Fluorene	less than 1.0	less than 1.0
Indeno(1,2,3-cd)pyrene	less than 1.0	less than 1.0
Naphthalene	less than 1.0	less than 1.0
Phenanthrene	less than 1.0	less than 1.0
Pyrene	less than 1.0	less than 1.0

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	62.7%
p-Terphenyl-d14	82.6%

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	PDB/KJY/RJS/AMG/GJB	Edward Grieve

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lab no.
93C01688
p.o. no.
2F2-4065-2435

sample description: 4065-6105-006 PLUM BROOK UST STUDY
REACTOR - SUMP
5/6/93 1300

analysis: Polynuclear Aromatic Hydrocarbons

procedure: The sample was analyzed as outlined in US EPA "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", SW-846, Third Edition, November 1986, Method 8100.

results:

COMPOUND	METHOD PQL (µg/L)	RESULTS (µg/L)
Acenaphthene	less than 1.0	163
Acenaphthylene	less than 1.0	414
Anthracene	less than 1.0	215
Benzo (a) anthracene	less than 1.0	4.82
Benzo (a) pyrene	less than 1.0	less than 1.0
Benzo (b) fluoroanthene	less than 1.0	less than 1.0
Benzo (k) fluoroanthene	less than 1.0	less than 1.0
Benzo (ghi) perylene	less than 1.0	less than 1.0
Chrysene	less than 1.0	17.6
Dibenzo(a,h)anthracene	less than 1.0	18.1
Fluoranthene	less than 1.0	71.8
Fluorene	less than 1.0	690
Indeno(1,2,3-cd)pyrene	less than 1.0	less than 1.0
Naphthalene	less than 1.0	less than 1.0
Phenanthrene	less than 1.0	less than 1.0
Pyrene	less than 1.0	32.9

Surrogate Recovery

Compound	% Recovery
2-Fluorobiphenyl	100%
p-Terphenyl-d14	169% See note 4

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.
3) Due to the multi-component nature of petroleum hydrocarbon fuels, the majority of which falls within the retention time window which include PAH's, a strong possibility exists for the detection of false positives in samples where hydrocarbon fuels are detected.
4) High surrogate recovery due to matrix interference.

date completed:	tech:	approved by:
5/24/93	GJB	Edward J. Hunt

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APPENDIX B-7

Morrison Knudsen Corporation Sump Cleaning Laboratory Data and Figures, 1994

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ample NASA - PLUM BROOK R.A.
escription: PBS R.A. SUMP & DRAINS
8/10/94 11:30

ANALYTE	METHOD	RESULT
Ignitability - Setaflash	SW-846, 1020	greater than 200° F
pH in Solution	EPA 600, 150.1	7.48
Total Oil & Grease Infrared)	EPA 600, 413.2	3,700 mg/L

leted: tech: approved by:

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sample description: NASA - PLUM BROOK R.A.
PBS R.A. SUMP & DRAINS
8/10/94 11:30

results:

Analyte	Method	Result
Total Arsenic	EPA 600, 206.2	9.2 mg/L
Total Barium	EPA 600, 208.1	30 mg/L
Total Cadmium	EPA 600, 213.1	0.34 mg/L
Total Chromium	EPA 600, 218.1	24 mg/L
Total Lead	EPA 600, 239.1	12 mg/L
Total Mercury	EPA 600, 245.1	270 mg/L
Total Selenium	EPA 600, 270.2	less than 5 mg/L
Total Silver	EPA 600, 272.1	less than 0.1 mg/L

Note: Results reported by sample volume. Percent dry solids is 10.2%.

completed:	tech:	approved by:
8/19/94	SP/JB	Richard Hurst

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sample description: NASA - PLUM BROOK R.A.
PBS R.A. SUMP & DRAINS
8/10/94 11:30

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/L)	RESULT (µg/L)
Acrolein	10	< 40
Acrylonitrile	10	< 40
Acetone	10	< 40
Benzene	1	< 4
Bromodichloromethane	1	< 4
Bromoform	1	< 4
Bromomethane	1	< 4
2-Butanone (MEK)	10	< 40
Carbon disulfide	1	< 4
Carbon tetrachloride	1	< 4
Chlorobenzene	1	< 4
Chlorodibromomethane	1	< 4
Chloroethane	2	< 8
2-Chloroethyl vinyl ether	2	< 8
Chloroform	1	< 4
Chloromethane	1	< 4
1,2-Dibromoethane (EDB)	1	< 4
Dibromomethane	1	< 4
1,2-Dichlorobenzene	1	< 4
1,3-Dichlorobenzene	1	< 4
1,4-Dichlorobenzene	1	< 4
1,4-Dichloro-2-butene	2	< 8
Dichlorodifluoromethane	1	< 4
1,1-Dichloroethane	1	< 4
1,2-Dichloroethane	1	< 4
1,1-Dichloroethene	1	< 4
cis-1,2-Dichloroethene	1	< 4
trans-1,2-Dichloroethene	1	< 4
1,2-Dichloropropane	1	< 4
cis-1,3-Dichloropropene	1	< 4

completed:	tech:	approved by:
2/94	DWH	[signature]

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twinsburg, ohio 44087
(216) 425-8200

sample description: NASA - PLUM BROOK R.A.
PBS R.A. SUMP & DRAINS
8/10/94 11:30

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

COMPOUND	METHOD PQL (µg/L)	RESULT (µg/L)	
trans-1,3-Dichloropropene	1	< 4	
Ethyl acetate	2	< 8	
Ethyl benzene	1	< 4	
Ethyl ether	2	< 8	
Ethyl methacrylate	1	< 4	
2-Hexanone	2	< 8	
Methylene chloride	1	< 4	
Methyl iodide	1	< 4	
4-Methyl-2-pentanone (MIBK)	10	< 40	
Naphthalene	1	10.8	
Styrene	1	< 4	
1,1,1,2-Tetrachloroethane	1	< 4	
1,1,2,2-Tetrachloroethane	1	< 4	
Tetrachloroethene	1	< 4	
Tetrahydrofuran	2	< 8	
Toluene	1	< 4	
1,1,1-Trichloroethane	1	< 4	
1,1,2-Trichloroethane	1	< 4	
Trichloroethene	1	< 4	
Trichlorofluoromethane	1	< 4	
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1	< 4	
1,2,3-Trichloropropane	1	< 4	
Vinyl acetate	2	< 8	
Vinyl chloride	1	< 4	
m & p-Xylenes	1	< 4	(1.03)
o-Xylene	1	< 4	

completed: 8/29/94 | tech: JWH | approved by: Michael Kuirt

All reports are submitted on condition that client accepts ...

MK-Ferguson
NASA Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, Ohio 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307
1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

sample description: NASA - PLUM BROOK R.A.
PBS R.A. SUMP & DRAINS
8/10/94 11:30

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
1,2-Dichloroethane-d4	91.5%	76-114
Toluene-d8	89.3%	88-110
4-Bromofluorobenzene	88.4%	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.

3) A value reported as "less than" at a higher value than the Method PQL has been elevated due to dilution required for sample matrix.

completed:	tech:	approved by:
3-2/94	JWH	Murza Khurit

THIS SECTION IS FOR RESEARCH OIL USE ONLY!

Generator NASA

Acceptance No. 1443210

Date logged in 9-7-94

Date completed 9-19-94

Box # 336

% Organic <1
% Water 85
% Solids 15

Pounds/Gal 8.54

pH (s.u.) 7.0

COD (ppm) <12,500

Viscosity water & slurry

% Total Chlorination: <.005

% Volatile Chlorination: <.005

Flash Point >140 °F

Phenol (ppm)

Zit (ppm) 25

Aminoantipyrine (ppm)

Layered two

Appearance clear liquid brown slurry

Odor mild

Additional Notes:

Unloading Station:

Approval - Lab Manager

Aqueous Metals - All units reported in ppm

Ag	<.1	Cr	<.1	Ni	.52
As	<.5	Cu	<.1	Pb	<.1
Ba	<1.0	Fe	4.88	Se	<.1
Cd	<.1	Hg	.09	Zn	.2

Organic Metals - All units reported in ppm

Cd Cr Pb

ND=None Detected

Solvent Analysis X Yes No (reported in %)

Methanol	-all ND-	Methylene chloride	
Ethanol		MEK	
Acetone		sec-butanol	
2-Propanol		n-butanol	
Toluene		Ethyl Acetate	
Iso-butanol		1,1,1 Trichlor	
Xylene		MIBK	

Others

Total Solvents

Acid Test

Caustic Test

Ammonia

BTU Value

Suggested EPA Codes D004, D007, D008, D009, D010

Subject to Land Ban Yes No

Consent to Service ___ Yes ___ No

** TOTAL PAGE.002 **

Patient Name	Patient ID	Accession No
SAMPLE #01	94809339	94 809339

Age	Sex	Date Drawn	Time Drawn	Received
		08/09/94	00:00	08/10/94

Referred by	Room	Location	Client Lab No	Reported
MATT CONSTRUCTION	9339	00000		08/11/94

Test	Normal	Abnormal	Reference Range	Units
METHYL CHLOROFORM				
	METHYL CHLOROFORM (MCM)= 1,1,1 TRICHLOROETHANE			
SPECIMEN SUBMITTED	STD CHARCOAL TUBE			
VOLUME AIR SAMPLED	2.8			LITERS
MCM mass/sample	0.0			UG/SAMPLE
* METHYL CHLOROFORM	0.000		0 350	PPM
method detection lim	20.0			UG/SAMPLE
sample detection lim	1.2414			PPM
LABORATORY ANALYST	ALIANA LUNGU			
	REVIEWED BY ALBERT F. VICINIE III, LAB SUPERVISOR A.I.H.A. ACCREDITED LABORATORY (I.D. #9349)			
INDUSTRIAL RUSH FEE	8/11/94			

--- DIRECTORS ---
Patrick K. Jaynes Ph.D.
Anthony Nasrallah Ph.D.
DeYor Laboratories
7855 Market St. - Suite 500
Youngstown, OH 44512
Phone: 1-216-758-5788

--- PATHOLOGISTS ---
John C. York II, M.D.
Arlington G. Kuklinca M.D.

ARIES ENVIRONMENTAL CONSULTANT
ATTN: TAMMY DEGITC
820 EVERGREEN AVENUE
PITTSBURGH PA 15209

* * * * * * * * F I N A L R E P O R T * * * *

Laurel, MD

LAIDLAW ENVIRONMENTAL SERVICES

NAME OF WASTE STREAM

MATERIAL PROFILE NO.

☐ ✓ ☐ Amendment

A. GENERATOR INFORMATION

Generator Name: NASA PlumBrook Station
Facility Address: 6100 Columbus Ave
City/County: Sandusky / Erie
State: Ohio Zip Code: 44870
USEPA ID#: OH8800015379
State ID#:

Technical Contact: ELISE ALLEN
Telephone (216) 977-7523 EXT.
Fax (216) 433-2014
Billing Name: Morrison Knudsen Corp
Billing Address: 21000 Brookpark Rd MS-SPTD-5
City: Cleveland State: OH Zip Code: 44135
Attention: ELISE EALLEN
Telephone (216) 977-7523 EXT.

B. DOT Shipping Name: Hazardous Waste Solid, NOS
Class 9,
Hazard Class: D009
UN/NA No.: 3077 Packing Group: III RQ: 1 Pound

C. RCRA RCRA Non Hazardous/Exempt? ☐ Yes ☒ No Process Generating: Cleanup of
State Waste Codes:
EPA Waste Codes: D009

D. ANNUAL REPORT CODES

SIC Code:
Source Code: A
Form Code: B
Origin Code:
System Type: M

E. OTHER COMPONENTS

	No	Yes	Total ppm
PCB's	☒	☐	
Cyanides	☒	☐	
Sulfides	☒	☐	
Pesticides	☒	☐	
Phenolics	☒	☐	
Dioxins	☒	☐	
Halogens	☒	☐	%

F. PHYSICAL CHARACTERISTICS AT 70° F

Infectious or Biological Waste? ☐ Yes ☒ No
NRC Regulated Radioactive? ☐ Yes ☒ No
Reactivity ☒ None ☐ Water Reactive ☐ Pyrophoric ☐ Shock Sensitive ☐ Cyanides ☐ DOT Explosive ☐ Sulfides ☐ Other

☐ Gas (Cylinder) ☒ Solid %
☐ Aerosol ☒ Sludges %
☐ Lab-Pack ☐ Free Liquids %
100%

Layers: ☐ Single Layered ☐ Bi-layered ☒ Multi-layered
Viscosity: ☐ Low ☐ Medium ☐ High
Odor: ☐ None ☒ Mild ☐ Strong Describe:
Color/Appearance:

Weight
Density lbs./gal. (US, liq) lbs./cu. foot
Dry Weight ☐ <1.0% ☒ 5-20% ☐ 1-5% ☐ 20-100%

pH ☐ N/A ☐ 0-2 ☒ 4.1-10 ☐ ≥ 12.5 ☐ 12.1-4 ☐ 10.1-12.4 Exact

Flash Point (liquid only)
☐ <73°F (23°C) ☐ 73-140°F (23-60°C) ☐ 142-200°F (61-93°C) ☒ >200°F (93°C) ☐ N/A

Boiling Point
☐ <85°F (35°C) ☐ >95°F (35°C) ☐ N/A

BTU/Lb.

Dermal Toxicity LD_{50} (Mg/Kg)
☐ ≤40 ☐ >200, ≤1000 ☐ >40, ≤200 ☐ >1000
4. Material poisonous by inhalation? ☐ Yes ☐ No

Oral Toxicity LD_{50} (Mg/Kg)
☐ ≤5 ☐ >5, ≤50
Solids: ☐ >50, ≤200 ☐ >200
Liquids: ☐ >50, ≤500 ☐ >500

5. Is this waste stored in vented drums? ☐ Yes ☒ No
6. Is this waste pumpable? ☐ Yes ☐ No
7. Is this waste polymerizable? ☐ Yes ☐ No
8. Is waste stream subject to the National Emission Standards for Benzene Waste Operations (40 CFR 61 Subpart FF)? ☐ Yes ☒ No
9. Is this waste regulated as an ozone depleting substance (40 CFR part 82)? ☐ Yes ☒ No
10. Does this waste contain scrap metal pieces greater than 2 inches in size? ☐ Yes ☒ No

G. METALS
☐ NONE ☐ TCLP (MG/L) ☒ TOTAL (PPM)

	Reg. Limit	Below	Above	Range
Arsenic	5 mg/L	☒	☐	
Barium	100 mg/L	☒	☐	
Cadmium	1 mg/L	☒	☐	
Chromium	5 mg/L	☒	☐	
Copper		☐	☐	
Lead	5 mg/L	☒	☐	
Mercury	0.2 mg/L	☐	☒	270 ppm
Nickel	134 mg/L	☐	☐	
Selenium	1 mg/L	☒	☐	
Silver	5 mg/L	☒	☐	
Zinc		☐	☐	
Others:				

H. PHYSICAL/CHEMICAL CONSTITUENTS

Sludge *	90 %
PPE, Plastic	10 %
	%
* Sludge comprised	%
of dirt, water,	%
oil.	%
	%
	%
	%
	%
	%
	%
	100 %

(Attach All MSDS, Sample Analysis and Additional Info.)

I. ANTICIPATED VOLUME

Qty.	Container	Qty.	Container
☐	5 gl. pail	☐	Cubic Yard Box*
☐	15 gl. carboy	☐	Super Sack*
☐	30 gl. drum	☐	Rolloff/Dump Trailer*
☒ 7	55 gl. drum	☐	Tanker*
☐	85 gl. drum	☐	Other

Per ☒ 1 Time ☐ Week ☐ Month ☐ Year ☐ Other

(*) Is this waste regulated as a Marine Pollutant (49 CFR 171.8)? ☐ Yes ☐ No

Generator's Certification:

I hereby certify that the above and attached description is complete and accurate to the best of my knowledge and ability to determine that no deliberate or willful omissions of composition properties exist and that all known or suspected hazards have been disclosed. I certify that the materials tested are representative of all material described by this form.

Date / /

RGANICS (Volatiles and Semi-Volatiles): Indicate if this waste contains or exceeds the indicated characteristics of toxicity defined in CFR 261.24.

Organics	Characteristic Level mg/l (ppm)	(Circle One)		Actual Value
D018 Benzene	0.5	Yes	No	
D019 Carbon Tetrachloride	0.5	Yes	No	
D020 Chlordane	0.03	Yes	No	
D021 Chlorobenzene	100.0	Yes	No	
D022 Chloroform	6.0	Yes	No	
D023 o-Cresol	200.0	Yes	No	
D024 m-Cresol	200.0	Yes	No	
D025 p-Cresol	200.0	Yes	No	
D026 Cresol	200.0	Yes	No	
D027 1,4-Dichlorobenzene	7.5	Yes	No	
D028 1,2-Dichloroethane	0.5	Yes	No	
D029 1,1-Dichloroethylene	0.7	Yes	No	
D030 2,4-Dinitrotoluene	0.13	Yes	No	
D031 Heptachlor (and its hydroxide)	0.008	Yes	No	
D032 Hexachlorobenzene	0.13	Yes	No	
D033 Hexachlorobutadiene	0.5	Yes	No	
D034 Hexachloroethane	3.0	Yes	No	
D035 Methyl Ethyl Ketone	200.0	Yes	No	
D036 Nitrobenzene	2.0	Yes	No	
D037 Pentachlorochenol	100.0	Yes	No	
D038 Pyridine	5.0	Yes	No	
D039 Tetrachlorethylene	0.7	Yes	No	
040 Trichlorethylene	0.5	Yes	No	
041 2,4,5-Trichlorophenol	400.0	Yes	No	
D042 2,4,6-Trichlorophenol	2.0	Yes	No	
D043 Vinyl Chloride	0.2	Yes	No	

submitted information is based on: Generator knowledge ✓ or analytical data ✓. If analytical , please supply copy of data.

NERATOR CERTIFICATION:

) _____ I hereby certify that all information submitted in this and all attached documents contains true and accurate descriptions of waste material, and all relevant information regarding known or suspected hazards in the possession of the generator has been osed. I understand that if this form is not fully complete (Under the requirements 40 CFR 262.11, 264.13, 265.13, and 268.7); then law will be required to conduct analysis upon receipt and that I agree to the associated costs of sampling and analysis as part of the a treatment contract.

ature: Amy L. Bauer Date: 10/18/94

Name: Amy L. Bauer Title: Inst. Oper. Mgr.

S AMENDMENT IS REQUIRED FOR EACH PROFILE. YOUR ORIGINAL SIGNATURE IS REQUIRED.

MK-Ferguson
NASA Lewis Research Center
Attn: Elise Allen
21000 Brookpark Road, M.S. 66-2
Cleveland, Ohio 44135

biological & environmental control laboratories, inc.
615 front street
toledo, ohio 43605
(419) 693-5307

1632 enterprise parkway
twinsburg, ohio 44087
(216) 425-8200

sample description: NASA - PLUM BROOK R.A.
PBS R.A. SUMP & DRAINS
8/10/94 11:30

ANALYTE	METHOD	RESULT
Ignitability - Setaflash	SW-846, 1020	greater than 200° F
pH in Solution	EPA 600, 150.1	7.48
Total Oil & Grease (Infrared)	EPA 600, 413.2	3,700 mg/L

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sample description: NASA - PLUM BROOK R.A.
PBS R.A. SUMP & DRAINS
8/10/94 11:30

results:

Analyte	Method	Result
Total Arsenic	EPA 600, 206.2	9.2 mg/L
Total Barium	EPA 600, 208.1	30 mg/L
Total Cadmium	EPA 600, 213.1	0.34 mg/L
Total Chromium	EPA 600, 218.1	24 mg/L
Total Lead	EPA 600, 239.1	12 mg/L
Total Mercury	EPA 600, 245.1	270 mg/L
Total Selenium	EPA 600, 270.2	less than 5 mg/L
Total Silver	EPA 600, 272.1	less than 0.1 mg/L

Note: Results reported by sample volume. Percent dry solids is 10.2%.

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twinsburg, ohio 44087
(216) 425-8200

sample description: NASA - PLUM BROOK R.A.
PBS R.A. SUMP & DRAINS
8/10/94 11:30

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/L)	RESULT (µg/L)
Acrolein	10	< 40
Acrylonitrile	10	< 40
Acetone	10	< 40
Benzene	1	< 4
Bromodichloromethane	1	< 4
Bromoform	1	< 4
Bromomethane	1	< 4
2-Butanone (MEK)	10	< 40
Carbon disulfide	1	< 4
Carbon tetrachloride	1	< 4
Chlorobenzene	1	< 4
Chlorodibromomethane	1	< 4
Chloroethane	2	< 8
2-Chloroethyl vinyl ether	2	< 8
Chloroform	1	< 4
Chloromethane	1	< 4
1,2-Dibromoethane (EDB)	1	< 4
Dibromomethane	1	< 4
1,2-Dichlorobenzene	1	< 4
1,3-Dichlorobenzene	1	< 4
1,4-Dichlorobenzene	1	< 4
1,4-Dichloro-2-butene	2	< 8
Dichlorodifluoromethane	1	< 4
1,1-Dichloroethane	1	< 4
1,2-Dichloroethane	1	< 4
1,1-Dichloroethene	1	< 4
cis-1,2-Dichloroethene	1	< 4
trans-1,2-Dichloroethene	1	< 4
1,2-Dichloropropane	1	< 4
cis-1,3-Dichloropropene	1	< 4

approved by

MK-Ferguson
NASA Lewis Research Center
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8/10/94 11:30

analysis: GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS

results: Continued

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2-Hexanone	2	< 8	
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Methyl iodide	1	< 4	
4-Methyl-2-pentanone (MIBK)	10	< 40	
Naphthalene	1	10.8	
Styrene	1	< 4	
1,1,1,2-Tetrachloroethane	1	< 4	
1,1,2,2-Tetrachloroethane	1	< 4	
Tetrachloroethene	1	< 4	
Tetrahydrofuran	2	< 8	
Toluene	1	< 4	
1,1,1-Trichloroethane	1	< 4	
1,1,2-Trichloroethane	1	< 4	
Trichloroethene	1	< 4	
Trichlorofluoromethane	1	< 4	
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1	< 4	
1,2,3-Trichloropropane	1	< 4	
Vinyl acetate	2	< 8	
Vinyl chloride	1	< 4	
m & p-Xylene	1	< 4	(1.03)
o-Xylene	1	< 4	

Completed by: [illegible] Tech: [illegible] approved by: [illegible]

MK-Ferguson
NASA Lewis Research Center
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sample description: NASA - PLUM BROOK R.A.
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8/10/94 11:30

analysis: VOLATILE ORGANICS

results: continued

Surrogate Recovery - Volatiles

Compound	% Recovery	Acceptable Range
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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.

3) A value reported as "less than" at a higher value than the Method PQL has been elevated due to dilution required for sample matrix.

b.e.c. laboratories

TWINSBURG OHIO | TOLEDO OHIO

☐ RUSH-ADDITIONAL CHARGE

RESULTS BY _____
MUST CONFIRM WITH LABORATORY

Analysis Per Quote No. P.O. # 2F4-4065-2733

RT TO: [illegible]
PHONE: [illegible]
PANY: [illegible]
FAX: [illegible]
ESS: [illegible]
STATE: [illegible]
ZIP: [illegible]
LOCATION: [illegible]
SAMPLER (PRINT): [illegible]

MATRIX: WATER-W SOIL-S SLUDGE-SL DRUMS-D OTHER-O

SAMPLE IDENTIFICATION	DATE TIME	COMPOSITE	GRAB	# CONTAINERS	SHIPPED VIA	WATER-W	TCLP-METALS ☐ VOA ☐ SVOA ☐ PEST/HERB ☐	FLASH POINT: OPEN CUP ☐ CLOSED CUP ☒	PAINT FILTER	pH	CYANIDE: TOTAL ☐ REACTIVE ☐	SULFIDE: TOTAL ☐ REACTIVE ☐	SOLIDS: TOTAL ☐ DISS ☐ SUSP ☐ ASH ☐	METALS: RCRA (8) ☒ MICHIGAN (10) ☐	VOLATILES: 624 ☐ 8240 ☒	SEMIVOLATILES: 625 ☐ 8270 ☐	PESTICIDES: 608 ☐ 8080 ☐	PCB's: 608 ☐ 8080 ☐	HERBICIDES: 8150 ☐	PRIORITY POLLUTANTS: METALS ☐ VOA ☐ SVOA ☐ PEST/PCB ☐	BTEX: 602 ☐ 8020 ☐ PLUS MTBE ☐ PLUS TBA ☐	TPH: GRO ☐ DRO ☐ 418.1 ☐	PAH: 8100 ☐ 8270 ☐	LEAD: TCLP ☐ TOTAL ☐	OTHER: Oil and Grease		
	[illegible] 1130		✓	5		W		✓		✓				✓	✓										✓		
																	94C0339 2										

MENTS AND SPECIAL HANDLING INSTRUCTIONS

[illegible]

	DATE	TIME		DATE	TIME
IVED BY SAMPLER: [illegible]	[illegible]	[illegible]	RECEIVED BY: [illegible]	8/10/94	1600
QUISHED BY: [illegible]	8/10/94	1650	RECEIVED BY:	DATE	TIME
QUISHED BY:	DATE	TIME	RECEIVED BY: [illegible]	8/10/94	1650

SAMPLE MAY BE RETURNED TO CLIENT AT BEC'S DISCRETION, UNLESS ARRANGEMENTS HAVE BEEN MADE PRIOR TO SAMPLE SUBMISSION.

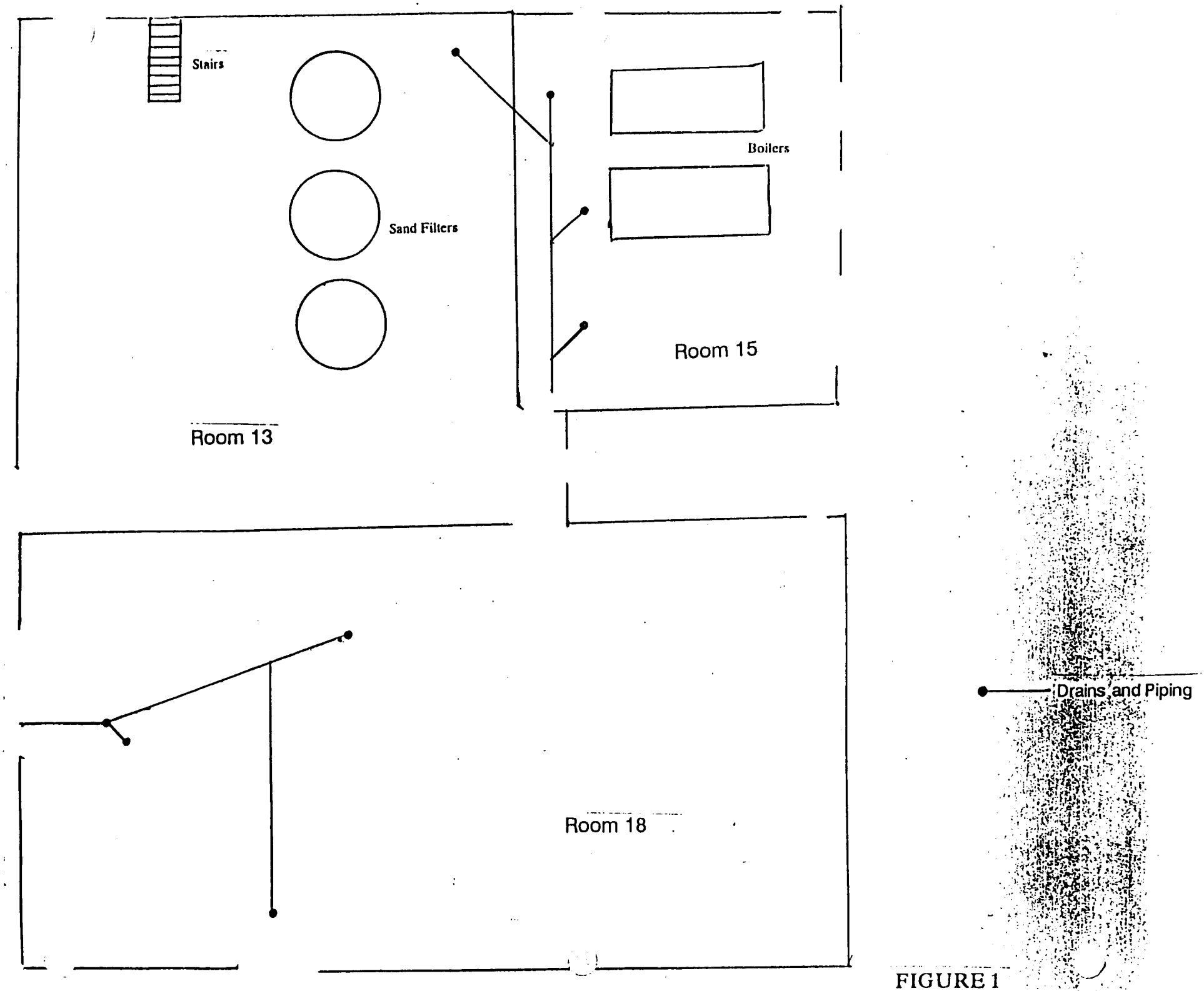
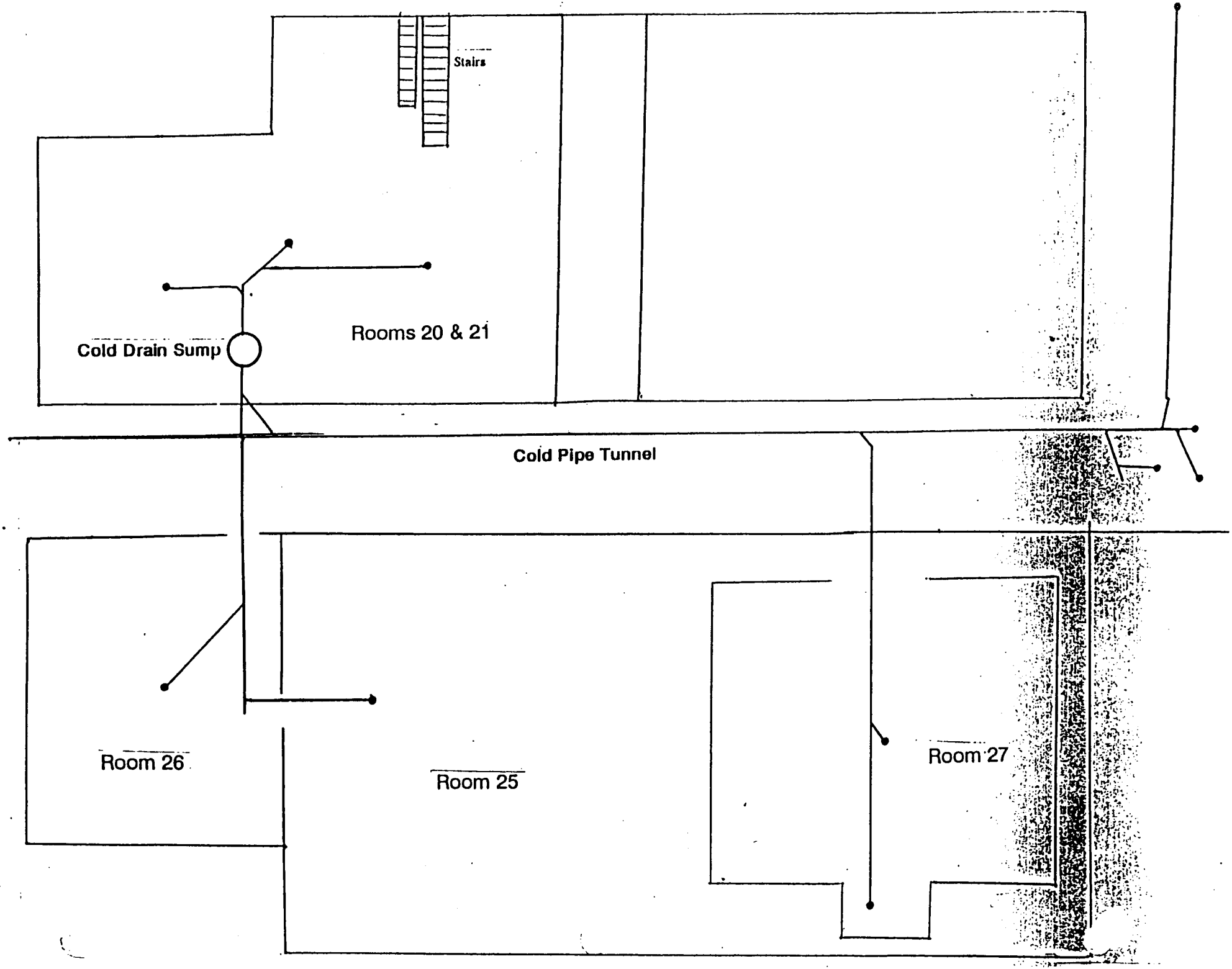
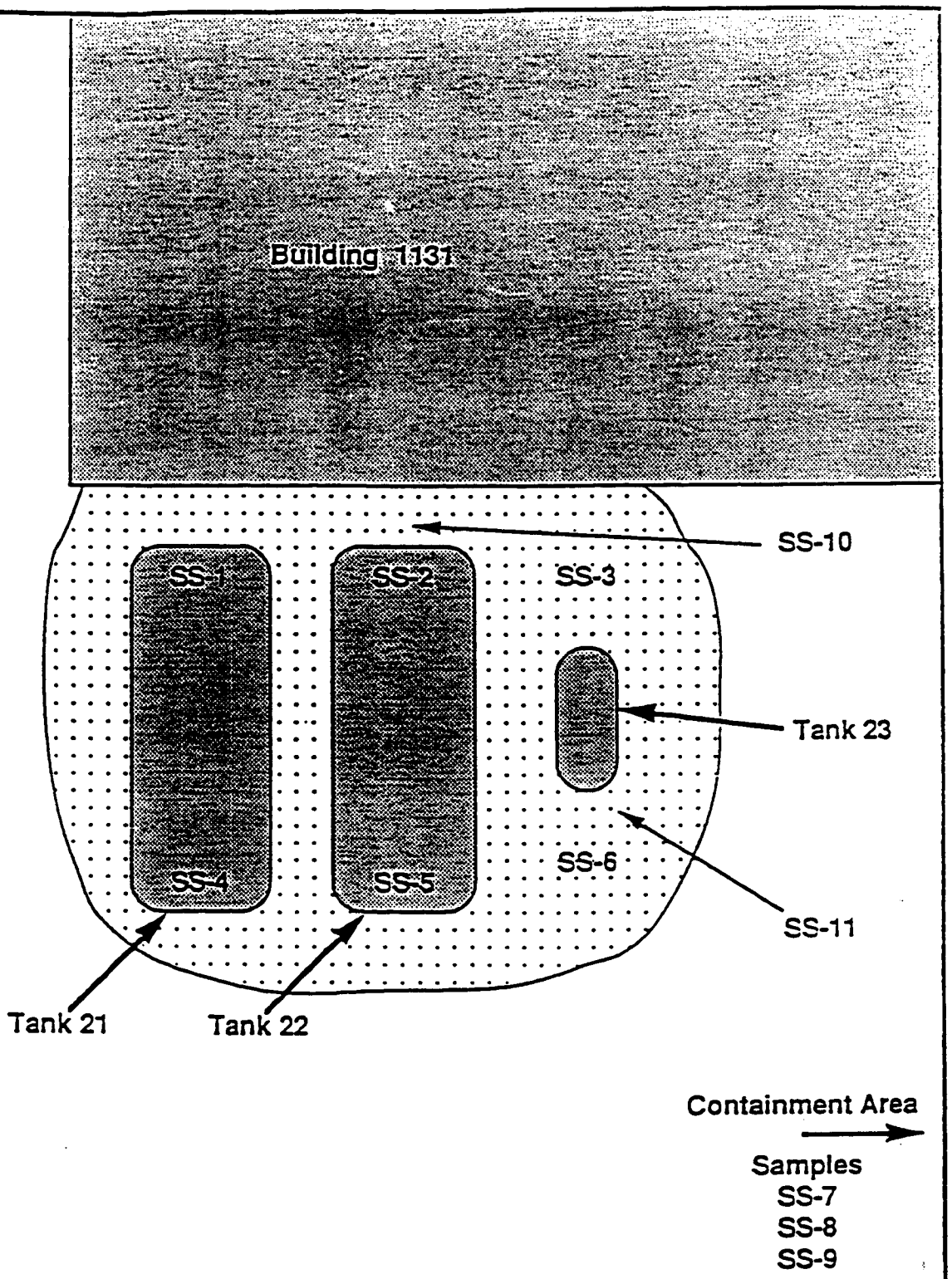

Stairs
Sand Filters
Boilers
Room 15
Room 13
Room 18
Drains and Piping

FIGURE 1


Stairs
Rooms 20 & 21
Cold Drain Sump
Cold Pipe Tunnel
Room 26
Room 25
Room 27

APPENDIX C

UST Layout, Prepared by EBASCO Environmental, May 1990 Report



Buildings

Excavated Tank Pit

Locations of Excavated Tanks

SS-4 Soil Sample Locations

North

Not to Scale

NASA Plum Brook Station
Building 1131

EBASCO ENVIRONMENTAL

FIGURE [6]

Locations of Removed Underground Storage Tanks and Soil Sampling Points

APPENDIX D

Hazardous Waste Manifests from Disposal for 1989 UST Closure, and Sump Cleaning, 1994

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
DIVISION OF HAZARDOUS WASTE
One Winter Street
Boston, Massachusetts 02108

CL0108

36186

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator US EPA ID No. OHH 3 8 0 0 0 1 5 3 7 9 — Manifest Document No. C 1 0 0 8

2. Page 1 of — Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
N.A.S.A.
6100 Columbus Ave.
Sandusky, OH 44870

4. Generator's Phone (419) 621-3233

A. State Manifest Document Number: MA C742186

B. State Gen. ID

C. State Trans. ID: 13-QP-70

D. Transporter's Phone (617) 585-5111

E. State Trans. ID

F. Transporter's Phone ( )

G. State Facility's ID: Not Required

H. Facility's Phone (617) 849-1800

5. Transporter 1 Company Name: Clean Harbors of Kingston, Inc.
6. US EPA ID Number: M A D 0 3 9 3 2 2 2 5 0

7. Transporter 2 Company Name
8. US EPA ID Number

9. Designated Facility Name and Site Address
Clean Harbors of Braintree, Inc.
385 Quincy Ave.
Braintree, MA 02184
10. US EPA ID Number: M A D 0 5 3 4 5 2 6 3 7

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. Waste Oil Non D.O.T. Regulated	18	DM	1440	G	MA01
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above (include physical state and hazard code.)
a. Profile #R43798
b.
c.
d.

K. Handling Codes for Wastes Listed Above
a. S 2 2
b.
c.
d.

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. Bauer — Signature: Amy L. Bauer — Date (Month Day Year): 02 14 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: FRED WILLIAMS — Signature: FRED WILLIAMS — Date (Month Day Year): 02 14 90

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name — Signature — Date (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: John Insall — Signature — Date (Month Day Year): 02 17 90

Form Approved OMB No. 2050-0039, Expires 9-30-91
EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

COPY>3: FACILITY MAILS TO GENERATOR

MA C742186 COPY>3: FACILITY MAILS TO GENERATOR

a. RQ =	c. RQ =	EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT:	
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300	

SEE SECTION 15

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: OH3 80 00 15 37 9 Manifest Document No: 90 0 17
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, Ohio 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: PA D 0 41 2585 1 75
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, Ohio 43616
10. US EPA ID Number: OHD 0 45 2 43 7 06
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	0 01	CM	Estimate 2 75 0 0	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above: PCN 2123 AT

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information: 15.07T 30140P.

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 23 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Lee Marshall | Signature: Lee Marshall | Month Day Year: 03 23 90

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name | Signature | Month Day Year

FACILITY

19. Discrepancy Indication Space: 1 Ton Kilndust added to stabilize load total Disposal 16.07 T.

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 | Month Day Year: 3 23 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete. ORIGINAL COPY

a. RQ =	c. RQ =	EMERGENCY NUMBER OR LOCAL OPERATOR:	SEE SECTION 15
b. RQ =	d. RQ =	EMERGENCY CONTACT: CHEMTREC (800) 424-9300	

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039. Expires 9-30-89

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH 38 00 0 15 37 9 9 0 0 18 — 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 Ave.
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: PA ID 0 41 2 55 1 75
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: OHD 0 45 2 43 7 06
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	0 01	CM	Estimate 2 7 50 0	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
S1-D01

15. Special Handling Instructions and Additional Information
15.96T 3190P

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.

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: 03 23 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: James L McQuiston — Signature: James L McQuiston — Month Day Year: 03 23 90

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name — Signature — Month Day Year

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: Jerry Pickle — Signature — Month Day Year: 3 23 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. OH 3800001537999 — Manifest Document No. 01 9

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) 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
876 Otter Creek Rd.
Oregon, OH 43616
10. US EPA ID Number: OHD042432706

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	Estimate 275 00	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
SelkDS1

15. Special Handling Instructions and Additional Information
1739T. 34780P

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 23 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Donnie Jenkins — Signature: Donnie Jenkins — Month Day Year: 03 23 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 PICKLE — Signature — Month Day Year: 3 23 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete. 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

Please print or type. *(Form designed for use on elite (12-pitch) typewriter.)* *Form Approved. OMB No. 2050-0039. Expires 9-30-89* 91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. 0H 3 80 0 01 5 37 9 90 0 20 — Manifest Document No.

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

Generator's Name and Mailing Address
NASA-Plum Brook Station
6100 Columbus Ave.
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: P AD 0 41 2 55 1 75

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: 0 HD 0 45 2 43 7 06

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	0 01	CM	Estimate 2 75 0 0	P	F002
b.					
c.					
d.					

Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
15-28T 30560P.

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 23 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: x John T Hall — Signature: John T Hall — Month Day Year: 03 23 90

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name — Signature — Month Day Year

FACILITY

19. Discrepancy Indication Space

Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19

Printed/Typed Name: Lee Pickle — Signature — Month Day Year: 3 23 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete. 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. 0 H3 8 00 0 15 3 79 9 00 2 1 — 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 Ave.
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: P AD 0 41 2 55 1 75

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: 0 HD 0 45 2 43 7 06

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	Estimate 2 7 50 0	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
3570-P. 17.85T

AGENCY DISPLAY OF ESTIMATED BURDEN
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Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 03 23 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: John T Hall — Signature: John T Hall — Month Day Year: 03 23 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 PICKLE — Signature — Month Day Year: 3 23 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		

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. 0H 3 80 0 01 5 37 9 90 0 22 — Manifest Document No.

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

1. Generator's Name and Mailing Address
NASA-Plum Brook Station
6100 Columbus Ave.
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: P AD 0 41 2 55 1 75

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: 0 HD 0 45 2 43 7 06

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	0 01	CM	Estimate 2 7 50 0	P	F002
b.					
c.					
d.					

Additional Descriptions for Materials Listed Above

PCN 2123 AT

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

15.02T 30040P

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."

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GENERATOR

Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 03 23 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: DONNIE JENKINS — Signature: Donnie Jenkins — Month Day Year: 03 23 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 PILLIE — Signature: [signature] — Month Day Year: 3 23 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	

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. OH 3 80 0 01 5 37 9 90 0 23 — 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 Ave.
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: PA D 04 1 25 5 1 75

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: O HD 0 45 2 43 7 06

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	0 01	CM	Estimate 2 7 50 0	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
17T 34340P

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.

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: 03 23 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Lee Marshall — Signature: Lee Marshall — Month Day Year: 03 23 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 Pille — Signature — Month Day Year

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete. 1-GENERATOR ORIGINAL COPY

a. RQ =	c. RQ =	RESPONSE CENTER (800) 424-8802, AND 911 EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT:	PROVIDED
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300	

Public reporting burden for this collection of information is estimated to average 37 minutes for generators, 15 minutes and 10 minutes for treatment, storage and disposal [illegible] DC 20460; and to the Office of Information and Regulatory, Office of Management and Budget, Washington, DC 20640."

SEE SECTION 15

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. 0H380015379900 24 — Manifest Document No.
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

GENERATOR

3. Generator's Name and Mailing Address
NASA-Plum Brook Station
6100 Columbus Ave.
Sandusky, OH 44879

A. State Manifest Document Number
B. State Generator's ID

4. Generator's Phone (419) 625-1123

TRANSPORTER

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

FACILITY

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	Estimate 2750	P	F002
b.					
c.					
d.					

Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
17.24 T 34480P.

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 23 90

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Jim L McQuiston — Signature: Jim L McQuiston — Month Day Year: 03 23 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: JERRY Pickle — Signature — Month Day Year: 3 23 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete. 1-GENERATOR ORIGINAL COPY

RQ's - 5000/1000/100/10/1

a. RQ =	c. RQ =	RESPONSE CENTER (800) 424-8802, AND 911 EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT: CHEMTREC (800) 424-9300
b. RQ =	d. RQ =	

SEE SECTION 15

minutes for generators, 15 minutes and 10 minutes for treatment, storage and disposal ... 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. 0 H 3 8 0 0 1 5 3 7 9 9 0 0 2 5 — 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 Ave.
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: P A D 0 4 1 2 5 5 1 7 5

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: O H D 0 4 5 2 4 3 7 0 6

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	0 0 1	CM	2 7 5 0 0	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
See I D 81

15. Special Handling Instructions and Additional Information
14.75 T 29500P

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: 03 26 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: John T Hall — Signature: John T Hall — Month Day Year: 03 26 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 30 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

RQ's - 5000/1000/100/10/1

a. RQ =	c. RQ =	RESPONSE CENTER (800) 424-8802, AND 911 EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT:
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300

PROVIDED

minutes for generators, 15 minutes and 10 minutes for treatment, storage and disposal ... garding ... to: ... S. ... Washington, DC 20460, and to the Office of Information and Regulatory, Office of Management and Budget, Washington, DC 20640."

SEE SECTION 15

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. 0 H3 8 00 0 15 3 79 9 00 2 6 — 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 Ave.
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: P AD 0 40 2 55 1 75

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: 0 HD 0 45 2 43 7 06

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 XXX NA9189 NOS F002	0 01	C M	2 7 50 0	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
S04 T D91

15. Special Handling Instructions and Additional Information
15.77T 31540

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."

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Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 03 26 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Bob Smiley — Signature: Bob Smiley — Month Day Year: 03 26 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 26 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

RQ's - 5000/1000/100/10/1

a. RQ =
b. RQ =
c. RQ =
d. RQ =

RESPONSE CENTER (800) 424-8802, AND 911
EMERGENCY NUMBER OR LOCAL OPERATOR.
EMERGENCY CONTACT:
CHEMTREC (800) 424-9300

PROVIDED

minutes for generators, 15 minutes and 10 minutes for treatment, storage and disposal

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. 0 H 3 8 0 0 0 1 5 3 7 9 9 0 2 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 Ave.
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: PAD 0 4 1 2 5 5 1 7 5

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: O H D 0 4 5 2 4 3 7 0 6

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	0 0 1	C M 2	7 5 0 0	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
Sect I D 81

15. Special Handling Instructions and Additional Information
34300 · 17.15 T

AGENCY DISPLAY OF ESTIMATED BURDEN
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GENERATOR

Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 03 26 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Lee Marshall — Signature: Lee Marshall — Month Day Year: 03 26 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: [illegible] — Month Day Year: 03 26 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

ORIGINAL COPY

a. RQ =	c. RQ =	RESPONSE CENTER (800) 424-8802, AND 911 EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT:	PROVIDED
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300	

"Public reporting burden for this collection of information is estimated to average 37 minutes for generators, 15 minutes and 10 minutes for treatment, storage and disposal [illegible] DC 20460, and to the Office of Information and Regulatory, Office of Management and Budget, Washington, DC 20640."

SEE SECTION 15

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. 0 H3 8 00 0 15 3 79 9 00 2 8 — Manifest Document No.

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

Generator's Name and Mailing Address: NASA-Plum Brook Station, 6100 Columbus Ave., 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: P AD 0 41 2 55 1 75

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: 0 HD 0 45 2 43 7 06

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	0 01	CM	Estimate 2 7 50 0	P	F002
b.					
c.					
d.					

Additional Descriptions for Materials Listed Above: PCN 2123 AT

K. Handling Codes for Wastes Listed Above: Scot J D81

15. Special Handling Instructions and Additional Information: 15.62 J 3120 P

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."

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Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 03 26 90

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Donnie Jenkins — Signature: Donnie Jenkins — Month Day Year: 03 26 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: [illegible] — Month Day Year: 03 26 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

a. RQ =	c. RQ =	RESPONSE CENTER (800) 424-8802, AND 911 EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT: CHEMTREC (800) 424-9300	PROVIDED
b. RQ =	d. RQ =		

minutes for generators, 15 minutes and 10 minutes for treatment, storage and disposal ... DC 20460; and to the Office of Information and Regulatory, Office of Management and Budget, Washington, DC 20640."

SEE SECTION 15

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. 0 H3 80 00 15 3 79 9 00 29 — 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 Ave.
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: PAD 041 255 175

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: OHD 045 243 706

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	Estimate 27500	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
See Item D 81

15. Special Handling Instructions and Additional Information
1551 T 31,020

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."

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Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 08 26 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: James McQuiston — Signature: James L McQuiston — Month Day Year: 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: JEFF HARDING — Signature: [illegible] — Month Day Year: 03 06 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

a. RQ =	c. RQ =	RESPONSE CENTER (800) 424-8802, AND 911 OR LOCAL OPERATOR. EMERGENCY CONTACT: CHEMTREC (800) 424-9300	PROVIDED
b. RQ =	d. RQ =		

minutes for generators, 15 minutes and 10 minutes for treatment, storage and disposal ... Washington, DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20640."

SEE SECTION 15

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. Manifest Document No.: 0H 3 80 0 01 5 37 9 90 0 30

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) 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: PA D 04 1 25 5 1 75

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: 0 HD 04 5 24 3 70 6

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.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ Hazardous Waste Solid NA9189 NOS F002	001	CM	Estimate 2 75 0 0	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above: PCN 2123 AT

K. Handling Codes for Wastes Listed Above: See I D 81

15. Special Handling Instructions and Additional Information: 33340 P. 11607 T

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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GENERATOR

Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 03 26 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Lee Marshall — Signature: Lee Marshall — Month Day Year: 03 26 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: [illegible] — Month Day Year: 03 27 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

RQ's - 5000/1000/100/10/1		RESPONSE CENTER (800) 424-8802, AND 911 EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT: CHEMTREC (800) 424-9300	PROVIDED	minutes for generators, 15 minutes and 10 minutes for treatment, storage and disposal ... DC 20460; and to the Office of Information and Regulatory, Office of Management and Budget, Washington, DC 20640."
a. RQ =	c. RQ =			
b. RQ =	d. RQ =			

SEE SECTION 15

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. 0 H 3 8 0 0 0 1 5 3 7 9 9 | Manifest Document No. 0 0 3 1

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

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: P A D 0 4 1 2 5 5 1 7 5

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: O H D 0 4 5 2 4 3 7 0 6

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 NA 9189 NOS F002	0 0 1	C M	Estimate 2 7 50 0	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
S01 T08

15. Special Handling Instructions and Additional Information
34900 P. 17.45 T

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 26 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: James McQuiston | Signature: James L McQuiston | Month Day Year: 03 26 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 HASDINE | Signature: Jeff Hasdine | Month Day Year: 03 26 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

a. RQ =	c. RQ =	RESPONSE CENTER (800) 424-8802, AND 911. 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 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 9-30-88* 91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. 0 H3 8 00 01 5 3 79 90 0 3 2 — 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 Ave.
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: P A D 0 4 1 2 5 5 1 7 5

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: O H D 0 4 5 2 4 3 7 0 6

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	0 01	CM	Estimate 2 75 0 0	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
S01 I D81

15. Special Handling Instructions and Additional Information
27680 P. 13.84 T

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.

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Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 03 26 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: John T Hall — Signature: John T Hall — Month Day Year: 03 26 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: J H Harding — Month Day Year: 03 26 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

ORIGINAL COPY

a. RQ =	c. RQ =	EMERGENCY NUMBER OR LOGAL OPERATOR. EMERGENCY CONTACT:	
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300	

SEE SECTION 15

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: OH 380 015 379 190 03 3
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 Ave.
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: PA D041 255 175

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: OH D045 243 706

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 XNA9189 NOS F002	001	CM	Estimate 2750	P	F002
b.					
c.					
d.					

Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
S01 I D81

15. Special Handling Instructions and Additional Information
31480 P. 1574 T

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."

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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: 03 26 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Bob Smiley
Signature: Bob Smiley
Month Day Year: 03 26 90

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACILITY

19. Discrepancy Indication Space

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 31 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

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 9-30-89 91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No: OH 3 80 0 01 53 7 9 90 03 4
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 Ave.
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: PA D 0 41 2 55 1 75

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: OH D 0 45 2 43 7 06

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	0 01	CM	Estimate 2 75 0 0	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
Scr. D 81

15. Special Handling Instructions and Additional Information
29420 , 14.71 T

AGENCY DISPLAY OF ESTIMATED BURDEN
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GENERATOR

Printed/Typed Name: Amy L. Bower
Signature: Amy L. Bower
Month Day Year: 03 26 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Donnie Jenkins
Signature: Donnie Jenkins
Month Day Year: 03 26 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 31 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

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 9-30-88 91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No: 0 H3 8 00 0 15 3 79 9 00 3 5 — Manifest Document No.

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

Generator's Name and Mailing Address: NASA-Plum Brook Station, 6100 Columbus Ave., 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: P AD 0 41 2 55 1 75

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: O HD 0 45 2 43 7 06

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	0 01	CM	2 75 0 0	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: 32030 · 11.04 T

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."

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Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 05 26 92

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Bob Smiley — Signature: Bob Smiley — Month Day Year: 10 3 26 92

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: [signature] — Month Day Year: 08 31 92

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

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. OH 38 0 00 1 53 7 99 0 03 6 — 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 Ave.
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: P AD 0 41 2 55 1 75

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: O HD 0 45 2 43 7 06

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	0 01	CM	Estimate 2 75 0 0	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
Scr I D 81

15. Special Handling Instructions and Additional Information
21.070 13.02 T

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."

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GENERATOR

Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 03 26 90

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Lee Marshall — Signature: Lee Marshall — Month Day Year: 03 26 90

18. Transporter 2 Acknowledgement of Receipt of Materials

TRANSPORTER

Printed/Typed Name — Signature — Month Day Year

19. Discrepancy Indication Space

FACILITY

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: [illegible] — Month Day Year: 03 27 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. 0·H3·8·00·0·15·3·79
Manifest Document No. 9·00·3·7
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

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: PA·D·04·1·25·5·1·75
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: OH·D·04·5·24·3·70·6
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)	HM		12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.		RQ Hazardous Waste Solid NA9189 NOS F002	001	CM	Estimate 27500	P	F002
b.							
c.							
d.							

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
Scy I D81

15. Special Handling Instructions and Additional Information
17.87 T 35740

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 03 Day 26 Year 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: James L McQuiston
Signature: James L McQuiston
Month 03 Day 26 Year 90

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name
Signature
Month Day Year

FACIL

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 03 Day 27 Year 90

EPA Form 8700-22 (Rev. 9-88) Previous edition obsolete.

ORIGINAL — RETURN TO GENERATOR

7-BLS-C6

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. 0·H3·8·00·0·15·3·79
Manifest Document No. 9·0·03·8
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) 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
PA·D0·4·12·5·51·7·5

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
OH·D0·4·52·4·37·0·6

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)	HM	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.	RQ Hazardous Waste Solid NA 9189 NOS F002		0 01	CM	Estimate 2 75 0 0	P	F002
b.							
c.							
d.							

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
Scap: D81.

15. Special Handling Instructions and Additional Information
10.34 J 20,680 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.

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: 03 26 90

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: DONNIE JENKINS
Signature: Donnie Jenkins
Month Day Year: 03 26 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 HAIDING
Signature: [illegible]
Month Day Year: 03 27 90

GENERATOR — TRANSPORTER — FACILITY

EPA Form 8700-22 (Rev. 9-88) Previous Edition Obsolete.

ORIGINAL — RETURN TO GENERATOR

7-BLS-C6

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH3 8 0 00 1 53 7 9
Manifest Document No. 9 0 03 9
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) 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
PA D0 4 12 5 51 7 5

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
OH D 04 5 24 3 70 6

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*)

	HM		12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.		RQ Hazardous Waste Solid NOS F002 NA9189	0 01	CM	Estimate 2 75 00	P	F002
b.							
c.							
d.							

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
Scy I D81

15. Special Handling Instructions and Additional Information
30960 . 15.48 T

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: 03 26 90

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: John T Hall
Signature: John T Hall
Month Day Year: 03 26 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 27 90

GENERATOR — TRANSPORTER — FACILITY

Previous edition obsolete

ORIGINAL — RETURN TO GENERATOR

7-BLS-C6

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. 0 H3 8 00 0 15 3 79
Manifest Document No. 9 00 4 0
2. Page 1 of 1
Information in the shaded areas is not required by Federal law.

GENERATOR

3. Generator's Name and Mailing Address
NASA-Plum Brook Station
6100 Columbus Ave.
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
PAD 0 41 2 55 1 7 5

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
OHD 0 45 2 43 7 06

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*)	HM		12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.		RQ Hazardous Waste Solid NA9189 NOS F002	00 1	CM	Estimate 27 5 00	P	F002
b.							
c.							
d.							

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
Scep I D81.

15. Special Handling Instructions and Additional Information
24940 P. 1247 T

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 03 Day 27 Year 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: James LMcQuiston
Signature: James L McQuiston
Month 03 Day 27 Year 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 03 Day 27 Year 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

ORIGINAL — RETURN TO GENERATOR

7-BLS-C6

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH3 8 00 0 15 3 79
Manifest Document No. 9 00 4 1
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) 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
PA D 04 1 25 5 1 75

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
OH D0 4 52 4 37 0 6

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*)

	HM	11. US DOT Description	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	15. Waste No.
a.		RQ Hazardous Waste Solid NA9189 NOS F002	001	CM	Estimate 2 75 00	P	F002
b.							
c.							
d.							

Additional Descriptions for Materials Listed Above

PCN 2123 AT

K. Handling Codes for Wastes Listed Above

See I D 81

15. Special Handling Instructions and Additional Information

17.80 T 35600

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.

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: 03 27 90

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Donnie Jenkins
Signature: Donnie Jenkins
Month Day Year: 03 27 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 28 90

GENERATOR

TRANSPORTER

FACILITY

EPA Form 8700-22 (Rev. 9-88) Previous edition obsolete.

ORIGINAL — RETURN TO GENERATOR

7-BLS-C6

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. 0 H 3 8 0 0 0 1 5 3 7 9 9 0 0 1 Manifest Document No. 42

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) 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: P A D 0 4 1 2 5 5 1 7 5

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: O H D 0 4 5 2 4 3 7 0 6

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	Estimate 2750	P	F002
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
See I D 81

15. Special Handling Instructions and Additional Information
2480 lb
12.4T

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 27 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Lee Marshall | Signature: Lee Marshall | Month Day Year: 03 27 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 M Pertner | Signature: Dale M Pertner | Month Day Year: 03 27 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete. GENERATOR'S ORIGINAL 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 9-30-88* 91

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No: 0 H 3 8 0 0 0 1 5 3 7 9 9 0 0 4 3
Manifest Document No.
2. Page 1 of 1
Information in the shaded areas is not required by Federal law

GENERATOR

3. Generator's Name and Mailing Address: NASA-Plum Brook Station, 6100 Columbus Ave., 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: P A D 0 4 1 2 5 5 1 7 5
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: O H D 0 4 5 2 4 3 7 0 6
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	0 0 1	C M	Estimate 2 7 5 0 0	P	F002
b.					
c.					
d.					

Additional Descriptions for Materials Listed Above: PCN 2123 AT

K. Handling Codes for Wastes Listed Above: S01 I D81

15. Special Handling Instructions and Additional Information: 38810 · 19.43 T

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: 10 3 2 7 9 0

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Bob Smiley
Signature: Bob Smiley
Month Day Year: 10 3 2 7 8 0

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: [illegible]
Month Day Year: 10 30 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

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 9-30-91*

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No: OH380001537990 Manifest Document No: 0044
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) 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, 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	Estimate 27500	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: NAPD , 8.12 T

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.

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Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 03 27 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: John T Hall — Signature: John T Hall — Month Day Year: 03 27 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: [illegible] — Month Day Year: 03 27 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

ORIGINAL COPY

a. RQ =	c. RQ =	EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT:	
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300	

SEE SECTION 15

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. 0 H 3 8 0 0 0 1 5 3 7 9 Manifest Document No. 0 0 4 5

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

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: P A D 0 4 1 2 5 5 1 7 5

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: O H D 0 4 5 2 4 3 7 0 6

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	Estimate 27500	P	F002
b.					
c.					
d.					

Additional Descriptions for Materials Listed Above

PCN 2123 AT

K. Handling Codes for Wastes Listed Above

Scot I D81.

15. Special Handling Instructions and Additional Information

1150 T 23,000

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 27 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Bob Smiley | Signature: Bob Smiley | Month Day Year: 03 27 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 27 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

ORIGINAL COPY

a. RQ =	c. RQ =	EMERGENCY NUMBER OR LOCAL OPERATOR. EMERGENCY CONTACT:	
b. RQ =	d. RQ =	CHEMTREC (800) 424-9300	

SEE SECTION 15

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: 0 H 3 8 0 0 0 1 5 3 7 9 9 — Manifest Document No: 0 0 4 6

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) 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: P A D 0 4 1 2 5 5 1 7 5

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: O H D 0 4 5 2 4 3 7 0 6

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	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ Hazardous Waste Solid NA9189 NOS F002	001	CM	Estimate 27500	P	F002
b.					
c.					
d.					

GENERATOR

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above

Sept 3 D91

15. Special Handling Instructions and Additional Information

13.96 T 27920

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.

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: 03 27 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: James L McQuiston — Signature: James L McQuiston — Month Day Year: 03 29 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 30 90

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

ORIGINAL COPY

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. 0 H 3 8 0 0 0 1 5 3 7 9 — Manifest Document No. 9 0 0 4 7

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) 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 P A D 0 4 1 2 5 5 1 7 5

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
Environsafe
876 Otter Creek Rd.
Oregon, OH 43616

10. US EPA ID Number O H D 0 4 5 2 4 3 7 0 6

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)	HM	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.	Hazardous Waste Solid NA9189 F002	RQ NOS	001	CM	Estimate 27500	P	F002
b.							
c.							
d.							

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
Scy I D81

15. Special Handling Instructions and Additional Information
1447 T 28940

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 27 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Lee Marshall — Signature: Lee Marshall — Month Day Year: 03 27 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 28 90

Style F15 REV-6 LABELMASTER, Div of AMERICAN LABELMARK CO., CHICAGO, IL 60646

EPA Form 8700-22 (Rev 9-88) Previous editions are obsolete

ORIGINAL-RETURN TO GENERATOR

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. 0 H 3 8 0 0 0 1 5 3 7 9 — Manifest Document No. 9 0 0 4 8

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.
Sanduksy, 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 P A D 0 4 1 2 5 5 1 7 5

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
Environsafe
876 Otter Creek Rd.
Oregon, OH 43616

10. US EPA ID Number O H D 0 4 5 2 4 3 7 0 6

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.	HM RQ NOS Hazardous Waste Solid NA9189 F002	001	CM	Estimate 27500	P	F002
b.						
c.						
d.						

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
Scey I D81

15. Special Handling Instructions and Additional Information
27500 1375 T

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.

GENERATOR

Printed/Typed Name: Amy L. Bower — Signature: Amy L. Bower — Month Day Year: 03 27 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Donnie Jenkins — Signature: Donnie Jenkins — Month Day Year: 03 27 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 Hard — Month Day Year: 03 28 90

Style F15 REV-6 LABELMASTER, Div. of AMERICAN LABELMARK CO., CHICAGO, IL 60646

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

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. 0 H 3 8 0 0 0 1 5 3 7 9
Manifest Document No. 9 0 0 4 9

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) 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 P A D 0 4 1 2 5 5 1 7 5

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
Environsafe
876 Otter Creek Rd.
Oregon, OH 43616

10. US EPA ID Number O H D 0 4 5 2 4 3 7 0 6

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)	HM	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. RQ NOS Hazardous Waste Solid NA9189 F002		0 0 1	C M	Estimate 2 7 5 0 0	P	F002
b.						
c.						
d.						

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
See I D 81.

15. Special Handling Instructions and Additional Information
20330 P. 10.44 T

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: 0 9 2 8 9 0

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Lee Marshall
Signature: Lee Marshall
Month Day Year: 0 3 2 8 9 0

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: 0 3 2 8 9 0

Style F15 REV-6 LABELMASTER, Div of AMERICAN LABELMARK CO., CHICAGO, IL 60646

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

ORIGINAL-RETURN TO GENERATOR

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. 0 H 3 8 0 0 0 1 5 3 7 9 — Manifest Document No. 9 0 0 5 0

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) 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 P A D 0 4 1 2 5 5 1 7 5

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
Environsafe
876 Otter Creek Rd.
Oregon, OH 43616

10. US EPA ID Number O H D 0 4 5 2 4 3 7 0 6

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)	HM	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.	RQ NOS Hazardous Waste Solid NA9189 F002		001	CM	Estimate 27500	P	F002
b.							
c.							
d.							

J. Additional Descriptions for Materials Listed Above
PCN 2123 AT

K. Handling Codes for Wastes Listed Above
Scq I-D81

15. Special Handling Instructions and Additional Information
28080lb 1404T

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: 03 28 90

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: DONNIE JENKINS — Signature: Donnie Jenkins — Month Day Year: 03 28 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 Y: 03 28 90

Style F15 REV-6 LABELMASTER, Div of AMERICAN LABELMARK CO., CHICAGO, IL 60646

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

ORIGINAL RETURN TO GENERATOR

Department of the Environment - Waste Management Administration
2500 Broening Highway Baltimore, MD 21224

Hazardous Waste Program

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form approved OMB No. 2050-0039 Expires 9/30/94

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID NO. OH3 8000159 7 9 Manifest Document No. 94011 2. Page 1 of 1

Information in the shaded areas is not required by Federal law. WVM

A. State Manifest Document Number MDC 0523989

3. Generator's Name and Mailing Address
NASA-PLUMBROOK STATION
6100 COLUMBUS AVENUE, SANDUSKY, OH ~~44870~~ 44870

B. State Generator's ID Number

4. Generator's Phone (419 ~~621-3333~~ 625-1123 ~~303-[illegible]~~

C. State Transporter's ID HWH
Vehicle Sticker Number A DC

5. Transporter 1 (Company Name) ECO-TRON, INC.
6. US EPA ID Number OHD 987023090

D. Transporter's Phone 216 497 8810

E. State Transporter's ID HWH 0517
Vehicle Sticker Number PA-4H-0400 94A5586 DC 1138

7. Transporter 2 (Company Name) J.R. HUNT SPEC CLEAN INC
8. US EPA ID Number ARD 048 510555

F. Transporter's Phone 1-800-368-8539

9. Designated Facility Name and Site Address
LAIDLAW ENVIRONMENTAL SERVICES (TS), INC.
3527 WHISKEY BOTTOM ROAD
LAUREL, MD 20724
10. US EPA ID Number MDD 980554653

G. State Facility ID A207

H. Facility's Phone 301 953 9583

GENERATOR

11. US DOT Description (Including Proper Shipping Name, Hazard Class and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit W/Vol	I. Waste No.
NA					
a. HAZARDOUS WASTE SOLID, N.O.S., (MERCURY), 9, NA3077, RQ, III, RQ(D009)	007	DM	2960 EST.	P	D009
b.					
c.					
d.					

J. Additional Description for Materials Listed Above

	HAZ CODE	Physical State	Specific Gravity	Percentage		HAZ CODE	Physical State	Specific Gravity	Percentage		K. Handling Codes for Waste Listed Above
a.	PT	S	1.10	100 %	c.				%	a.	S c.
b.				%	d.				%	b.	d.

15. Special Handling Instructions and Additional Information Emergency Contact: 1-800-535-5053 (596) Infotrac
Additional a. c.
EPA Codes b. d.

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 and Maryland Statutes or 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 Date 110994

TRANSPORT

17. Transporter 1 (Acknowledgement of Receipt of Materials)
Printed/Typed Name JAMES MARSHALL Signature James Marshall Date 110994

18. Transporter 2 (Acknowledgement of Receipt of Materials)
Printed/Typed Name JAMES PRADCLIFFE Signature [illegible] Date 110994

19. Discrepancy Indication Space

FACILITY

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed/Typed Name CHARLES CONNOR Signature [illegible] Date 112294

EPA Form 8700-22 (10-91)

MDC 0523989

In case of an emergency or spill, immediately call the National Response Center at (800) 424-8802 and the MDE at (410) 631-3900. Highway Site Number

DNR

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

DO NOT WRITE IN THIS SPACE

ATT. ☐ DIS. ☐ REJ. ☐ PR. ☐

Required under authority of Act 64, P.A. 1979, as amended and Act 136, P.A. 1969.

Failure to file is punishable under section 299.548 MCL or Section 10 of Act 136, P.A. 1969.

Please print or type.

Form Approved. OMB No. 2050-0039 Expires 9-30-9

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. 0 H 3 3 0 0 0 1 5 3 7 9 Manifest Document No. 9 4 6 1 2

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
NASA LEWIS RESEARCH CENTER
6100 COLUMBUS AVE
SANDUSKY, OH 44870

4. Generator's Phone (419) 621-3223

A. State Manifest Document Number MI 3472859

B. State Generator's ID

5. Transporter 1 Company Name
HAZ MAT ENVIRONMENTAL, INC.

6. US EPA ID Number N Y D 9 8 0 7 6 9 9 4 7

C. State Transporter's ID 11626PNY

D. Transporter's Phone 716-827-7200

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
CHEM MET SERVICES, INC.
18550 ALLEN ROAD
WYANDOTTE, MI 48192

10. US EPA ID Number M T D 0 9 6 9 6 3 1 9 4

G. State Facility's ID

H. Facility's Phone 800-282-9251

	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.	N/H
a.	NON HAZARDOUS, NON REGULATED MATERIAL	001	TT	24110	G	029	N
b.							
c.							
d.							

J. Additional Descriptions for Materials Listed Above

11a. NAS 37901

K. Handling Codes for Wastes Listed Above

a/ /
b/ /
c/ /
d/ /

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.

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GENERATOR

Printed/Typed Name: Amy L. Bower
Signature: Amy L. Bower
Date (Month Day Year): 1 1 1 0 9 4

17. Transporter 1 Acknowledgement of Receipt of Materials

TRANSPORTER

Printed/Typed Name: JOHN FAHEY
Signature: John Fahey
Date (Month Day Year): 1 1 1 0 9 4

18. Transporter 2 Acknowledgement or Receipt of Materials

Printed/Typed Name:
Signature:
Date (Month Day Year):

19. Discrepancy Indication Space

FACILITY

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name: MATT GABRIS - Chem Met
Signature: Matt Gabris
Date (Month Day Year): 1 1 1 5 7

CENTER AT 1-800-424-8802 24 HOURS PER DAY.