

PRELIMINARY SITE INVESTIGATION REPORT

100% SUBMITTAL

PHASE I

REMEDICATION OF CONTAMINATED  
UNDERGROUND STORAGE TANK SITES

TASK ORDER 6105-004

PLUM BROOK STATION  
6100 COLUMBUS AVENUE  
SANDUSKY, OHIO 44870

JANUARY 28, 1993

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# TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE NO.</u>
INTRODUCTION.....	1
SITE PRIORITIZATION.....	1-3
UST SITE CHARACTERIZATIONS.....	3
Building 7121 and 7131 Areas.....	3
Soils.....	3-4
Groundwater.....	4
Closure of the 7121 and 7131 Areas.....	4-5
Reactor Area (Building 1131).....	5
Soils.....	5
Groundwater.....	6
Closure of the Reactor Area.....	6
Space Power Facility (Building 1411).....	6
Soils.....	6
Groundwater.....	6
Closure of the Space Power Facility.....	7
Building 7132 USTs.....	7
Soils.....	7-8
Groundwater.....	8
Closure of Building 7132 USTs.....	8
Pump Station Area (Building 8133).....	8
Soils.....	8
Groundwater.....	9
Closure of Pump Station Area.....	9
REVIEW OF EXISTING MATERIAL.....	9

## FIGURES

FIGURE 1.....	Site Plan
FIGURE 2.....	Garage and Maintenance Area (7121/7131)
FIGURE 3.....	Reactor Facility
FIGURE 4.....	Space Power Facility
FIGURE 5.....	Building 7132 Area
FIGURE 6.....	Pump Station

TABLE OF CONTENTS (continued)

TABLES

TABLE 1.....Summary of Former Underground Storage Tank Areas

TABLE 2.....Summary of Detected Soil Contamination

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

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## 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.

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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.

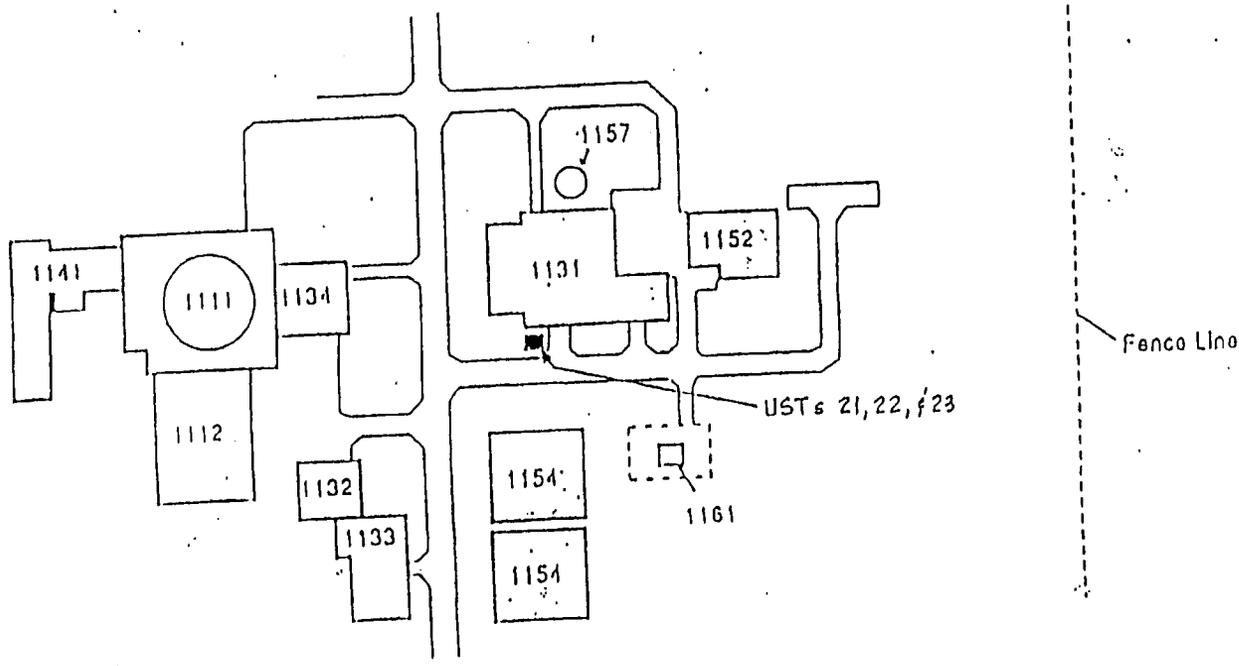
REVIEW OF EXISTING MATERIAL

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.

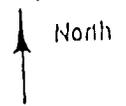
FIGURES





Legend

- Buildings
- ▨ UST Location
- .... Fenco



Approximate Scale 1" = 200'

KENNEDY SPACE CENTER RESEARCH CENTER PLUM BROOK 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	BLDG.7121	BLDG.7121	BLDG.7131	BLDG.1411	BLDG.1131
	ug/kg	7121-1 ug/kg	7121-2,3,4 ug/kg	7131-1 ug/kg	1411-1,2 ug/kg	1131-1,2,3 ug/kg
Chloroethane	6.9	10.0	34.0	ND (1)	ND	ND
Trichlorofluoromethane	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
Trans-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
phthalene	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.

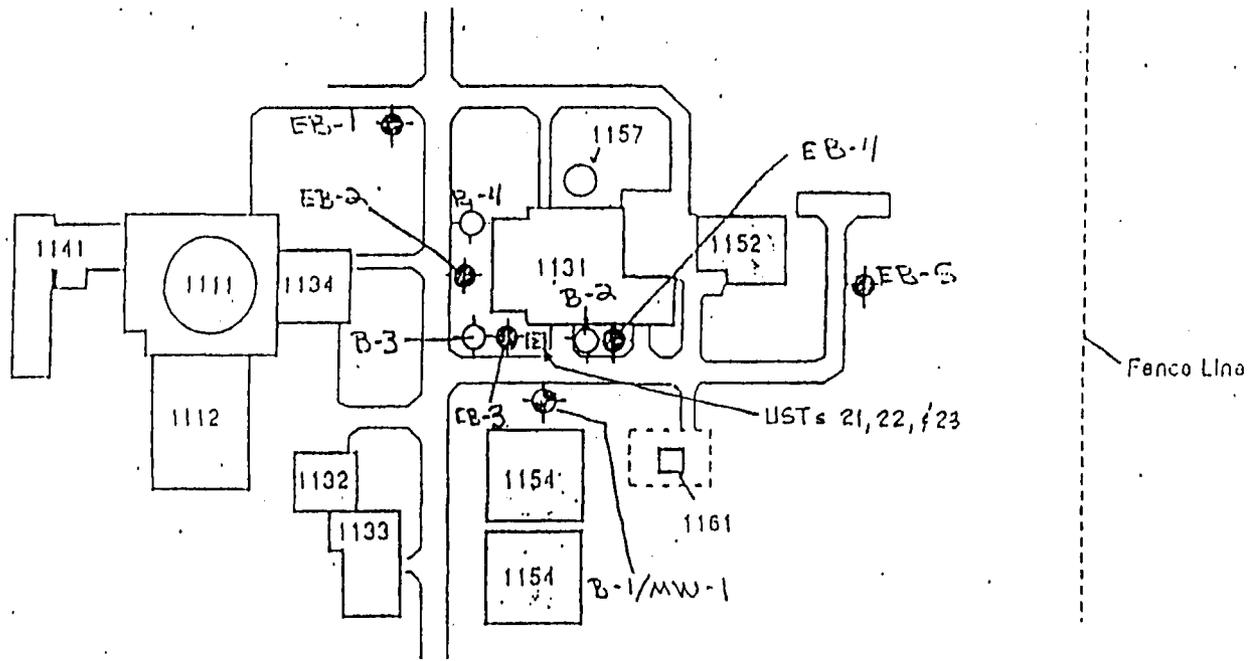
Boring B-1/MW-1 was developed into a monitoring well. This well was sampled along with six (6) other wells previously installed. A sump area inside of the Reactor Building was also sampled. The sump collects water from the building foundation drain system. All of the groundwater was analyzed for:

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

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

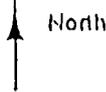
TABLE 2

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



North

- EXISTING MONITOR WELLS (EB- )
- PROPOSED MONITOR WELLS (MW- )
- PROPOSED BORINGS (B- )

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
LEWIS RESEARCH CENTER PLUMB BROOK STATION

REACTOR FACILITY

FIGURE 2

Approximate Scale 1" = 200'

TPH AND BTEX RESULTS FOR SOIL

REACTOR AREA  
TASK NO. 6105-006

BORING NUMBER	SAMPLE DEPTH	TPH (418.1) (mg/kg) <sup>(1)</sup>	BENZENE (ug/kg) <sup>(2)</sup>	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 <sup>D(3)</sup>	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) <sup>(1)</sup>	PQL (ug/kg) <sup>(2)</sup>
B1	2'-4'	---	--- <sup>(3)</sup>	---
B1	4'-6'	---	---	---
B1	14'-16'	---	---	---
B2	2'-4'	---	---	---
B2	4'-6'	---	---	---
B2 <sup>D(4)</sup>	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

RECTOR AREA  
TASK NO. 6105-006

BORING NUMBER	SAMPLE DEPTH	COMPOUND	RESULT (mg/kg) <sup>(1)</sup>	PQL (mg/kg) <sup>(2)</sup>
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 <sup>D(3)</sup>	4'-6'	ACENAPHTHENE	0.132	< 0.1
B2	6'-8'	---	--- <sup>(4)</sup>	---
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) <sup>(1)</sup>	PQL (mg/kg) <sup>(2)</sup>
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'	---	--- <sup>(4)</sup>	---
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) <sup>(1)</sup>	PQL (ug/L) <sup>(2)</sup>
MW1 <sup>(3)</sup>	---	--- <sup>(4)</sup>	---
MW1A <sup>(5)</sup>	---	---	---
EB1 <sup>(6)</sup>	DICHLORODIFLUORO- METHANE <sup>(7)</sup>	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 <sup>(8)</sup>	1.70 <sup>(4)</sup>	1
SUMP 2 <sup>(9)</sup>	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) <sup>(1)</sup>	PQL (ug/L) <sup>(2)</sup>
MW1 <sup>(3)</sup>	---	---- <sup>(4)</sup>	---
MW1A <sup>(5)</sup>	BENZO (a) ANTHRACENE	1.30	< 1.0
EB1 <sup>(6)</sup>	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) <sup>(1)</sup>	PQL (ug/L) <sup>(2)</sup>
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