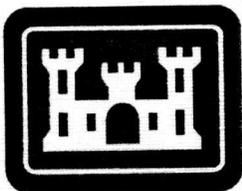


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DRAFT SITE ASSESSMENT REPORT 80TH DIVISION RESERVE SITE, LIGHTER
AMPHIBIOUS RESUPPLY CARGO (LARC) 60 MAINTENANCE AREA FORT STORY VA
3/1/1994
MONTGOMERY WATSON

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**U.S. Army Corps
Of Engineers**

Omaha District

**U.S. Army Corps of Engineers
Missouri River Division**

Draft Site Assessment Report

**80th Division LARC 60 Area
Fort Story, Virginia**

March 1994



MONTGOMERY WATSON

**DRAFT SITE ASSESSMENT REPORT
80-DRS LARC 60 AREA
FORT STORY, VIRGINIA**

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1.0 INTRODUCTION

1.1 OBJECTIVE

Montgomery Watson (Montgomery) has been contracted by the United States Army Corps of Engineers (USACE), Omaha District, to conduct a Site Assessment at the 80th Division LARC 60 Area (80-DRS LARC Area) at Fort Story, Virginia. Soil in the 80-DRS LARC area will be excavated during the planned expansion of the existing wash pad. This Site Assessment will evaluate:

- the presence or absence of contamination in soils that will be disturbed during site construction;
- the potential chemical exposure of construction personnel during excavation and construction at the site, and determine if they require protection from chemical exposure; and
- the detected levels of contaminants about potentially applicable regulatory standards.

This Site Assessment investigated soil quality in the excavation area. Groundwater quality was not investigated because construction personnel are not expected to contact groundwater.

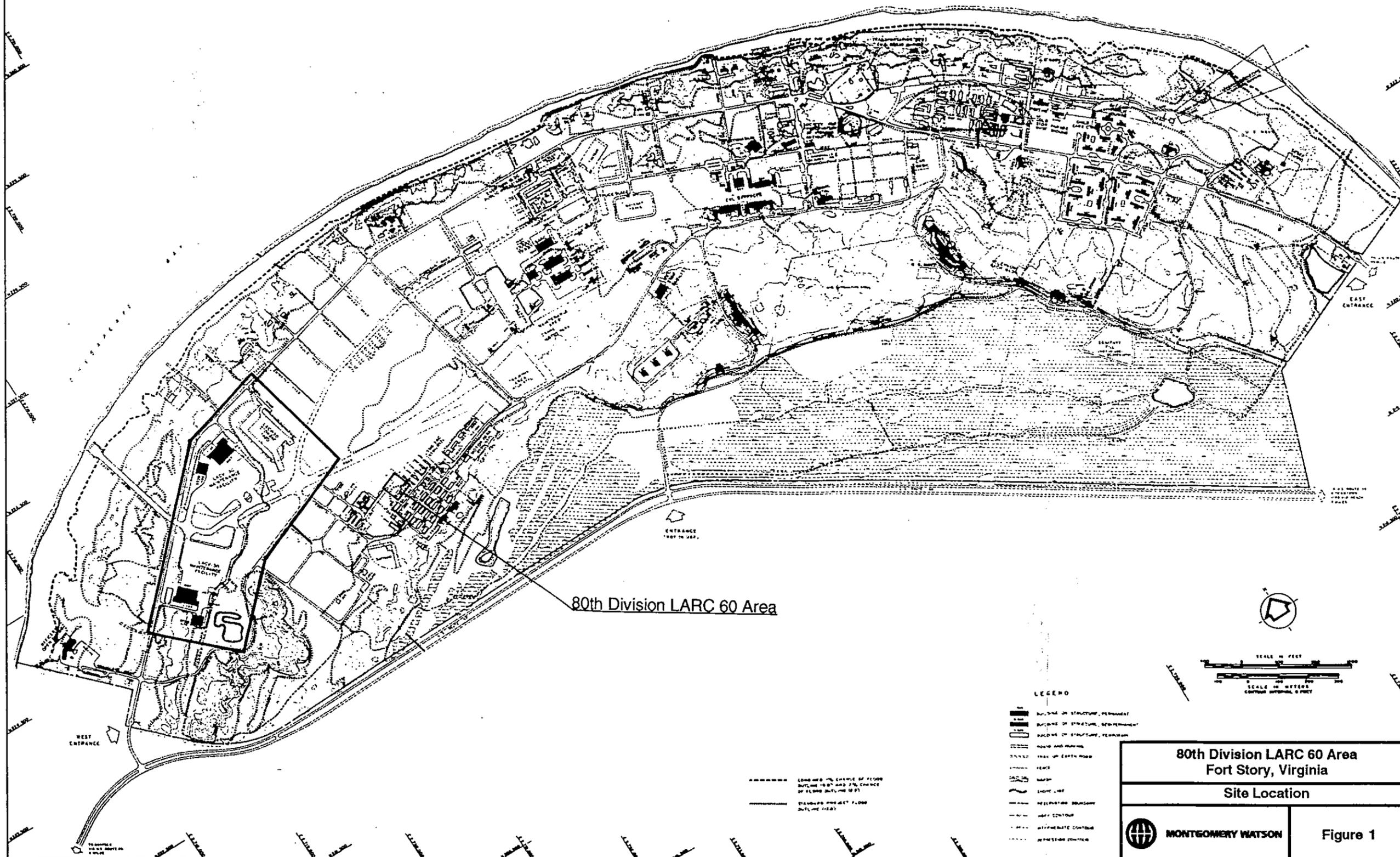
1.2 SITE DESCRIPTION

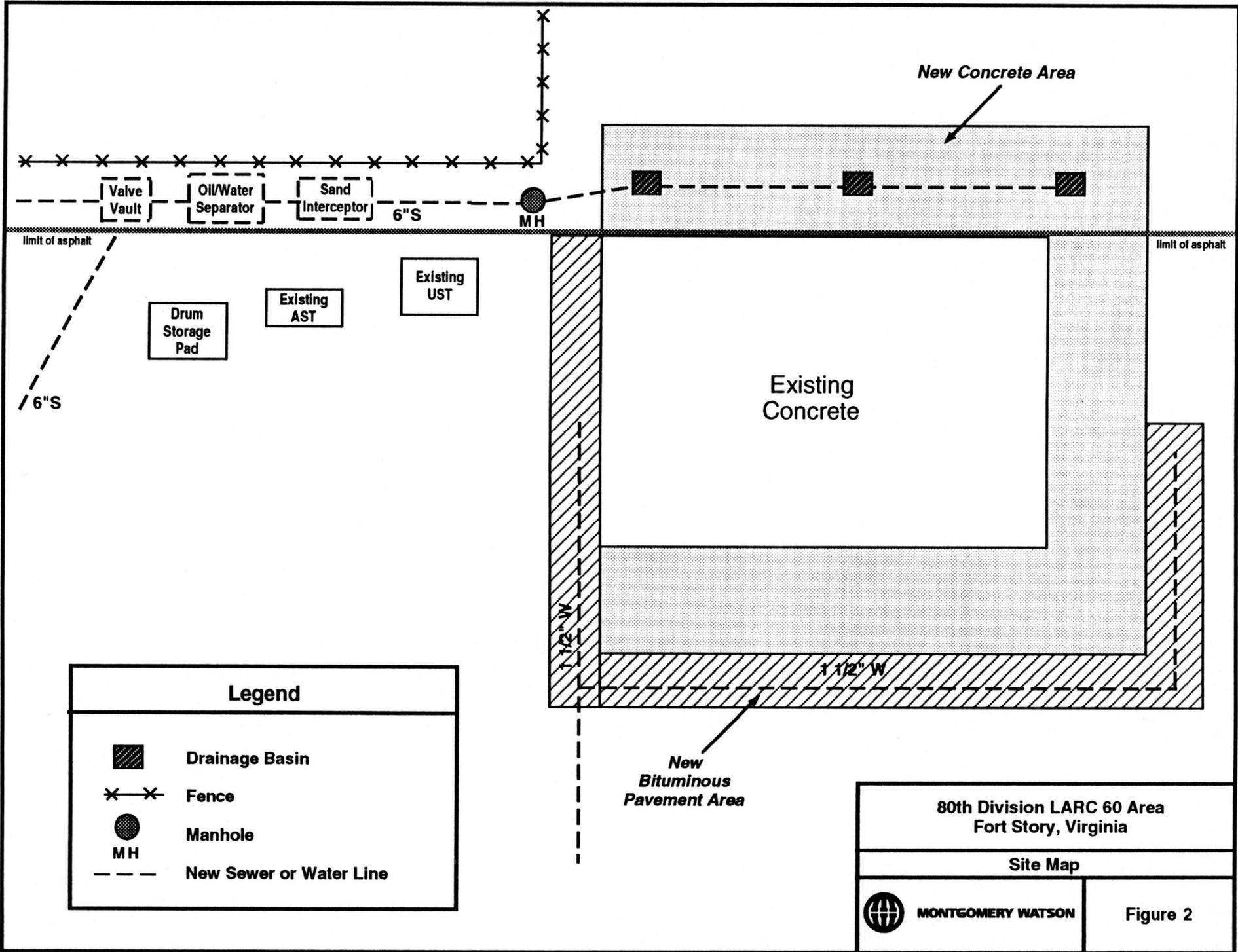
Fort Story is located on Cape Henry in Virginia Beach, Virginia. Fort Story is bounded by the Atlantic Ocean and the Chesapeake Bay to the north, and by the Virginia Seashore State Park to the south. The 80-DRS LARC area at Fort Story is located north of Da Nang Road and east of Hospital Road (see Figure 1). Amphibious craft are washed and serviced in this area.

The 80-DRS LARC area contains a 50 foot by 70 foot concrete pad surrounded by asphalt on three sides (see Figure 2). The fourth side is not paved. An underground storage tank (UST) is located west of the concrete pad. Next to the UST, an aboveground fuel tank has been placed on a raised, bermed concrete platform with a valved outlet for draining storm water. Several drums of oil and lubricants are stored on a similar platform (Drum Storage Area in Figure 2). In this report, the tanks and platforms are referred to as the POL (petroleum, oil and lubricants) storage area.

During the planned expansion of the 80-DRS LARC area, additional concrete will be poured on the north, east and south sides of the existing pad. Water lines will also be installed on these three sides, and a sewer line will be extended west from the north side of the pad. Drainage basins, a manhole, a sand interceptor, an oil/water separator, and a valve vault will be installed along the sewer line (Figure 2). Based on the construction drawings for the expansion project, soils will be excavated to 4 feet to install the drainage basins, manhole and sand interceptor. Excavation will proceed down to 8 feet below grade for the valve vault and oil/water separator. Sewer and water pipes will be installed 4 to 6 feet below grade. Soil will be excavated to a depth of 2 feet around the perimeter of the existing pad to pour new concrete. At the time of this investigation, the asphalt on the south, east and west sides of the existing pad had been removed to pour new concrete, but soil had not been excavated.

Note: Based on Base Site Map (FS 266-2.3)
 Department of the Army
 Norfolk District Corps of Engineers





Legend	
	Drainage Basin
	Fence
	Manhole
	New Sewer or Water Line

80th Division LARC 60 Area Fort Story, Virginia	
Site Map	
 MONTGOMERY WATSON	Figure 2

1.3 ENVIRONMENTAL SETTING

Fort Story lies within the Atlantic Coastal Plain physiographic province. The topography at Fort Story consists of sand dunes, sand flats and marsh areas. The geology is characterized by marine sediments consisting of unconsolidated sands, silts, gravels and clays. The 80-DRS LARC area is located in a flat sandy area. The shallow groundwater aquifer at Fort Story extends from the ground surface to 20 feet below ground surface. Groundwater at the 80-DRS LARC Area is approximately 8 feet below ground surface.

1.4 INVESTIGATION ACTIVITIES

The activities for this Site Assessment included layout of sample locations, collecting soil samples, field screening soil samples, analyzing soil samples, compiling and evaluating data, performing a qualitative exposure evaluation, and preparing a Site Assessment report. Except where noted, all activities were conducted following the Final Site Assessment Workplan for the 80th Division LARC 60 Area (Montgomery, 1994).

2.0 FIELD OPERATIONS

Field activities for the Site Assessment were conducted on Friday, February 11, 1994. These activities included laying out sample locations, collecting soil samples, screening soil samples and preparing samples for laboratory analysis. The purpose of the screening was to provide a semi-quantitative indication of non-specific volatile organic compound (VOC) contamination in the soils, and to select samples for laboratory analysis. The workplan called for collecting and screening 40 samples in 20 locations, of which only 10 samples were to be analyzed. Based on the screening, soil samples were selected for VOC and Total Recoverable Petroleum Hydrocarbons (TRPH) analysis. Samples from pre-selected locations were submitted for lead analysis. Three samples were selected for priority pollutant metals analysis based on physical appearance.

2.1 SAMPLE LOCATIONS

Samples were collected at the 20 locations indicated in Figure 3. At each location, samples were collected at 2 foot intervals up to the total depth indicated in Figure 3. The depth of sampling at each location was based on the expected depth of excavation in that area. For example, construction drawings indicate that the drainage basins will extend approximately 3.8 feet below grade. Therefore soils were sampled to a depth of 4 feet at the approximate future site of each drainage basin.

2.2 SAMPLE COLLECTION

The majority of soil samples were collected by the Geo-probe hydraulic sampling system. At locations requiring only a sample from the 0-2 foot interval, samples were collected with a hand auger. The hand auger, although a deviation from the 80-DRS LARC Area workplan, is an accepted sampling system used during preliminary assessment/site investigation (PA/SI) work at Fort Story (JMM, 1990). The hand auger was used to expedite the sampling because site access was restricted due to inclement weather. Decontamination and sample collection and handling procedures presented in the 80 DRS workplan were followed for samples collected with the hand auger, and therefore the use of the hand auger will not affect data quality.

The Geo-probe system uses a hydraulically driven piston-type sampler with a dedicated butyrate liner. The sampler was driven to the top of the sampling interval. The piston was released, and the sampler and liner were pushed through the desired interval. After removing the drive rod,

the sampler was removed from the boring. The liner was then pushed out of the sampler. The sample was removed from the butyrate liner, and a portion of the sample was placed in a one quart Zip-loc bag for soil screening (Section 2.3). The remainder of the sample was placed in a single glass jar with a teflon lined lid. Due to the limited volume of soil in the Geo-probe sampler, a single jar was collected for all analyses, including metals. The 80-DRS workplan calls for mixing samples for metals analysis. However, because mixing would cause loss of volatile compounds and negatively impact VOC and TPH analysis, samples were not mixed.

The sample jar was labeled and placed in a cooler. The butyrate liner was discarded and the sampler was decontaminated. After completion, all holes were backfilled with a bentonite based grout and brought flush with the surrounding ground surface.

A duplicate sample was collected at sample location SB03. The duplicate sample was not collected from a single push due to the limited volume of soil in the Geo-probe sampler. An initial 0-2 foot sample was collected as described above. Then the sampler was placed approximately 6 inches from the original sample location, and pushed through the 0-2 foot interval again.

The hand auger was used to collect samples from borings SB8, SB10, SB12, SB14, SB16, SB18, SB19 and SB20. At each location the auger, with a stainless steel mud bucket, was advanced to a depth of 2 feet and then withdrawn. After collection of the 2 foot sample from SB19, the decontaminated auger was advanced to a depth of 4 feet. Samples were collected from the auger using a clean, dedicated stainless steel utensil. The auger bucket was decontaminated after each sample.

2.3 SAMPLE SCREENING

The soil screening evaluated non-specific volatile organic vapors in the soils and identified samples for laboratory analysis. The screening was conducted with a Photovac Microtip photoionization detector (PID) with a 10.2 eV lamp. The PID was calibrated using 100 part per million (ppm) isobutylene four times during the course of the screening. The PID response ranged from 99 to 100 ppm. The background reading for air at the site was 0 ppm. However, moisture did affect PID readings during screening, as discussed below.

To screen the samples, a portion of the sample was placed in a Zip-loc bag. The bag was sealed and then shaken to break up the sample. The weather during sampling was cloudy and cold, and volatilization was expected to occur slowly. Samples were allowed to sit for at least 30 minutes to allow volatile compounds in the soil to equilibrate with the air in the Zip-loc bag. After the equilibration period, the PID probe was inserted in the head space of the bag for at least 3 minutes. The probe was not allowed to contact the soil in the bag. The maximum PID reading was recorded, and an average reading for the 3 minute period was also estimated. The screening results are recorded in Table 1. Positive PID responses followed a consistent pattern. After an initial rapid increase to some maximum reading, the PID response slowly decreased. In many cases, the PID reading decreased to 0 ppm, though usually not within 3 minutes.

Because of rain before and during sampling, soil samples were moist. Moisture is known to affect the function of the Microtip PID. The effect of moisture was tested by placing rain water in a Zip-loc bag and placing the PID probe in the Zip-loc. The maximum PID response was 2.0 ppm, and this response quickly decreased to 0 ppm.

TABLE 1
SUMMARY OF SOIL SCREENING DATA
80th Division LARC-60 Area
Fort Story, Virginia

Sample Location	0-2' Interval	2-4' Interval	4-6' Interval	6-8' Interval
SB01	5.5	12	15.4	NS
SB02	6	2.4	0	0
SB03	0	0	0	0
SB04	0.1	0.1	0	NS
SB05	5.7	4.4	10.2	NS
SB06	2.5	2.2	NS	NS
SB07	1.5	1	NS	NS
SB08	0	NS	NS	NS
SB09	2.6	1.1	NS	NS
SB10	0	NS	NS	NS
SB11	2	4.1	NS	NS
SB12	0	NS	NS	NS
SB13	2	2	NS	NS
SB14	0	NS	NS	NS
SB15	5.4	3.4	NS	NS
SB16	1.6	NS	NS	NS
SB17	0	4.4	NS	NS
SB18	0	NS	NS	NS
SB19	0	0	NS	NS
SB20	0	NS	NS	NS

Numbers indicate the maximum PID response in parts per million recorded for the indicated interval.

NS - No sample collected at this interval.

2.4 SAMPLE ANALYSIS

Of the 40 soil samples collected, 16 samples were initially selected for either metals analysis, VOC/TRPH analysis or both. This section describes the selection of these samples. The remaining 24 samples were submitted to the laboratory and held at four degrees centigrade. After the initial analytical results were evaluated, several samples were analyzed for TRPH or lead. All samples were analyzed within holding times.

The qualitative soil screening was used to determine the 10 samples submitted for laboratory VOC/TRPH analysis and a more quantitative evaluation. The five samples with the highest maximum PID readings were selected for VOC/TRPH analysis. The sample with the sixth highest PID reading, the 0-2 foot sample from SB01, was not initially selected because two other samples from that boring had been selected for analysis. Samples from other borings had similar PID readings, and were selected to cover more of the excavation area. Similarly, the 2-4 foot sample from SB05 (eighth highest PID reading) was not initially selected for analysis because other samples from SB05 were selected.

Most samples selected for VOC/TRPH analysis were near the POL storage area. Selected samples were from different depth intervals. Three samples near the concrete pad were selected. Two sample locations (SB15, SB17) were formerly covered by asphalt, and one sample location (SB11) was not covered.

The duplicate sample location (SB03) had a PID reading of 0 ppm. This location was selected, despite no PID reading, because the duplicate sample location had to be chosen before the screening results were available. There was at least a 30 minute lag time between soil sample collection and screening (due to the cold temperature), and field personnel could not determine if a particular location was "hot" in time to collect a duplicate sample. Boring SB03 was selected as the duplicate location because of positive screening results at nearby sample locations.

Sample locations for lead analysis (see Figure 3) were selected before field work began as described in the workplan. The sample locations had not been covered by asphalt. The 0-2 foot interval was chosen because it was believed that any lead contamination came from surface sources and would be highest at the surface.

Samples for priority pollutant metals analysis were selected in the field based on sample appearance. The 0-2 foot sample from boring SB02 appeared to leave a slight oily residue inside the Zip-loc bag used for screening, and was selected for analysis. No other samples contained visible contamination. The 0-2 foot samples from borings SB06 and SB11 contained higher levels of organic matter than other samples. They were selected for a full metals scan because of the potential for increased binding of metals with the organic matter.

Lab reports are attached as Appendix B. The analytical results are summarized in Tables 2 through 5. Table 2 presents data on TRPH levels in soil samples. After the initial analysis of 10 samples based on the field screening, four more samples were analyzed to define the extent of TRPH contamination. These included the two samples with high PID readings which were passed over during initial selection. The TRPH data are also presented in Figure 4. Table 3 presents data on VOC levels. Analytical results for lead are presented in Table 4. After the initial 10 samples were analyzed for lead, two more samples (the 2-4 foot interval from SB02 and SB03) were analyzed to define the vertical extent of lead contamination. The lab also analyzed a third sample for lead, the 0-2 foot interval from SB01. Priority pollutant metals data are included in Table 5.

TABLE 2
SUMMARY OF TRPH DATA
80th Division LARC-60 Area
Fort Story, Virginia

Results are in mg TRPH/kg soil.

Sample Location	0-2' Interval	2-4' Interval	4-6' Interval	6-8' Interval
SB01	824	7.9	<2.5	NS
SB02	1270	4.5	NA	NA
SB03	2390	<2.5	NA	NA
SB03 duplicate	470	NS	NS	NS
SB04	NA	NA	NA	NS
SB05	722	208	12.5	NS
SB06	NA	NA	NS	NS
SB07	NA	NA	NS	NS
SB08	NA	NS	NS	NS
SB09	NA	NA	NS	NS
SB10	NA	NS	NS	NS
SB11	NA	<2.5	NS	NS
SB12	NA	NS	NS	NS
SB13	NA	NA	NS	NS
SB14	NA	NS	NS	NS
SB15	<2.5	NA	NS	NS
SB16	NA	NS	NS	NS
SB17	NA	<2.5	NS	NS
SB18	NA	NS	NS	NS
SB19	NA	NA	NS	NS
SB20	NA	NS	NS	NS

Shaded numbers exceed the 100 mg/kg TRPH guideline used by the state of Virginia to indicate a release from an UST.

NS - No sample collected at this interval.

NA - Sample collected and screened by PID, but not analyzed for TRPH.

TABLE 3
SUMMARY OF VOC DATA
80th Division LARC-60 Area
Fort Story, Virginia

The indicated samples were analyzed by Method 8240. The full list of parameters and method detection limits are indicated in Appendix B.

Sample Location	0-2' Interval	2-4' Interval	4-6' Interval	6-8' Interval
SB01	NA	None Detected	None Detected	NS
SB02	None Detected	NA	NA	NA
SB03	None Detected	NA	NA	NA
SB03 duplicate	None Detected	NS	NS	NS
SB04		NA	NA	NS
SB05	None Detected	NA	2.75 mg/kg PCE	NS
SB06	NA	NA	NS	NS
SB07	NA	NA	NS	NS
SB08	NA	NS	NS	NS
SB09	NA	NA	NS	NS
SB10	NA	NS	NS	NS
SB11	NA	None Detected	NS	NS
SB12	NA	NS	NS	NS
SB13	NA	NA	NS	NS
SB14	NA	NS	NS	NS
SB15	None Detected	NA	NS	NS
SB16	NA	NS	NS	NS
SB17	NA	None Detected	NS	NS
SB18	NA	NS	NS	NS
SB19	NA	NA	NS	NS
SB20	NA	NS	NS	NS

NS - No sample collected at this interval.

NA - Sample collected and screened by PID, but not analyzed for VOCs based on PID reading.

TABLE 4
SUMMARY OF LEAD DATA
80th Division LARC-60 Area
Fort Story, Virginia

Results are in mg lead/kg soil.

Sample Location	0-2' Interval	2-4' Interval	4-6' Interval	6-8' Interval
SB01	285	NA	NA	NS
SB02	93	11	NA	NA
SB03	124	12	NA	NA
SB03 duplicate	186	NS	NS	NS
SB04	128	NA	NA	NS
SB05	NA	NA	NA	NS
SB06	36	NA	NS	NS
SB07	36	NA	NS	NS
SB08	13	NS	NS	NS
SB09	87	NA	NS	NS
SB10	66	NS	NS	NS
SB11	11	NA	NS	NS
SB12	NA	NS	NS	NS
SB13	NA	NA	NS	NS
SB14	NA	NS	NS	NS
SB15	NA	NA	NS	NS
SB16	NA	NS	NS	NS
SB17	NA	NA	NS	NS
SB18	NA	NS	NS	NS
SB19	NA	NA	NS	NS
SB20	NA	NS	NS	NS

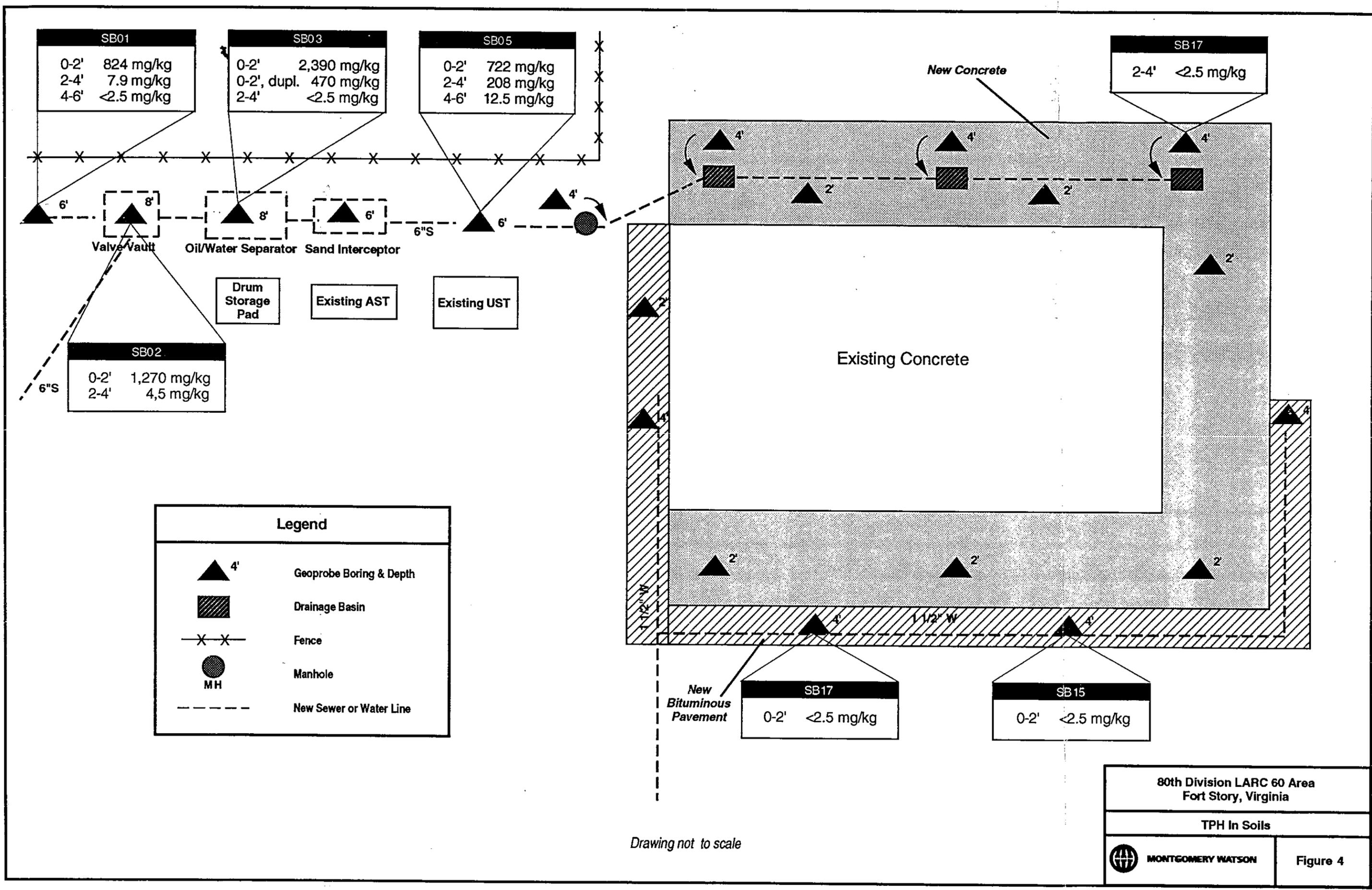
Shaded numbers exceed the 71 mg/kg lead trigger level developed during the Fort Story PA/SI.
 NS - No sample collected at this interval.
 NA - A sample was collected from this interval, but not analyzed for lead.

TABLE 5
PRIORITY POLLUTANT METALS ANALYSIS
80th Division LARC-60 Area
Fort Story, Virginia

All results in mg/kg soil.

Sample Location	SB02	SB06	SB11
Sample Interval	0-2'	0-2'	0-2'
<u>Analyte</u>			
Antimony	3.03	0.36	0.46
Arsenic	0.751	1.08	0.750
Beryllium	<0.5	<0.5	<0.6
Cadmium	0.7	0.8	0.9
Chromium	9.0	12	9
Copper	4.7	4.6	<0.6
Lead	93	36	11
Mercury	0.02	0.02	0.02
Nickel	<5	<5	<6
Selenium	<0.104	<0.12	<0.115
Silver	<0.5	<0.6	<0.6
Thallium	<0.052	<0.06	<0.058
Zinc	23.8	43.9	20.4

< The analyte was not detected in the sample at the method reporting level indicated.



SB01	
0-2'	824 mg/kg
2-4'	7.9 mg/kg
4-6'	<2.5 mg/kg

SB03	
0-2'	2,390 mg/kg
0-2', dupl.	470 mg/kg
2-4'	<2.5 mg/kg

SB05	
0-2'	722 mg/kg
2-4'	208 mg/kg
4-6'	12.5 mg/kg

SB17	
2-4'	<2.5 mg/kg

SB02	
0-2'	1,270 mg/kg
2-4'	4.5 mg/kg

SB17	
0-2'	<2.5 mg/kg

SB15	
0-2'	<2.5 mg/kg

Legend	
	Geoprobe Boring & Depth
	Drainage Basin
	Fence
	Manhole
	New Sewer or Water Line

80th Division LARC 60 Area Fort Story, Virginia	
TPH In Soils	
MONTGOMERY WATSON	Figure 4

Drawing not to scale

2.5 DECONTAMINATION

All sampling equipment that could potentially contact the sample was decontaminated between sample locations. In the Geo-probe sampling system, the dedicated liner contacts the sample. There is minimal contact between the sampler itself and the sample. After each sample, the sampler was washed with an Alconox solution and then rinsed three times with distilled water. Samples collected with the hand auger only contact the auger bucket. Between each sample, the auger bucket was washed with an Alconox solution, rinsed with tap water, rinsed with isopropanol, and then rinsed three times with distilled water.

3.0 QUALITY ASSURANCE/QUALITY CONTROL MEASURES

Quality Assurance/Quality Control (QA/QC) procedures were used to ensure the validity and quality of screening and analytical results. Field QA/QC procedures include PID calibration, field decontamination procedures, and collection of one duplicate sample at SB03. Laboratory QA/QC procedures included the use of standard test methods from SW-846, and laboratory performance standards for equipment and analysis performance. Analytical methods are listed below.

<u>Analyte</u>	<u>Test Method</u>	<u>Analyte</u>	<u>Test Method</u>
VOCs	8240	TRPH	418.1
Antimony	7040	Mercury	7470
Arsenic	7060	Nickel	7520
Beryllium	7090	Selenium	7740
Cadmium	7130	Silver	7760
Chromium	7190	Thallium	7840
Copper	7210	Zinc	7950
Lead	7420		

The results of the field duplicate sample can be used to assess the precision of sampling and analysis. Lead and TRPH were detected in the duplicate sample. The Relative Percent Difference (RPD) for these analyses was calculated, as shown below. An RPD for VOC analysis was not calculated because no VOCs were detected in either the sample or duplicate.

<u>Analyte</u>	<u>Results</u> <u>(mg/kg)</u>	<u>RPD</u>
Lead	124;186	40
TRPH	2390;470	134

The RPD for TRPH analysis is particularly high. Sources of variation for field duplicates include problems during sampling, handling and transport, as well as lab analysis. The duplicate samples were not collected from a blended composite sample because of the low volume of the Geo-probe sampler. Instead, the samples were collected from two separate locations approximately 6 inches apart. Heterogeneities in TRPH and lead distribution may therefore account for the variation in the duplicate results.

4.0 DATA EVALUATION

4.1 SITE CHARACTERIZATION

The subsurface at the LARC 60 area consists almost entirely of medium grained sand of varying colors. A fine lens of organic material was present in many samples at a depth of approximately 3 feet. Surface soils near the POL storage areas contain a larger amount of organic material. There was no visible contamination in any soils, except for the 0-2 foot interval from SB02. This sample left a slight oily residue on the inside of the Zip-loc bag used for field screening.

Soil samples collected from the 6-8 foot interval (SB02, SB03) appeared to be water saturated. The water table may have been elevated during sampling due to recent rain. This also indicates that groundwater may be encountered during installation of the oil/water separator and the valve vault.

4.2 FIELD SCREENING

The maximum PID reading during screening was 15.4 ppm. Seven samples had PID readings of greater than 5 ppm. These readings indicate that low levels of VOCs are present in the soil. Many samples gave low level PID readings, 2 to 3 ppm or less. These readings are equivalent to the reading for a Zip-loc bag containing a small amount of water. Therefore, low-level PID readings may have been caused by moisture in the soils rather than actual contaminants. Apart from water vapor interference, there were no other known problems with PID function. Calibration of the PID was consistently accurate.

Field screening selected a single sample containing PCE, the 4-6 foot interval from SB05. This indicates that the screening could identify soils containing detectable levels of VOCs. It is expected that samples containing higher levels of VOCs would have been detected by the field screening. Because field screening did not detect any samples with high levels of Method 8240 VOCs, there is no evidence of major VOC contamination in the area surveyed.

Screening did not correlate with areas of TRPH contamination. For example, the 0-2 foot sample from SB03 had the highest TRPH level detected, but a PID response of 0 ppm. Other samples with lower TRPH levels had a higher PID response. There is no correlation between PID screening and TRPH levels because TRPH analysis detects volatile, semi-volatile and non-volatile compounds, while the PID detects only volatile compounds. The PID response of the TRPH contaminated samples is likely due to volatile compounds such as hexane and octane. Straight chain volatiles such as octane will cause a positive reading on the PID, although the response is lower than that for compounds such as PCE (The Photovac PID's relative response is 1.4 for PCE and 0.39 for n-octane; Photovac, 1991). The field screening data indicates that the TRPH in the soils do not include large amounts of volatile components. Therefore the TRPH in the samples is dominated by non-volatile constituents.

4.3 TRPH

The TRPH were detected in all surface samples near the POL storage area that were analyzed. TRPH levels in the 0-2 foot interval ranged from 470 to 2390 mg/kg. However, TRPH levels in samples from the 2-4 foot interval were significantly lower. At SB05, elevated TRPH levels extend into the 2-4 foot interval. In all other locations, high TRPH levels were not present in the 2-4 foot interval. Therefore, based on limited data, the TRPH contamination is highest at the surface and drops off quickly with depth. The TRPH were not detected in the samples collected near the concrete pad.

The proposed sewer line (and therefore the sample locations) runs along the edge of the POL storage areas, at the edge of the asphalt. All samples were collected past the edge of the pavement. This area receives surface runoff from the POL storage area and a paved area on the other side of the POL storage areas. Any residual POLs on the pavement around the storage areas will be carried into this area with surface runoff. The presence of TRPH contamination at the surface, which diminishes quickly with depth, is consistent with this scenario. Therefore, the TRPH found in these samples probably comes from surface runoff. No samples were collected from underneath the pavement, or other adjacent areas not subject to surface runoff. Therefore the possibility of other sources cannot be ruled out.

The TRPH in the surface soils at the 80-DRS area did not originate from a leaky underground storage tank (LUST), and therefore Virginia LUST requirements do not apply. However, LUST guidelines do indicate that the TRPH levels detected are serious. Virginia uses a guideline of 100 mg/kg TRPH to indicate that a release from a UST has occurred (Commonwealth of Virginia, 1991a). Therefore, although this guideline is not strictly applicable, the TRPH levels detected (>1,000 mg/kg) typically require corrective action.

The extent of corrective action needed is unknown. First, the horizontal extent of TRPH contamination is not known because samples were collected only along the proposed sewer line. Second, the cleanup criteria is not known. Virginia has not set statewide action levels or clean-up standards for TPH. For example, clean-up standards for each LUST site are based on site-specific characterization and assessment reports (Commonwealth of Virginia, 1991b). Therefore there is no generic removal/remediation criteria to apply to the site. However, the 100 mg/kg TPH level has been used at Fort Story. During UST removal at Block 600 at Fort Story, soils containing less than 100 mg/kg of TRPH were not removed from the site (JMM, 1991a). Based on the 100 mg/kg TPH criteria, it is likely that corrective action will involve a limited amount of contaminated soil. Therefore removal of contaminated soil to an off-site facility would be a feasible approach. This is discussed further in Section 6.0.

4.4 VOCs

Based on the field screening results, there is no sign of significant VOC contamination in the 80-DRS LARC area. Only one compound from the Method 8240 list was detected. The 4-6 foot interval from boring SB05 contained 2.75 mg/kg of tetrachloroethylene (PCE). The source of the PCE is not known. Boring SB05 is located near the underground storage tank. This tank does not contain solvents, and the tank has been leak tested and found to be tight. Therefore it is not a probable source. Soil in this area may have been disturbed during installation of the tank. Contaminated surface soils may have been placed deeper as soil was backfilled. The 0-2 foot sample from SB05 did not contain PCE, but any PCE at the surface may have volatilized.

Compounds such as benzene, toluene and xylene, which are commonly associated with gasoline, were not detected in samples containing high TRPH levels. This could indicate that the source of the TRPH did not contain the lighter fraction (i.e., lube oil instead of gasoline). A second possible reason is that the volatile components in the TRPH have volatilized over time. This could be caused by weathering of material sitting on pavement.

4.5 METALS

Thirteen samples were analyzed for lead (Table 4). The highest level detected was 285 mg/kg (SB01). Lead levels were consistently elevated near the POL storage area, similar to the TRPH contamination. However, elevated lead levels were also found in SB09. Samples from the 2-4 foot interval of SB02 and SB03 contained 11 and 12 mg/kg of lead, respectively. This indicates that the lead contamination is confined to the surface.

The levels of priority pollutant metals were determined in three samples from the 0-2 foot interval (Table 5). Two samples were located near the POL storage area (SB02, SB06), and one sample was located near the concrete pad (SB11). Cadmium, chromium, mercury and zinc levels were similar in all three locations. Copper levels were higher near the POL storage area, and antimony was detected in a single sample near the POL storage area. Beryllium, selenium, silver and thallium were not detected. The distribution of priority pollutant metals with depth was not determined.

During a preliminary assessment/site investigation (PA/SI) conducted at Fort Story, background soil samples were collected from three locations and analyzed for total metals (JMM, 1991b). The background sample results were averaged to determine a mean background level (Table 6). The PA/SI also developed trigger levels for metals based on this background data. Trigger levels were used to indicate whether a particular site required further investigation, a remedial investigation/feasibility study, or no further action. The trigger level for metals was set at 10 times the upper 95 percent confidence interval for the background concentration (Table 6).

The lead levels in all soil samples exceed the mean background concentration. The lead levels in the 0-2 foot interval at SB02, SB03, SB04 and SB09 also exceed the lead trigger level. The lead levels in the 2-4 foot samples from SB02 and SB03 do not exceed the trigger level. The detected concentrations of arsenic, chromium, copper and zinc do not exceed trigger levels. Cadmium and mercury were not detected in the background samples, but were detected at low concentrations in all three samples from the 80-DRS site. The other priority pollutant metals were not included in background analysis during the PA/SI project.

Due to the high lead levels, any soil removed from the site should be tested for leachable lead by the Toxicity Characteristic Leaching Procedure (TCLP) test. This test is necessary to demonstrate that the soil is not characteristically hazardous.

5.0 QUALITATIVE EXPOSURE EVALUATION

The potential for occupational exposure of construction workers at 80-DRS has been qualitatively evaluated based upon Site Assessment data and other available information. Data reviewed included:

- 80-DRS LARC Area Site Assessment Workplan, Montgomery (February 1994);
- excerpts from Final Site Investigation Report for the Fort Story Preliminary Assessment/Site Investigation (August 1991);
- James R. Reed & Associates Laboratory Data (February 1994) Analytical data for soil borings; and
- 80-DRS Investigation Field Data, Montgomery (February 1994).

For purposes of the exposure evaluation, all compounds exhibiting concentrations above detection limits have been evaluated as potential compounds of interest (Tables 2, 3, 4 and 5). The analytical data was compiled to ascertain how many of the samples analyzed exhibited compound concentrations above detection limits (frequency). In addition, the maximum concentrations estimated in analysis were compiled. As discussed previously, our investigations showed a limited number of detectable volatile organics in the soil screening

TABLE 6
BACKGROUND SOILS DATA
PRELIMINARY ASSESSMENT/SITE INVESTIGATION
FORT STORY, VIRGINIA

Analyte	Number of Samples ^a	Method Reporting Level (mg/kg)	Samples Above MRL	Mean ^b (mg/kg)	Standard Deviation (mg/kg)	Upper 95% Confidence Limit (mg/kg)	Trigger Level ^c (mg/kg)
Arsenic	7	2.5	1	1.9	0.26	2.1	21
Cadmium	7	0.5	0				
Chromium	7	1	7	2.2	0.69	2.8	28
Copper	7	1	3	1.0	0.46	1.4	14
Lead	7	1	6	3.6	3.8	7.1	71
Mercury	7	0.02	0				
Nickel	7	4	0				
Zinc	7	2	4	3.2	2.7	5.7	57

Source: James M. Montgomery, 1991b

MRL - Method Reporting Level

(a) Includes one duplicate sample.

(b) Samples where the analyte was not detected were assigned a value of the MRL divided by the square root of two.

(c) The trigger level was set at 10 times the 95% confidence interval.

process. Only one of the laboratory analyzed samples indicated the presence of PCE in low concentration (2.7 mg/kg). In addition, several priority pollutant metals were detected in site soils. TRPH concentrations greater than 100 mg/kg were detected in soil borings at the new sewer line trench (Figure 3, SB 01 to 06). The higher lead concentrations (>100 ppm) were also detected in this area.

The maximum concentrations of metals detected at the 80-DRS LARC area were compared to site-wide background soil borings. This data, average values for metals in soils that are uncontaminated by industrial or hazardous waste activities, and natural background levels as seen in U.S. Geological Survey data, are presented in Table 7. Cadmium and lead were detected above site-wide background concentrations and U.S. soils data, but within the range of typical values for uncontaminated soils. Chromium, copper and zinc were detected above site-wide background concentrations, but are within or below all other values in Table 7. Total petroleum hydrocarbons are considered man-made compounds for evaluation at this site and therefore, natural background levels would not be considered for this chemical mixture in soils. The same is true for the tetrachloroethylene (PCE) detected.

The general toxicity of the compounds has also been evaluated. The following are brief toxicological profiles for the significant compounds of concern at the site, TPH and lead. These profiles are a synopsis of the information available for each of these compounds from the USEPA, IRIS computerized database and the U.S. Department of Health and Human Services, ATSDR Toxicological Profiles.

TPH. Petroleum hydrocarbons encompass numerous compounds of varying carbon chain length and arrangement. Within the group of hydrocarbons, individual compounds can be characterized as belonging to a specific fraction on the basis of boiling point.

The compounds with fewest carbons and highest potential for volatilization include natural gas and some gasoline constituents. Benzene, Toluene, Ethylbenzene and Xylene (BTEX) are in this fraction. Benzene is a known human carcinogen based on occupational epidemiology. Inhalation is the primary route of exposure and the blood cells the target organ. Leukemia is the resulting disease. Other members of this group have not demonstrated this carcinogenic potential but have been shown to cause adverse effects in the central nervous system and liver.

The middle distillate fraction includes compounds with six or more carbons. Many are used as solvents, thinners and varnishes. Inhalation of members of this fraction can cause increased respiration, cyanosis and pulmonary edema. The heaviest petroleum fraction includes fuel oils and kerosene. These molecules contain eight or more carbons. These compounds have relatively low to moderate toxicity. Ingestion cause central nervous system depression and gastrointestinal irritation. Dermal exposure can lead to dermatitis.

The polycyclic aromatic hydrocarbons (PAHs) consist of compounds where three or more benzene rings are joined. Benzo(a)pyrene is considered the most toxic of this group because of its association with cancer in animal and human occupational studies. It is postulated that metabolism renders these compounds more toxic. Therefore, the structure of the metabolite influences toxicity.

N-hexane (aliphatic hydrocarbons, surrogate for TPH). The straight chain hydrocarbons have a relatively low acute toxicity level. Long-term exposure to 500 to 2500 ppm has caused motor neuropathy in occupationally exposed persons. A numbness and weakness in the extremities was observed in chronically exposed workers. Some reproductive dysfunction in men has also been reported. This compound is currently not considered to be a carcinogen.

TABLE 7
COMPARISON OF SITE CONCENTRATIONS WITH SELECTED REFERENCE
VALUES
80th Division LARC-60 Area
Fort Story, Virginia

All concentrations in mg/kg soil.

Compound	80-DRS concentration range (Min-Max)	Fort Story background soil range ^a	Typical values for uncontaminated soil ^b	Common concentration range ^c	Average concentration ^c	Trigger level ^d
Cadmium	0.7 - 0.9	<0.5	0 - 1	0.01 - 0.1 ^e	0.06 ^e	-
Chromium	9.0 - 12.0	1.2 - 2.9	0 - 100	1 - 1000	52	28
Copper	<0.6 - 4.7	<1.0 - 1.8	30	<1 - 700	22	14
Lead	11 - 285	<1 - 11	0 - 500	<10 - 300	17	71
Zinc	20.4 - 43.9	<2 - 8.9	60	<5 - 2,900	5.2	57

ND - Not Detected.

- (a) Preliminary Assessment/Site Investigation, Fort Story, Virginia (JMM, 1991b). Based on seven background samples.
- (b) Gas Research Institute, 1987.
- (c) U.S. Geological Survey Professional Paper 1270, Element Concentrations in Soils and Other Surface Materials of the Conterminous United States, Page 4, Table 1 (unless otherwise noted).
- (d) Preliminary Assessment/Site Investigation, Fort Story, Virginia (JMM, 1991b).
- (e) Cadmium was not included in reference (c) above. Concentrations obtained from Hazardous Waste Land Treatment, USEPA Office of Solid Waste and Emergency Response, SW-874, p. 273, Table 6-45. April 1987.

Lead. Lead is an element with no nutritional value that is toxic to animals. Lead presents a major health hazard affecting children and workers. Sub-lethal effects include neurological defects, kidney dysfunction and anemia. OSHA has a set level for lead concentration in workplace air. Ongoing research has identified subtle effects of lead at levels below those previously considered safe. As a result of the research in progress and the extent of lead contamination, no USEPA toxicity values are currently available. However, lead is classified, based on animal studies, as a Group B₂ carcinogen by the USEPA.

The other metals detected at the site were comparable to background values and the single PCE detection was not considered significant due to its low magnitude in soil. Additional toxicological information for these compounds is presented in Appendix B.

Based on the described evaluation criteria, most of the compounds detected at the 80-DRS site are not considered to be of concern for the potential exposure of construction workers. The specific exposure scenario considered was construction workers at the 80-DRS site exposed primarily through inhalation and possibly dermal contact. Any conclusions drawn from this evaluation pertain only to construction activities conducted within the boundaries of the specified site. The construction work at the 80-DRS site is expected to be of short duration, thereby the potential exposure to workers is limited. Given the relatively short exposure duration, the primary toxicological consideration would be acute effects. Most of these compounds are not considered to be extremely acute toxins, although they potentially can cause respiratory, dermal, renal, hepatic, central nervous system, and reproductive effects via chronic exposure. In addition, most maximum concentrations of metals found were comparable with soil concentrations typically found across the United States.

However, several compounds detected have been classified as potential carcinogens by the U.S. Environmental Protection Agency. Because these detected compounds (cadmium, chromium, lead, PCE) are considered to be potential carcinogens, further evaluation of potential exposure to construction workers was conducted. N-hexane was used to calculate potential exposure to construction workers to TPH concentrations at the site. N-hexane is a relatively toxic, short-chain (C-6) hydrocarbon and represents a conservative surrogate compound for the chemical mixture TPH. The toxicity of hydrocarbons generally decreases as chain length increases (Andrews and Snyder, 1991). The light-end hydrocarbons (e.g., n-hexane) present in TPH are removed via biodegradation first, leaving the longer chain, less toxic components of TPH in the soil. Therefore, use of n-hexane as a "toxicity" surrogate for the TPH concentrations detected at the site represents a conservative (protective) approach.

A "worst-case" calculation was completed to estimate the amount of soil containing the compound specific maximum concentration necessary to produce an air concentration of that compound equal to a NIOSH/OSHA recommended occupational exposure level. It was assumed that the full maximum concentration of the compound found in the soil would be liberated to the air during any construction activities disturbing the soil. This calculation used the following form and parameters:

$$X = \frac{C \text{ mg} / \text{m}^3 \text{ air}}{A \times 10^{-3} \text{ mg} / \text{mg soil}}$$

where A = compound specific maximum concentration, in mg compound/kg soil

A x 10⁻³ = maximum compound concentration in mg compound/mg soil

C = recommended occupational exposure concentration, in mg compound/ m³ of air

X = the airborne soil or dust concentration that produces an estimated exposure concentration equal to the recommended occupational exposure level C, assuming that the soil or dust contained the maximum compound concentration A.

The typical benchmark used in evaluating the amount of particulate matter in air in occupational exposure is 10 mg/m³. The level of 10 mg/m³ particulate matter in air is the OSHA nuisance dust standard value for clearly visible dust. Therefore comparing the calculated "worst-case" value X to the 10 mg/m³ benchmark indicates whether the level X is likely to occur at a construction site. If the level X exceeds the 10 mg/m³ benchmark, then exposures in excess of the NIOSH/OSHA recommended exposure level are not likely to occur.

All "worst-case" estimates of compound-specific contaminated soil in air produced values greater than 10 mg/m³. Calculations for cadmium produced the lowest airborne soil concentration. For example, it would take approximately 222 mg soil/ m³ air to produce an airborne cadmium concentration equal to the NIOSH recommended exposure level for cadmium, under the assumption described above. This value was calculated as follows:

A = maximum cadmium concentration detected in soil = 0.9 mg/kg = 0.9 x 10⁻³ mg/mg soil

C = NIOSH REL for cadmium = 0.2 mg/m³ air

$$\text{Then } X = \frac{0.2 \text{ mg / m}^3 \text{ air}}{0.9 \times 10^{-3} \text{ mg / mg soil}} = 222 \text{ mg soil / m}^3 \text{ air}$$

If the NIOSH ceiling for cadmium (0.6 mg/m³ air) is used, then the airborne soil concentration X is calculated as:

$$X = \frac{0.6 \text{ mg / m}^3 \text{ air}}{0.9 \times 10^{-3} \text{ mg / mg soil}} = 666 \text{ mg soil / m}^3 \text{ air}$$

Using these conservative qualitative calculations for potential occupational construction worker exposure for selected compounds of potential concern, there does not appear to be significant occupational hazard to construction workers who may be involved in shallow excavation and construction activities in the concrete pad area at the 80-DRS site.

There are several uncertainties in this assessment process that should be noted. As indicated in previous sections of this report, soil screening procedures were used to indicate absence or presence of volatile organics. Although this process is qualitative and sustained some problems, the screening still indicates that the areas of highest detected concentrations are contiguous with known petroleum sources (i.e., the new sewer line and the POL storage area). Further, the remaining site acreage has been covered in asphalt and past site history does not indicate potential sources nor the expectation for contamination.

TPH volatiles are not accounted for in the screening calculation; however, the highest concentrations of TPH were detected in surface soils and the lighter, more toxic fractions of the petroleum products would not be expected to have a long residence time in these soils. Therefore, the particulate basis for the screening calculation appears to be consistent with

expected potential toxicity. The exposure evaluation does not include semi-volatile compounds, because the investigation did not gather information on these compounds.

6.0 CONCLUSIONS

Soils near the POL storage area of the 80-DRS LARC site contain elevated levels of TRPH and lead. TRPH levels exceed 100 mg/kg, and lead levels exceed the trigger level developed for Fort Story. The elevated levels were found along the path of the proposed sewer line. Surface drainage from the POL storage area and adjacent areas is a probable source of the TRPH and lead contamination. The vertical extent of TRPH and lead contamination is mostly limited to the 0-2 foot interval, but does extend deeper in one area. There is no indication of TRPH contamination in other portions of the 80-DRS area, which will be disturbed during construction. Soils in at least one other location do contain slightly elevated levels of lead.

The soil screening process showed there to be a limited number of detectable volatile organics in the soil, and only one of the laboratory analyzed samples indicated the presence of PCE in low concentration (2.7 mg/kg). In addition, several priority pollutant metals were detected in site soils. With the exception of lead, these metals were detected in concentrations typical of uncontaminated soils.

A qualitative exposure evaluation and a screening calculation indicate no apparent potential for significant occupational exposure hazards to construction workers involved in shallow (0-8 feet below ground surface) excavation and construction activities at the site. However, the marked distribution of petroleum products near the new sewer line and the preliminary nature of the sampling and analysis indicate a need for prudence during all construction activities in the area of the 80-DRS site. This applies equally to a construction contractor laying pipe or a response contractor removing TRPH contaminated soil. Therefore it is recommended that any construction activities that will disturb contaminated soil be conducted by workers trained in the health and safety protocols for hazardous waste operations and emergency response. Work plans must consider the source and nature of potential contaminants and health and safety precautions to protect workers. At a minimum, air monitoring for VOCs should be conducted during any excavation in this area and respiratory protection considered if elevated readings are sustained for a significant period of time (i.e., 15-30 minutes).

The TRPH levels in the 80-DRS area exceed typical Virginia guidelines for sites requiring corrective action. The vertical extent of TRPH in the soil is limited in the area investigated, but areas outside the pipeline alignment were not investigated, and the horizontal extent of contamination is not known. Based on the limited vertical extent of contaminated soil, excavation of soil and off-site treatment and disposal is feasible. Contaminated soil may be disposed of in an approved sanitary landfill, or it may be taken to a soil treatment/recycling facility. Appendix C includes Virginia state requirements for disposal of petroleum contaminated soils at landfills, as well as a list of landfills approved to accept these materials. There are several private facilities in Virginia that treat petroleum contaminated soil. The State Department of Waste Management maintains a list of permitted firms. Any treatment facility should provide a certificate of disposal indicating the level of treatment achieved and the ultimate disposition of the soil.

The disposal site or facility will require that the excavated soil be tested. Testing requirements will vary depending on the disposal method. Testing requirements for landfill disposal are described in Section D of the Virginia state requirements (Appendix C). Testing requirements for private soil treatment facilities vary. All facilities require TCLP testing for metals, which is particularly important due to the high lead levels. Excavated soil should be placed preferably in a roll-off container for easier transport to off-site facilities. However, soil may be placed on,

and covered with, an impermeable liner. A composite sample should then be collected for analysis.

An appropriate cleanup standard will need to be selected to guide any soil removal. The soil removal itself must be carefully conducted and documented to ensure that all contaminated soil is removed. Investigation to determine the horizontal extent of contamination can take place during soil removal if field screening techniques (i.e., immunoassays for TPH) are used in conjunction with the removal. Additional screening and sampling should also be conducted near SB05 to check for PCE contamination.

Due to the presence of contamination, further investigation is needed at the site. The soil removal can be used to conduct at least part, if not all, of this investigation. Information gathered during the removal can determine whether the TRPH and lead contamination is limited in extent, as indicated by this investigation. It can also provide more information on potential groundwater impacts. This project did not evaluate groundwater quality because groundwater was believed to be below the depth of excavation. Based on this investigation, groundwater may be encountered during installation of the valve vault and oil/water separator. The TRPH and lead contamination detected in surface soils did not appear to extend to the water table. However, future work plans should consider potential groundwater contamination, and any investigation plans should include some form of groundwater sampling.

APPENDIX A

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APPENDIX B

LABORATORY REPORTS

James R. Reed and Associates, Inc.



February 18, 1994

SUBMITTED TO:

Montgomery Watson
ATTN: Dave Sarr
560 Herndon Parkway, Suite 300
Herndon, VA 22070

Samples Received: 02/12/94 @ 12:00
Samples Collected: 02/11/94 @ Grab times not given
RE: 1868 1260 Location: 80-DRS (Soil Samples)

SUBMITTED BY:

James R. Reed and Associates, Inc.
11864 Canon Boulevard, Suite 103
Newport News, VA 23606
(804) 873-4703

Respectfully,

Beverly E. Blanchard
for Carol Isenhour
Vice President

Sample Identification: (Soil)	S80-SB1-0211-24	S80-SB1-0211-46	S80-SB02-0211-02	S80-SB03-0211-02	S80-SB03-0211-02-D	Method
JRA Sample ID:	94-1284	94-1285	94-1286	94-1287	94-1288	Detection Limit

ANALYSIS (reported in mg/kg unless otherwise indicated)

Total Petroleum Hydrocarbon	7.9	<2.5	1270 ¹	2390 ²	470 ³	2.5, 25 ¹ , 250 ² , 62.5 ³
Lead	*	*	93	124	186	5

ORGANICS (Method 8240)

Acetone	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Acetonitrile	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Acrolein	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Acrylonitrile	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Benzene	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Bromodichloromethane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Bromoform	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Bromomethane	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
2-Butanone	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Carbon disulfide	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Carbon tetrachloride	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Chlorobenzene	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Chlorodibromomethane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Chloroethane	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
2-Chloroethyl vinyl ether	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Chloroform	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Chloromethane	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
1,2-Dibromo-3-chloropropane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,2-Dibromoethane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Dibromoethane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Dichlorodifluoromethane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,1-Dichloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,2-Dichloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,1-Dichloroethene	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
trans-1,2-Dichloroethene	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,2-Dichloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
cis-1,3-Dichloropropene	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
trans-1,3-Dichloropropene	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Ethanol	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Ethylbenzene	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
2-Hexanone	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Isobutyl alcohol	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Methylene chloride	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
4-methyl-2-pentanone	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Styrene	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,1,1,2-Tetrachloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,1,2,2-Tetrachloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Tetrachloroethene	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Toluene	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,1,1-Trichloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,1,2-Trichloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Trichloroethene	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Trichlorofluoromethane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,2,3-Trichloropropane	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Vinyl chloride	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Xylene (Total)	<0.25	<0.25	<0.25	<0.25	<0.25	0.25

ANALYSIS (reported in mg/kg unless otherwise indicated)

Total Petroleum Hydrocarbon	722 ⁴	12.5	<2.5	<2.5	<2.5	<2.5	2.5, 125 ⁴
ORGANICS (Method 8240)							
Acetone	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Acetonitrile	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Acrolein	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Acrylonitrile	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Benzene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Bromodichloromethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Bromoform	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Bromomethane	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
2-Butanone	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Carbon disulfide	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Carbon tetrachloride	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Chlorobenzene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Chlorodibromomethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Chloroethane	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
2-Chloroethyl vinyl ether	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Chloroform	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Chloromethane	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
1,2-Dibromo-3-chloropropane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,2-Dibromoethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Dibromoethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Dichlorodifluoromethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,1-Dichloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,2-Dichloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,1-Dichloroethene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
trans-1,2-Dichloroethene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,2-Dichloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
cis-1,3-Dichloropropene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
trans-1,3-Dichloropropene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Ethanol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Ethylbenzene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
2-Hexanone	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Isobutyl alcohol	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Methylene chloride	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
4-methyl-2-pentanone	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0
Styrene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,1,1,2-Tetrachloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,1,1,2-Tetrachloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Tetrachloroethene	<0.25	2.75	<0.25	<0.25	<0.25	<0.25	0.25
Toluene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,1,1-Trichloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,1,2-Trichloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Trichloroethene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Trichlorofluoromethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
1,2,3-Trichloropropane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Vinyl chloride	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Xylene (Total)	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25

Sample Identification: (Soil)	S80-SB04-0211-02	S80-SB06-0211-02	S80-SB07-0211-02	S80-SB08-0211-02	S80-SB09-0211-02	S80-SB10-0211-02	S80-SB11-0211-02	Method
JRA Sample ID:	94-1289	94-1292	94-1293	94-1294	94-1295	94-1296	94-1297	Detection Limit
ANALYSIS (reported in mg/kg unless otherwise indicated)								

Lead	128 ⁵	36 ⁶	36 ⁵	13 ⁵	87 ⁶	66 ⁶	11 ⁵	6 ⁵ , 5 ⁶
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NOTES:

<u>Analysis</u>	<u>Method</u>	<u>Analyst/Date/Time</u>
Total Petroleum Hydrocarbon	418.1	CLH-02/16/94 @ 14:50
Lead	7740	SKH-02/17/94 @ 13:00
Organics	8240	HP-02/16/94 @ 20:12, 20:51, 21:29, 22:08, 22:46, 23:25; 02/17/94 @ 00:03, 00:42, 01:20, 01:59

*Analysis not requested.

¹Normal detection limit cannot be reached due to dilution factor.

²Normal detection limit cannot be reached due to sample matrix.

³Normal detection limit cannot be reached due to sample matrix.

March 2, 1994

SUBMITTED BY:



Montgomery Watson
ATTN: Dave Sarr
560 Herndon Parkway, Suite 300
Herndon, VA 22070

James R. Reed & Associates, Inc.
11864 Canon Boulevard, Suite 103
Newport News, VA 23606
(804) 873-4703

Sample Received: 02/12/94 @ 12:20
Sample Collected: 02/11/94 @ Time not given
RE: 1868.1260
Location: 80-DRS

<u>Sample Identification</u>	<u>Method Number</u>	<u>Method Detection Limit (mg/kg)</u>	<u>Practical Quantitation Limit</u>	<u>Results (mg/kg)</u>	<u>Analyst/Date/Time</u>
LARC 60					
S80-SB01-0211-02					
94-1501					
Total Petroleum Hydrocarbon	418.1	2.50	125	824	CLH-02/23/94 @ 20:00
Lead	SW846 7420	12	12	285	SKH-03/01/94 @ 08:00
80-DRS					
S80-SB02-0211-24					
94-1502					
Total Petroleum Hydrocarbon	418.1	2.50	2.50	4.50	CLH-02/23/94 @ 20:00
Lead	SW846 7420	6	6	11	SKH-03/01/94 @ 08:00
LARC DRS					
S80-SB03-0211-24					
94-1503					
Total Petroleum Hydrocarbon	418.1	2.50	2.50	<2.50	CLH-02/23/94 @ 20:00
Lead	SW846 7420	6	6	12	SKH-03/01/94 @ 08:00
LARC DRS					
S80-SB05-0211-24					
94-1504					
Total Petroleum Hydrocarbon	418.1	2.50	50	208	CLH-02/23/94 @ 20:00

Results calculated on total (wet) weight basis.

Respectfully,

for 
Carol Isenhour
Vice President

March 4, 1994

SUBMITTED BY:

Montgomery Watson
 ATTN: Darr Sarr
 560 Herndon Parkway, Suite 300
 Herndon, VA 22070

James R. Reed and Associates, Inc.
 11864 Canon Blvd., Suite 103
 Newport News, VA 23606
 (804) 873-4703



Samples Received: 02/22/94 @ 12:20
 Samples Collected: 02/11/94 @ Time not given

Parameter	SW846 Method Number	Method Detection Limit (mg/kg)	Result (mg/kg)	Analyst/Date/Time
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Sample Identification: S80-SB02-0211-02
 JRA ID No.: 94-1286

TOTAL METALS

Antimony	7041	0.26	3.03	FPE-03/02/94 @ 16:18
Arsenic	7060	0.050	0.751	FPE-02/25/94 @ 12:50
Beryllium	7090	0.5	<0.5	SKH-02/24/94 @ 06:00
Cadmium	7130	0.4	0.7	SKH-02/22/94 @ 13:30
Chromium	7190	2	9	SKH-02/22/94 @ 13:00
Copper	7210	0.5	4.7	SKH-02/22/94 @ 14:00
Mercury	7470	0.01	0.02	SKH-03/01/94 @ 07:00
Nickel	7520	5	<5	SKH-03/03/94 @ 11:30
Selenium	7740	0.104	<0.104	FPE-02/25/94 @ 15:29
Silver	7760	0.5	<0.5	SKH-03/02/94 @ 12:15
Thallium	7841	0.052	<0.052	FPE-03/02/94 @ 18:00
Zinc	7950	0.5	23.8	SKH-02/22/94 @ 10:00

Sample Identification: S80-SB06-0211-02
 JRA ID No.: 94-1292

TOTAL METALS

Antimony	7041	0.30	0.36	FPE-03/02/94 @ 16:22
Arsenic	7060	0.060	1.08	FPE-02/25/94 @ 12:55
Beryllium	7090	0.5	<0.5	SKH-02/24/94 @ 06:00
Cadmium	7130	0.4	0.8	SKH-02/22/94 @ 13:30
Chromium	7190	2	12	SKH-02/22/94 @ 13:00
Copper	7210	0.5	4.6	SKH-02/22/94 @ 14:00
Mercury	7470	0.01	0.02	SKH-03/01/94 @ 07:00
Nickel	7520	5	<5	SKH-03/03/94 @ 11:30
Selenium	7740	0.120	<0.120	FPE-02/25/94 @ 15:33
Silver	7760	0.6	<0.6	SKH-03/02/94 @ 12:15
Thallium	7841	0.060	<0.060	FPE-03/02/94 @ 18:10
Zinc	7950	0.5	43.9	SKH-02/22/94 @ 10:00



MONTGOMERY WATSON

CHAIN OF CUSTODY RECORD
WATER SAMPLES

Fed Ex # NA Cooler # 1
DESTINATION: ~~SAVANNAH LABORATORIES~~
OTHER: JR Reed

PROJECT INFORMATION					PROJECT LAB #		ANALYSES REQUIRED													
USACE - Omaha - Fort Fenton Va					1868, 1260		<div style="display: flex; justify-content: space-between;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Parameters / Size of Containers</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">BNA + (TC) Two 1 Liter Amber Glass</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Cu One 1 Liter Plastic</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Metals One (TAL + Pb, Silica) One 500 ml Plastic</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Metals Tot (TAL + Pb, Silica) One 500 ml Plastic</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">(NO₃ -N)NO₂ -N, NH₄ -P-Totals One 250 ml Plastic</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Pest/PCB Two 1 Liter Amber Glass</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">pH, EC, Alk, TDS) One 500 ml Plastic</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">(PO₄ -S) & -Cl One 250 ml Plastic</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Hg, B, One 250 ml Plastic</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">TPH-H, Two 1 Liter Plastic</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">TPH-L, Three 40 ml Vials</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">TOC One 125 ml Vial</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">TPPH, Two 125 ml Vials</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">VOCs One 125 ml Amber Glass</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Lead 418.1</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Lead 8240</div> </div>													
Remedial Investigation/Confirmatory Sampling					1104															
SAMPLER(S): PRINTED NAME AND SIGNATURE																				
David Sarr David Sarr																				
NUMBER	TIME	LOCATION	IDENTIFIER	QA/QC	GRAB	NUMBER OF CONTAINERS														REMARKS
1		EO-DRS	S80-SB01-0211-24		✓	1														
2			S80-SB01-0211-46		✓	1														
3			S80-SB02-0211-02		✓	1														
4			S80-SB03-0211-02		✓	1														
5			S80-SB03-0211-02-D	X	✓	1														
6			S80-SB04-0211-02		✓	1														
7			S80-SB05-0211-02		✓	1														
8			S80-SB05-0211-46		✓	1														
9			S80-SB06-0211-02		✓	1														
10			S80-SB07-0211-02		✓	1														
11			S80-SB08-0211-02		✓	1														
12			S80-SB09-0211-02		✓	1														
13			S80-SB10-0211-02		✓	1														

SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
RELINQUISHED BY: <i>David Sarr</i>	Dave Sarr	Montgomery Watson PM	2/12/94	12:00
RECEIVED BY: <i>Carol Isenhour</i>	Carol Isenhour	Reed + Assoc.	2/12/94	12:00
RELINQUISHED BY:				
RECEIVED BY:				

For LAB USE ONLY: Sample Condition Upon Receipt

APPENDIX C

TOXICOLOGICAL INFORMATION

The following are brief toxicological profiles for compounds detected at the 80-DRS site (i.e., cadmium, chromium, copper, zinc and tetrachloroethylene [PCE]). These profiles are a synopsis of information available from the USEPA Integrated Risk Information System (IRIS, 1994) and the USPHS ATSDR Toxicological Profiles for each of the compounds listed.

CADMIUM

Acute effects due to exposure to cadmium include gastrointestinal distress, and inhalation of cadmium dust causes respiratory irritation and infection. Long-term exposure may result in emphysema. Ingestion of cadmium damages the kidneys, which is evidenced by proteinuria and anemia. Animal studies have produced liver and central nervous system disorders. Other critical systemic effects include possible damage to the bone, testes, immune system and the cardiovascular system.

OSHA has set limits for occupational exposure to dust and fumes. Cadmium is considered a probable human carcinogen via inhalation route only. This is based on limited evidence of lung cancer observed in smelter workers. Lung tumors and mammary tumors have been reported in laboratory studies. Developmental and reproductive effects have not been shown in humans, but some evidence of effect has been demonstrated in animal studies. But most inhalation and ingestion studies have not shown developmental or fetotoxic effects. Mutagenicity studies in humans and animals have indicated equivocal results. Positive responses have been seen in mutation assays with hamster cells and mouse lymphoma cells, but bacteria and yeast studies have been inconclusive.

Cadmium has no nutritional value to animals and has shown to have bioaccumulative potential. Toxicity depends on the chemical and physical form. Soluble forms (cadmium chloride, cadmium oxide) tend to be more toxic than insoluble forms (cadmium sulfide).

CHROMIUM

Acute effects may include dermatitis, respiratory irritation and renal tubular necrosis (kidney tissue damage). Chronic effects include ulceration of the nasal cavity and eczema.

In occupational settings chromium is associated with pulmonary irritation, corrosion of the nasal septa and lung cancer. OSHA has set exposure limits for insoluble and soluble chromium salts.

Hexavalent chromium is considered a USEPA Group A human carcinogen via the inhalation route of exposure. This classification is based on human epidemiologic data showing an increase in lung cancer. No data with regard to potential developmental effects is available and no reproductive effects have been observed in humans or animals. Mutagenicity has been demonstrated for chromium VI via positive results in human red blood cells, Chinese hamster cells and bacteria tests.

Chromium is found in both a trivalent and hexavalent form. The hexavalent form is found in strongly oxidizing conditions. The trivalent form is the far more common under typical environmental conditions and is also less toxic. Chromium is an essential mineral involved

in glucose metabolism in animals. Excess chromium is rapidly excreted and therefore not cumulative in the body. Chromium is a widely distributed metal in soil.

COPPER

Acute effects due to high doses may include metal fume fever, gastritis and other gastrointestinal effects, discoloration of skin and hair. Excessive doses can be fatal. Dermal exposure to high doses of copper salts may produce skin irritation and eczema. Chronic effects indicated from long-term exposure include anemia and for a small portion of the population with Wilson's disease hepatic (liver) cirrhosis may develop. Wilson's disease is an inherited autosomal recessive disorder of copper metabolism. This ailment results in increased copper deposition in the liver, brain and cornea. Besides hepatic cirrhosis, high levels of accumulated copper may result in damage to erythrocytes (red blood cells), kidneys, corneas and the central nervous system. Normal exposure may result in adverse effects due to the effected individual's inability to metabolize copper.

An OSHA occupational exposure limit has been set for copper dust in the workplace. Inhalation of dusts and mists of copper salts may result in irritation of the mucous membranes and pharynx, and ulceration and perforation of the nasal septum. Metal fume fever has also been reported. It is currently not considered a human carcinogen under USEPA classification. Increases in fetal mortality were seen in both mice and minks. In a rat study, increases in rat weights were seen. Sexual impotence has been noted in factory workers. No evidence of mutagenicity has been demonstrated in humans or animals.

Copper is widely found in soils and is an essential mineral to animals. It has not been shown to bioaccumulate in animals.

ZINC

Acute effects due to high dose exposure may include metal fume fever and irritation of the respiratory tract. OSHA regulates zinc fumes in the workplace due to the adverse effects of inhalation on respiratory function and the onset of metal fume fever. Anemia has also been shown as a possible long-term or chronic effect due to exposure to high levels of zinc fumes. Zinc is not currently considered a human carcinogen under USEPA classification. No information is available with regard to developmental or reproductive effects. No information is available with regard to mutagenic potential, as well.

Zinc is an essential element for animals as a part of a number of metalloenzymes involved with cell differentiation and growth. It also serves as a metabolic antagonist to cadmium meaning that zinc intake can protect animals from toxic effects of cadmium. It is not considered to appreciably bioaccumulate in animals.

TETRACHLOROETHYLENE (PCE)

Acute effects at high doses in air may cause depression to the central nervous system (i.e., dizziness, headache, slowed reaction times, sleepiness and facial numbness). Eye, nose and throat irritation may also occur and are more pronounced after longer exposure. Animal studies have indicated that high doses via inhalation and oral routes of exposure have resulted in liver and kidney damage and effects on the immune system and the blood.

OSHA has set occupational limits for inhalation of PCE in the workplace. USEPA has designated PCE as a Group B₂ carcinogen. This is based on animal studies indicating cancer of the liver, kidney and lung. No developmental or reproductive effects studies via inhalation or ingestion in humans are available. Animals studies have indicated some fetotoxic and teratogenic effects due to ingestion and inhalation of PCE. Positive results for genotoxicity in nonhumans studies has been indicated, but human studies are inconclusive. PCE is expected to metabolize rapidly in the body and therefore is not considered to have significant bioaccumulative potential.

**OCCUPATIONAL LIMITS FOR COMPOUNDS DETECTED
AT THE 80-DRS SITE, FORT STORY, VIRGINIA**

<u>Compound</u>	<u>Occupational Limits*</u>
n-hexane (surrogate for TPH) (1ppm = 3.58 mg/m ³)	180 mg/m ³ (NIOSH/OSHA) 5000 ppm (IDHL)
lead	0.1/05 mg/m ³ (NIOSH/OSHA) 700 mg/m ³ (IDHL)
cadmium (dust)	0.2 mg/m ³ (OSHA) 0.6 mg/m ³ (OSHA, ceiling) 50 mg/m ³ (IDHL)
cadmium (fumes)	0.1 mg/m ³ (OSHA) 0.3 mg/m ³ (OSHA, ceiling) 9.0 mg/m ³ (IDHL)
chromium (III)	0.5 mg/m ³ (NIOSH) 1.0 mg/m ³ (OSHA)
chromium (VI)	.001 mg/m ³ (NIOSH) 0.1 mg/m ³ (OSHA) 30 mg/m ³ (IDHL)
copper	1.0 mg/m ³ (NIOSH/OSHA)
zinc (chloride fume)	1.0 mg/m ³ (NIOSH/OSHA) 2 mg/m ³ (short term level) 4800 mg/m ³ (IDHL)
zinc (oxide fume)	5 mg/m ³ (NIOSH/OSHA) 10 mg/m ³ (short term level)
Tetrachloroethylene (PCE) (1 ppm = 6.89 mg/m ³)	170 mg/m ³ (OSHA) 500 ppm (IDHL)

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

IDHL = Immediate danger to health and life

Reference : U.S. Department of Health and Human Services. 1990.
NIOSH Pocket Guide to Chemical Hazards

* Based on a daily eight hour time-weighted average.

APPENDIX D

**GUIDELINES FOR THE DISPOSAL OF SOIL
CONTAMINATED WITH PETROLEUM PRODUCTS**

COMMONWEALTH OF VIRGINIA



COMMONWEALTH of VIRGINIA

DEPARTMENT OF WASTE MANAGEMENT

11th Floor, Monroe Building

101 N. 14th Street

Richmond, VA 23219

(804) 225-2667

TDD (804) 371-8737

GUIDELINES FOR THE DISPOSAL OF SOIL CONTAMINATED WITH PETROLEUM PRODUCTS

A. Applicability

1. The guidelines and criteria specified herein apply to anyone submitting special waste requests to dispose of soil contaminated with petroleum products to include diesel fuels, kerosene, gasoline, hydraulic fluids, JP-4, and motor oil.
2. The guidelines and criteria specified herein do not apply to anyone submitting special waste requests to dispose of any other type of contaminated soil to include but not limited to solvents, PCB's, CCA, etc. Such requests are fully subject to Part VIII of the Virginia Solid Waste Management Regulations (VSWMR).
3. Any on-site remediation of only those contaminated soils described in Section A.1 above performed under the approval of the Virginia Water Control Board (VWCB) would be considered outside the scope of VSWMR permitting requirements. For the purpose of these guidelines, on-site means the same or geographically contiguous property which may be divided by public or private right-of-way, provided the entrance and exit between the properties is at a cross-roads intersection, and access is by crossing as opposed to going along, the right-of-way. Non-contiguous properties owned by the same person but ~~not~~ connected by a right-of-way which he controls and to which the public does not have access, is also considered on-site property. However, the VSWMR requirements and the guidelines and criteria specified herein would be

fully applicable to any off-site remediation or disposal of such contaminated soil regardless of the level of contamination, with the exception of Section F.3 of these guidelines. For off-site thermal treatment, specific requirements for approval are available in the Thermal Treatment of Petroleum Contaminated Soil Requirements guidance document.

4. Any contaminated soil which is a hazardous waste as defined by the Virginia Hazardous Waste Management Regulations (VHWMR) would be excluded from this part and must be managed in accordance with the VHWMR.
5. Any contaminated soil from a state other than Virginia which is a hazardous waste in the state of origin must be managed as a hazardous waste. Such wastes are not acceptable for disposal in a solid waste management facility in the Commonwealth.

B. Required Information

1. A statement from the generator certifying that the soil is non-hazardous waste as defined by the VHWMR or federal regulations under subtitle C, RCRA.
2. The amount of petroleum contaminated soil to be disposed.
3. A description of the sampling protocol and a copy of all laboratory analyses.
4. Documentation showing that the VWCB has been notified regarding the contamination.
5. If generated in a state other than Virginia, certification from the generator that the waste is not considered a hazardous waste in its state of generation.

C. Testing Requirements - Media and Debris Contaminated by Leakage from an Underground Storage Tank

1. A minimum of one composite sample must be analyzed for each required test for every 100 cubic yards of soil to be disposed.
2. The soil may not contain free liquid as demonstrated by EPA SW-846 method 9095, Paint Filter Liquids Test.

3. The Total Petroleum Hydrocarbon (TPH) concentrations must be determined by using EPA method 418.1 for chemical analysis of water and wastewater, which has been modified for use with soil.
4. The sum of benzene, toluene, ethyl benzene, and xylene (BTEX) concentrations must be determined by using EPA SW-846 method 5030/8020.
5. The soil must be tested for Total Organic Halogens (TOX) in accordance with test methods contained in EPA SW-846.
6. Soil contaminated with motor oil must be analyzed for EP Toxicity for all metals; soil contaminated with any other petroleum product must be analyzed for EP Toxicity Lead. EP Toxicity must be determined by using EPA SW-846 method 1310.
7. The testing requirements for gasoline for lead, TOX and the paint filter liquids test may be waived, if the request for disposal contains a statement from the VWCB that the material does not contain any halogenated hydrocarbons, free liquids, and, if the soil is contaminated with gasoline, that the gasoline is unleaded. The statement from the VWCB may certify any or all of the above. This waiver must be granted by the Department of Waste Management.

D. Testing Requirements - Soil Contaminated as a Result of Anything Other Than Leakage from an Underground Storage Tank

1. A minimum of one composite sample must be analyzed for each required test for every 100 cubic yards of soil to be disposed.
2. The soil may not contain free liquid as demonstrated by EPA SW-846 method 9095, Paint Filter Liquids Test.
3. The Total Petroleum Hydrocarbon (TPH) concentrations must be determined by using EPA method 418.1 for chemical analysis of water and wastewater, which has been modified for use with soil.
4. The sum of benzene, toluene, ethyl benzene, and xylene (BTEX) concentrations must be determined by using EPA SW-846 method 5030/8020.

5. The soil must be tested for Total Organic Halogens (TOX) in accordance with test methods contained in EPA SW-846.
6. The soil must be tested by the Toxicity Characteristic Leaching Procedure (TCLP) for all constituents likely to be present (at a minimum, test for lead and benzene). If other TCLP constituents are not tested for, the generator must be able to certify that the soil is not a hazardous waste and did not contain those constituents.

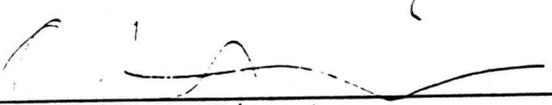
E. Criteria for Disposal Approval

1. Soils failing the EP Toxicity Test or the TCLP Test must be managed in accordance with the Virginia Hazardous Waste Management Regulations.
2. Soils exhibiting a TOX > 100 ppm may not be disposed of until separate approval from the Department of Waste Management is granted.
3. If the concentration of total BTEX > 10 ppm or TPH > 500 ppm, the soil cannot be disposed of in any permitted sanitary or industrial landfill in Virginia with the exception of E.4.
4. Due to its design and construction, Chambers Landfill in Charles City County has received authorization to accept petroleum contaminated soils with up to 1500 ppm TPH. Therefore, if the concentration of TPH < 1500 ppm and total BTEX < 10 ppm, the contaminated soil may be disposed of at the Chambers Landfill in Charles City County.
5. If the concentration of TPH < 500 ppm and total BTEX < 10 ppm, the contaminated soil shall only be disposed of in permitted sanitary or industrial landfills equipped with liners and leachate collection systems.
6. If the concentration of TPH < 100 ppm and total BTEX < 10 ppm, the contaminated soil may be disposed of in any permitted sanitary or industrial landfill unless Section F.3 of these guidelines applies.

F. Exemptions

1. Contaminated soil resulting from an underground storage tank release or from a spill may be considered for a variance from the limits specified in Section E. of these guidelines where the total volume of contaminated soil from a cleanup site is less than 20 cubic yards, and the contaminated soil is not a hazardous waste. This variance must be granted by the Department of Waste Management.
2. The VWCB may approve the disposal of contaminated soil resulting from an emergency clean-up of a spill, provided that the waste is non-hazardous as defined by the Virginia Hazardous Waste Management Regulations, and the VWCB notifies the Department regarding the spill. The amount of contaminated soil to be disposed of may not exceed 10 cubic yards.
3. Soil containing less than 50 ppm TPH and BTEX less than 10 ppm may be used as clean fill. This soil, however, may not be disposed of closer than 100 feet of any regularly flowing surface water body or river, 500 feet of any well, spring or other groundwater source of drinking water, and 200 feet from any residence, school, hospital, nursing home or recreational park area. In addition, if the soil is not to be disposed of on the generator's property, the generator must notify the property owner that the soil is contaminated and with what it is contaminated.

*NOTE: These guidelines are subject to change and will be updated periodically as necessary.


Cynthia V. Bailey, Director

Date of Issuance: April 1, 1990

Date of Amendment: January 15, 1991

10/18/91

**FACILITIES HAVING APPROVAL TO ACCEPT
PETROLEUM CONTAMINATED SOILS**

<u>FACILITY</u>	<u>LOCATION</u>	<u>CONTACT PERSON</u>
Big Bethel Landfill	City of Hampton	Manfred Freeman (804) 766-1092
Browning Ferris Industries (BFI)	Henrico County	B. J. Kirksey (804) 222-7070
Chambers Landfill	Charles City County	Landfill Manager (804) 966-7146
First Piedmont Landfill	Pittsylvania County	Tommy Stump (804) 432-0211
Loudoun County Landfill	Loudoun County	Terrance Wharton (703) 777-0220
New River Resource Authority Landfill	City of Radford	Charles Maus (703) 731-3615
Roanoke Valley Sanitary Landfill	City of Roanoke	Jeff Cromer (703) 981-9331
SEPSA Landfill	City of Suffolk	Durwood Curling (804) 420-4700
Shoosmith Landfill	Chesterfield County	James McCook (804) 748-5823
Virginia Beach - Mt. Trashmore II	City of Virginia Beach	P. Wade Kyle (804) 430-2450

* NOTE: These facilities have approval to accept petroleum contaminated soils in accordance with the *Petroleum Contaminated Soil Disposal Guidelines* and corresponding approvals, and their respective permit requirements, without receiving approval from the Department of Waste Management for each individual case. Other facilities may accept petroleum contaminated soils, but must receive approval from the Department of Waste Management for each individual case.