LAW ENVIRONMENTAL

JOB No. 11-1564

CONTRACT No. DACW41-89-D-0124

FINAL 100%
DESIGN ANALYSIS REPORT
FOR
INTERIM REMOVAL ACTION DESIGNS
AT
GRIFFISS AIR FORCE BASE
ROME, NEW YORK

PREPARED FOR

U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT

PREPARED BY

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES BRANCH

AUGUST 1992

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Kennesaw, Georgia 30144

AUGUST 1992

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1.0 INTRODUCTION

The objective of this Design Analysis Report is to provide a description of the general objectives, criteria, design process and elements of the Interim Removal Action Designs at Griffiss Air Force Base (GAFB), Rome, New York.

This Interim Removal Action Design Report includes the Building #101 "Yellow Submarine" UST Site (IRP Site ST-06), the Building #112 UST Site (IRP Site SS-08), and the Building #110/Jet Fuel Transfer Pipeline Site (IRP Site ST-36).

1.1 AUTHORITY AND SCOPE

Law Environmental, Inc. (Law) has prepared this Final 100% Design Analysis Report in accordance with the CEMRK Scope of Work for Delivery Order No. 0040, dated September 20, 1991. The Design Analysis Report is based on the CEMRK "Design Analysis Guidelines" dated April 1983.

1.2 ECONOMY OF DESIGN

Each of the Interim Removal Action Sites has been studied by Law while in the process of preparing Engineering Evaluation/Cost Analysis (EE/CA) reports and Action Memorandum. These reports outline and compare suggested remedial methods applicable to the sites. Each remedial method is compared in terms of effectiveness, ease of implementation and cost. All selected remedial methods have been evaluated and determined to be cost effective. The removals of the underground storage tanks (USTs) have a higher initial cost than closure in-place; however, this is offset by the lack of any long-term costs. The closure in-place of the 5600 LF Jet Fuel Transfer Pipeline was selected due to the high cost of removing the pipeline.

1.3 APPLICABLE CRITERIA

The following list provides the general criteria for all disciplines used in the Design Analysis.

- Instructions for Preparation of Bidding Documents for Construction Contracts, April 1988.
- A-E Guidelines for Corps of Engineers, Kansas City District Drawings, dated 11 October 1983, revised 19 March 1985.
- Preparation of Construction Cost Estimates for Hazardous Waste Cleanup Projects, Issue No. 1, dated January 1985.
- EM 1110-2-1302, Cost Estimates, 15 January 1982.
- EP 1110-1-8, Volume 1, Construction Equipment Ownership and Operating Expense Schedule, Region 1, December 1988 edition. Obtain from: U.S. Government Printing Office, Document Warehouse, 8160 Cherry Lane, Laurel, MD 20707; Phone (301) 953-7974.
- Design Analysis Guidelines, April 1983.
- April 1986 Index of the Department of the Army Technical Manuals (TMs).
- February 1985 List of Engineering Technical Letters (ETL).
- EP 310-1-5, Index of Guide Specifications, dated 15 July 1987.
- Applicable specifications selected from above EP-310-1-5 Index.

- Health and Safety Guidelines List, included in the Scope of Work.

- Design Document Distribution and Mailing List included in the Scope of Work.

- COE Kansas City District Drafting Standards, dated January 1984.

- Forms: (For additional copies, AE shall reproduce as needed.)

  ENG Form 93 - Payment Estimate Form
  ENG Form 150 - Cost Estimating Form

- Instructions for Completion of ENG Form 93 - Payment Estimate.

- ER-1110-1-263, Chemical Quality Management-Toxic and Hazardous Wastes, dated 1 October 1990.

- Sample Handling Protocol for Low, Medium, and High Concentration Samples of Hazardous Wastes, USACE, dated October 1986.

- Site Assessments at Bulk Storage Facilities, New York State Department of Environmental Conservation (NYDEC) dated 15 May 1991.

- "Contained-In" Criteria Guidance, New York State Department of Environmental Conservation (NYDEC).

- Permanent Closure of Petroleum Storage Tanks, New York State Department of Environmental Conservation (NYDEC), dated July 19, 1988.

1.4 GENERAL DESCRIPTION OF WORK

Law has prepared a Final 100% Interim Removal Action Design for Installation Restoration Program (IRP) sites at Griffiss AFB.

Law conducted interviews with officials at Griffiss AFB to obtain information critical for the designs. Griffiss AFB also assisted Law in a document search through record files for drawings and reports.

Law conducted topographical and planimetric surveys at each site to supplement existing Base drawings for compiling updated, detailed site plans. The site plans include physical features such as buildings, roads, curbs, sidewalks, ditches and creeks. The site plans are indexed in series by means of New York State Plane Coordinates (NAD-83).

1.5 BUILDING #101 "YELLOW SUBMARINE" UST SITE

1.5.1 Site Specific Description

The Yellow Submarine UST is approximately fifteen feet from the south edge of Building #101 and is located within a small graveled area approximately 20 feet by 30 feet adjacent to the personnel parking area for the building.

1.5.2 Site Specific Details

The Yellow Submarine, a 12,000-gallon capacity UST, was formerly used as a holding and dilution tank for metal plating wastes. The UST received effluent from floor drains and sinks from a metal plating shop located within Building #101. The Yellow Submarine UST was placed in service in 1973 and was subsequently taken out of

service in 1987. The plating shop was closed and rendered inoperable in 1989. Plating shop activities included: anodizing, chrome plating, cadmium plating, nickel plating, and chemical stripping of metal components. The UST held effluent prior to discharging into the sanitary sewer system. The UST reportedly received less than 20 gallons per day of plating washdown and approximately 10 gallons per year of plating solids and plating bath solution. All influent and effluent piping associated with the UST was reportedly sealed in 1987.

Historically, no environmental assessment data (soil or ground-water samples) have been gathered from this site. No records exist that show the tank was checked for leakage.

Chemical sampling of the Yellow Submarine UST contents (including any remaining sludge) has been performed. Analytes found both in aqueous and sludge phase included organic and inorganic hazardous substances.

This data is presented in Appendix A. In both the water and sludge sample, the highest inorganic concentrations were determined for lead and chromium, and the highest organic concentrations were determined for tetrachloroethylene and 1,2-trans-dichloroethylene.

No records exist stating that the tank has been checked for leakage. Law has installed a soil boring and monitoring well at the site to obtain geotechnical data for the design of an excavation shoring system and ground-water samples to determine extent of contamination.

1.5.3 Removal Action

The Removal Action proposed for this site is UST removal. The Final (100%) Design involves the removal of the UST and capping all ancillary piping associated with the UST.

1.6 BUILDING #112 UST SITE

1.6.1 Site Specific Description

The Building #112 UST Site involves three USTs that are located approximately fifteen feet east of Building #112. The USTs are situated under a concrete paved area.

1.6.2 Site Specific Details

The three USTs were each determined by base personnel to be approximately 500 gallons in capacity. No historical data exists concerning these tanks, including sizes, dimensions or usage of the tanks. Due to the fact that Building #112 was formerly used as an engine test cell, it is assumed that these tanks were used to hold AVGAS (aviation gasoline) and/or JP-4 (jet fuel). Presently, two tanks contain water and the third tank is filled with sand.

The two tanks containing water were sampled for chemical analysis. The contents indicated the presence of hazardous constituents. Methylene chloride, trichloroethylene, tetrachloroethylene, and oil and grease were discovered at various concentration levels. The presence of these hazardous constituents suggest that the tanks contained hazardous waste. Thus, the site will have to be treated, and closed, as a hazardous waste site.

The chemical sampling parameters and results are shown in Appendix A. Sample number 112-UST-201 is a duplicate sample for sample 112-UST-2.

No environmental assessment data (soil or ground-water samples) have been obtained at this site. No records exist that the tanks were checked for leakage.

1.6.3 Removal Action

The Removal Action proposed for this site is removal of the three 500-gallon capacity USTs and capping of all ancillary piping associated with the USTs.

1.7 BUILDING #110/JET FUEL TRANSFER PIPELINE SITE

1.7.1 Site Specific Description

The Building #110 Site includes four 25,000-gallon USTs and ancillary piping located south of Building #110. Building #110 itself houses pumps, piping, and two oil-water separator tanks. The portion of the Jet Fuel Transfer Pipeline considered under this scope of work extends from Building #110 to a block valve and vent in the general vicinity of Building #752, Ski Chalet, and is approximately 5600 feet in length. Included along the Jet Fuel Transfer Pipeline is an abandoned Truck Fill stand that will be considered by this design.

1.7.2 Site Specific Details

The Building #110 area served as a fuel storage station along the fuel distribution system. This Jet Fuel Transfer Pipeline consists of a 12-inch diameter steel pipe network which previously provided aviation gasoline (AVGAS) and JP-4 to various areas of the flight line and aircraft parking aprons.

The Jet Fuel Transfer Pipeline fuel distribution network, including Building #110, was built in 1942, and served as a storage facility which supplied fuel (JP-4) and leaded AVGAS to the flight line. Fuel was obtained from bulk fuel storage tanks in the former Tank Farms 1 and 3.

Tank Farm 3, located southeast of Building #112 was closed and removed in 1987-1988. Contaminated soil previously used as spill containment berms was stockpiled south of Building #112 and has not been disposed of. This stockpiled soil is located approximately 350 feet from the Jet Fuel Transfer Pipeline. During the early 1980s, the portion of the Jet Fuel Transfer Pipeline under consideration by this action was closed in-place. The pipeline was capped without cleaning or draining the system.

The Building #110/Jet Fuel Transfer Pipeline Site has produced no documented leaks or spills. However, the Jet Fuel Transfer Pipeline was not leak tested or pressure tested during its operational period or thereafter according to base personnel. This site is not presently monitored for contamination, however, a soil gas survey along the Jet Fuel Transfer Pipeline was performed in November 1991. The parameters analyzed for were benzene, toluene, ethylbenzene, xylenes, and total volatile hydrocarbons. The ranges of the levels of these parameters detected along the pipeline were very low.

The four 25,000-gallon capacity USTs at Building #110 were sampled for chemical analysis (BTEX, total iron and lead, oil and grease, and TPH). All four tanks contained a layer of free product. The analysis indicated the presence of petroleum products (gasoline, diesel, oil and grease). The chemical sampling parameters and results are included in Appendix A. A ground-water monitoring well was installed and sampled in the vicinity of the USTs, and these results are also included in Appendix A.

1.7.3 Removal Action

The Removal Action for this site includes the removal of the four 25,000-gallon capacity USTs at Building #110. Building #110 houses two 500-gallon capacity USTs within the basement and these tanks

will also be removed. Building #110 will be demolished and removed from the site. The Jet Fuel Transfer Pipeline will be drained, cleaned, and closed in-place. Features along the pipeline such as manholes, valves and pits will be removed. The Truck Fill Stand will be removed including a single ±110 gallon-capacity UST located at the Truck Fill Stand.

2.0 DETAILS OF INTERIM REMOVAL ACTIONS

The following section provides a brief summary of the major details of the Interim Removal Action Designs.

2.1 CLOSURE OF USTs

The Interim Removal Action Designs include the removal of several USTs. In accordance with the state and federal UST regulations, to permanently close a tank system it must be either removed or closed in place. If removed, the UST system must be:

- Emptied of liquids and sludge
- Rendered free of petroleum vapors
- Have connecting lines disconnected and removed
- Excavated and removed from the ground
- Have the excavation zone sampled and analyzed for contaminants

Closure by removal is an effective means of permanently closing UST systems. By removing the tanks and ancillary piping, the source of contamination, or potential contamination, no longer exists. Tank system removal also facilitates identification and remediation of contaminated soils. The designs include detailed site plans and specifications to direct the Contractor in the task of removing the USTs. The Contractor is directed to remove and/or cap the ancillary piping associated with the USTs. The concrete tiedown pads at each site will also be removed. Some additional over-excavation of highly contaminated soils will be required, if encountered.

Soil sampling of the excavation limits is described in the specifications as are the disposal requirements of the contaminated soils and tank contents. Soil sampling for the Building 110 site

is per NY-DEC guidance "Spill Prevention Operations Technology Series - Site Assessments at Bulk Storage Facilities" and additional discussion with NY-DEC personnel (MR. Jack Marsh). Soil sampling for the Buldings 101 and 112 sites is based on discussions with Mr. John Greco of the NY-DEC.

Removal is the most effective method for closing the system's USTs. Soil samples can be obtained from directly beneath the tanks during the removal activities. Also, by removing the USTs, the potential for their interference with future construction and excavation activities is reduced. The location of the tanks makes removing them relatively easy.

UST closures are designed in accordance with U.S. EPA and NYDEC regulations.

2.2 CLOSURE OF JET FUEL TRANSFER PIPELINE

The Jet Fuel Transfer Pipeline consists of an abandoned 5600 LF steel fuel distribution pipeline. In-place closure of the Jet Fuel Transfer Pipeline is expected to be an effective, timely approach to permanent closure. In-place closure would create less disruption to the surrounding operations of Griffiss AFB. The Jet Fuel Transfer Pipeline would be drained, cleaned and capped to eliminate the possibility of future contaminant release.

The advantages of closure in place are:

- Adjacent buildings/structures are in less danger of structural damage due to excavation activities.
- Piping does not need to be disassembled and disposed off-site.
- Utilities, roads and other structures overlying the Jet Fuel Transfer Pipeline are not disturbed.

The abandoned JP-4 fuel transfer pipeline will be cleaned by using a hydraulically propelled polyurethane pipeline cleaner "pig." Compressed nitrogen will be used to force the "pig" through the pipe. The polyurethane flexible foam material allows the "pig" to negotiate 90° angles and any irregular size and shape pipe fittings. Several passes with various grades of "pigs" will dry and wipe the bore of the pipeline to removal any remaining JP-4 or residue. See Appendix B for additional information. This method was selected to prevent flushing large quantities of water through the pipeline, thus creating additional contaminated water to collect and dispose of. Compressed nitrogen will be used as the hydraulic propellant to prevent the development of a potentially combustible condition during the cleaning operation. Upon completion of pipe cleaning, the ends of the existing pipe will be capped in-place. Structures along the pipeline, such as manholes, valves, etc., will be removed and the pipeline will be capped in these areas.

2.3 PAVEMENTS

Existing Griffiss AFB pavement that is disturbed during the Removal Actions will be replaced to the original thickness and type of material removed by the Contractor. Law has received as-built drawings from Griffiss AFB detailing the exact sections of the pavements to be removed and has incorporated appropriate details into the drawings. However, the base has requested that entire pavements be removed in one area (Truck Fill Stand). This will eliminate pavement replacement in this area. The Base has also requested that the concrete pavement at Building #112 be removed and replaced with asphalt.

Two types of pavements are specified by Law at the request of the COE.

At the Yellow Submarine Site, the area disturbed by the removal of an underground storage tank, a rigid pavement was specified. This concrete pavement will be of the same cross-sectional characteristics as that of the surrounding pavement. The area is small (23.5' x 29.5') and will receive light traffic only. The joints (construction joints) with the adjacent pavement will be sealed with a cold, hand applied sealant. The pavement will be placed over 6 inches of selected aggregate. Technical Manuals TM 5-822-6 and TM 5-822-7 were used for reference

Flexible pavement was selected to be placed over the area of tank removal at Building #112. This area will receive light vehicle traffic. The area will be used mostly by pedestrians. For this reason a mix with small aggregate was specified to provide a smooth and soft surface as specified in Technical Manual TN 5-822-8, Bituminous Pavements Standard Practice.

2.4 SHORING

Excavation shoring will be required during the removal of the Yellow Submarine UST. A detailed shoring design has been prepared and included in this submittal. Law has conducted two soil borings at the site to obtain the geotechnical data necessary to design an adequate shoring system. This data is included in Appendix B.

At-rest (Ko) earth pressures were used to design a soldier pile and lagging system utilizing two levels of brace struts for the 19 feet deep excavation to the bottom of the existing concrete foundation and counterweight pad.

The excavation in plan is approximately 18' x 32'. The long axis of this excavation is parallel with Griffiss AFB Building #101. The inside face of the soldier piles are approximately 5.5' from the building wall. The bracing and excavation system as proposed

should allow the intact removal of the 10' (diameter) by 21' (length) tank. However, there is no compelling reason not to break up the tank during removal if contents have been removed. Well points or other drainage systems outside of the excavation area will be required to keep the ground-water level 1' below excavation limits at all times. The dewatering system will be designed by the Contractor.

The shoring system at this site was designed with the primary goal of limiting movement of the adjacent building. The at-rest earth pressures presume no soil movement. The struts will be prestressed to limit deflection of the system. The waler beams, and soldier piles were all designed with a sufficiently deep section to limit deflections. Struts will be installed near the excavation bottom as the excavation progresses.

The Contractor will be required to install the lagging sufficiently close to the excavation invert to reduce soil movements. The lagging is required to be in close contact with the soil.

All tank material and contents including the foundation are to be removed and disposed of in accordance with appropriate regulations. At the end of tank removal, excavation is to be compaction backfilled per specification with all excavation support systems to be removed in conjunction with backfilling including removal of soldier piles. A four foot sidewalk is to be repaired if damaged or restored if removed.

2.5 BASE COORDINATION

Throughout the process of removal actions, the contractor will be required to maintain an open communication with Griffiss AFB. To prevent possible conflict, the Contractor will need to obtain clearance from Griffiss AFB prior to the execution of each major

task (i.e., UST removals, utilities clearance, building demolition) in the project. Griffiss AFB points of contact will include but not be limited to: Base Operations, 416 CES/DEV, Base Civil Engineering, Base Security Police, and Base Fire Department. The contractor will prepare a Construction Staging Plan, showing a proposed schedule of remediation activities to be approved by Griffiss AFB points of contact prior to execution.

2.6 SITE SECURITY

The current submittal depicts limits of contractor work areas for the removal action sites. Law has incorporated into the specifications the type of site security fencing required at the sites. The fencing consists of high strength plastic mesh supported by 4-inch x 4-inch posts.

2.7 EROSION CONTROL

Erosion control devices will be required at each removal action site to prevent the migration of contaminated silt from the remediation activities. The Contractor will use erosion control devices such as silt fencing, and straw bale-filter fabric sediment barriers to "isolate" each work zone from its surrounding. This will aid in preventing the construction areas from becoming an "eye-sore" and detracting from the appearance of Griffiss AFB.

The Contractor will periodically clean the collected silt from the erosion control devices and properly dispose of the silt. The silt will be handled under the same criteria as all other waste soil encountered during remedial activities. Upon completion of each soil disturbing activity at each site, the Contractor will re-seed the area and provide straw to aid in complete grass restoration.

2.8 CONTRACTING

Law has carefully attempted to eliminate undefined quantities of construction. The desired approach to remedial contracting is to eliminate unknowns and require the contractor to bid and perform the work on a lump-sum basis. However, some qualities will remain undefined and thus require a unit rate bidding approach. This specifically involves disposal of contaminated (hazardous and non-hazardous) soil from the excavations and excavation and disposal from over-excavation of contaminated soil. Over-excavation and additional disposal to remove additionally contaminated soils will also require a unit rate approach. An additional unit rate item will involve the disposal of contaminated liquids from the Jet Fuel Transfer Pipeline. This approach attempts to eliminate contractual problems during construction between the contractor and CEMRK.

APPENDIX A

CHEMICAL SAMPLING AND ANALYSIS REPORT

CHEMICAL SAMPLING AND ANALYSIS REPORT
INTERIM REMOVAL ACTION DESIGN

FOR

GRIFFISS AIR FORCE BASE
ROME, NEW YORK

Prepared For:

U.S. Army Corps of Engineers
Kansas City District

Prepared By:

Law Environmental, Inc.
Government Services Branch
114 TownPark Drive
Kennesaw, Georgia 30144

AUGUST 1992

CHEMICAL SAMPLING AND ANALYSIS REPORT
INTERIM REMOVAL ACTION DESIGN
GRIFFISS AFB,NEW YORK
LAW PROJECT No. 11-1564

The field investigation for the Interim Removal Action Design at Griffiss AFB, involved an investigation of the ground water and Underground Storage Tanks (USTs) contents. Ground-water samples were planned to be collected for chemical analysis at the area of Pumphouse #5. UST contents were planned to be sampled also for chemical analysis based on the field conditions and conditions of the contents. Should there be more than one phase in the UST contents, each phase was planned to be sampled. Additionally, should there be any free product layer observed in tanks or in the ground water, it was planned to be sampled and sent to the Corps of Engineers Missouri River Division (CEMRD) laboratory for product identification.

Samples of the ground water and UST contents at Buildings 101 and 110 were collected as planned during the week of January 26, 1992. Two tanks located at the basement of Building 110 could not be accessed due to safety reasons. The samples from those tanks and the ground-water samples from the two newly installed monitoring wells at Building 101 and 110 were planned to be collected during the months of May, June and July 1992. One UST at Building 110 and the newly installed monitoring well at Building 101 was sampled during May 1992. A newly installed monitoring well at Building 110 was sampled during July 1992. The other UST at the basement of Building 110 was found to be empty.

The analyses were performed by two laboratories. The Princeton Testing Laboratory, located in Princeton, New Jersey, performed the analysis of all parameters except ethylene glycol. CTM Laboratories, located in Latham, New York, analyzed for ethylene glycol.

The data obtained from both laboratories were evaluated for the holding time compliance. Other quality control information, including blank contamination, surrogate recoveries, Matrix Spike/Matrix Spike Duplicate (MS/MSD) recoveries and Laboratory Control Spike recoveries, is included in the laboratory data package.

The quality of the data obtained from both laboratories was found to be acceptable. The holding time was exceeded for the BTEX analysis on Samples 771-MW4, 110-UST 3 and 110-UST 4, for mercury analysis for sample 112 UST 1 and TPH and BTEX analysis for the sample 110 UST-5. However, the samples indicated the presence of the analytes of interest at high levels indicating that the exceeding of holding time did not affect the quality of the data. Therefore the data were accepted as reported without any qualification. They were of sufficient quality to meet the overall project objective, which was to characterize the UST contents and the ground-water contamination at Building 771.

The results obtained from the analyses are summarized in the following sections. The data generated from the laboratories, field documentation, Daily Quality Control Reports, chain-of-custody records and Sample Tracking Tables (that verify holding times) are presented in Appendix A.

Building 101 (Yellow Submarine): UST Site

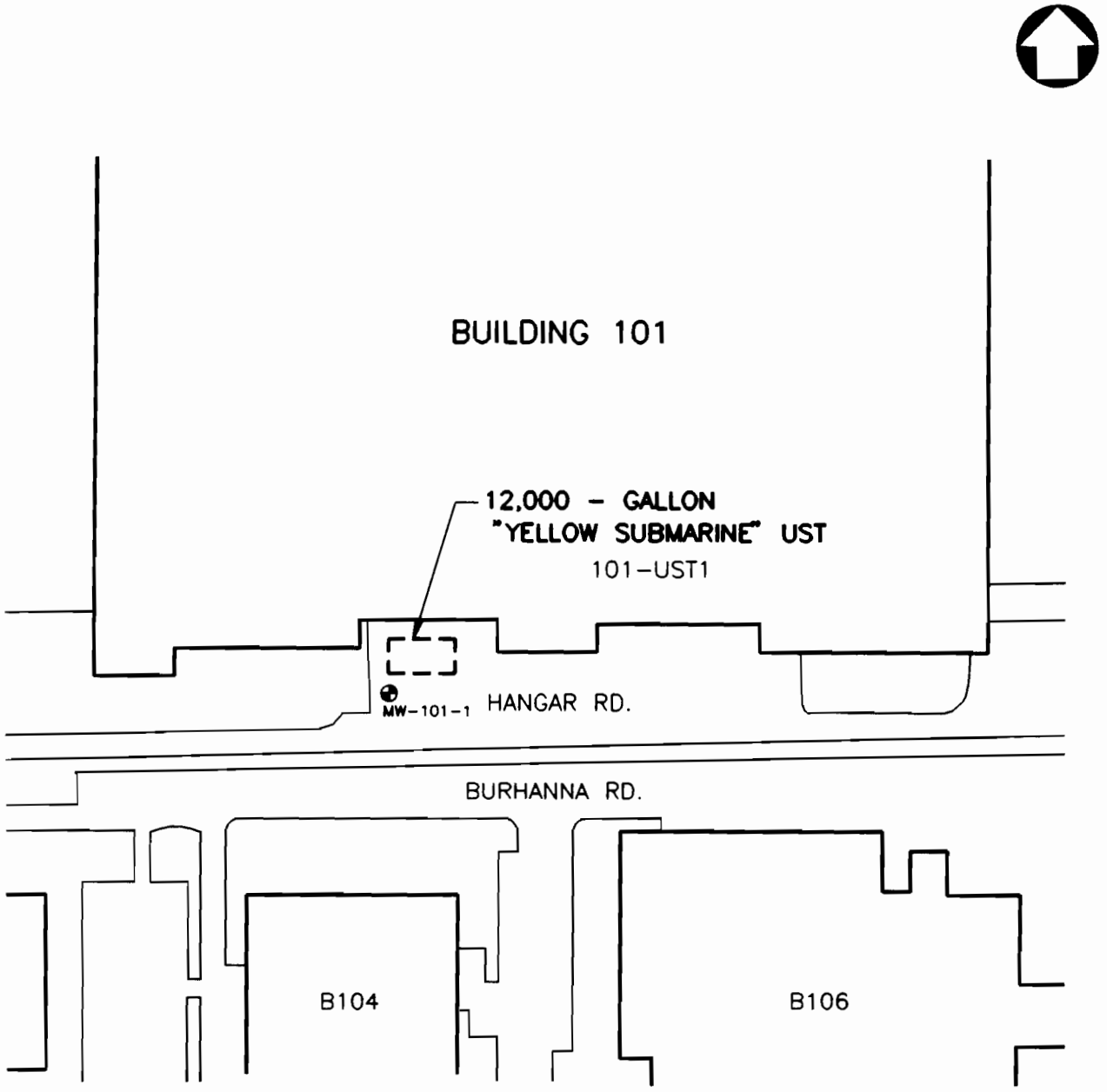
One 12,000-gallon UST, also known as Yellow Submarine, is located near Building 101 (see Figure 1). It is believed to previously have contained plating and solvent wastes. At present the tank is believed to contain water.

At the time of the sampling, the tank contents were found to have two phases: an aqueous and a sludge phase. Samples were collected from both phases and were analyzed for the following parameters:

FIGURE 1

CHEMICAL SAMPLING LOCATION AT YELLOW SUBMARINE UST – BUILDING 101

GRIFFISS AFB ROME, NEW YORK



SOURCE:
GRIFFISS AFB COMPREHENSIVE BASE MAP
FURNISHED BY GRIFFISS AFB.

0 200

SCALE IN FEET

1564LJ14

- Total cadmium, chromium, lead, nickel and silver
- Volatile Organic Analysis (VOA)
- Cyanide

The analytes detected in the aqueous and sludge phase and their respective concentrations are summarized below:

AQUEOUS PHASE (Sample No. 101 UST 1)

Cadmium	0.131	mg/L
Chromium	0.836	mg/L
Nickel	0.065	mg/L
Lead	2.46	mg/L
Cyanide	0.094	mg/L
Methylene Chloride	180JB	µg/L
Tetrachloroethylene	7300	µg/L
1,2-Trans Dichloroethylene	240J	µg/L
Trichloroethylene	1800	µg/L

SLUDGE PHASE

	101 UST 1	101 UST 101
Cadmium	140 mg/kg	26.2 mg/kg
Chromium	670 mg/kg	167 mg/kg
Nickel	71.6 mg/kg	19.97 mg/kg
Lead	1060 mg/kg	218 mg/kg
Cyanide	6.64 mg/kg	2.35 mg/kg
Benzene	ND	1900J µg/kg
1,1-Dichloroethylene	600 µg/kg	ND
Ethylbenzene	190 µg/kg	ND
Methylene Chloride	190 µg/kg	66000BJ µg/kg

	101 UST 1	101 UST 101
Tetrachloroethylene	6000000 µg/kg	6000000 µg/kg
Toluene	820 µg/kg	6200J µg/kg
1,2-Trans-Dichloroethylene	79000 µg/kg	210000 µg/kg
Trichloroethylene	960000 µg/kg	1700000 µg/kg

Building 101 (Yellow Submarine): UST Site

Ground Water sample

	101 MW1	101 MW101
Total Lead	0.098 mg/L	0.090 mg/L
Total Chromium	ND	0.118 mg/L
Cyanide	0.01 mg/L	ND
Methylene chloride	ND	2.1 µg/L
Tetrachloroethylene	56 µg/L	48 µg/L
1,2-Dichloroethylene	4.1 µg/L	3.9 µg/L
Trichloroethylene	36 µg/L	31 µg/L
Toluene	1.4 µg/L	3.1 µg/L

Building 110 : Jet Fuel Transfer Pipeline Site

There are six USTs located at Building 110 (see Figure 2). Two of them are 500-gallon capacity and are located in the basement of the building. They are believed to have been used as JP-4/water separators in the past. At present they are believed to contain water. The remaining four tanks are of 25,000-gallon capacity and are believed to contain JP-4 in the past. At present they are believed to contain water.

At the time of the sampling, all 50,000-gallon capacity tanks located outside the building were found to contain a layer of free product along with the aqueous layer. Samples of the free product were collected and sent to the CEMRD laboratory for the product identification. Aqueous phase of the tank contents was also sampled and was analyzed for the following parameters:

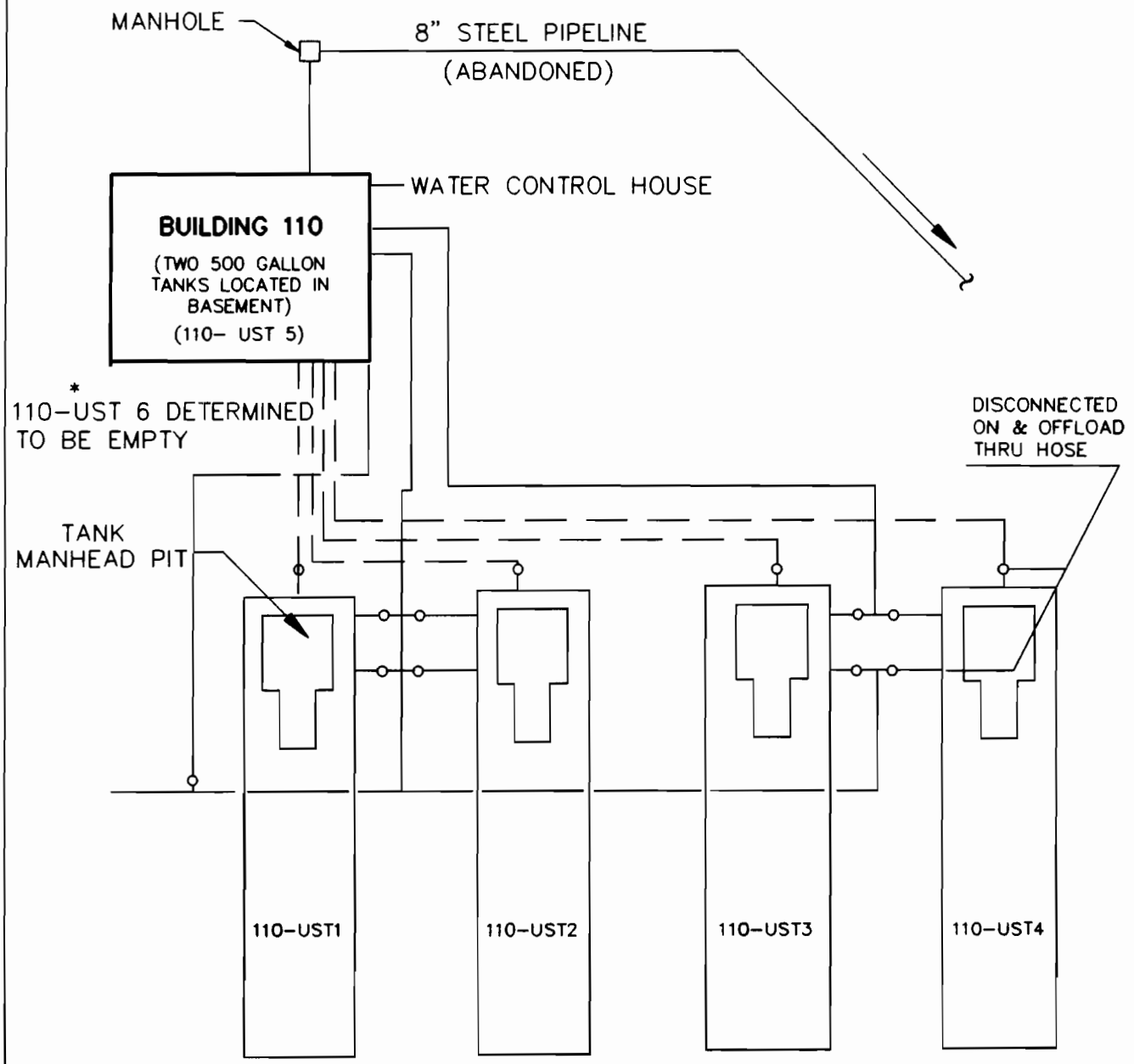
- Benzene, Toluene, Ethylbenzene and Xylene (BTEX).
- Total iron and lead
- Oil and grease
- Total Petroleum Hydrocarbons (TPH)

The analytes detected in the tank contents and their respective concentrations are listed below.

FIGURE 2

CHEMICAL SAMPLING LOCATIONS AT BUILDING # 110 SITE

GRIFFISS AFB ROME, NEW YORK



4 - 25,000 GALLON STORAGE TANKS (UNDERGROUND)

⊕ MW- 101-1

NOT TO SCALE

SOURCE:
AS-BUILT DRAWINGS OF AQUA-SYSTEM FURNISHED BY GRIFFISS AFB.

1564LJ15

Tank 1 (Sample No. 110 UST 1)

Benzene	5700 µg/L
Toluene	170 µg/L
Ethylbenzene	660 µg/L

Tank 1 (Sample No. 110 UST 1)

Xylenes	13000 µg/L
Iron	14.8 mg/L
Lead	0.156 mg/L
Oil and grease	2930 mg/L
Diesel	>90 %
Gasoline	619 ppm

Tank 2 (Sample No. 110 UST 2)

Benzene	15000 µg/L
Toluene	12000 µg/L
Ethylbenzene	790 µg/L
Xylenes	15000 µg/L
Iron	393 mg/L
Lead	0.0375 mg/L
Oil and grease	3010 mg/L
Diesel	>90 %
Gasoline	214.6 ppm

Tank 3 (Sample No. 110 UST 3)

Benzene	210 µg/L
Toluene	2.5 µg/L
Ethylbenzene	170 µg/L
Xylenes	3900 µg/L
Iron	521 mg/L
Lead	0.0384 mg/L
Oil and grease	31.5 mg/L
Diesel	19000 µg/L
Gasoline	9.6 ppm

Tank 4 (Sample No. 110 UST 4)

Benzene	3000 µg/L
Toluene	2800 µg/L
Ethylbenzene	720 µg/L
Xylenes	9400 µg/L
Iron	21.6 mg/L
Lead	0.0235 mg/L
Oil and grease	314 mg/L

Tank 4 (Sample No. 110 UST 4)

Diesel	36800 µg/L
Gasoline	49 ppm

Tank 5 (Sample No. 110 UST 5)

	110 UST 5	110 UST 501
Benzene	33000 µg/L	40000 µg/L
Toluene	50000 µg/L	61000 µg/L
Ethylbenzene	5000 µg/L	7400 µg/L
Xylenes	33000 µg/L	4600 µg/L
Iron	3480 mg/L	569 mg/L
Lead	5.29 mg/L	7.82 mg/L
Oil and grease	20990 mg/L	13180 mg/L
Gasoline	ND	153 mg/L

Building 110: Ground-Water Sample

	110 MW1***	110 MW101***
Total Lead	0.0105 mg/L	0.0084 mg/L
Total Copper	0.031 mg/L	ND
Naphthalene	9J µg/L	7J µg/L
Phenanthrene	11 µg/L	10 µg/L
Methylene chloride	1.9J µg/L	1.8J µg/L
Acetone	5.1 µg/L	14 µg/L
Benzene	1.4J µg/L	2.6J µg/L
Toluene	2.4J µg/L	3.3J µg/L
Ethylbenzene	8.4 µg/L	9.5 µg/L
Xylenes	14 µg/L	14 µg/L

*** Data not reviewed; subject to change

Building 112: UST Site

Three USTs are located near Building 112 (see Figure 3). They are approximately 500-gallon capacity and are believed to have contained JP-4 or AV-gas fuel in the past. At present two tanks contain water and the one tank contains sand (inert material).

At the time of sampling it was found that the middle tank contained sand and the other two contained water. Samples were collected from the tanks containing water. A stainless-steel bailer was used to collect samples from Tank No. 2. The samples were analyzed for the parameters listed below. The tank containing sand was not sampled.

- VOA
- BNA
- Pesticide/PCBs
- Total arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver
- Oil and grease

The analytes detected in the tank contents and their respective concentrations are listed below.

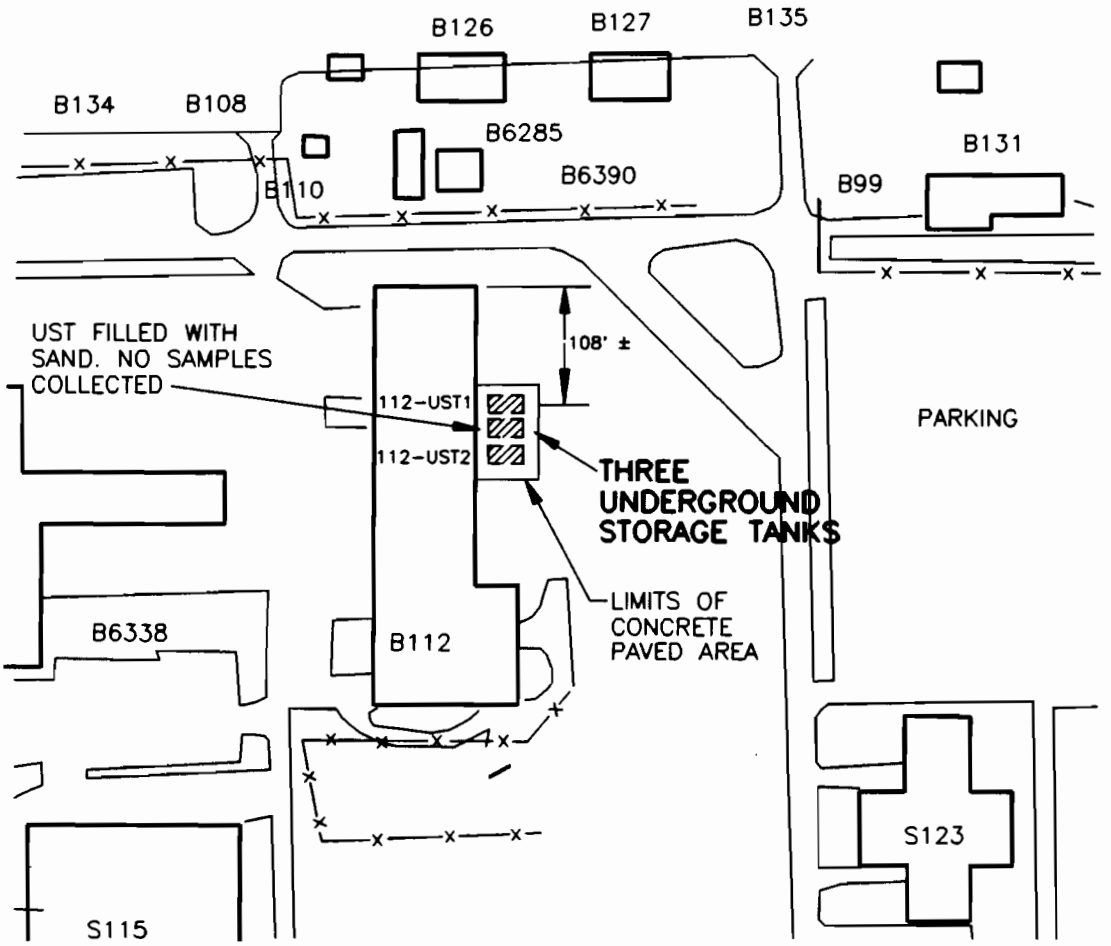
Tank 1 (Sample No. 112 UST 1)

Methylene Chloride	200JB µg/L
Toluene	125J µg/L
2,4-Dimethylphenol	6J µg/L
4,6-Dinitro-o-cresol	1J µg/L
4-Nitrophenol	9J µg/L
Anthracene	2J µg/L
bis(2-Ethylhexyl)phthalate	2JB µg/L
Butylbenzyl Phthalate	2JB µg/L
Fluorene	15 µg/L
Naphthalene	1J µg/L
Phenanthrene	8J µg/L
Pyrene	1J µg/L

FIGURE 3

CHEMICAL SAMPLING LOCATIONS AT UNDERGROUND STORAGE TANKS – BUILDING 112

GRIFFISS AFB ROME, NEW YORK



0 300

SCALE IN FEET

1564LJ16

Lead	0.030 mg/L
Barium	0.0168 mg/L
Oil and grease	16 mg/L

Tank 2 (Sample No. 112 UST 2)

	112 UST 2	112 UST 201
Benzene	36 µg/L	35 µg/L
Ethylbenzene	ND	14J µg/L
Methyl chloride	17J µg/L	15J µg/L
Methylene chloride	110000 µg/L	96000 µg/L
Tetrachloroethylene	180 µg/L	480 µg/L
Toluene	47 µg/L	37 µg/L
1,2-trans-Dichloroethylene	440 µg/L	320 µg/L
Trichloroethylene	51000 µg/L	53000 µg/L
Isophorone	31J µg/L	ND
Naphthalene	ND	28J µg/L
Barium	1.01 mg/L	1.18 mg/L
Chromium	0.034 mg/L	ND
Lead	0.262 mg/L	0.555 mg/L
Mercury	0.0076 mg/L	0.0112 mg/L
Oil and grease	97.2 mg/L	62.9 mg/L

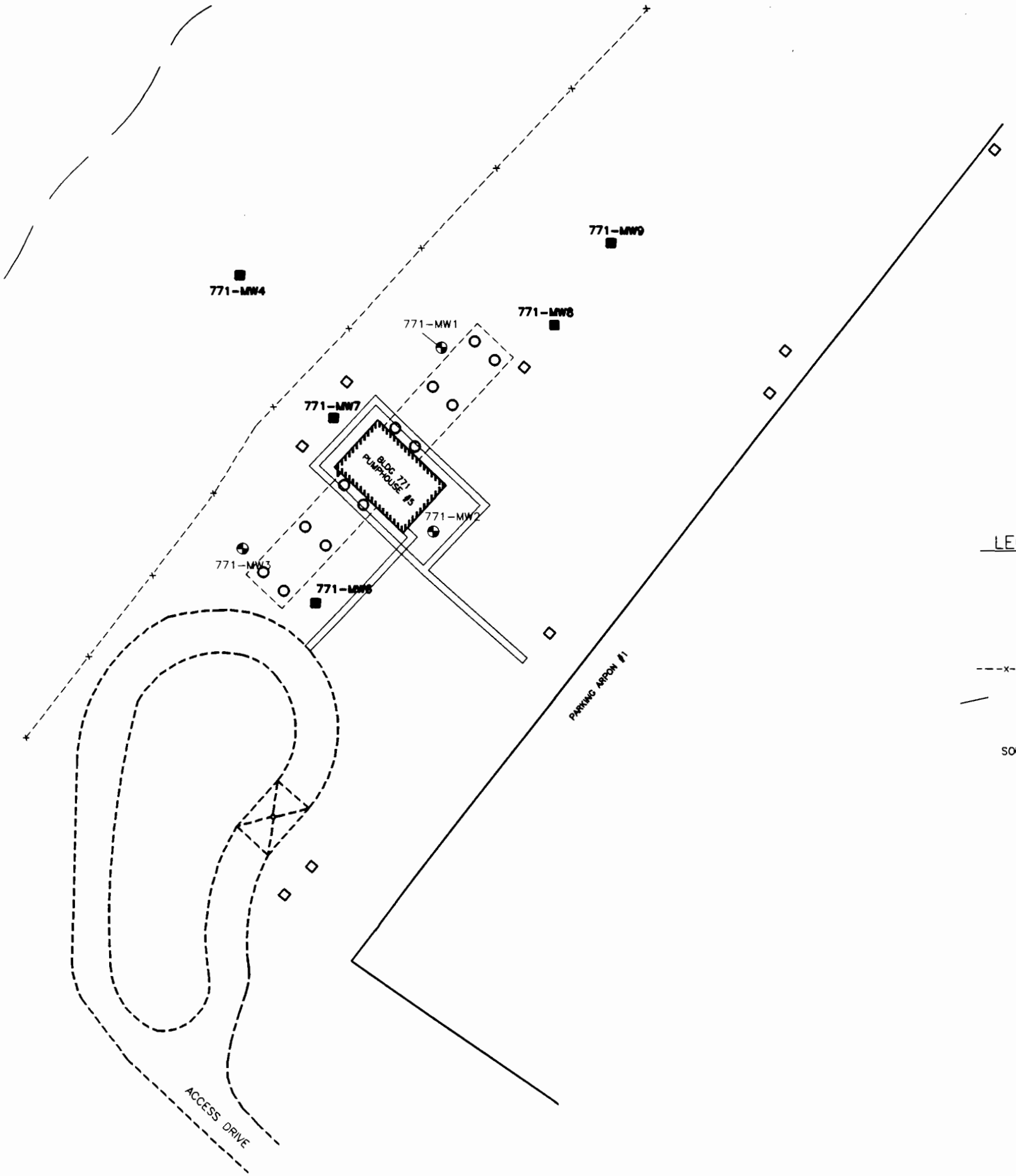
Pumphouse #5: Free Product Recovery Site

A total of six monitoring wells were planned to be sampled (see Figures 4 and 5). They are numbered as follows:

- 771-MW4
- 771-MW5
- 771-MW6
- 771-MW7
- 771-MW8
- 771-MW9

The ground-water samples collected from these monitoring wells were numbered according to the well numbers in the laboratory results.

FIGURE 4
CHEMICAL SAMPLING LOCATIONS AT PUMPHOUSE #5 (BUILDING NO. 771)
GRIFFISS AFB – ROME, NEW YORK



LEGEND

- EXISITNG MONITORING WELLS
- NEW MONITORING WELLS
- PITS
- FENCE (CHAINLINK)
- CREEK

SOURCE:
AS-BUILT TOPOGRAPHICAL SURVEY BY LAW ENVIRONMENTAL, INC. NOVEMBER, 1991.

0 60 120
SCALE IN FEET

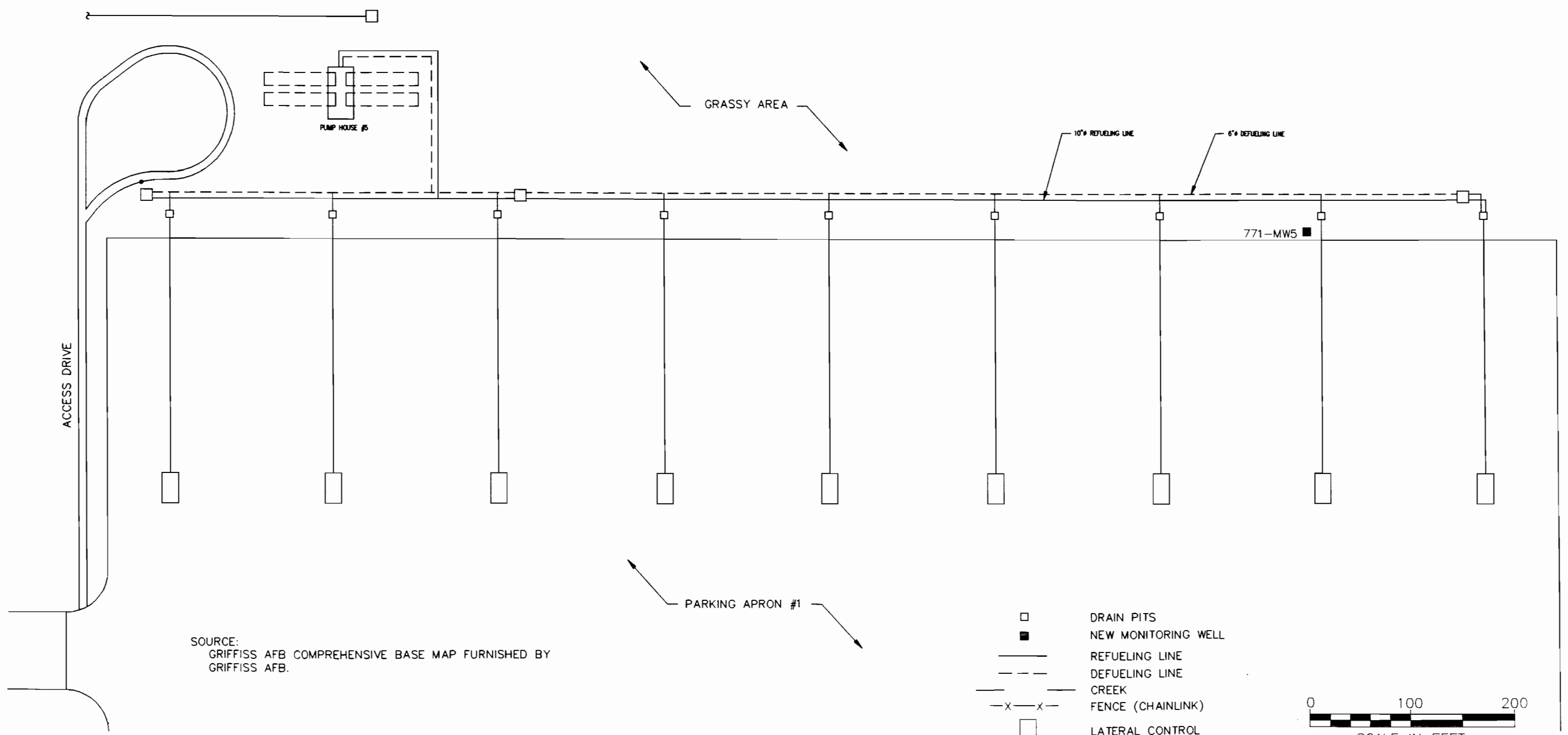
1564LJ17

LAW ENVIRONMENTAL INC.
GOVERNMENT SERVICES BRANCH

FIGURE 5

CHEMICAL SAMPLING LOCATION AT PARKING APRON #1

GRIFFISS AFB – ROME, NEW YORK



SOURCE:
GRIFFISS AFB COMPREHENSIVE BASE MAP FURNISHED BY GRIFFISS AFB.

1564LJ18

A layer of free product was expected in monitoring wells 771-MW4 and 771-MW7. The layer in monitoring well was thick enough (>0.5 ft.) to collect the sample. The free product was sampled and sent to the CEMRD laboratory for the product identification. A ground-water sample was not collected from this monitoring well. The layer in monitoring well 771-MW4 was not thick enough (0.2 ft) to collect the sample; therefore, only ground-water was collected from this well. All remaining monitoring wells were sampled and analyzed for the following parameters:

- BTEX
- TPH
- Total and dissolved lead
- Glycol

The analytes detected in the ground-water and their respective concentrations are listed below.

771-MW4

Benzene	5200 µg/L
Toluene	610 µg/L
Ethylbenzene	610 µg/L
Xylenes	7500 µg/L
Gasoline	28.5 mg/L
Lead, Total	0.0376 mg/L
Lead, Dissolved	0.0023 mg/L

771-MW5

Gasoline	0.2 mg/L
Lead, Total	0.0057 mg/L

771-MW6

Lead, total	0.0418 mg/L
Gasoline	0.2 mg/L

771-MW8 and 771-MW801

	771-MW8	771-MW801
Benzene	750 µg/L	11000 µg/L
Toluene	250 µg/L	2400 µg/L
Ethylbenzene	1100 µg/L	1200 µg/L
Xylenes	6600 µg/L	16000 µg/L
Diesel	13400 µg/L	ND
Gasoline	99.5 mg/L	65.5 mg/L
Lead, Total	0.0536 mg/L	0.0584 mg/L

771-MW9

Gasoline	0.6 mg/L
Lead, Total	0.0247 mg/L

Notes:

J Concentration estimated
B Analyte also found in the Method Blank

The tables summarizing all analytical results are presented in the following sections.

GRI[illegible] AF[illegible]

PARAMETER	101-UST-101SL	101-UST-1AQ	101-UST-1SL
Solids And Soils, Method SW-846 6010:			
Cadmium	26.2 mg/kg	0.131 mg/L	140 mg/kg
Chromium	167 mg/kg	0.836 mg/L	670 mg/kg
Cyanide	2.35 mg/kg	.094 mg/L	6.64 mg/kg
Lead	218 mg/kg	2.46 mg/L	1060 mg/kg
Nickel	19.97 mg/kg	0.065 mg/L	71.6 mg/kg
Silver	<0.05 mg/kg	<0.01 mg/L	<0.05 mg/kg
Volatile Organics By GCMS - Method 8240:			
1,1,1-Trichloroethane	<8600 µg/kg	<250 µg/L	<270 µg/kg
1,1,2,2-Tetrachloroethane	<8600 µg/kg	<250 µg/L	<270 µg/kg
1,1,2-Trichloroethane	<8600 µg/kg	<250 µg/L	<270 µg/kg
1,1-Dichloroethane	<8600 µg/kg	<250 µg/L	<270 µg/kg
1,1-Dichloroethylene (1,1-Dichloroethene)	<8600 µg/kg	<250 µg/L	600 µg/kg
1,2-Dichloropropane	<8600 µg/kg	<250 µg/L	<540 µg/kg
1,2-Dichlorothane	<8600 µg/kg	<250 µg/L	<270 µg/kg
1,2-Trans-Dichloroethylene	210000# µg/kg	240 J µg/L	79000 µg/kg
1,3-Dichloropropylene (1,3-Dichloropropene)	<8600 µg/kg	<250 µg/L	<540 µg/kg
2-Chloroethylvinyl ether	<8600 µg/kg	<250 µg/L	<540 µg/kg
Acrolein	<86000 µg/kg	<250 µg/L	<27000 µg/kg
Acrylonitrile	<86000 µg/kg	<250 µg/L	<27000 µg/kg
Benzene	1900J µg/kg	<250 µg/L	<270 µg/kg
Bromoform (Tribromomethane)	<8600 µg/kg	<250 µg/L	<270 µg/kg
Carbon Tetrachloride (Tetrachloromethane)	<8600 µg/kg	<250 µg/L	<270 µg/kg
Chlorobenzene	<8600 µg/kg	<250 µg/L	<270 µg/kg
Chlorodibromomethane (Dibromochloromethane)	<8600 µg/kg	<250 µg/L	<270 µg/kg
Chloroethane	<17000 µg/kg	<500 µg/L	<100 µg/kg
Chloroform(Trichloromethane)	<8600 µg/kg	<250 µg/L	<270 µg/kg
Dichlorobromomethane (Bromodichloremethane)	<8600 µg/kg	<250 µg/L	<270 µg/kg
Ethylbenzene	<8600 µg/kg	<250 µg/L	190 µg/kg
Methyl bromide (Bromomethane)	<17000 µg/kg	<500 µg/L	<540 µg/kg
Methyl chloride (Chloromethane)	<17000 µg/kg	<500 µg/L	<540 µg/kg
Methylene chloride (Dichloromethane)	6600JB µg/kg	180 JB µg/L	190 µg/kg
Tetrachloroethylene (Tetrachloroethene)	6000000# µg/kg	7300 µg/L	6000000# µg/kg
Toluene	6200J µg/kg	<250 µg/L	820 µg/kg
Trichloroethylene (Trichloroethene)	1700000# µg/kg	1800 µg/L	960000 µg/kg
Vinyl chloride (Chloroethylene:Chloroethene)	<17000 µg/kg	<500 µg/L	<540 µg/kg

\# Concentration over the upper range limit (URL)
* Results from the diluted sample
AQ Aqueous Sample
J Concentration estimated
B Also found in associated method blank.
SL Sludge Sample

GRIFFISS

PARAMETER	110-UST-1	110-UST-2	110-UST-3	110-UST-4
Benzene, Toluene, Ethylbenzene & Xylenes In Liquid				
Benzene	5700* µg/L	15000* µg/L	210* µg/L	3000* µg/L
Ethylbenzene	660* µg/L	790* µg/L	170* µg/L	720* µg/L
Toluene	170* µg/L	12000* µg/L	2.5* µg/L	2800* µg/L
Xylenes	13000* µg/L	15000* µg/L	3900* µg/L	9400* µg/L
Iron In Water Method 200.7				
Iron	14.8 mg/L	393 mg/L	521 mg/L	21.6 mg/L
Lead In Liquids By GFAA, Method 239.2				
Lead by GFAA	0.156 mg/L	.0375 mg/L	.0384 mg/L	0.0235 mg/L
Oil And Grease (Gravimetric) EPA 413.1				
Oil and Grease (Gravimetric)	2930 mg/L	3010 mg/L	31.5 mg/L	314 mg/L
Total Petroleum Hydrocarbons - CAL DHS, Diesel				
Diesel	>90%	>90%	19000 µg/L	36800 µg/L
Gasoline by GCMS	619 ppm	214.6 ppm	9.6 ppm	49 ppm

\# Concentration over the upper range limit (URL)
* Results from the diluted sample
J Concentration estimated
B Also found in associated method blank.

PARAMETER	112-UST-1	112-UST-2	112-UST-201
Acid Extractables By GCMS (8270) In Liquid Sample			
2,4,6-Trichlorophenol	<10 µg/L	<200 µg/L	<200 µg/L
2,4-Dichlorophenol	<10 µg/L	<200 µg/L	<200 µg/L
2,4-Dimethylphenol	6J µg/L	<200 µg/L	<200 µg/L
2,4-Dinitrophenol	<50 µg/L	<1000 µg/L	<1000 µg/L
2-Chlorophenol	<10 µg/L	<200 µg/L	<200 µg/L
2-Nitrophenol	<10 µg/L	<200 µg/L	<200 µg/L
4,6-Dinitro-o-cresol	1J µg/L	<1000 µg/L	<1000 µg/L
4-Nitrophenol	9J µg/L	<1000 µg/L	<1000 µg/L
Pentachlorophenol	<50 µg/L	<1000 µg/L	<1000 µg/L
Phenol	<10 µg/L	<200 µg/L	<200 µg/L
p-Chloro-m-cresol (4-Chloro-3-methylphenol)	<10 µg/L	<200 µg/L	<200 µg/L
Base/Neutral Extractable-Aqueous-Method 8270			
1,2,4-Trichlorobenzene	<10 µg/L	<200 µg/L	<200 µg/L
1,2-Dichlorobenzene	<10 µg/L	<200 µg/L	<200 µg/L
1,2-Diphenylhydrazine	<10 µg/L	<200 µg/L	<200 µg/L
1,3-Dichlorobenzene	<10 µg/L	<200 µg/L	<200 µg/L
1,4-Dichlorobenzene	<10 µg/L	<200 µg/L	<200 µg/L
2,4-Dinitrotoluene	<10 µg/L	<200 µg/L	<200 µg/L
2,6-Dinitrotoluene	<10 µg/L	<200 µg/L	<200 µg/L
2-Chloronaphthalene	<10 µg/L	<200 µg/L	<200 µg/L
3,3'-Dichlorobenzidine	<10 µg/L	<200 µg/L	<200 µg/L
3,4-Benzofluoranthene	<10 µg/L	<200 µg/L	<200 µg/L
4-Bromophenyl phenyl ether	<10 µg/L	<200 µg/L	<200 µg/L
4-Chlorophenyl Phenyl Ether	<10 µg/L	<200 µg/L	<200 µg/L
Acenaphthene	<10 µg/L	<200 µg/L	<200 µg/L
Acenaphthylene	<10 µg/L	<200 µg/L	<200 µg/L
Anthracene	2J µg/L	<200 µg/L	<200 µg/L
Benzidine	<10 µg/L	<200 µg/L	<200 µg/L
Benzo(a)anthracene (1,2-Benzoanthracene)	<10 µg/L	<200 µg/L	<200 µg/L
Benzo(a)pyrene (3,4-Benzopyrene)	<10 µg/L	<200 µg/L	<200 µg/L
Benzo(g,h,i)perylene (1,12-Benzoperylene)	<10 µg/L	<200 µg/L	<200 µg/L
Benzo(k)fluoranthene (11,12-Benzofluoranthene	<10 µg/L	<200 µg/L	<200 µg/L
Butylbenzyl Phthalate	2JB µg/L	<200 µg/L	<200 µg/L

PARAMETER	112-UST-1	112-UST-2	112-UST-201
Chrysene	<10 µg/L	<200 µg/L	<200 µg/L
Di-n-butyl phthalate	<10 µg/L	<200 µg/L	<200 µg/L
Di-n-octyl phthalate	<10 µg/L	<200 µg/L	<200 µg/L
Dibenzo(a,h)anthracene	<10 µg/L	<200 µg/L	<200 µg/L
Diethyl phthalate	<10 µg/L	<200 µg/L	<200 µg/L
Dimethyl phthalate	<10 µg/L	<200 µg/L	<200 µg/L
Fluoranthene	<10 µg/L	<200 µg/L	<200 µg/L
Fluorene	15 µg/L	<200 µg/L	<200 µg/L
Hexachlorobenzene	<10 µg/L	<200 µg/L	<200 µg/L
Hexachlorobutadiene	<10 µg/L	<200 µg/L	<200 µg/L
Hexachlorocyclopentadiene	<10 µg/L	<200 µg/L	<200 µg/L
Hexachloroethane	<10 µg/L	<200 µg/L	<200 µg/L
Indeno(1,2,3-cd)pyrene	<10 µg/L	<200 µg/L	<200 µg/L
Isophorone	<10 µg/L	31J µg/L	<200 µg/L
N-Nitrosodi-n-propylamine	<10 µg/L	<200 µg/L	<200 µg/L
N-Nitrosodimethylamine	<10 µg/L	<200 µg/L	<200 µg/L
N-nitrosodiphenylamine	<10 µg/L	<200 µg/L	<200 µg/L
Naphthalene	1J µg/L	<200 µg/L	28J µg/L
Nitrobenzene	<10 µg/L	<200 µg/L	<200 µg/L
Phenanthrene	8J µg/L	<200 µg/L	<200 µg/L
Pyrene	1J µg/L	<200 µg/L	<200 µg/L
bis(2-Chloroethoxy)methane	<10 µg/L	<200 µg/L	<200 µg/L
bis(2-Chloroethyl)ether	<10 µg/L	<200 µg/L	<200 µg/L
bis(2-Chloroisopropyl)ether	<10 µg/L	<200 µg/L	<200 µg/L
bis(2-Ethylhexyl)phthalate	2JB µg/L	<200 µg/L	<200 µg/L
Heavy Metals In Liquid			
Arsenic	<.01 mg/L	<.01 mg/L	<.01 mg/L
Barium	0.0168 mg/L	1.01 mg/L	1.18 mg/L
Cadmium	<.005 mg/L	<.005 mg/L	<.005 mg/L
Chromium	<.01 mg/L	0.034 mg/L	<.01 mg/L
Lead	0.03 mg/L	0.262 mg/L	0.555 mg/L
Mercury	NA mg/L	0.0076 mg/L	0.0112 mg/L
Selenium	<.005 mg/L	<.005 mg/L	<.005 mg/L
Silver	<.01 mg/L	<.01 mg/L	<.01 mg/L

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PARAMETER	112-UST-1	112-UST-2	112-UST-201
Oil And Grease (Gravimetric) EPA 413.1			
Oil and Grease (Gravimetric)	16 mg/L	97.2 mg/L	62.9 mg/L
Pesticides & PCB's - Aqueous- Method 8080			
4,4-DDD	<1.0 µg/L	<.1 µg/L	<.1 µg/L
4,4-DDE	<0.4 µg/L	<.04 µg/L	<.04 µg/L
4,4-DDT	<1.0 µg/L	<.1 µg/L	<.1 µg/L
Aldrin	<0.4 µg/L	<.04 µg/L	<.04 µg/L
BHC, Alpha	<0.4 µg/L	<.04 µg/L	<.04 µg/L
BHC, Beta	<0.4 µg/L	<.04 µg/L	<.04 µg/L
BHC, Delta	<0.4 µg/L	<.04 µg/L	<.04 µg/L
BHC, Gamma (Lindane)	<0.4 µg/L	<.04 µg/L	<.04 µg/L
Chlordane	<2.9 µg/L	<.29 µg/L	<.29 µg/L
Dieldrin	<0.4 µg/L	<.04 µg/L	<.04 µg/L
Endosulfan Sulfate	<1.0 µg/L	<.1 µg/L	<.1 µg/L
Endosulfan, Alpha	<0.4 µg/L	<.04 µg/L	<.04 µg/L
Endosulfan, Beta	<1.0 µg/L	<.1 µg/L	<.1 µg/L
Endrin	<0.4 µg/L	<.04 µg/L	<.04 µg/L
Endrin Aldehyde	<2.5 µg/L	<.25 µg/L	<.25 µg/L
Heptachlor	<0.4 µg/L	<.04 µg/L	<.04 µg/L
Heptachlor Epoxide	<0.4 µg/L	<.04 µg/L	<.04 µg/L
PCB-A1016	<5.5 µg/L	<.55 µg/L	<.55 µg/L
PCB-A1221	<10 µg/L	<1.0 µg/L	<1 µg/L
PCB-A1232	<10 µg/L	<1.0 µg/L	<1 µg/L
PCB-A1242	<10 µg/L	<1.0 µg/L	<1 µg/L
PCB-A1248	<10 µg/L	<1.0 µg/L	<1 µg/L
PCB-A1254	<10 µg/L	<1.0 µg/L	<1 µg/L
PCB-A1260	<10 µg/L	<1.0 µg/L	<1 µg/L
Toxaphene	<7.5 µg/L	<.75 µg/L	<.75 µg/L
Volatile Organics By GCMS - Method 8240			
1,1,1-Trichloroethane	<250 µg/L	<25 µg/L	<25 µg/L
1,1,2,2-Tetrachloroethane	<250 µg/L	<25 µg/L	<25 µg/L
1,1,2-Trichloroethane	<250 µg/L	<25 µg/L	<25 µg/L

PARAMETER	112-UST-1	112-UST-2	112-UST-201
1,1-Dichloroethane	<250 µg/L	<25 µg/L	<25 µg/L
1,1-Dichloroethylene (1,1-Dichloroethene)	<250 µg/L	<25 µg/L	<25 µg/L
1,2-Dichloropropane	<250 µg/L	<25 µg/L	<25 µg/L
1,2-Dichlorothane	<250 µg/L	<25 µg/L	<25 µg/L
1,2-Trans-Dichloroethylene	<250 µg/L	440 µg/L	320 µg/L
1,3-Dichloropropylene (1,3-Dichloropropene)	<250 µg/L	<25 µg/L	<25 µg/L
2-Chloroethylvinyl ether	<250 µg/L	<25 µg/L	<25 µg/L
Acrolein	<2500 µg/L	<250 µg/L	<250 µg/L
Acrylonitrile	<2500 µg/L	<250 µg/L	<250 µg/L
Benzene	<250 µg/L	36 µg/L	35 µg/L
Bromoform (Tribromomethane)	<250 µg/L	<25 µg/L	<25 µg/L
Carbon Tetrachloride (Tetrachloromethane)	<250 µg/L	<25 µg/L	<25 µg/L
Chlorobenzene	<250 µg/L	<25 µg/L	<25 µg/L
Chlorodibromomethane (Dibromochloromethane)	<250 µg/L	<25 µg/L	<25 µg/L
Chloroethane	<500 µg/L	<50 µg/L	<50 µg/L
Chloroform(Trichloromethane)	<250 µg/L	<25 µg/L	<25 µg/L
Dichlorobromomethane (Bromodichloremethane)	<250 µg/L	<25 µg/L	<25 µg/L
Ethylbenzene	<250 µg/L	<25 µg/L	14J µg/L
Methyl bromide (Bromomethane)	<500 µg/L	<50 µg/L	<50 µg/L
Methyl chloride (Chloromethane)	<500 µg/L	17J µg/L	15J µg/L
Methylene chloride (Dichloromethane)	200JB µg/L	110,000# µg/L	96000 # µg/L
Tetrachloroethylene (Tetrachloroethene)	<250 µg/L	180 µg/L	480 µg/L
Toluene	125J µg/L	47 µg/L	37 µg/L
Trichloroethylene (Trichloroethene)	<250 µg/L	51,000# µg/L	53000 # µg/L
Vinyl chloride (Chloroethylene:Chloroethene)	<500 µg/L	<50 µg/L	<50 µg/L

\# Concentration over the upper range limit (URL)
* Results from the diluted sample
J Concentration estimated
B Also found in associated method blank.

PARAMETER	771-MW-4	771-MW-5	771-MW-6	771-MW-8
Benzene, Toluene, Ethylbenzene & Xylenes In Liquid				
Benzene	5200* µg/L	<0.5 µg/L	<0.5 µg/L	750* µg/L
Ethylbenzene	610* µg/L	<0.5 µg/L	<0.5 µg/L	1100* µg/L
Toluene	610* # µg/L	<0.5 µg/L	<0.5 µg/L	250* µg/L
Xylenes	7500* µg/L	<1.0 µg/L	<1.0 µg/L	6600* µg/L
Lead In Liquids By GFAA, Method 239.2				
Lead by GFAA	.0376 mg/L	0.0057 mg/L	0.0418 mg/L	.0536 mg/L
Lead, Dissolved, In Water By GFAA, Method 239.2				
Lead, Dissolved, By GFAA	.0023 mg/L	<0.002 mg/L	<.002 mg/L	<.002 mg/L
Total Petroleum Hydrocarbons - CAL DHS, Diesal				
Diesel	<500 µg/L	<500 µg/L	<500 µg/L	13400 µg/L
Gasoline	28.5 ppm	0.2 ppm	0.2 ppm	99.5 ppm
Ethylene Glycol	<0.05 mg/L	<0.04 mg/L	<0.04 mg/L	<0.04 mg/L

\# Concentration over the upper range limit (URL)
* Results from the diluted sample
J Concentration estimated
B Also found in associated method blank.

PARAMETER	771-MW-801	771-MW-9
Benzene, Toluene, Ethylbenzene & Xylenes In Liquid		
Benzene	11000* µg/L	<0.5 µg/L
Ethylbenzene	1200* µg/L	<0.5 µg/L
Toluene	2400* µg/L	<0.5 µg/L
Xylenes	16000* µg/L	<1.0 µg/L
Lead In Liquids By GFAA, Method 239.2		
Lead by GFAA	0.0584 mg/L	0.0247 mg/L
Lead, Dissolved, In Water By GFAA, Method 239.2		
Lead, Dissolved, By GFAA	<.002 mg/L	<.002 mg/L
Total Petroleum Hydrocarbons - CAL DHS, Diesal		
Diesel	<500 µg/L	<500 µg/L
Gasoline	65.5 ppm	0.6 ppm
Ethylene Glycol	<0.04 mg/L	<0.04 mg/L

\# Concentration over the upper range limit (URL)
* Results from the diluted sample
J Concentration estimated
B Also found in associated method blank.

APPENDIX B

CIVIL DESIGN SUPPORT DOCUMENTS

ASBESTOS INVENTORY

FACILITY NO 110

SUMMARY OF FINDINGS:

DATE 11/21/91

This facility does not contain any thermal insulation. The only material in this facility that would contain asbestos would be the gaskets in the fuel piping system and associated pumps, values etc. No samples were taken.

Note: The pumping facility at the corner of Hanger Road and Otis Street also has no thermal insulation and any asbestos would be associated with the fuel system as is in B-110. No samples were taken.

SKETCH:

James K Scott
SIGNATURE

ASBESTOS RELATED DOCUMENT
DO NOT DISCARD
MAINTAIN INDEFINITELY IAW
HQ USAF POLICY

GROUNDWATER MONITORING WELL INSTALLATION,
SOIL TEST BORING AND CONCRETE CORE
INTERIM REMOVAL ACTION DESIGN
GRIFFISS AIR FORCE BASE, NEW YORK

parratt wolff inc
FISHER RD. EAST SYRACUSE, N.Y. 13057
TELEPHONE AREA CODE 315/437-1429
FAX 315/437-1770

June 25, 1992

Mr. Michael E. Bartenfeld
Law Environmental, Inc.
Government Services Branch
114 Town Park Drive - 4th Floor
Kennesaw, Georgia 30144-5508

Re: 92148
Interim Removal Action Design
Griffiss Air Force Base, New York

Dear Mr. Bartenfeld:

Enclosed are driller's field logs of a groundwater monitoring well, a soil test boring and a concrete core made for you for the above project.

Soil samples from the drilling were retained by your representative at the job site.

Boring and well locations were established in the field by you. Drilling, sampling and the well installation were done at your direction.

Thank you for this opportunity to work with you.

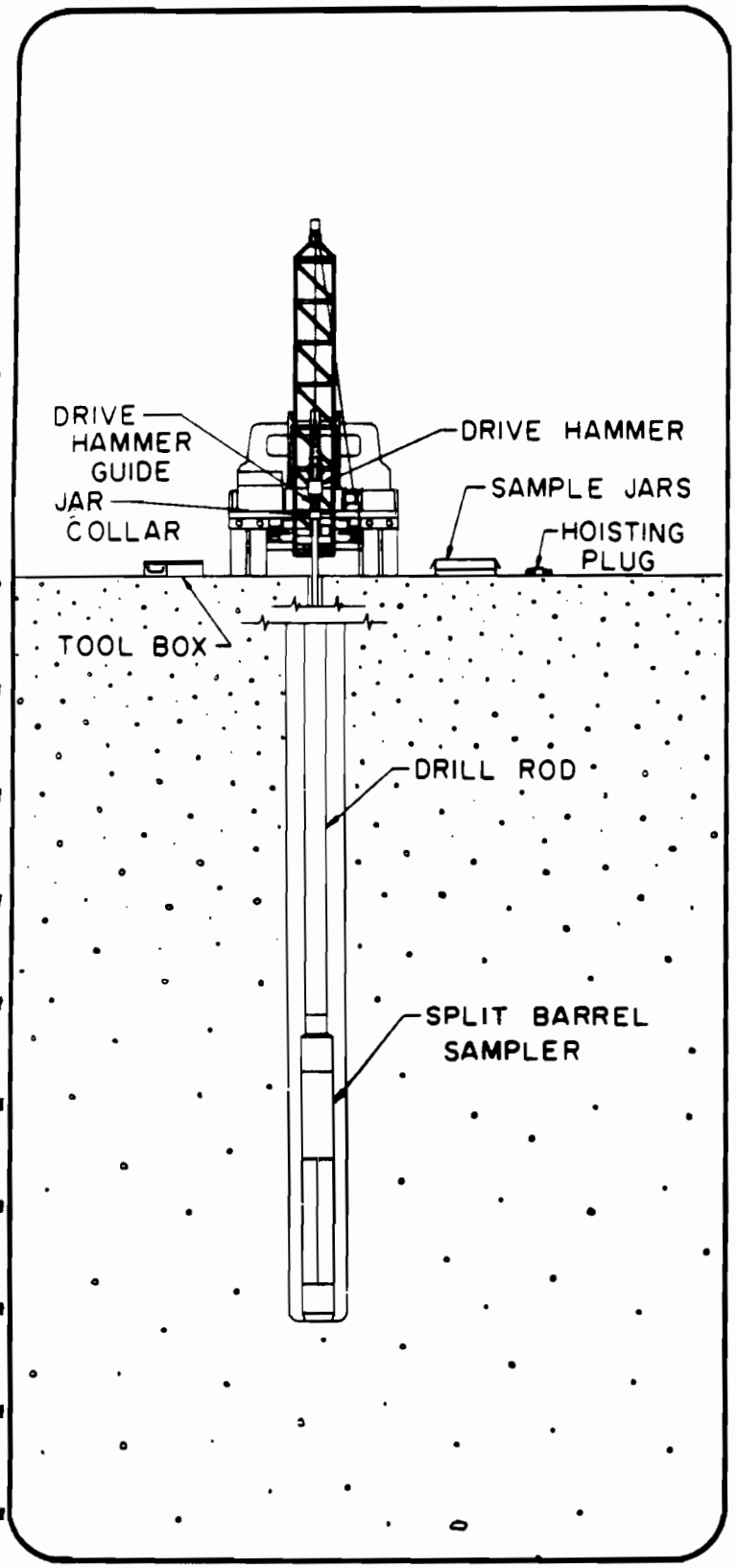
Very truly yours,

PARRATT - WOLFF, INC.

Michael D. Ellingworth
V.P. - Manager-Field Explorations
MDE/lnc
encs:

SOIL SAMPLING - METHODS

parratt wolff inc
FISHER RD EAST SYRACUSE N Y 13057
TELEPHONE AREA CODE 315 437 1429



Split barrel sampling

The following excerpts are from "Standard Method for penetration test and split-barrel sampling of soils."[1] (ASTM designation: D-1586-67 AASHO Designation: T-206-70.)

1. Scope

1.1 This method describes a procedure for using a split-barrel sampler to obtain respresentative samples of soil for identification purposes and other laboratory tests, and to obtain a measure of the resistance of the soil to penetration of the sampler.

2. Apparatus

2.1 Drilling Equipment – Any drilling equipment shall be acceptable that provides a reasonably clean hole before insertion of the sampler to ensure that the penetration test is performed on undisturbed soil, and that will permit the driving of the sampler to obtain the sample and penetration record in accordance with the procedure described in 3. Procedure. To avoid "whips" under the blows of the hammer, it is recommended that the drill rod have stiffness equal to or greater than the A-rod. An "A" rod is a hollow drill rod or "steel" having an outside diameter of 1-5/8 in. or 41.2 mm and an inside diameter of 1-1/8 in. or 28.5 mm, through which the rotary motion of drilling is transferred from the drilling motor to the cutting bit. A stiffer drill rod is suggested for holes deeper than 50 ft (15m). The hole shall be limited in diameter to between 2-1/4 and 6 in. (57.2 and 152mm).

2.2 Split-Barrel Sampler – The sampler shall be constructed with the dimensions indicated (in Fig. 1.) The drive shoe shall be of hardened steel and shall be replaced or repaired when it becomes dented or distorted. The coupling head shall have four 1/2-in. (12.7-mm) (minimum diameter) vent ports and shall contain a ball check valve. If sizes other than the 2-in. (50.8-mm) sampler are permitted, the size shall be conspicuously noted on all penetration records.

2.3 Drive Weight Assembly – The assembly shall consist of a 140-lb (63.5-kg) weight, a driving head, and a guide permitting a free fall of 30 in. (0.76 m). Special precautions shall be taken to ensure that the energy of the falling weight is not reduced by friction between the drive weight and the guides.

2.4 Accessory Equipment – Labels, data sheets, sample jars, paraffin, and other necessary supplies should accompany the sampling equipment.

parratt wolff inc
FISHER RD. EAST SYRACUSE, N.Y. 13057
TELEPHONE AREA CODE 315/437-1429

GENERAL NOTES

1. Soil boring logs, notes and other data shown are the results of personal observations and interpretations made by Parratt-Wolff, Inc.

Exploration records prepared by our drilling foreman in the field form the basis of all logs, and samples of subsurface materials retained by the driller are observed by technical personnel in our laboratory to check field classifications.

2. Explanation of the classifications and terms:

a. Bedrock — Natural solid mineral matter occurring in great thickness and extent in its natural location. It is classified according to geological type and structure (joints, bedding, etc.) and described as solid, weathered, broken or fragmented depending on its condition.

b. Soils — Sediments or other unconsolidated accumulations of particles produced by the physical and chemical disintegration of rocks and which may or may not contain organic matter.

PENETRATION RESISTANCE

COHESIONLESS SOILS

Blows Per Ft.	Relative Density
0 to 4	Very Loose
4 to 10	Loose
10 to 30	Medium Dense
30 to 50	Dense
Over 50	Very Dense

COHESIVE SOILS

Blows Per Ft.	Consistency
0 to 2	Very Soft
2 to 4	Soft
4 to 8	Medium Stiff
8 to 15	Stiff
15 to 30	Very Stiff
Over 30	Hard

Size Component Terms

Boulder	Larger than 8 inches	
Cobble	8 inches to 3 inches	
Gravel — coarse	3 inches to 1 inch	
— medium	1 inch to 3/8 inch	
— fine	3/8 inch to 4.76 mm	
Sand — coarse	4.76 mm to 2.00 mm	(#10 sieve)
— medium	2.00 mm to 0.42 mm	(#40 sieve)
— fine	0.42 mm to 0.074 mm	(#200 sieve)
Silt and Clay	Finer than 0.074 mm	

Proportion By Weight

Major component is shown with all letters capitalized.

Minor component percentage terms of total sample are:

and . . . 35 to 50 percent
some . 20 to 35 percent
little . . 10 to 20 percent
trace . . 1 to 10 percent

c. Gradation Terms — The terms coarse, medium and fine are used to describe gradation of Sand and Gravel.

d. The terms used to describe the various soil components and proportions are arrived at by visual estimates of the recovered soil samples. Other terms are used when the recovered samples are not truly representative of the natural materials, such as soil containing numerous cobbles and boulders which cannot be sampled, thinly stratified soils, organic soils, and fills.

e. Ground water — The measurement was made during exploration work or immediately after completion, unless otherwise noted. The depth recorded is influenced by exploration methods, soil type and weather conditions during exploration. Where no water was observed it is so indicated. It is anticipated that the ground water will rise during periods of wet weather. In addition, perched ground water above the water levels indicated (or above the bottom of the hole where no ground water is indicated) may be encountered at changes in soil strata or top of rock.

parratt wolff inc
FISHER RD. EAST SYRACUSE, N.Y. 13057
TELEPHONE AREA CODE 315. 437 1429

A BRIEF DESCRIPTION OF THE UNIFIED SOIL SYSTEM

The Unified Classification System is an engineering soil classification that is an outgrowth of the Air-Field classification developed by Casagrande.

The system incorporates the textural characteristics of a soil into the engineering classification. All soils are classified into fifteen groups, each group being designated by two letters. These letters are as follows: G—gravel, S—sand, M—Non plastic or low plasticity fines, C—plastic fines, Pt—peat, humus and swamp soils, O—organic, W—well graded, P—poorly graded, L—low liquid limit, H—high liquid limit.

GW and SW Groups

These groups comprise well graded gravelly and sandy soils which contain less than 5% of non plastic fines passing a #200 sieve. Fines which are present must not noticeably change the strength characteristics of the coarse grain fraction and must not interfere with its free draining characteristics. In areas subject to frost action the material should not contain more than about 3% of soil grains smaller than .02 millimeters in size.

GP and SP Groups

These groups are poorly graded gravels and sands containing less than 5% non plastic fines. They may consist of uniform gravels, uniform sands, or non uniform mixtures of very coarse material and very fine sand with intermediate sizes lacking. Materials of this latter type are sometimes referred to as skip graded, cap graded, or step graded.

GM and SM Groups

In general, these groups include gravels or sands which contain more than 12% of fines having little or no plasticity. The plasticity index and liquid limit of a soil in either of these groups plot below the "A" line on a plasticity chart. Gradation is not important and both low grade and poorly graded materials are included. Some sands and gravels in these groups may have a binder composed of natural cementing agents so proportioned that the mixture shows negligible swelling or shrinkage. Thus, the dry strength is provided by a small amount of soil binder or dry cementation of calcareous materials or iron oxide. A fine fraction of non cemented materials may be composed of silts or rock flour types having little or no plasticity, and the mixture will exhibit no dry strength.

GC and SC Groups

These groups comprise gravelly or sandy soils with more than 12% of fines which exhibit either low or high plasticity. The plasticity index and liquid limit of a soil in either of these groups plot above the "A" line on the plasticity chart. Gradation of these materials is not important. Plasticity of the binder fraction has more influence on the behavior of the soils than does the variation in gradation. A fine fraction is generally composed of clays.

ML and MH Groups

These groups include predominantly silty materials and micaceous or diatomaceous soils. An arbitrary division between the two groups has been established with a liquid limit of 50. Soils in these groups are sandy silts, clayey silts or organic silts with relatively low plasticity. Also included are loessial soils and rock flours. Micaceous and diatomaceous soils generally fall within the MH group, but may extend into the ML group when their liquid limit is less than 50. The same is true for certain types of kaolin clays and some illite clays having relatively low plasticity.

CL and CH Groups

The CL and CH groups embrace clays with low and high liquid limits respectively. They are primarily inorganic clays. Low plasticity clays are classified as CL and are usually lean clays, sandy clays, and silty clays. The medium plasticity and high plasticity clays are classified as CH. These include fat clays, gumbo clays, certain volcanic clays and bentonite.

OL and OH Groups

The soils in these groups are characterized by the presence of organic matter including organic silts and clays. They have a plasticity range that corresponds with the ML and MH groups.

Pt Group

Highly organic soils which are very compressible have undesirable construction characteristics and are classified in one group with the symbol Pt. Peat, humus and swamp soils with a highly organic texture are typical of the group. Particles of leaves, grass, branches of bushes and other fibrous vegetable matter are common components of these soils.

Borderline Classification

Soils in the GW, SW, GP and SP groups are non plastic materials having less than 5% passing the #200 sieve, while GM, SM, GC, and SC soils have more than 12% passing the #200 sieve. When these coarse grain materials contain between 5% and 12% of fines they are classified as borderline, and are designated by the dual symbol such as GW-GM. Similarly coarse grain soils which have less than 5% passing the #200 sieve, but which are not free draining or in which the fine fraction exhibits plasticity are also classed as borderline and are given a dual symbol. Still another type of borderline classification occurs when a liquid limit of a fine grain soil is less than 29 and the plasticity index lies in the range of four to seven. These limits are indicated by the shaded area on the plasticity chart.

Silty and Clayey

In the Unified System, these terms are used to describe soils whose Atterberg limits plot below and above the "A" line on the plasticity chart. The adjectives silty and clayey are used to describe soils whose limits plot close to the "A" line.

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES DIVISION

TEST BORING RECORD

BORING NUMBER MW-101-1
JOB NUMBER 11-1564
DATE STARTED 6/1/92
DATE COMPLETED 6/1/92
DRILLED BY PARRATT WOLFF
LOGGED BY ANTHONY D. MURTAUGH
CHECKED BY TOM RICHARDSON

REMARKS:

PAGE 1 OF 1

Boring performed using hollow-stem augers;
See Well Installation Diagram for details fo well installation.

ELEV. IN FEET	DEPTH IN FEET	DESCRIPTION	MONITORING WELL CONSTRUCTION	SYM-BOLS	LAB TESTS	SPT N VALUE
471.3						
		Firm brown silty fine-medium sand, well rounded gravel, dry SM				11
						13
465.3	6.0					
						7
						7
		Loose brown fine-med. sand with med-large gravel trace silt, SM, moist @ 10', wet @ 12' SM				6
						11
						5
455.3	16.0					
454.3	17.0	Firm, brown coarse sand, some med. sand and fine-med. gravel, trace silt, wet SM				20
						16
		Firm, brown fine-med sand, some fine gravel, wet SM-SP				17
449.3	22.0					
		BORING TERMINATED @22'				

1564.63

HTW DRILLING LOG

1. COMPANY NAME: LAW Environmental	2. DRILLING SUBCONTRACTOR: Parratt Wolff
3. PROJECT: Interim Removal Action Design	4. LOCATION: Griffiss AFB Rome, N
5. NAME OF DRILLER: Brian Waters	6. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" Split Spoon Sampler; LAW Job # 11-1564	8. HOLE LOCATION: South of Bldg 101, Near yellow Submarine TA
	9. SURFACE ELEVATION:
	10. DATE STARTED: 6/1/92 — 11. DATE COMPLETED: 6/1/92
12. OVERBURDEN THICKNESS:	13. DEPTH GROUNDWATER ENCOUNTERED: ~ 12.8' Below Ground L
14. DEPTH DRILLED INTO ROCK:	15. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETE: 12.6 11.6' Below Grade on 6/3/9
16. TOTAL DEPTH OF HOLE: 22' w/split spoon, 20' w/ 4¼ HSA	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):
18. GEOTECHNICAL SAMPLES: DISTURBED / UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES:
20. SAMPLES FOR CHEMICAL ANALYSES: VOC / METALS / OTHER (SPECIFY) / OTHER (SPECIFY) / OTHER (SPECIFY)	21. TOTAL RECOVERY
22. DISPOSITION OF HOLE: BACKFILLED / MONITORING WELL: 2" PVC / OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR: Anthony D Mustang

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	.5' Concrete Pavement					
	1						
	2						
	3		0 PPM HNu	12"	S-1	3,5 6,5	
	4						
	5	SM Firm, Brown Silty F-C. Sand with well round med. Gvl Dry	0 PPM HNu	8"	S-2	9,7, 6,5	0 HNu At Bot
	6						
	7	SM Loose F-M. Sand, Dry	0 PPM HNu	2" Poor Recov.	S-3	3,3 4,3	Very l recover pushing
	8						
	9	SM-SP Loose Brn, Fine And Med Sand w/gravel Dry	0 PPM HNu	1"	S-4	2,3 4,3	
	10						

MRK FORM 6/88

PROJECT: Interim Removal Action Design; Bldg 101, Contract No. DACW 41-89-D-0124

HOLE No. ~~Bldg 101~~ MW-101-1

Interim Removal Action Designs | A. Murtaugh

Elev	Depth	Description of Materials	Field Screening Results	Sketch Showing Zone Recovered	Analytical Samples	Blow Counts
	11	SM Loose Brown F-M. Sand with med-Large Gvl moist	0 PPM HNU No odor	3" Recov	S-5	3,3,3 3
	12					
	13	Lg gravel in shoe piece, No Recovery wet @ 13'	0 PPM HNU	0"	S-6	6,5 6,5
	14					
	15	Brown Med Sand With Med-Lg Gvl wet	0 PPM HNU	0"	S-7	1,1,4 8
	16					
	17	SM Firm Coarse Sand with some med Sand And F-Med Gvl Change @ 17' to Fine Sand trace med sand wet	0 PPM	24"	S-8	8,9, 11,10
	18					
	19	SM Firm Fine Snd with ltl med Snd wet	0 PPM HNU No odor	13"	S-9	4,8, 8,12
	20					
	21	SM with SP Firm Brn F-M Sand, Seam of C. Snd + F. Gvl @ 21' (3" thick), 21.5 F Snd	0 PPM HNU	16"	S-10	10,9 8,12
	22	w/ F. Gvl @ 22' Reddish Brn Slt w/ ltl Clay				

MRK Form No. 88-2

Interim Removal Action Designs
Bldg 101, Contract No. DACW 41-89-D-0124

Hole No. Bldg 101 MW-1
TOTAL F. 2

MW-101-1

TYPE II MONITORING WELL INSTALLATION DIAGRAM

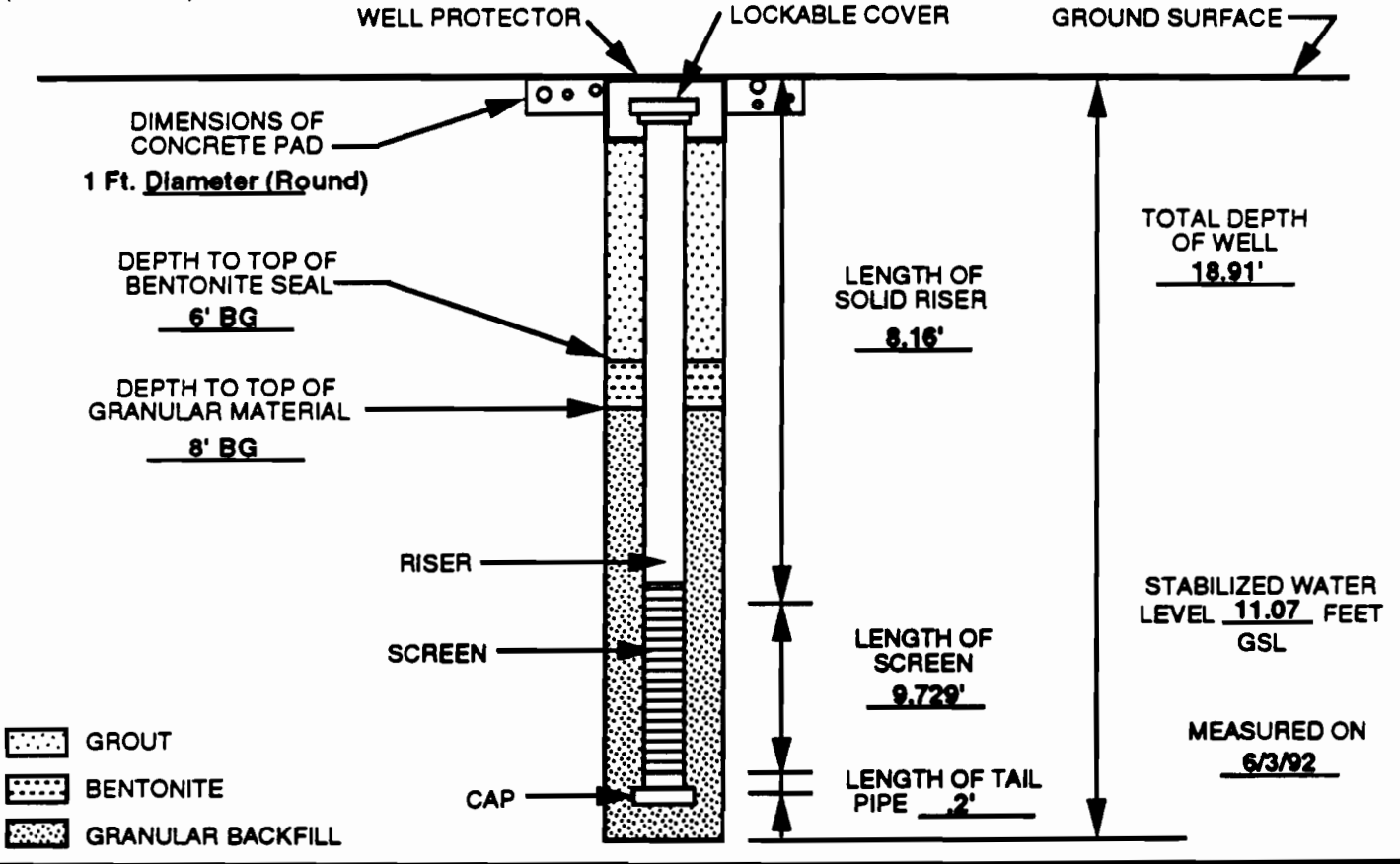
LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES DIVISION
KENNESAW, GEORGIA

JOB NAME: GRIFFISS AFB
WELL NO.: MW-101-1 JOB NO.: 11-1564
DATE: 6-1-92 TIME: 1:40
WELL LOCATION: SOUTH OF BLDG. 101

GROUND SURFACE ELEVATION: 471.3
TOP OF SCREEN ELEVATION: 462.32
REFERENCE POINT ELEVATION: ~470.48
TYPE SAND PACK: 0 GRADATION: Uniform
SAND PACK MANUFACTURER: Morey
SCREEN MATERIAL: PVC
MANUFACTURER: Dietrick
RISER MATERIAL: PVC
MANUFACTURER: Dietrick
RISER DIAMETER: 2"
DRILLING TECHNIQUE: H.S.A
AUGER SIZE AND TYPE: 4 1/4" I.D., Acker
STRATUM (feet):

BENTONITE TYPE: 3/4" Pellets
MANUFACTURER: Entire Plug
CEMENT TYPE: Type II
MANUFACTURER: Lehigh Co.
BOREHOLE DIAMETER: 8"
SCREEN DIAMETER: 2" SLOT SIZE: 1010
LAW ENVIRONMENTAL, INC. FIELD REPRESENTATIVE: Anthony D. Murtaugh
DRILLING CONTRACTOR: Parratt Wolff
AMOUNT BENTONITE USED: 1 Bucket
AMOUNT CEMENT USED: 3 Bags
AMOUNT SAND USED: 2 Bags
STATIC WATER DEPTH (after dev.): 11.07 BMP

(NOT TO SCALE)



QA / QC

INSTALLED BY: Parratt Wolff INSTALLATION OBSERVED BY: A. Murtaugh
DISCREPANCIES:

HF

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES DIVISION

JOB NAME Griffiss Air Force Base Interim Removal Action Design JOB No. 11-1564

BY Anthony D. Murtaugh CHECKED _____ SHEET 1 OF 1

WELL DEVELOPMENT DATA

1. Well No. Bldg. 101 MW-1
2. Date of Installation : 6/1/92
3. Date of Development : 6/3/92
4. Static Water Level : Before Development 11.21 BMP ft.: 24 Hours After 11.07 ft
5. Quantity of Water Loss During Drilling, If Used 0 Gal.
6. Quantity of Standing Water in Well and Annulus Before Development 5.72 Gal.

	Start	During		End
7. Physical Appearence	Brown/Silty	Brown	Silty	Clearing Slightly
Specific Conductance (umhos/cm)		389		
Temperature (c°)		74.3°F		
pH (s.u.)		6.83		

8. Depth From Top of Well Casing to Bottom of Well 19 ft.
9. Screen Length 10 ft.
10. Depth to Top of Sediment : Before Development 0 ft.; After Development 0 ft.
11. Type and Size of Well Development Equipment : 2" Bailer repeatily surged in well.
12. Description of Surge Technique, If Used : Bailer repeatily surged in well.
13. Height of Well Casing Above Ground Surface : 0 ft. ~.5 BGS
14. Quantity of Water Removed : 50+ Gal. Time for Removal : 6 hrs. Hr./Min.
15. 1-Liter Water Sample Collected : _____ (Time)
16. Turbidity in Nephelometric Units _____ NTUs

*Development Conditions : 1) Well Water if Reasonably Clear
2) Sediment Thickness 5% of Screen Length
3) Removal of 5 Well Volumes, Including Saturated Filter Annulus
4) Stabilization of Specific Conductance and Water Temperature

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES DIVISION

TEST BORING RECORD

BORING NUMBER SB-101-1
JOB NUMBER 11-1564
DATE STARTED 6/2/92
DATE COMPLETED 6/2/92
DRILLED BY PARRATT WOLFF
LOGGED BY ANTHONY D. MURTAUGH
CHECKED BY TOM RICHARDSON

REMARKS:

PAGE 1 OF 1

Boring performed using hollow-stem augers
* 3" diameter (I.D.) split spoon

ELEV. IN FEET	DEPTH IN FEET	DESCRIPTION	MONITORING WELL CONSTRUCTION	SYM-BOLS	LAB TESTS	SPT N VALUE
471.3		Loose, brown medium and fine sand, some coarse sand and fine coarse gravel, trace silt, dry SM				7
						21
						14
461.3	10.0					11*
		Loose, brown medium-coarse sand, trace silt and fine sand, few medium-large gravel, moist, wet SP-SM			GS	14
457.3	14.0	Firm, well rounded medium-very large gravel with sand, wet GP				19
456.3	15.0	Loose brown fine-coarse sand and gravel, wet SM				22
452.8	19.0					10*
451.8	20.0	Firm fine gravel and coarse sand, wet SP-GP				
		Firm brown medium and fine sand, trace silt, wet SP-SM			GS	14
						79
	25.0					23
445.3		BORING TERMINATED @26'				
	30.0					

1564.63

HTW DRILLING LOG

1. COMP ANY NAME: LAW Environmental	2. DRILLING SUBCONTRACTOR: Parratt Wolff	SHEET 1 OF 2 SHEETS
3. PROJECT: Interim Removal Action Design	4. LOCATION: Griffis AFB Rome, N	
5. NAME OF DRILLER: Brian Waters	6. MANUFACTURER'S DESIGNATION OF DRILL: CME-55	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: LAW Sub# 11-1564 — 2" Split Spoon; 3" Split Spoon; Shelby Tube	8. HOLE LOCATION: Near North Eastern corner of Yellow Sub	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 6/2/92	11. DATE COMPLETED: 6/2/92
12. OVERBURDEN THICKNESS	13. DEPTH ENCOUNTERED WATER ENCOUNTERED: ~12'	
14. DEPTH DRILLED INTO ROCK	15. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
16. TOTAL DEPTH OF HOLE: 26'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL RECOVERY
			Split			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Tremie Grouted				Anthony Muntaing

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h
	1	.5' of Concrete Pavement					
	2	SM Loose Brn Med Sand w/some Fine sand and med. -Lg gvl Dry	0 PPM HNU	8"	S-1	5,3 4,5	2" S
	3						
	4						
	5	Shelby Tube SM Loose Brn Med Sand w/ F,t Coarse Sand and F-Med Gvl Dry		10" Recovered in Distorted Tube, CAN'T Soil		Hydraulic Pressure	Shelby Tube Tube eli in Grave
	6						
	7	SM Loose Brn F & Med. Sand w/some C. Snd And well Rnd. Gvl moist	0 PPM HNU	7"	S-2	7,10 11,9	2" Spo Drilling Gravelly Materia
	8						
	9	Loose Brn F-Med. Sand	0 PPM Hnu No ODOR	2" Poor Recovery	S-3	6,9 5,5	2" Spo
	10						

Interim Removal Action Design — A. Mustaquah

Sample	Depth	Description of Materials	Field Screening Results	Depth Interval of Core Recovered	Analytical Sample ID	Blow Counts	
	11	SM Loose Med-C. Snd Trace Silt, Few med-Lg. Well Rnd. Gvl moist	0 PPM HNu	18"	S-4	7,6 5,4	3" 140
	12						
	13	SM Loose Well Srt Med Snd w/ some Fine Snd, Trace Silt Gvl Layer @ 14' wet @ Bottom spoon	0 PPM HNu	10"	S-5	3,4 10,14	3"
	14						
	15	SM 14-15' Gvl w/Snd well rnd med-U.lg (3" gvl) wet 15-16 Lse F-M Snd wet	0 PPM HNu	18"	S-6	10,10 9,10	3" Interb Snd
	16						
	17	SM Loose C. Snd and Gvl, some med. + F. Sand Saturated	0 PPM HNu	12"	S-7	9,11 11,10	3"
	18						
	19	18-18.5 SP F-M Sand, uniform, 18.5-19.5 Gvl And C. Sand, well Rd. Clast support F. Gvl. (GP) 19.5-20 Uniform F. Snd, wet	0 PPM HNu	24"	S-8	4,4, 6,6	3"
	20						
	21	SM-SW Firm Med And Fine Snd. wet	0 PPM HNu	16"	S-9	4.5, 9,13	3"
	22						
	23	SM-SW Firm Fine and Med Sand wet	0 PPM HNu	19"	S-10	24,34 45,47	3"
	24						
	25	SM Firm Med Snd w/ some fine Snd U.F Snd + Silt @ 26'	0 PPM HNu	24"	S-11	12,12 11,17	3"
	26						
	27	T.D. 26' Grout Borehole					

MAK 88-2

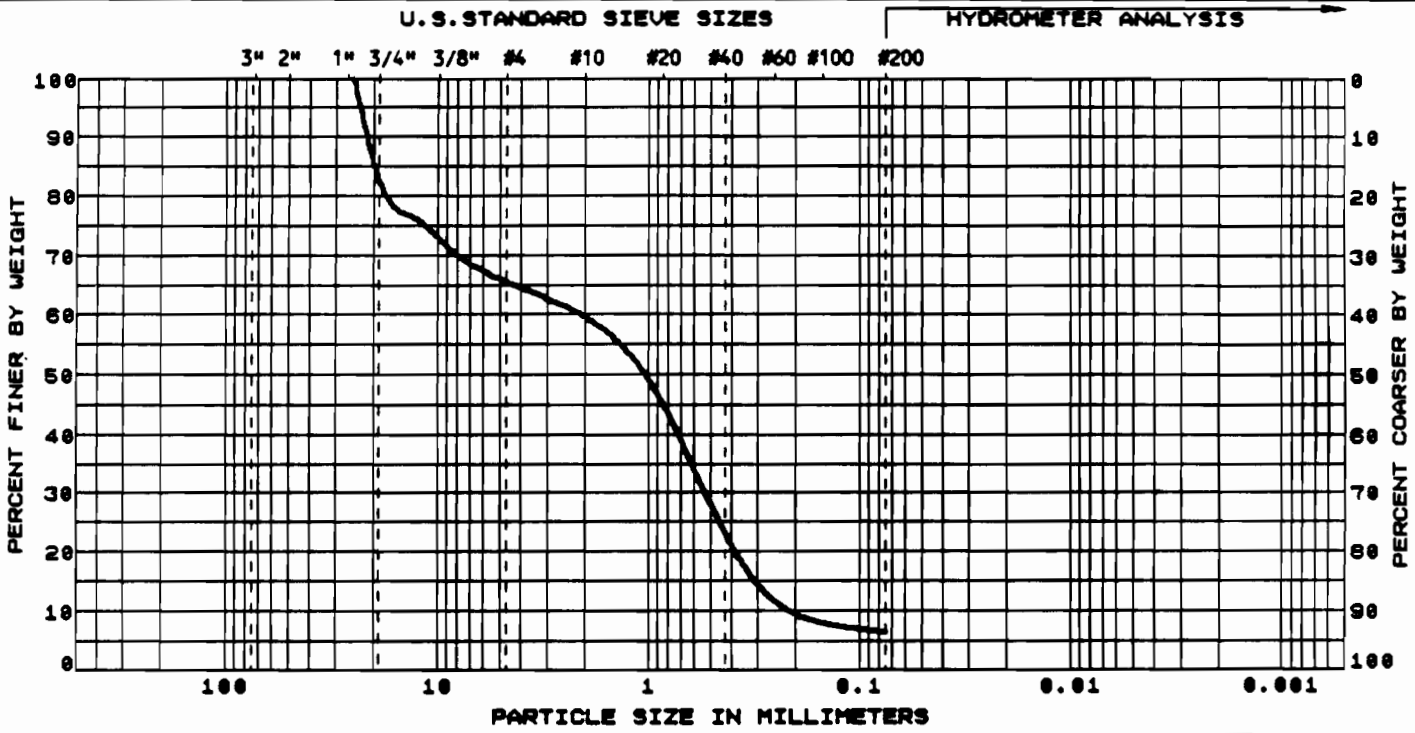
Interim Removal Action Design
Bldg 101, SB-1 Contract No. DACW 41-89-D-0124

Bldg 101 SB-101-1

LAW ENVIRONMENTAL, INC.
300 CHASTAIN CNTR BLVD, SUITE 315
KENNESAW, GEORGIA 30144
404-425-7879

PARTICLE SIZE DISTRIBUTION & PHYSICAL PROPERTIES

CLIENT _____
JOB NO. 11-1564 DATE June 18, 1992
LAB NO. 02488 PAGE 1
PROJECT Griffis AFB IRAD
CLIENT JOB NO./PO# _____
SAMPLE ID SB-1 S-4 Bldg 10110-12'



COBBLES	GRAVEL		SAND			SILT & CLAY
	COARSE	FINE	CO.	MEDIUM	FINE	

U.S. STANDARD SIEVE SIZE		*PERCENT PASSING		HYDROMETER
SIEVE NO.	SIEVE SIZE (MILLIMETERS)			PARTICLE DIAMETER (MILLIMETERS)
3"	75			0.050
2"	50			0.020
1-1/2"	37.5			0.005
1"	25	100.0		0.002
3/4"	19	82.7		0.001
1/2"	12.5	78.0		
3/8"	9.5	72.3	*REMARKS: TABULATED HYDROMETER VALUES ARE COMPUTER INTERPOLATED FROM A LINEAR DATA PLOT. PLOTTED VALUES MAY BE MORE ACCURATE FOR THE 0.050 mm PARTICLE DIAMETER.	
No.4	4.75	65.5		
No.10	2.00	59.6		
No.20	0.850	45.1		
No.40	0.425	22.5		
No.60	0.250	11.5		
No.100	0.150	8.0		
No.200	0.075	6.4		
			TESTED BY: JM HJ MO	

TOTAL POROSITY (%) _____
EFFECTIVE SIZE (mm) _____
COEFFICIENT OF UNIFORMITY 10.55
COEFFICIENT OF CURVATURE 0.67
LIQUID LIMIT NP
PLASTIC LIMIT NP
PLASTICITY INDEX NP
CLASSIFICATION POORLY GRADED SAND with SILT and GRAVEL (SP-SM)
WATER CONTENT (%) _____
DRY DENSITY (PCF) _____
SPECIFIC GRAVITY OF SOLIDS _____
HYDRAULIC CONDUCTIVITY (cm/sec - 20C) _____
TEST PROCEDURES: ASTM D422.

LAW ENVIRONMENTAL, INC.
M. A. O'Kelley

LAW ENVIRONMENTAL, INC.
300 CHASTAIN CNTR BLVD, SUITE 315
KENNESAW, GEORGIA 30144
404-425-7879

PARTICLE SIZE DISTRIBUTION & PHYSICAL PROPERTIES

CLIENT _____

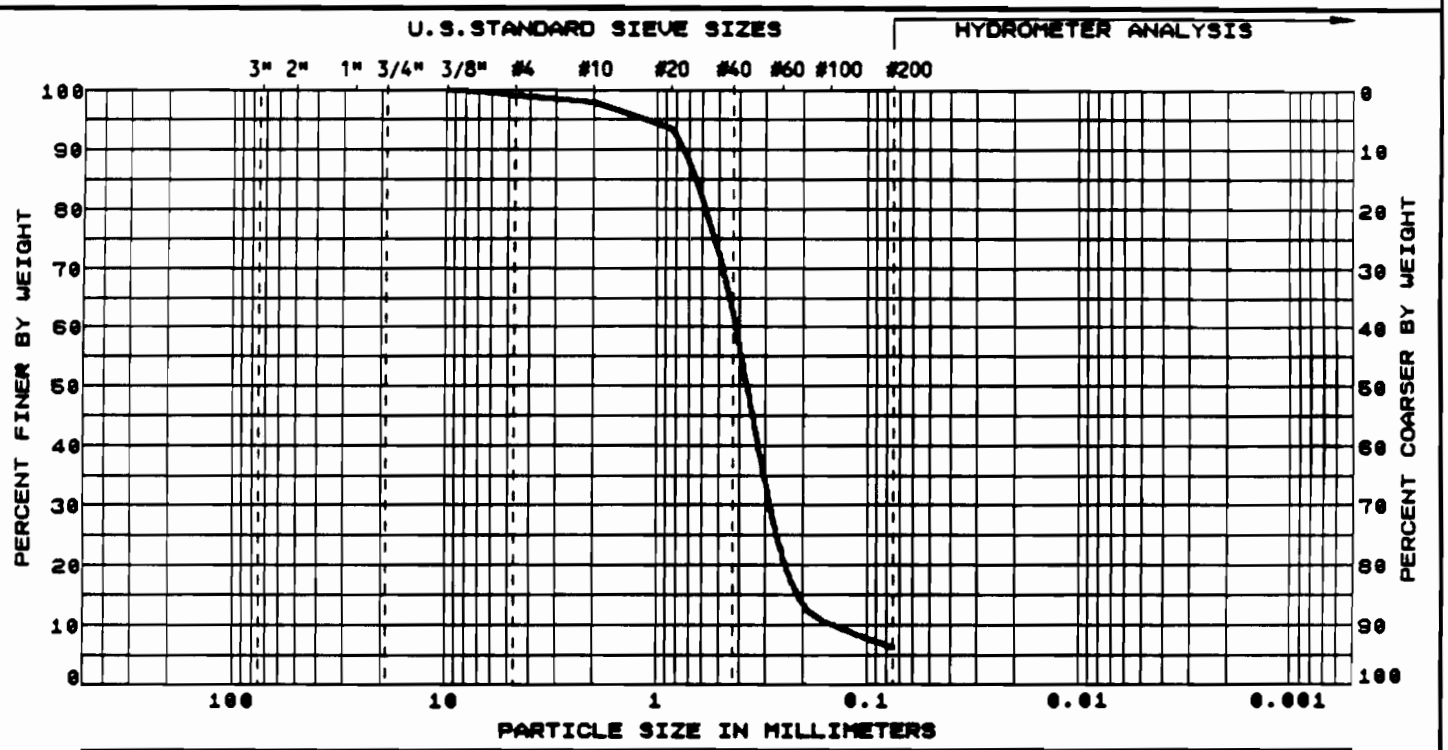
JOB NO. 11-1564 DATE June 18, 1992

LAB NO. 62469 PAGE 2

PROJECT Griffis AFB IRAD

CLIENT JOB NO./PO# _____

SAMPLE ID SB-1 S-9 Bldg 10120-22'



COBBLES	GRAVEL		SAND			SILT & CLAY
	COARSE	FINE	CO.	MEDIUM	FINE	

U.S. STANDARD SIEVE SIZE		*PERCENT PASSING	HYDROMETER
SIEVE NO.	SIEVE SIZE (MILLIMETERS)		PARTICLE DIAMETER (MILLIMETERS)
3"	75		0.050
2"	50		0.020
1-1/2"	37.5		0.005
1"	25		0.002
3/4"	19		0.001
1/2"	12.5		
3/8"	9.5	100.0	
No.4	4.75	99.1	
No.10	2.00	96.0	
No.20	0.850	93.6	
No.40	0.425	60.6	
No.60	0.250	21.2	
No.100	0.150	10.2	
No.200	0.075	6.2	

*REMARKS: TABULATED HYDROMETER VALUES ARE COMPUTER INTERPOLATED FROM A LINEAR DATA PLOT. PLOTTED VALUES MAY BE MORE ACCURATE FOR THE 0.050 mm PARTICLE DIAMETER.

TESTED BY: JM HJ MO

TOTAL POROSITY (%) _____
EFFECTIVE SIZE (mm) _____
COEFFICIENT OF UNIFORMITY 2.93
COEFFICIENT OF CURVATURE 1.30
LIQUID LIMIT NP
PLASTIC LIMIT NP
PLASTICITY INDEX NP
CLASSIFICATION POORLY GRADED SAND with SILT (SP-SM)
WATER CONTENT (%) _____
DRY DENSITY (PCF) _____
SPECIFIC GRAVITY OF SOLIDS _____
HYDRAULIC CONDUCTIVITY (cm/sec - 20C) _____
TEST PROCEDURES: ASTM D422.

LAW ENVIRONMENTAL, INC.
M.A. O'Kelley

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES DIVISION

TEST BORING RECORD

BORING NUMBER BLDG 110 MW-01
JOB NUMBER 11-1654
DATE STARTED 7/24/92
DATE COMPLETED 7/24/92
DRILLED BY PARRATT WOLFF
LOGGED BY ANTHONY D. MURTAUGH
CHECKED BY

REMARKS:

ELEV. IN FEET	DEPTH IN FEET	DESCRIPTION	MONITORING WELL CONSTRUCTION	SYM-BOLS	LAB TESTS	SPT N VALUE
	2					
	4	Firm Brown with gray SILT: Fine sand, fine coarse gravel; trace med sand, trace CL; fill, moist		ML-SM		19
	6			SM		4
	8			SM-SP		2
	10					5
	12	Very Loose - Loose, brown-gray; Fine-med sand with medium coarse gravel; light coarse sand, light silt; fill, wet		SM		11
	14					11
						1564.75

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES DIVISION

TEST BORING RECORD

BORING NUMBER BLDG 110 MW-01
JOB NUMBER 11-1654
DATE STARTED 7/24/92
DATE COMPLETED 7/24/92
DRILLED BY PARRATT WOLFF
LOGGED BY ANTHONY D. MURTAUGH
CHECKED BY

REMARKS:

ELEV. IN FEET	DEPTH IN FEET	DESCRIPTION	MONITORING WELL CONSTRUCTION	SYM-BOLS	LAB TESTS	SPT N VALUE
						4
	16	Loose brown med-coarse w. srt, w. round SAND; some gravel, trace SILT; wet, Native @ 16'		SW		4
	18					11
	19.5					
	20.0	Firm, tight light tan-brown SILT and fine sand, angular gravel poorly srt (sandy till?)		ML		24
	22.0	BORING TERMINATED @ 22.0'				
						1564.75

HTW DRILLING LOG

HOLE No. Bldg 110 MW-1

1. COMPANY NAME: LAW Environmental Inc	2. DRILLING SUBCONTRACTOR: Parratt-Wolff
3. PROJECT: Bldg 110 MW-1	4. LOCATION: Bldg 110 ; Griffis AFB
5. NAME OF DRILLER: Doug	6. MANUFACTURER'S DESIGNATION OF DRILL: Dietrick D-60
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼ HSA; 2 & 3" Split spoons	8. HOLE LOCATION: 50-Feet SW of Bldg 110
	9. SURFACE ELEVATION:
	10. DATE STARTED: 7/24/92 — 11. DATE COMPLETED: 7/24/92
12. OVERBURDEN THICKNESS:	13. DEPTH GROUNDWATER ENCOUNTERED: 9' Feet Below ground surface
13. DEPTH DRILLED INTO ROCK: —	15. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 9'5" Below ground on 7/27/92
14. TOTAL DEPTH OF HOLE: 22-Feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
Grain Size			

20. SAMPLES FOR CHEMICAL ANALYSES	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		✓		Anthony DMurlano

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	Recovery e	SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0-1	Frm brn Snd, Slt w/ lg gvl Dry				Hand Dug	
	1	Frm Brn Silty Sand Fill w/ Lg. gvl	.5 HNU	11"	1	29,17	2" spoon
ML-SM	2						
	3	Frm Grey-Brn F. Snd Slt + F. Gvl, moist Fill	0. HNU	10"	2	9,8,11,10	2" spoon
	4	No Petroleum Odor					
ML-SM	5	Frm Brn Slt, F. Gvl, And ltl F. Snd, moist Fill (Snd w/well rnd F.gvl @ 6')	0. HNU	12"	3	2,2,2,2	2" spoon
	6						
ML-SM	7	Frm-SFt Brn Slt & F. Snd ltl Cl, Fill moist	0. HNU	2"	4	2,1,1,2	2" spoon
	8						
SM	9	Frm Brn & Grey F-M Snd, tr Slt, M-L gvl Some Ang broken gvl Fill wet		14"	5	2,2,3,7	3" spoon
	10						

DRILLING LOG

PROJECT: Intrim Removal Action Design | INSPECTOR: A. Murtaugh | Bldg 110 MW | SHEET 2 OF 2 SHEETS 2

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	Recovery e	ANALYTICAL SAMPLE NO f	BLOW COUNTS g	REMARKS h
SM	11–12	V. Lse, Gry SAnd And V. well rnd M-L gvl No petroleum odor SAturated/soupy	O. HNU	8"	6	3,6,5,8	3" spoon
SM	13–14	Lse, Brn (w/ gry staining OLD petroleum?) Snd + Lg gvl, ltl slt Fill	O HNU	12"	7	10,6,5,7	TRACE 2" spoon petroleum - No ODOR - soupy sample
SM	15–16	Lse Brn-Gry w. srt, W. Rnd med snd Some C. Snd Wet	20 PPM Headspace	6"	8	WOH, 2,2,3	2" spoon
SW	17–18	Brn Lse Med-Conse well srt + well rnd snd, tr slt wet NATIVE @ 16'	3 PPM Headspace	18"	9	2,1,3,5	2" spoon Petroleum ODOR Noticed
SW	19	Lse Brn W. Srt Med-C. Snd + Gvl wet		16"	10	2,4,7,9	Petroleum ODOR Noticed
MC	20	Change @ 19.5 to Lt tan - Brn Fine Snd + Slt, gvl					
ML	21	Frm Brn Snd, 20-21 F.-Med w-srt, 21-21.5 C. Snd + V. well Rnd F. Gvl Some Fine Snd Damp @ 21.5 Tan tight		18"	11	8,10,14,17	No Petroleum ODOR Detected
	22	Slt, Fine Snd Ang gvl Sandy Till? TD = 22'					

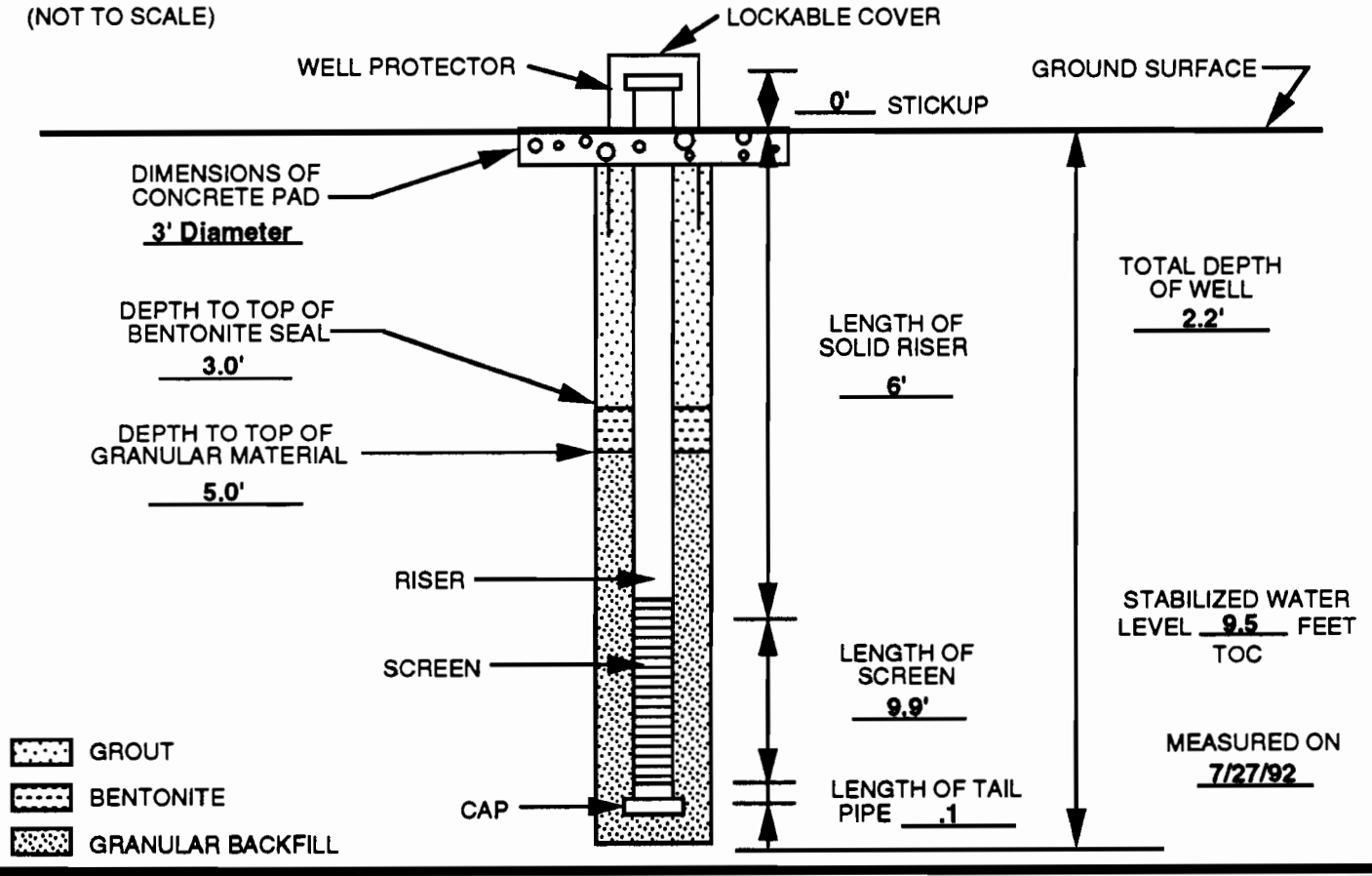
TYPE II MONITORING WELL INSTALLATION DIAGRAM

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES DIVISION
KENNESAW, GEORGIA

JOB NAME GAFB Interim Removal Action Design
WELL NO. Bldg. 110 MW-1 JOB NO. 11-1564
DATE 7/24/92 TIME
WELL LOCATION SW of BLDG. 110

GROUND SURFACE ELEVATION
TOP OF SCREEN ELEVATION
REFERENCE POINT ELEVATION
TYPE SAND PACK #0 GRADATION
SAND PACK MANUFACTURER Morey
SCREEN MATERIAL PVC
MANUFACTURER Dietrick
RISER MATERIAL PVC
MANUFACTURER Dietrick
RISER DIAMETER 2"
DRILLING TECHNIQUE 4 1/2 HSA
AUGER SIZE AND TYPE
STRATUM (feet)

BENTONITE TYPE Hole Plug
MANUFACTURER Envir. Seal
CEMENT TYPE Lehigh Portland Type II
MANUFACTURER
BOREHOLE DIAMETER 8"
SCREEN DIAMETER 2" SLOT SIZE .010
LAW ENVIRONMENTAL, INC. FIELD REPRESENTATIVE A. Murtaugh
DRILLING CONTRACTOR Parratt-Wolff
AMOUNT BENTONITE USED 1 Bag
AMOUNT CEMENT USED 2 Bags
AMOUNT SAND USED 3 Bags
STATIC WATER DEPTH (after dev.) 9.5'



QA / QC

INSTALLED BY: Parratt-Wolff INSTALLATION OBSERVED BY: A. Murtaugh
DISCREPANCIES:

1564.75

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES DIVISION

SHEET 1 OF 1

JOB NAME GRIFFISS AFB JOB NO. 11-1564

BY A. Murtaugh DATE 7/27/92 CHECKED _____ DATE _____

WELL DEVELOPMENT DATA

1. Well No. Bldg. 110 MW-1
2. Date of Installation : 7/24/92
3. Date of Development : 7/27/92
4. Static Water Level (TOC): Before Development 9' 5 3/8" ft.: 24 Hours After _____ ft
5. Quantity of Water Loss During Drilling, If Used 10 Gal.
6. Quantity of Water Loss During Installation, If Used 5.45 Gal.
7. Dates of surging & purging _____ _____ _____

Static Water Level (TOC)			
Specific Conductance (umhos/cm)	640	450	
Temperature (C°)	17	16.5	
pH (s.u.)	6.80	6.71	
Appearance			

8. Screen Length 10 ft.
9. Depth of Well (TOC): Before Development 15.0 ft.; After Development ---- ft.
10. Type and Size of Well Development Equipment : Brown silty with very fine sand
11. Description of Surge Technique, if used Stainless steel bailer
12. Height of Well Casing Above Ground Surface : 0 ft. (From Survey Data)
13. Quantity of Water Removed : ~15 Gal. Total Time for Development : 5 Hr./Min.
14. Date & Time Water Sample Collected : 6/30/92

REMARKS: * Development conditions:

1) Well water is reasonably clear;

2) Sediment thickness < 5% of screen length;

3) Removal of 5 well volumes including saturated filter and

parratt wolff inc

TEST BORING LOG

FISHER ROAD
EAST SYRACUSE, N.Y. 13057

PROJECT: Interim Removal Action Design
LOCATION: Griffiss Air Force Base, New York

HOLE NO. CB-1
SURF. EL.
JOB NO. 92148

DATE STARTED 6/2/92 DATE COMPLETED 6/2/92

GROUND WATER DEPTH
WHILE DRILLING Dry
BEFORE CASING REMOVED Dry
AFTER CASING REMOVED Dry

N — NO. OF BLOWS TO DRIVE SAMPLER 12" W/140# HAMMER FALLING 30" — ASTM D-1586, STANDARD PENETRATION TEST

C — NO. OF BLOWS TO DRIVE CASING 12" W/ # HAMMER FALLING
"/OR — % CORE RECOVERY

CASING TYPE - HOLLOW STEM AUGER
DRILLER'S FIELD LOG

SHEET 1 OF 1

DEPTH	SAMPLE DEPTH	SAMPLE NUMBER	C	SAMPLE DRIVE RECORD PER 6"	N	DESCRIPTION OF MATERIAL	STRATA CHANGE DEPTH
						CONCRETE	
						Bottom of Boring	0.7'
5.0							

{ CONCRETE BORE @ BLDG. 112 TO DETERMINE THICKNESS OF EXISTING PAVEMENT }

CALCULATION COVER SHEET

LAW ENVIRONMENTAL, INC.

PROJECT	PROJECT No.
GRIFFISS AFB. INTERIM ACTION DESIGN	11-1564

CALCULATION TITLE: FINAL DESIGN OF SHORING FOR EXCAVATION

ORIGINATED BY	DATE	CHECKED BY	DATE
C.K. BRASHER	6/23/92	Y.P. SINGH	8/5/92

SUBJECT:

DESIGN SHORING FOR UST REMOVAL EXCAVATION @ GAFB BLDG. #101 (YELLOW SUBMARINE UST)

IRP SITE ST-06

STATEMENT OF PROBLEM:

SOURCES OF DATA:

SOURCES OF FORMULA & REFERENCES:

INTENDED USE:

☐ PRELMINARY CALC. ☐ SUPERCEDES CALC. No. 95%

☑ FINAL CALC. ☐ OTHER _____

REV No.	DESCRIPTION	BY	DATE	CHK	DATE

EARTH PRESSURE DIAGRAM

$\sigma_L = 0.65\ K_A \cdot \gamma H$

$K_A = \tan^2 (45 - \frac{\phi}{2})$

N = 5 to 10 is loose to Med. Dense sand

$\phi \approx 28^\circ$ to 35°

say $\phi = 30^\circ$

$K_A = \tan^2 (45 - \frac{30^\circ}{2})$

$= 0.33$

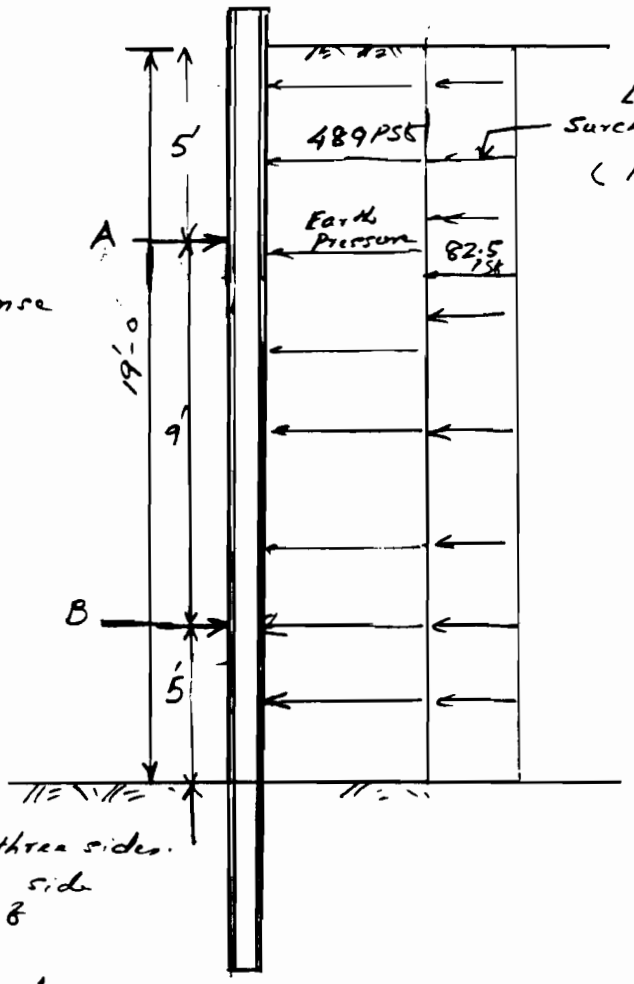
$K_a = 0.33$

$\gamma = 120$ pcf

$\sigma_h = 0.65 \times 0.33 \times 120 \times 19$

$= \underline{489}$ psf on three sides.

Surcharge load on North side assume = 250 psf



Horizontal pressure due to surcharge loading = $0.33 \times 250 = 82.5$ psf

Lateral Loading on North side = $489 + 82.5 = 571.5$ psf

say $\underline{572}$ psf

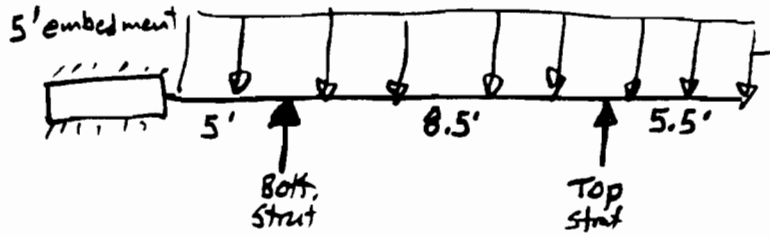
Consider struts (two numbers) along the width of excavation (Two struts required Minm.

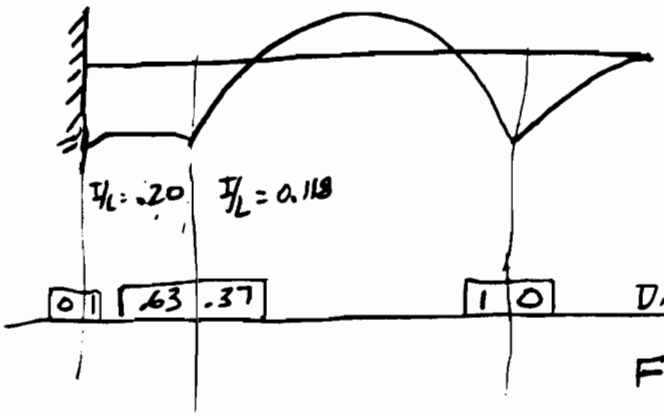
struts at 5 ft and 14 ft from top as shown

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES BRANCH

PROJECT NO 11-1564 SHEET 3 OF 5
PROJECT NAME Griffiss AFB
BY C.K. Brasher DATE 6/24
CHECKED BY YPS DATE 8/5/92

Consider Struts As Shown vs. YPS Spacing:
(assume drained)



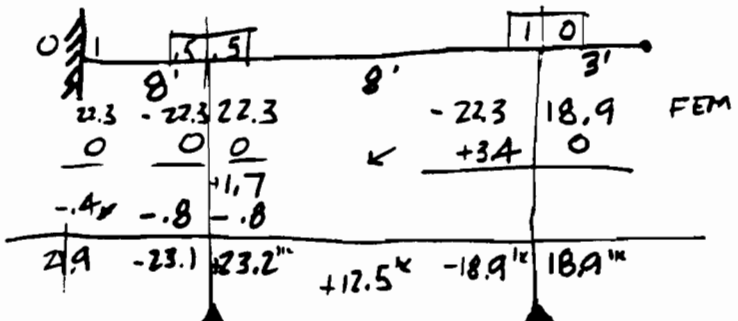


Cantilever Moment:
$4.19 \times \frac{5.5^2}{2} = 63.4^{'k}$

Interior Moment:
$4.19 \times \frac{8.5^2}{12} = 25.2^{'k}$

End Moment:
$4.19 \times \frac{5^2}{12} = 8.7^{'k}$

By inspection, the 63.4'k cantilever moment is too large; try 3'



Cant. Mom.: $4.19 \times \frac{3^2}{2} = 18.9^{'k}$

Int. Mom.: $4.19 \times \frac{8^2}{12} = 22.3^{'k}$

+ Mom. = $\frac{(4.19)(8^2)}{8} = 33.5^{'k}$

S_2 = 16.8k
+ .5k
+ 16.8k
+ (23.1 - 2.9)/8 = +.2
34.3k

S_1 = 3.0' x 4.19 = 12.6k
4' x 4.19 = 16.8k
- (23.2 - 18.9)/8 = - .5k
28.9k

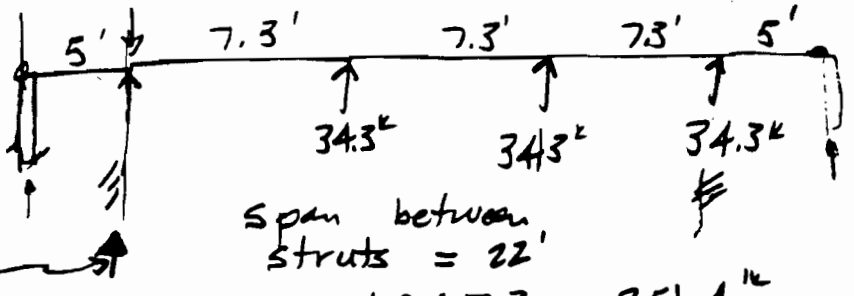
Pile S_x req'd. at F_y = 24 ksi; $S_x = M/F_b = \frac{34.3 \times 12}{24}$
= 17.15 in³ HP8 x 36, S_x = 29.8 in³ ∴ O.K

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES BRANCH

PROJECT NO. 11-1564 SHEET 4 OF 5
PROJECT NAME Griffiss AFB Tank Removal
BY C.K. Brasher DATE 6/24/92
CHECKED BY YPS DATE 8/5/92

34.3k ↓

Size Wales:



Shear Force

$\left(\frac{5}{2}+\frac{7.3}{2}\right)\times 34.3 = 28.9$
$+34.3$
63.2^k
7.3

Span between struts = 22'

$M = 34.3 \times 7.3 = 251.4^{'k}$

$S_{x\ req'd.} = \frac{251.4 \times 12}{24} = 125.7\ in^3$

W21x62, $S_x = 127.2\ in^3$ ✓ OK.
(21"x 8¼"x 5/8" Flgs.)
Side Wales

W8x31, at L=18'
Pallowable = 110k – O.K.

End Waler

$M = \frac{6}{7.33} \times 34.3 \times 6 = 168.5^{'k}$

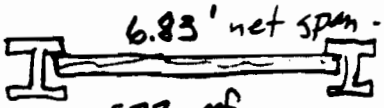
Allowing 10% for axial, bending size req'd:

$S_x = \frac{168.5 \times 12}{24 \times .90} = 93.6\ in^3$

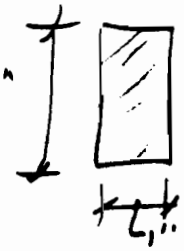
W21x50, $S_x = 94.5\ in^3$ ✓
However - use W21x62 to have one section on project.

Check Lagging Stress:

At:



572 psf = 46.67 #/in of width.



$S_x = \frac{bd^2}{6} = \frac{1 \times 3^2}{6} = 1.5\ in^3$

$M = 46.67\#/in. \times 1" \times \frac{(6.83ft)^2}{8} \times 12\ in/ft = 3266\ \#\text{-in.}$

$f_b = M/S_x = 3266/1.5 = 2,177\ psi.$ ✓

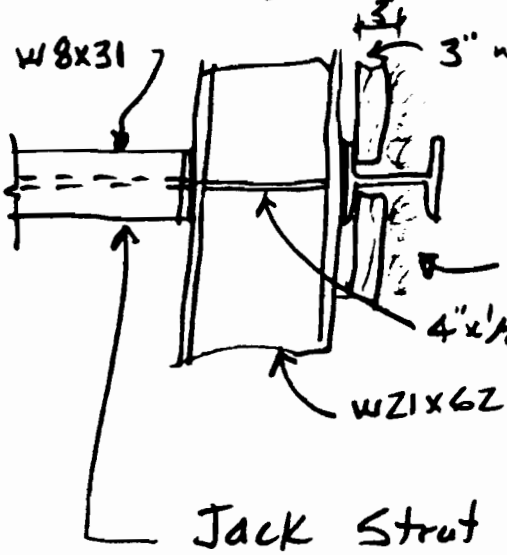
With 2/3 moment reduction due to temporary loading, $f_b = 1,452\ psi$

Dense hardwood, F_b = 2150 ksi -

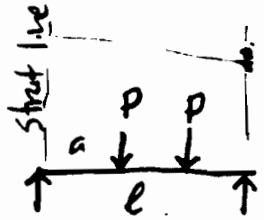
Therefore, use 3" full thickness (rough sawn) lagging timbers of dense hardwood.

Pile installation method may be by vibrating, driving or jetting/drilling. Piles must:

1) Be in solid contact with native soil
2) Be removed after excavation is backfilled.



Check waler Max. Δ:



$$\Delta_{max.} = \frac{Pa}{24EI}(3\ell^2 - 4a^2) = \frac{(34.3^k)(7.3')}{24(30{,}000\ ^k/_{in^2})(132.7\ in^4)}(3\times 21^2 - 4\times 7.3^2)\times 1728\ \frac{in^3}{ft^3}$$

($21 = 11.09.8\ ft^2$) units

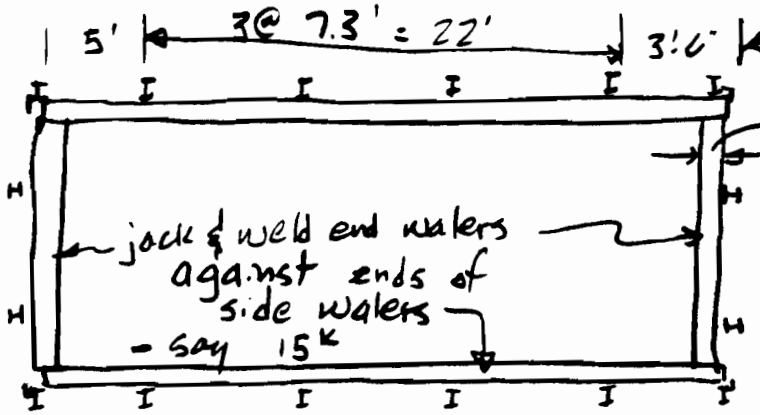
$\Delta_{max.}$ = 0.50" due to waler deflection -

Say OK -

LAW ENVIRONMENTAL, INC.
a professional engineering and earth science consulting firm

JOB NO 11-1564 SHEET 5A OF 5B
JOB NAME Griffiss AFB Tank Removal
BY C.K. Brasher DATE 8/5/92
CHECKED BY JPS DATE 8/5/92

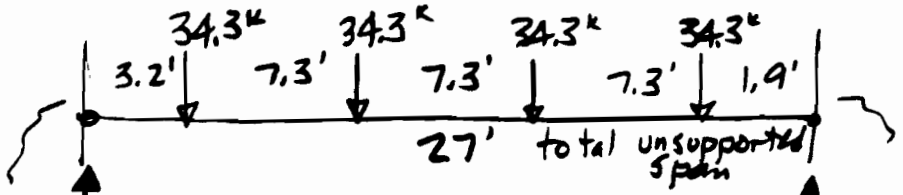
Update design and remove W8x31 struts –
Use jacked side walers for full span –
Shorten excavation to miss an electrical box –
Put angle to receive wooden lagging on corner piles and omit one corner pile.



PLAN

30'-6"
2-21" = 42" = 3'-6"
27' = inside span with soil arching around corners. This is a valid assumption.

Worst Case For Simple Span Side Waler is Bottom Waler At Elev. – 11'.



$R_1 = 34.3^k \times \frac{23.8}{27} = 30.2^k$
$\times \frac{16.5}{27} = 21.0^k$
$\times \frac{9.2}{27} = 11.7^k$
do. $\times \frac{1.9}{27} = \frac{2.4^k}{65.3^k}$

$R_2 = 4 \times 34.3 - 65.3^k = 71.9^k$

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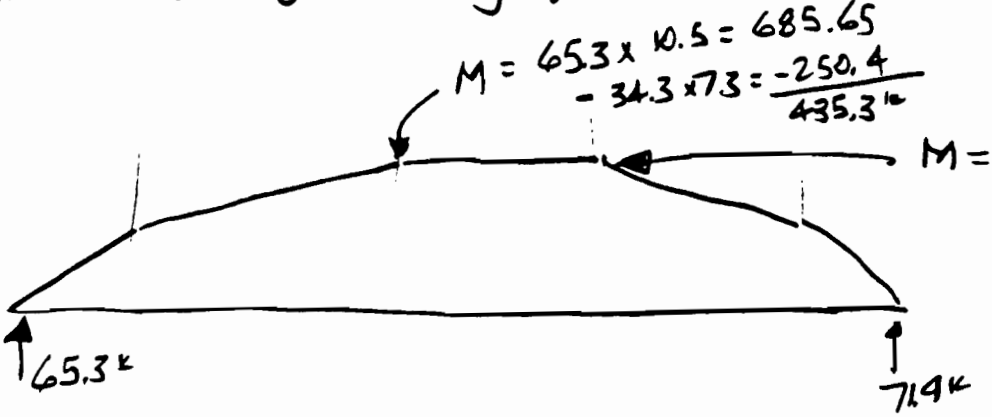
a professional engineering and earth science consulting firm

JOB NO 11-1564 SHEET 5B OF 5B
JOB NAME Griffiss AFB Tank Removal
BY CKB DATE 8/5/92
CHECKED BY JPS DATE 8/5/92

Update Excavation Design:



M_{max} = 435.3 'k (top waler = $435.3 \times \frac{28.9}{34.3}$ = 366.8 'k)

Using F_y = 24 ksi, S_x (req'd) = $\frac{4353 \times 12}{24}$ = 217.7 in.³

USE: W21 x 101, S_x = 227 in.³ - both levels.
side waler

Per Previous Calcs -
End waler Can Be W21 X 62. -

CALCULATION COVER SHEET

LAW ENVIRONMENTAL, INC.

PROJECT	PROJECT No.
GRIFFISS AFB - INTERIM ACTION DESIGN	11-1564

CALCULATION TITLE: "DETERMINE QUANTITIES FOR BID FORM"

ORIGINATED BY	DATE	CHECKED BY	DATE
J. F. LARSON	8/5/92	M.E. BARTENFELD	8/6/92

SUBJECT:

STATEMENT OF PROBLEM:

DETERMINE QUANTITIES FOR INCLUSION INTO SPECIFICATIONS BID FORM

SOURCES OF DATA:

SOURCES OF FORMULA & REFERENCES:

INTENDED USE:

☐ PRELIMINARY CALC. ☐ SUPERCEDES CALC. No. 95%

☑ FINAL CALC. ☐ OTHER _____

REV No.	DESCRIPTION	BY	DATE	CHK	DATE

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES BRANCH

PROJECT NO. 11-1564 SHEET 1 OF 5
PROJECT NAME GRIFFISS AFB
BY J. LARSON DATE 8-5-92
CHECKED BY M. BARTOLFOLD DATE 8/6/92

QUANTITY CALCULATIONS FOR BID FORM

BID ITEM 0002 PIPELINE LIQUIDS REMOVAL AND DISPOSAL. NO CALCULATION NECESSARY AS PER CONVERSATION WITH MR. FRAN FIORENTINO OF GRIFFISS AFB JULY 21, 1992, THE BASE FUELS SPECIALISTS ESTIMATE THE QUANTITY OF FUEL REMAINING IN THE PIPELINE TO BE ± 2000 GALLONS.

TO THIS ESTIMATE, ADD THE VOLUME OF LIQUID CONTAINED IN THE 4-in PIPING BETWEEN THE EXISTING OIL INTERCEPTOR AND THE MAN-HEAD PITS AT THE BLDG 110 SITE.

LF
6
45
7
21
21
100'

VOL. X-TRA LIQUID = $\pi R^2 L = \pi (0'-2")^2 100 = 9.07 CF; \times \frac{7.48 GAL}{CF} = \underline{68 GAL}$

TOTAL QUANTITY BID ITEM 0002 = 2000 + 68 = 2068 GAL, SAY 2070 GAL

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES BRANCH

PROJECT NO. 11-1564 SHEET 2 OF 5
PROJECT NAME GRIFFISS AFB
BY J. LARSON DATE 8-5-92
CHECKED BY M. BARTENFELD DATE 8/6/92

BID ITEM 0003 HAZ SOLIDS

NOW CONSIDER THE QUANTITY OF HAZ SOIL IF HAZ SOIL EXTENDS FROM THE TOP OF THE TANK DOWN. AT THE 95% REVIEW MTG. IT WAS AGREED BY ALL PARTIES THAT THE QUANTITY OF HAZARDOUS SOIL ASSUMED SHALL EXTEND FROM A HORIZONTAL LINE AT THE TOP OF THE TANK DOWN.

	L	W	H	L W H
OVERALL EXCAVATION	32'-8"	18'-8"	13'-6"	8234
DEDUCTS FOR SOIL VOLUME				
CONC. SUPPORT SLAB	26'-6"	13'-0"	3'-6"	(1206)
TANK: 12,000 GAL ÷ 7.48 GAL/CF ...				(1604)
				TTL. DEDUCT. (2810)

TOTAL HAZARDOUS SOILS SITE 101... 5424 CF = 201 CY

SOIL : 201 CY X 1.15 SWELL X 1.3 TON/CY (ASSUMED) = 300 TONS
CONC : 1206 CF X 150 #/CF X 1 TON/2000 # = 90 TONS
390 TONS

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES BRANCH

PROJECT NO. 11-1564 SHEET 3 OF 5
PROJECT NAME GRIFFISS AFB
BY J. LARSON DATE 8-5-92
CHECKED BY M. BARTENFELD DATE 8/6/92

BID ITEM 0003 HAZ SOLIDS

SITE 112 HAZARDOUS FROM TOP OF TANKS DOWN

	No.	L	W	H	LWH
OVERALL		23'-0"	5'-0"	5'-0"	575
EMBANKMENTS	2x½	5'-0"	7'-6"	5'-0"	188
EMBANKMENTS	2x½	23'-0"	7'-6"	5'-0"	863
					1626

DEDUCTS FOR SOIL VOLUME

ASSUME CONC. SUPPORT SLAB	23'-0"	5'-0"	1'-0"	(115)
TANKS	2 x ~~500GAL~~ 7.48 GAL/CF ...			(134)
(SAY SAND IN 1 TANK IS HAZ)			TOTAL DEDUCT	(249)

TOTAL HAZ SOILS SITE 112 ... 1377 CF = 51 CY

SOIL: 51 CY x 1.15 SWELL x 1.3 TON/CY = 76 TONS
CONC: 115 CF x 150 #/CF x 1 TON/2000 # = 9 TONS
85 TONS

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES BRANCH

PROJECT NO. 11-1564 SHEET 4 OF 5
PROJECT NAME GRIFFISS AFB
BY J. LARSON DATE 8-5-92
CHECKED BY M. BARTENFELD DATE 8/6/92

BID ITEM 0004 NON-HAZ CONTAMINATED SOILS

	No.	L	W	H	LWH
OVERALL		57'-0"	37'-6"	12'-0"	25650
EMBANKMENT	½	37'-6"	18'-0"	12'-0"	4050
EMBANKMENT	½	37'-6"	12'-0"	8'-0"	1800
EMBANKMENT	-	37'-6"	12'-0"	4'-0"	1800
EMBANKMENT	½	57'-0"	18'-0"	12'-0"	6156
EMBANKMENT	½	57'-0"	6'-9"	4'-6"	866
EMBANKMENT	-	57'	6'-9"	8'-0"	3078
					43400

DEDUCTS FOR SOIL VOLUME

TANK SADDLES	4	54'-0"	4'-0"	3'-3"	(2808)
UST'S	4 x (25000 ÷ 7.48 GAL/CF) ...				(13369)

TOTAL DEDUCT.. (16177)

27223 CF = 1008 CY

TOTAL CONTAM. SOIL SITE 110

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES BRANCH

PROJECT NO 11-1564 SHEET 4A OF 5
PROJECT NAME GRIFFISS AFB
BY J. LARSON DATE 5-21-92
CHECKED BY M-BARTENBACH DATE 8/6/92

UST AT FILL STAND

$VOL = \pi R^2 L$
$VOL = \pi(1'\text{-}1\tfrac{1}{2}")^2\ 4'\text{-}0" = 15.9$ C.F.
$VOL = 15.9\ CF \times 7.48\ GAL/CF = 120$ GAL

ASSUME EXCAVATION DIMENSIONS OF $8' \times 5' \times 6' = 240$ CF

SOIL REMOVED $= 240 - (120 \div 7.48\ \frac{GAL}{CF}) = 224$ CF $=$ 9 CY

WATER SEPARATING TANKS

TOTAL VOLUME (NOT INCL CONC) $= 19'\text{-}0" \times 5'\text{-}6" \times 3'\text{-}0" =$ 314 CF
VOLUME SOIL $= 314 - (2 \times \frac{500\ GAL}{7.48\ GAL/CF}) = 180$ CF $=$ 7 CY
VOLUME CONC. $= (19'\text{-}0" \times 5'\text{-}6" \times 1'\text{-}0")/27 =$ 4 CY

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES BRANCH

PROJECT NO. 11-1564 SHEET 5 OF 5
PROJECT NAME GRIFFISS AFB
BY J. LARSON DATE 8-5-92
CHECKED BY M. BARTON FOLD DATE 8/6/92

BID ITEM 0004 NON-HAZ CONTAMINATED @ SITE 110

SOIL (1008 + 9 + 7) CY x 1.15 SWELL x 1.3 TONS/CY = 1531 TONS
CONC (2808 + 105) CF x 150#/CF x 1 TON/2000# = 218 TONS
1749 TONS

POLLY-PIG DIVISION

GIRARD INDUSTRIES INCORPORATED

6531 North Eldridge Parkway / Houston TX 77041-3507
(713) 466-3100 / US (800) 231-2861 / TX (800) 392-2222
Telex 76-2565 FAX (713) 466-8050

Industrial Pipeline Cleaners

OUR REPRESENTATIVE IN YOUR AREA IS:

PIPING SPECIALTIES
SALES + SERVICE

GIRARD'S 25 YEARS OF MANUFACTURING AND FIELD EXPERIENCE IN POLLY-PIGS OFFERS YOU THE BEST ENGINEERED FOAM PIG ON THE MARKET

Girard Polly-Pigs are internal pipeline cleaners. The patented design consists of a flexible, bullet shaped foam cylinder with a sealed concave base and tough spirals of urethane rubber adhered to its surface. When pressure is applied, these bands try to expand, causing a scraping or sealing action. Girard Polly-Pigs are manufactured of the highest quality open-cell polyurethane flexible foam and are available in a variety of polyurethane rubber coatings and abrasives. Girard's 25 years of experience in pig manufacturing has perfected this tool and offers it to every industry that has a piping system. There are three basic polly-pigs: dryers, wipers and scrapers; each is available in three grades of durability. To choose the type required, determine the application, then choose the Girard Polly-Pig that will best suit your needs:

Scarlet series
Red series
Yellow series

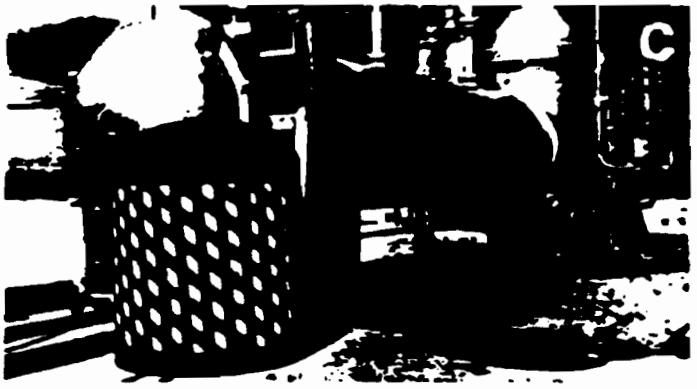
Specials are available:

Gray Hard Scale Pig:	for heavy industrial scraping
Maxi Brush Pig:	for extra heavy scraping
Unicast Pig:	for long straight line cleaning
Cavity Pig:	for tracking; features rear cavity to accommodate electronic transmitter.

Consult the factory for details on the special items. Wherever there is a pipe, there is a Girard Polly-Pig that may be effectively used to dry it, wipe it, scrape it, or dewater it at lower than normal costs.

A - Demonstrates POLLY-PIGS ability to negotiate 90 degree elbows. Approximately 100 gallons of solids were removed with one pass.

B -16" POLLY-PIG passing through a venturi plug valve. Seven such valves were negotiated on the run, each with as much as a 61% reduction.



C - For long straight runs, this unicast PIG actually rotates in the line to cause even wear. Runs of 1000 mi + are common.

D - This 16" POLLY-PIG has traveled through a gas line containing 11 miles of 12" and 9 miles of 16" pipe.

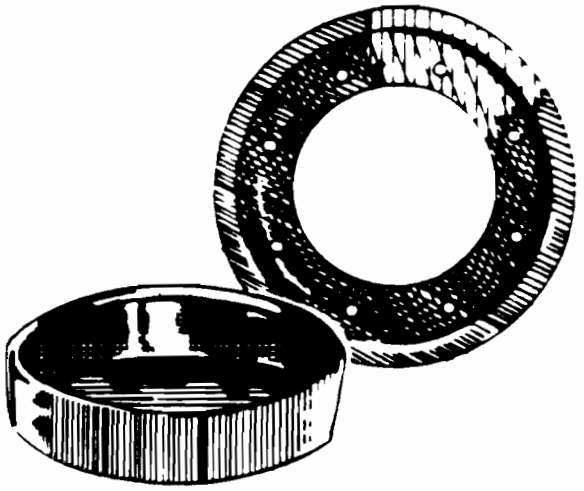
Most all pressurized piping systems have an application for GIRARD POLLY-PIGS.

Disposal Lines
Transmission Lines
Gathering Lines
Distribution Lines
Producing Lines
Water Lines
Waste Lines
Air & Gas Lines

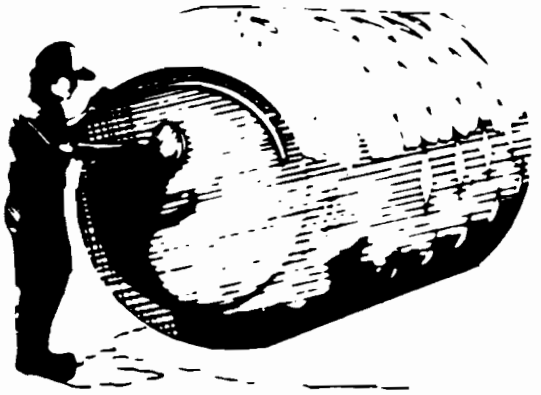
Tailings Lines
Solution/Slurry Lines
Flow Lines
Injection Lines
Packaging Lines
Loading Lines
Fly Ash Lines
Bottom Ash Lines

Fire Protection Lines
Liquor Lines
Process Lines
Product Lines
Gas Lines
Fuel Lines
Cooling Lines
Chill Lines

OTHER PRODUCTS & SERVICES AVAILABLE FROM GIRARD

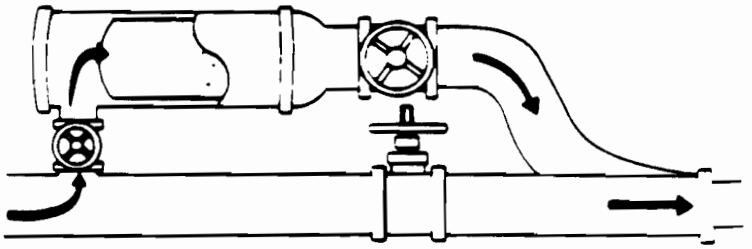


Polyurethane Cups & Discs
2" thru 48"



Custom Foam Pigs up to 9' Diameter (and special shapes)

Pipe Stoppers, Pressure Recorders and other pipe line related items.



Launchers and Receivers in all sizes.

Custom Urethane Parts

World Wide Network of Service Companies

Patents issued in seven countries. Patents pending in sixteen countries.

FORM 1000 (Revised 5/87)

GIRARD POLLY-PIGS

TYPE	STYLE	DENSITY	FUNCTION
SBD (Scarlet bare durafoam)		8 LBS CU FT	Heavy Drying Up to 200 MI
SCC (Scarlet criss-cross)		8 LBS CU FT	Heavy Wiping Up to 200 MI
SCC-WB (Scarlet criss-cross wire brush)		8 LBS CU FT	Heavy Scraping Up to 200 MI
SCC-SC (Scarlet criss-cross silicon carbide		8 LBS CU FT	Heavy Scraping Up to 200 MI
SCC-T (Turning)		8 LBS CU FT	Heaviest Wiping Up to 300 MI
SCC-WB-T (Turning)		8 LBS CU FT	Heaviest Scraping Up to 300 MI
SCC-SC-T (Turning)		8 LBS CU FT	Heaviest Scraping Up to 300 MI
RBS (Red bare squeegee)		5 LBS CU FT	Regular Drying Up to 10 MI
RCC (Red criss cross)		5 LBS. CU FT	Regular Wiping Up to 10 MI
RCC-WB (Red criss-cross wire brush)		5 LBS. CU. FT	Regular Scraping Up to 10 MI
RCC-SC (Red criss-cross silicon carbide)		5 LBS. CU. FT	Regular Scraping Up to 10 MI
RCC-T (Turning)		5 LBS. CU. FT	Longer Wiping Up to 25 MI
RCC-WB-T (Turning)		5 LBS. CU. FT	Longer Scraping Up to 25 MI
RCC-SC-T (Turning)		5 LBS. CU. FT.	Longer Scraping Up to 25 MI
YBS (Yellow bare swab)		2 LBS. CU. FT.	Light Drying Up to 1 MI
YCC (Yellow criss-cross)		2 LBS. CU. FT	Light Drying Up to 1 MI
YCC-SC (Yellow criss-cross silicon carbide)		2 LBS. CU. FT.	Light Drying Up to 1 MI
YBS-B (Bullet)		2 LBS. CU. FT.	Light Drying Up to 1 MI
YCC-T (Turning)		2 LBS. CU. FT	Light Drying Up to 3 MI
YCC-SC-T (Turning)		2 LBS. CU. FT.	Light Drying Up to 3 MI
SPECIAL APPLICATIONS			
BCC-PB (Blue plastic brush)		8 LBS. CU. FT.	Non Abrasive brushing
UNICAST		20 LBS. CU. FT.	Long Range Cleaning Up to 2000 MI
GRAY HARD SCALE		8 LBS. CU. FT.	Industrial Scraping Up to 300 MI
MAXI-BRUSH (LIGHT WIRE)		8 LBS. CU FT	Maximum Scraping Up to 300 MI
MAXI-BRUSH (HEAVY WIRE)		8 LBS. CU. FT.	Maximum Scraping Up to 300 MI

OPERATING INSTRUCTIONS

ON STREAM OPERATION:

LAUNCHER: Open 1 and Close 2, 3, and 4.

CATCHER: Open 5 and Close 6, 7, and 8.

OPERATION OF LAUNCHER:

1. Open 4.
2. Check pressure gauge for reading of 0 PSIG.
3. Open closure and insert pig as far forward as possible and close closure.
4. Slightly open 3 and purge thru 4.
5. After air is purged from launcher, close 4.
6. Finish opening 3 and then open 2.
7. Close 1 slowly.
8. After pig is launched, open 1, close 3 and 2.

OPERATION OF CATCHER:

1. Open 6, 7 and 8.
2. Close 5.
3. After pig has arrived, open 5, then close 6 and 7, and bleed pressure out of catcher thru 8.
4. Check pressure gauge for reading of 0 PSIG.
5. Open closure and remove pig.
6. Close closure.
7. Slightly open 6 & 7 to purge air out thru 8.
8. Close 6, 7 and 8.

TOPAZ OF THE SOUTHEAST, INC.
1408-C Capitol Circle N.E.
TALLASSEE, FLORIDA 32308
904-878-7048

25 pages

Mike Dartenfeld

GIRARD POLLY-PIG, INC.
8591 Addicks-Fairbanks Rd. / Houston, Texas 77041 / (713) 466-3100
Telex 76-2566 / Toll Free / 800-231-3961 / Texas 800-392-2222

CLEANING AND DRYING PIPELINES

LOW DEWPOINTS CAN BE ACCOMPLISHED INSIDE PIPELINES BY UTILIZING THE FOLLOWING PIGGING PROCEDURE IN CONJUNCTION WITH DRY AIR, NITROGEN OR NATURAL GAS.

STEP 1 A double dish polyurethane coated criss-cross model polyurethane 6 lb. per cubic foot density foam pig, complete with rear seal, shall be forced through the pipe at an approximate rate of 7 to 15 feet per second to remove construction debris and the bulk of any liquid in the line. (An alternate would be to use a steel shaft multi-cup pig for this step.)

STEP 2 A bare polyurethane 6 lb. per cubic foot density foam pig with a polyurethane drive seal shall be forced through the pipe at an approximate rate of 7 to 15 feet per second to remove additional moisture.

STEP 3 Bare pigs consisting of 1.5 to 2 lb. density polyester foa materials complete with polyurethane drive seal shall be forced through the pipe at a fast rate of speed (up to 73 feet per second) until units emerge dry to the touch.

STEP 4* Polyurethane 10 lb. per cubic foot density foam pigs with a polyurethane drive seal and an external cover of polyurethane coating and flame-hardened steel wire brushes shall be forced through the pipe at a fast rate of speed (up to 73 feet per second) to remove all mill scale.

STEP 5* Bare pigs consisting of 1.5 to 2 lb. density polyester foam materials complete with polyurethane drive seal shall be forced through the pipe at a fast rate of speed (up to 73 feet per second) to sweep out any loose debris.

* This step should be eliminated if pipe is internally coated.

NOTE: The launcher should be similar to a standard pig launcher connected to a check valve to avoid continuous closing and opening of a valve while loading and launching the large number of pigs. The receiver is provided with a net that will retain the discharged pigs. These general rules are for polyurethane foam pigs only.

Pigs prove very effective in cleaning brine, water lines

Flow dramatically increased, energy saved

PAULO R. CABRAL DE MELLO
Mining Engineer
Salgema Industries Quimicas, SA
Maceio, Alagoas, Brazil
MARION SOURS
Managing Editor

NEW SOLUTIONS

Problem

Salgema Industries Quimicas, SA was not satisfied with the flows through two of its pipelines. The salt refining plant, which produces table salt, industrial salt and chlorine, is located in the Brazilian city of Maceio.

The two pipelines in question—one a brine line and the other a water line—begin at the brine field pump station and proceed through Maceio to the plant located on a bay; a total of five miles. While neither line actually was blocked, the flows through the pipelines were not as rapid as might be expected. The flow in the 12" diameter brine line was 526 gpm at 80 psi. The flow in the 10" diameter water pipeline was 584 gpm at 72.5 psi. The plant felt certain that deposits and debris in the lines were slowing flows, and thus began to look for ways of clearing the pipelines.

Solution

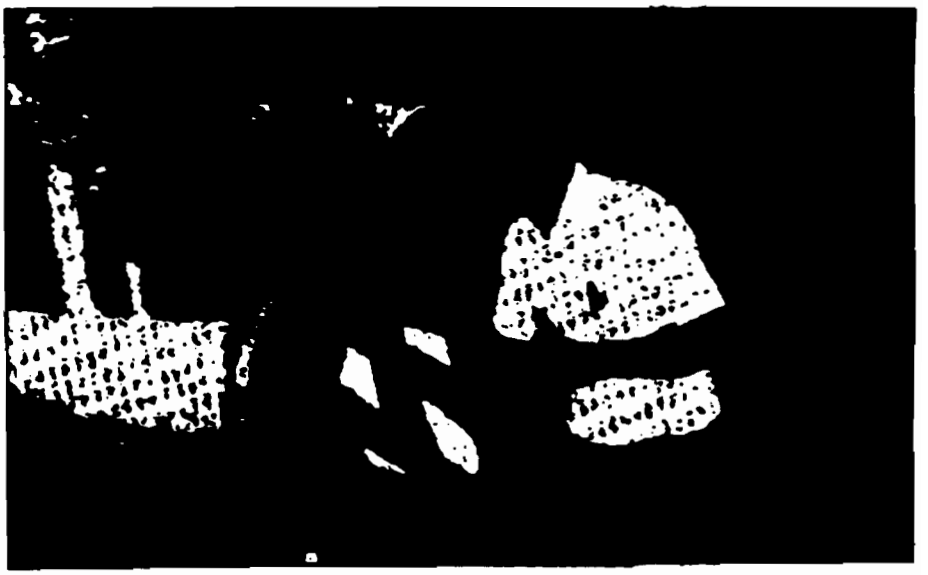
The plant learned of several types of pigs, manufactured by the same company, which seemed able to clear pipelines well and increase flows.

It was decided that some of these pigs would be purchased, and that the brine line would be the first to be cleaned. This line was suspected of having approximately ½" buildup of deposits, including salt encrustations, some mud-like deposit and iron tuberculation. The six-yr-old line never had been pigged before, and plant personnel were somewhat afraid that the pig would get stuck.

The line cleaning began by running a 5-lb density bare rubber foam pig to prove the line and gauge the effective inside dimension.

Brine water which was in the line was displaced to the brine tanks. When fresh water began to dilute the brine, the discharge was diverted to the storm sewers discharging to the ocean.

The discharge was black in color and semi viscous. There also were pieces of wood of various sizes and shapes, one measuring more than 6' in length. Other items in the discharge included: portions of steel reinforcing rod, pieces of steel—presumably cut from the pipe during installation, scraps of welding rod, cloth rags and about two wheelbarrow loads of large rocks. Probably the most bizarre item in the pipeline discharge was a plywood sign which read: "Do not take a shower in this area."



A wire brush pig is inserted for one of the final pipe cleaning runs

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6631 Addicks-Fairbanks Rd. / Houston, Texas 77041 / (713) 466-3100
Telex 76-2666 / Toll Free / 800-231-3661 / Texas 800-392-2222

RECOMMENDED PROCEDURE

Converting Oil Line to Potable Water Line

Step #1
Pig Line with three each Scarlet Criss-Cross

Step #2
Run a slug of 2% Detergent solution (DI-CHEM C) between two Double Dish Scarlet Criss-Cross pigs

Step #3
Run a slug of Soda Ash and water (100# to 25 BBLS water) between two double dish Scarlet Criss Cross pigs

Step #4
Flush line with water and two Scarlet Bare Durafoam pigs

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Telex 79-2386 / Toll Free / 800-231-2861 / Texas 800-392-2222

RECOMMENDED PROCEDURE

Hard Scale Line Cleaning

Fly Ash, Mine Tailing, Calcium Carbonate with a Moh's Scale of Hardness of 6.

Step #1
Run a 2 lb. density swab of line size

Step #2
Begin pigging by running a Gray Criss-Cross Wire Brush the size of worn swab

Step #3
Repeat this size run until pigs are received in good condition (usually six runs are sufficient)

Step #4
Increase size by ¼" on lines 8" and larger; ¼" for 6" and less and repeat step #3.

Step #5
Increase size and repeat steps 3 and 4

Step #6
Repeat this procedure until the scale is removed or satisfactory cleaning has been accomplished.

GIRARD POLLY-PIG, INC.

6531 Addicks-Fairbanks Rd. / Houston, Texas 77041 / (713) 466-3100
Telex 79-2565 / Toll Free / 800-231-3661 / Texas 800-392-2222

RECOMMENDED PROCEDURE

Acid Line - Sever Chemicals - Sacrificial Pigging

Many times sever chemicals must be removed from a line for repairs or for other reasons. The Girard Polly Pig is usually not compatible with these chemicals and other methods are not practical. The below listed procedure is an alternative which the customer may find useful.

Step #1
Insert pig and propel forward until it is consumed by the chemical and loses seal (if it moves 50 feet then 50 feet of sever chemicals have been removed).

Step #2
Run a second pig. It should travel further down the line than the first pig, before it is consumed.

Step #3
Run a third and fourth pig, etc. if necessary.

Step #4
The last pig through the line should wipe the line clean.

P. O BOX 27208
HOUSTON TEXAS 77087

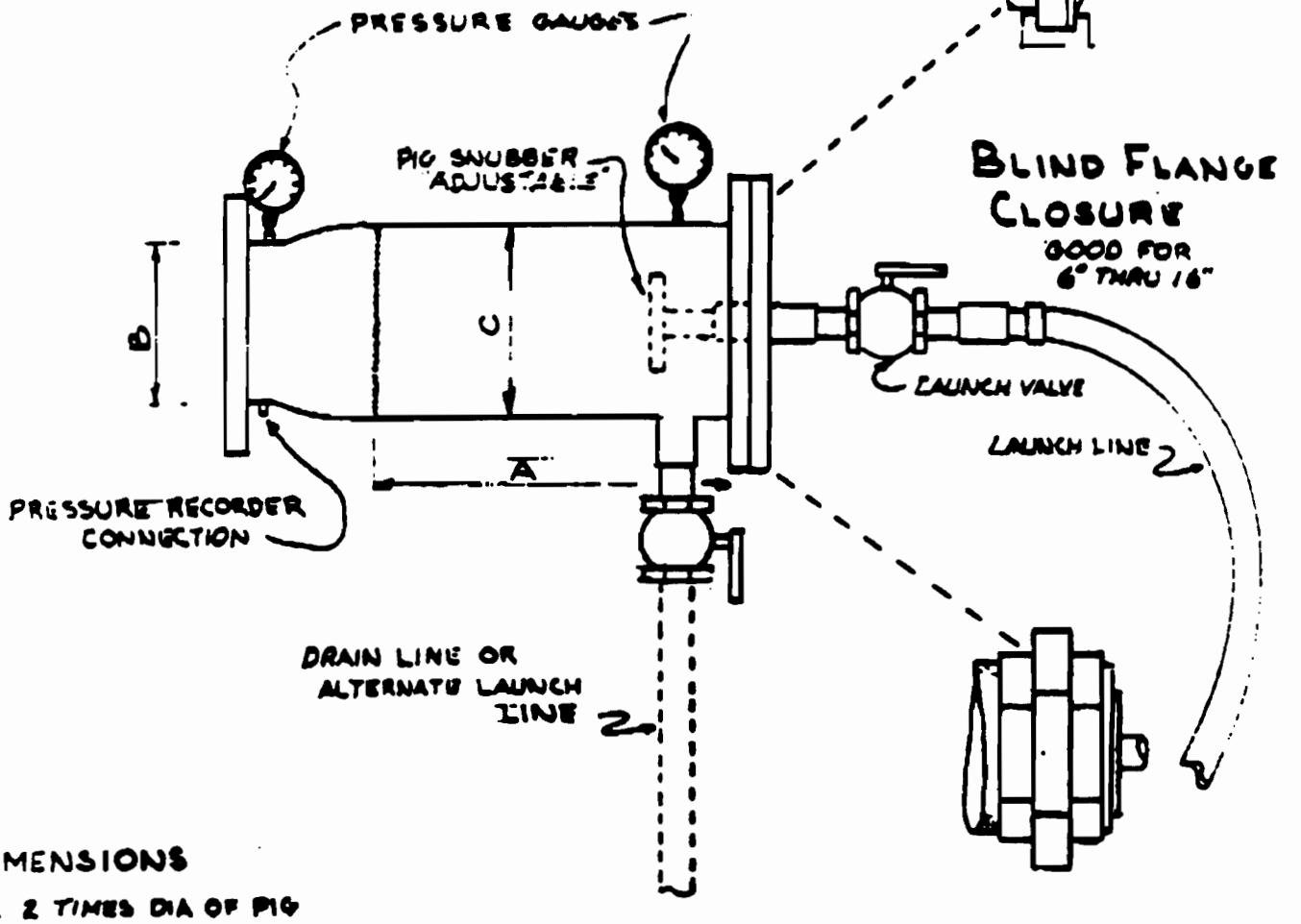
OFFICE 713/68
TELEX 76-2

FLOWMORE SERVICES CORP.

A PIPELINE FLOW IMPROVEMENT CO.

HINGED CLOSURE

GOOD FOR 16" & LARG



BLIND FLANGE CLOSURE

GOOD FOR 6" THRU 16"

DIMENSIONS

A. 2 TIMES DIA OF PIG
B. DIA. OF LINE TO BE CLEANED
C. ONE PIPE SIZE LARGER THAN PIG

UNION CLOSURE

GOOD FOR 4" & SMALLER

SUGGESTED LAUNCHED DESIGN

HOW TO LAUNCH A PIG

A launcher is probably the most important tool to use with the Girard Polly Pig. Many failures could have been a success if a launcher had been used.

The typical shotgun chamber or enlarged pipe is the best and most comm as described on the attached sheet.

There are times, however, when the expense of a specially built launch would negate the pigging job such as:

Pipe materials (unable to attach)
Field location - no launching water or air source, or other reasons.

Alternate methods must be used.

A few are:

A. 4" and smaller pigs can often times be twisted into the end of the pipe

B. Make a funnel or cone out of galvanized tin. Lubricate pig with water soluable grease or waterless hand cleaner and put into entry of funnel. Using a blunt ram rod, i.e. 4 x 4 or something similar with corners rounded off, start pushing. For larger pigs, use pickup truck or backhoe or bull dozer. Care must be taken not to push too quickly or wrinkling may occur and you should never use a sharp or pointed instrument for fear of penetrating the butt plate.

C. Build a "picket fence" around pig using wood plaster lath or flat steel and band in three or four places along the body of the pig from front to rear compressing the foam and pickets to less than I.D. of pipe. Snip each bond just before it enters the pipe. After pig and pickets are in the pipe, pull pickets out one at a time until all are out, then launch.

D. Split pipe approx. 3/4 length of pig. Insert pig (lubricated) and push beyond split. Pull split back together and weld.

E. Soak pig thoroughly in water. Place in front of car or truck wheel and drive vehicle on to top of pig and wait until water is displaced, then drive off, grab pig and run like H---.

HOW TO TRAP A PIG

Proper trapping facilities are as important as proper launching facilities.

The simplest method and where it is allowed, the pig can exit the pipe open ended and be picked up from the ground.

In ponds, pits, ocean, or reservoirs and tanks, a means should be available to "fish" the pig out. Keep in mind the pig will float. For these types of exits, it is recommended that a handling rope be built into the nose or butt of the pig to hook and handle.

When pigging with air, gas or nitrogen, extra care must be taken because the exiting pig will become a projectile. When pigging with water or another liquid, the pig will die with the flow.

Many applications require a catcher or trap. All of these situati must have a bypass arrangement so fluid or gas will continue on to holding system or waste without the pig.

A catcher basket or stopper must be provided to prevent the pig from following the path of least resistance and leaving the trap and continuing on through bypass system.

See enclosed drawings.

GIRARD POLLY-PIG, INC.
6631 Addicks-Fairbanks Rd. / Houston, Texas 77041 / (713) 466-3100
Telex 76-2566 / Toll Free / 800-231-8961 / Texas 800-392-2222

WHAT TO DO IF A PIG SHOULD BECOME STUCK

Usually there are two types of stuck pigs...

1. Those which have bypass
2. Those which do not have bypass

1. PIGS WHICH HAVE BYPASS

A. Increase pressure and volume
B. Remove pressure
C. Remove pressure and volume
D. Remove pressure and volume for a period of time
E. Flow a swab up to pig to provide a more positive seal
F. Super chlorinate
G. Reverse flow and pressure

2. PIGS WHICH DO NOT HAVE BYPASS

A. Increase pressure and volume
B. Remove pressure
C. Remove pressure and volume
D. Remove pressure and volume for a period of time
E. Apply pressure in reverse direction

page 2 What to do if a Pig becomes stuck.

1. For those which have bypass, we recommend the following steps (in order).

   A. Increase Volume & Pressure

   B. Remove pressure by opening a discharge valve and dropping pressure to zero, then reapply pressure.

   C. Remove pressure and volume by opening a discharge valve and dropping pressure to zero and allowing to drain down; the surge the line. This will cause a water hammer and usually force the pig on through the tight spot.

   D. Remove pressure & volume and leave system down for 30 mins. to 1 hour . Due to normal movement of the pig whereby pressure is applied to the rear of the pig and friction drag is applied to the front, a pig has natural response to compress in the line. By allowing to rest, it can return to normal length and when the system is returned to normal pigging condition, the pig will probably begin to move again without any significant increase in pressure.

   E. Insert swab and move up to the pig to create a new positive seal to bring the pig on out.

   F. Apply pressure in reverse direction. Usually there is no need to return pig to the launch end, but back it up a few feet, then begin pigging procedure agai

   Note: On certain types of line (primarily water), a strong concentration of chlorine can be added and flowed past the pig to dissolve and help break down the cell structure.

2. For those which do not have bypass, all of the above steps except E will also apply

GIRARD POLLY-PIG, INC.

6631 Addicks-Fairbanks Rd. / Houston, Texas 77041 / (713) 466-3166
Telex 76-8566 / Toll Free / 800-231-3661 / Texas 800-392-2222

GIRARD PROGRESSIVE PIGGING METHOD

1. Isolate the line to be cleaned from the system.
2. Check to make sure all valves are fully opened.
3. Turn on water to double check the direction of flow.
4. Run a full size bare swab to prove the direction of flow.
5. Run a full size bare pig to gauge the "true opening".
6. Examine the bare pig after it has run. Measure it's diameter and introduce a criss-cross type unit into the line that will just fit the "true opening". Run a full size bare swab behind the criss-cross unit to assure a tight seal. Continue this process until a unit is discharged from the line in reusable condition.
7. Increase the size of the criss-cross pigs in one inch increments until units which measure the same as the pipe I.D. are being used. For pipes with a build-up of hard scale, such as iron oxide, criss-cross wire brush pigs can be applied on the final pass.
8. Run a full size bare swab to sweep out any loose debris.

SPECIAL NOTES FOR BEST CLEANING RESULTS

1. Flush the line after each pig run until water is clear.
2. Run pigs until desired "C factor" (flow coefficient) is reached.
3. To assure against excessive abrasion, do not apply more than two wire brush pigs on the final pass. (Consult Girard Polly Pig for further discussion on this point)
4. Flush all lines that were affected (shut down) during the operation, in sequence, from point of launch to point of retrieval. (Prevents red water problems from arising)
5. Launching can be accomplished using fire hydrants for lines of 8 inches or smaller, or with concentric reducers, pipe couplings, spools, eccentric reducers, or by hand.
6. Ideal pigging speed is between 450 and 1400 feet per minute.
7. For lines of less than 4 inches, keep pig runs under 300 feet.

GIRARD POLLY-PIG, INC.

6631 Addicks-Fairbanks Rd. / Houston, Texas 77041 / (713) 466-3100
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THE GIRARD PROGRESSIVE PIGGING TWO PERCENT RULE

When using Girard Polly-Pigs to clean water main and supply lines, the following rule should be applied.

A water line can be considered clean and pigging should be stopped when-

The time elapsed between the moment that the effluent begins to blacken and the moment the Polly-Pig exits from the line is equivalent to TWO PERCENT of the TOTAL TIME of the pig run.

EXAMPLE:

(Average) Pig run time, from launch to retrieval; 20 minutes, 20 seconds
Total 1220 seconds. 1220 x .02 = 24.5

Pigging should be stopped when water begins to blacken 1195.5 seconds, or 19 minutes, 55½ seconds into pig run.

HOW TO DETERMINE WHICH PIG TO USE

Misapplication and/or not understanding how a pig works is probably the downfall of most potential polly pig salesmen or saleswomen and also contributes to the slow acceptance of this product in the field by those charged with maintaining pipelines.

We must keep in mind that each pig has a specific application for which it was designed. Many times, however, it will perform in other areas for which it was not designed. Due to pipe, valve, field or other conditions, its use may be acceptable.

Let's start at the top of the list and work through each one briefly. Keep in mind that each person using or recommending can think of other areas where each pig could also be used.

1. YBS - Yellow Bare Swab

   2# cu. ft. density foam
   70 durometer urethane rubber coating (on rear only)

   Specific Function - Light drying, wiping, and line proving.

   Alternate Function - Can be used on a daily basis where pressures are low, but client wants to maintain his lines clean in order to reduce rapidity of buildup.

   Used as a gauging pig when scale in the pipe is rough enough to tear and wear away part of the foam.

   Used as a sealer pig when progressive cleaning and smaller than line size pigs are being run. This prevents too much bypass of the cleaning pig and causes it to come out on time.

2. YCC - Yellow Criss Cross

   2# cu. ft. density foam
   70 durometer urethane rubber coating

   Specific Function - Light wiping and light scraping. Should use only where line conditions do not allow heavier density foam pigs to be used. Criss cross bands add strength to foam, but does not allow for good cleaning. Good when only entrance into a larger line is through a much smaller line, i.e. 12" through a 6" opening. Also good when pressures are extremely low. Can be hand launched.

   Alternate Function - When line conditions or less expensive pig is required.

3. YCC SC - Yellow Criss Cross Silicone Carbide

2# cu. ft. density foam
70 durometer urethane rubber coating
#34 grit carbide sprinkled into coating

Specific Function - Light scraping. Should be applied with same discretion and basically under same conditions as YCC.

Alternate Function - Could be used with caution in lines, i.e. PVC, fiberglass, etc. where very mild abrasion is needed.

4. RBS - Red Bare Squeegee

5# cu. ft. density foam
70 durometer urethane rubber coating (on rear only)

Specific Function - Regular drying. Best use for drying any smooth interior pipelines usually 1 mile or less in length. Good for removal of soft buildups in any type of pipe.

Alternate Function - Where low pressures prevail, can be used for mild cleaning, gauging the I.D. of a scaled line or as a prover pig.

5. RCC - Red Criss Cross

5# cu. ft. density foam
70 durometer urethane rubber coating

Specific Function - Regular wiping. Good in oilfield flow lines for paraffin removal. Good for wiping most pipelines with a soft buildup. Best in minimum pressure lines with large quantity of short radius 90 deg. bends, tees, valves, etc. Should be limited to 1 mile or less.

Alternate Function - Good substitute for Scarlet Criss Cross where piping condition, pressures and volume are questionable, or in situations where the SCC cannot be used.

6. RCC SC - Red Criss Cross Silicon Carbide

5# cu. ft. density foam
70 durometer urethane rubber coating
#34 grit carbide sprinkled into coating

Specific Function - Regular scraping good where mild abrasion is needed in short distances, i.e. 2,000' or less. Not recommended for normal or tough abrasion.

Alternate Function - Good substitute for Scarlet Criss Cross Silicone Carbide when line conditions or price will not allow use of SCC SC. Not recommended under normal conditions.

7. SBD - Scarlet Bare Durafoam

8# cu. ft. density foam
70 durometer urethane rubber coating (on rear only)

Specific Function - Heavy drying. Best for use in long lines, i.e. 1 mile to 10 miles where heavy drying or wiping is needed. Good for any type drying needs. Good for product removal such as shampoo, chocolate, light oils, etc.

Alternate Function - Can be substituted for Red Bare Squeegees and Swabs in larger lines. Good substitute for SCC when pigging multiple dimension lines and successful manipulation of system with existing pressure and volume is questionable.

8. SCC - Scarlet Criss Cross

8# cu. ft. density foam
70 durometer urethane rubber coating

Specific Function - Heavy wiping, drying and first stages of progressive cleaning. Best use for lines 1 mile or longer. Long runs should be kept under 25 miles, although it may be used up to 100 miles under ideal conditions.

Alternate Function - Many times used in lieu of Carbide or Wire Brush when there is a danger of damaging the interior of the pipe, i.e. fiber glass, PVC, epoxy lined, etc.
BEST ALL-AROUND PIG TO USE.

9. SCC WB - Scarlet Criss Cross Wire Brush

8# cu. ft. density foam
70 durometer urethane rubber coating
24 gage wire brush strap
60 gage wire brush strap fro 2" to 14"

Specific Function - Heavy scraping. Best use for heaviest scraping, plowing and medium hard scale removal, i.e. up to 7 on Moh's scale of hardness. Usually best choice for most calcium carbonate scales. Can travel distances up to 100 miles in good line conditons.

10. SCC SC - Scarlet Criss Cross Silicon Carbide

8# cu. ft. density foam
70 durometer urethane rubber coating
24 grit carbide straps

Specific Function - Heavy scratching. Best use in hard scratchin i.e. bare wall steel pipe, scales harder than 7 on Moh's scale.

Alternate Function - Good when used as a Criss Cross Pig where li conditons would shorten the life of the criss cross. Good when some scraping needed, but Wire Brush would be too much.

RELATIONSHIPS BETWEEN PIPE & PIG DIAMETERS AND MAXIMUM RECOMMENDED PIG REDUCTION

NOMINAL PIPE SIZE	PIPE I.D. (STD. WALL)	PIPE AREA IN SQ. INS.	BARE PIG DIAMETER	PIG CROSS-SEC. AREA	PIG CROSS-SEC. AREA @ 35% RED.	EQUIVALENT REDUCED DIA.
2	2.067	3.356	2.250	3.976	2.584	1.814
2½	2.469	4.788	2.750	5.940	3.861	2.218
3	3.068	7.393	3.250	8.296	5.392	2.620
3½	3.548	9.887	3.750	11.045	7.179	3.023
4	4.026	12.730	4.250	14.186	9.221	3.426
4½	4.506	15.947	4.750	17.721	11.519	3.830
5	5.047	20.006	5.250	21.648	14.071	4.233
6	6.065	28.890	6.500	33.183	21.569	5.240
7	7.023	38.738	7.500	44.179	28.716	6.047
8	7.981	50.027	8.500	56.745	36.884	6.853
9	8.941	62.786	9.500	70.882	46.073	7.659
10	10.020	78.854	10.500	86.590	56.284	8.465
11	11.000	95.033	11.500	103.869	67.515	9.272
12	12.000	113.098	12.500	122.719	79.767	10.078
14	13.250	137.887	13.750	148.490	96.519	11.105
16	15.250	182.655	15.750	194.828	126.638	12.698
18	17.250	233.706	17.750	247.450	160.843	14.311
20	19.250	291.040	19.750	308.355	200.431	15.975
22	21.250	354.657	21.750	371.543	241.503	17.535
24	23.250	424.558	23.750	443.015	287.960	19.146
26	25.250	500.742	25.750	520.769	338.500	20.760
28	27.250	583.209	27.750	604.807	393.125	22.373
30	29.250	671.959	29.750	695.128	451.833	23.985
32	31.250	766.992	31.750	791.732	514.626	25.598
34	33.250	868.309	33.750	894.620	581.503	27.210
[illegible]	35.250	975.909	35.750	1003.790	652.464	28.823

GIRARD POLLY-PIG, INC.

APPROXIMATE PRESSURES AND FLOWS SUGGESTED FOR POLLY PIGGING

NOMINAL PIPE I.D.	PRESSURE PSIG	PRESSURE BARS	LIQUID FLOW GPM*	LIQUID FLOW LPM	GASEOUS FLOW (SCFM) @5 30 PSI	GASEOUS FLOW (SCFM) @10 45	M^3/M
5.0 cm	100-200	7.0-14.0	30-50	113-189	21-56		.59-1.5
7.6 cm	100-150	7.0-10.5	70-100	264-378	46-124		1.3 -3.51
10.0 cm	75-125	5.2- 8.8	120-200	454-757	80-215		2.2 -6.08
15.2 cm	50-100	3.5- 7.0	250-450	946-1703	182-340		5.1 -9.62
20.0 cm	30-80	2.1- 5.6	450-800	1703-3028	316-849		8.9 24.0
25.4 cm	20-60	1.4- 4.2	750-1250	2838-4731	499-1341		14.1-38.0
30.4 cm	10-50	0.7- 3.5	1000-1800	3785-6813	715-1921		20.2-54.4
35.4 cm	10-40	0.7-2.8	1400-2500	5299-9463	873-2345		24.7-66.4
40.6 cm	5-35	0.35-2.4	1800-3000	6813-11,355	1158-3108		32.8-88.0
45.4 cm	5-30	0.35-2.1	2000-4000	7570-15,140	1477-3965		41.8-112.28
50.5 cm	5-25	0.35-1.7	2800-5000	10,598-18,925	1842-4944		52.1-140.0
55.0 cm	5-25	0.35-1.7	3000-6000	11,355-22,710	2243-6022		63.5-170.54
60.0 cm	5-20	0.35-1.4	4000-7000	15,140-26,495	2690-7221		76.1-204.5
65.2 cm	5-20	0.35-1.4	5000-8000	18,925-30,280	3173-8519		89.8-241.2
70.0 cm	5-20	0.35-1.4	6000-9000	22,710-34,065	3693-9814		104.6-277.9
76.2 cm	5-10	0.35-0.7	7000-11,000	29,710-41,635	4259-11,432		120.6-323.7
91.4 cm	5-10	0.35-0.7	10,000-16,000	37,850-60,560	4860-12,448		137.6-352.5
101.6 cm	5-10	0.35-0.7	12,000-20,000	45,420-75,700	5140-15,422		145.6-436.8
106.6 cm	5-10	0.35-0.7	13,000-22,000	49,205-83,270	5679-17,038		160.8-482.5
121.9 cm	5-10	0.35-0.7	17,000-27,500	64,345-104,087	6242-22,362		176.7-633.1
137.1 cm	5-10	0.35-0.7	22,000-38,000	83,270-143,830	9,733-29,192		275.6-826.7
152.4 cm	5-10	0.35-0.7	26,000-42,000	98,410-158,970	11,720-35,159		331.9-995.7
182.9 cm	5-10	0.35-0.7	37,000-65,000	140,045-246,025	17,304-51,903		490.0-1469

*G.P.M.- Based on 3 and 5 FPS (feet per second) velocity

*S.C.F.M. -Based on 5 FPS @30 PSI and 10 FPS @45 PSI

PSIG- Differential Pressure

Formula for SCFM Calculation ft ^{3}/ ft x PSI in atmospheres x FPM
Cubic feet of volume per linear foot of pipe x atmospheres (14.7 PSI) x feet per minute)

NOTE: Values are recommendations only. NOT TO BE CONSIDERED AS ABSOLUTE REQUIREMENTS

PIPE - FLOW RELATIONSHIPS

Fig. #1

CLEAN PIPE

Laminar flow is created in this manner when pipes are clean. Type of pipe or media has no effect. The lower velocities allow solids to drop out of the flow and begin to adhere to the walls of the pipe.

Fig. #3

DIRTY PIPE

Turbulent flow can also occur in dirty pipes containing uneven deposits. Wavy deposi as slight as 1/32" (soft or hard) can cause flow to be reduced by one third. PVC, Fiberglass, metal, non-ferrous and lined pipes can suffer this problem.

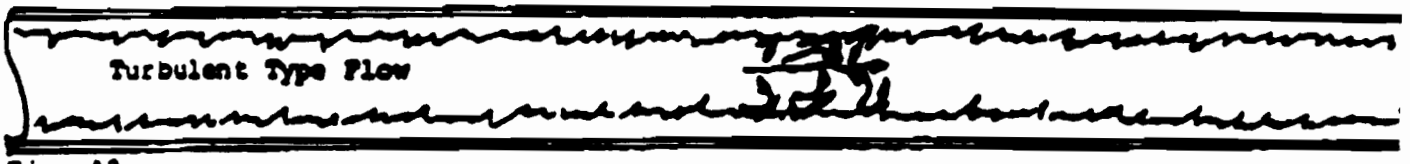


Fig. #2

CHOKED DOWN PIPE

Turbulent flow is created when pipelines contain large buildups such as tuberculation Cast iron and steel pipes often develop stalagtite/stalagmite types of growths. It i at this point the flow changes from laminar to turbulent reducing flow and increasing pumping pressures

Fig. #4

CLEANING

When a Girard Polly Pig is run through the line the following takes place: (A) Frict drag on the front (B) Pressure applied to the rear (C) These two forces meet in the middle making the pig shorter and directing the forces to the outside (D) A high vel by-pass from rear to front past the pig resulting in a sliding seal thus helping to loose deposits and flushing ahead of the pig.

HOW A PIG WORKS

The Girard Polly Pig is constructed of polyurethane rubber foam with various types of outside coatings or coverings. Starting with the bare foam (squeegee), for strength and mild scraping or abrasion, a criss-cross spiral coating of 70 durometer polyurethane rubber is applied approximately 3/16" thick. The wire brush and carbide straps can also be attached or imbedded in this tough coating which again adds strength.

One must keep in mind that the more application of coatings and wire brush or carbide strap, the stiffer and less compressible the pig becomes.

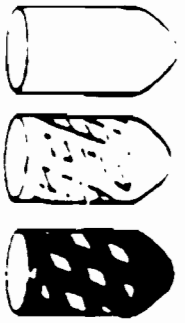
When a pig is put into a line, three very important things happen:

1. The standard pig being slightly oversized causes a friction drag which is the resistance to the pressure being applied to the rear of the pig.
2. As pressure is applied to the rear end, the cylindrical body and spirals begin to compress longitudinally and expand radially acting like a wedge in the pipe. We call this "polly pigging".
3. As pressure is applied to the rear end of the pig, there is a high pressure, low volume bypass going from back to front of the pig which is a jetting action much like squeezing the end of a garden hose.

This jetting action is important because it helps lubricate and cool the pig. It helps in the cutting away of materials on the walls of the pipe, thus prolong the life of the coating and also washes the loose debris in front of the pig keeping the materials removed in suspension and reducing bridging or plugging.

2 LBS./CU. FT. DENSITY

Short runs—up to 1 mi. can be hand launched.



(Yellow Bare Swab) — DRYING

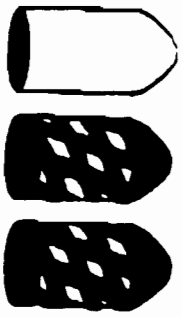
(Yellow Criss-Cross) — WIPING

(Yellow Criss-Cross Silicon Carbide) — SCRAPING

RED TUFCOAT SERIES

5 LBS./CU. FT. DENSITY

Medium runs-1-10 mi.



RBS — DRYING
(Red bare Squeegee)

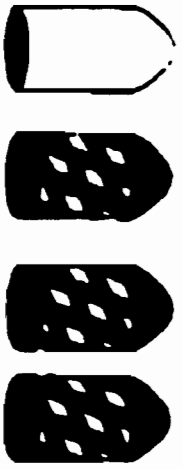
RCC — WIPING
(Red Criss-Cross)

RCC-SC — SCRAPING
(Red Criss-Cross silicon carbide)

SCARLET DURA-COAT SERIES

8 LBS./CU. FT. DENSITY

Long runs-10-300 mi.



SBD — DRYING
(Scarlet bare durafoam)

SCC — WIPING
(Scarlet criss-cross)

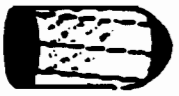
SCC-WB — SCRAPING
(Scarlet Criss-Cross Wire Brush)

SCC-SC — SCRAPING
(Scarlet Criss-Cross Silicon Carbide)

SPECIAL 8 LBS./CU. FT. DENSITY
Best for heavy industrial scraping applications.

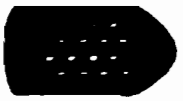
GRAY HARD SCALE - Heavy Scrapir

SPECIAL 8 LBS./CU. FT. DENSITY
Limited to 1½ R bends. Option-rear seal. Use on one nominal pipe size.



MAXI BRUSH — Maximum scrapin

SPECIAL 20 LBS./CU. FT. DENSITY
Rotates for even wear. 300-1200 mi., limited to 3R bends one nominal pipe size.



UNICAST — Long range cleaning

SPECIAL 5 LBS./CU. FT. DENSITY
Approved for food process.

SANI RABBIT — Product recovery

SPECIAL 8 LBS./CU. FT. DENSITY
Recommended to be used with Heath's

CAVITY — Tracking

GIRARD POLLY-PIG, INC.
6631 Addicks-Fairbanks Rd. / Houston, Texas 77041 / (713) 466-3100
Telex 76-2666 / Toll Free / 800-231-3661 / Texas 800-392-2222

TECHNICAL SPECIFICATIONS FOR USE OF PIGS IN CLEANING, HYDROSTATIC TESTING AND DRYING

Steel, concrete, cast iron, asbestos cement, plastic, fiberglass or other pipe shall be cleaned free of all foreign material such as mill scale, welding slag, icicles, construction debris, etc., leaving the internal periphery of the pipe smooth and as free of irregularities as age and internal conditions of pipe allow.

CLEANING

Cleaning shall be accomplished by using a hydraulically propelled polyurethane pipeline cleaner as manufactured by Girard Polly Pig. The pig shall be constructed of open cell polyurethane foam as follows:

An inner core of 2 lb. cu.ft density foam surrounded by 8 lb. cu.ft. density foam.* (Foam body construction combines minimum weight & maximum flexibility with maximum abrasion & tear resistanc

The cleaning pig is to have a dished base and a parabolic nose and a criss cross outer coating of tough polyurethane rubber which is abrasive resistant. The scratching surface shall be of 24 gauge flame hardened wire bristle and the pig shall have the ability to reduce itself to 60% of its original cross-sectional area.

FILLING, AIR PURGING, WATER REMOVAL

Line filling, air purging and water removal shall be accomplished by using a hydraulic polyurethane pipeline pig as manufactured by Girard Polly Pig, Inc. The pig shall be constructed of open cell polyurethane foam, as follows:

An inner core of 2 lb. cu.ft. density foam surrounded by 8 lb. cu.ft. density foam.* (Foam body construction combines minimum weight and maximum flexibility with maximum abrasion and tear resistance.)

The filling, air purging, water removal pig shall be of Bi-Directional design having a dished pressure seal at both ends, to utilize the maximum available pressure when required to travel in the forward or reverse direction, and a criss cross outer coating of tough polyurethane rubber which is abrasion resistant.

FINAL DRYING

The final drying phase of the project shall be accomplished by using t hydraulic polyurethane pipe line pig as manufactured by Girard Polly Pig, Inc., or approved equal. The pig shall be constructed of open cell polyurethane foam as follows:

An inner core of 2 lb. cu.ft. density foam surrounded by an 8 lb.cu.ft. density foam.* (Foam body construction combines minimum weight and maximum flexibility with maximum abrasion and tear resistance.)

The drying pig is to have a parabolic nose, and a dished pressure seal rear end and foam sides to provide absorption and wiping at the peripheral surface. It shall provide a sliding seal so as to move forward in the pipe under air, nitrogen or gas pressure.

Additional runs were made with a wire-brush pig to remove more rocks and heavy deposits. The last pig run brought out no rocks and very little discoloration.

The water line presented an even greater challenge. This schedule 20 welded steel pipeline had a great deal of encrustation of iron tuberculation, approaching 6 on Mohs Scale of Hardness.

To begin the operation, a 2-lb density rubber foam swab was run to gauge and prove the line. This soft pig was used rather than a harder one because of the heavy and rough buildup and short radius 90° bends. (This line ran parallel to the brine line, but had more bends.)

The swab run was three hours long. The discharge was very red and viscous, with tiny pieces of hard tuberculation. These pieces were the fine tips of the encrustation which had broken off; the viscous portion of the flow came from the solids which had not had time to adhere to the other tuberculation.

After the swab exited, the flow increased to 662.5 gpm—indicating the degree to which the fine sediment had restricted flow.

The 10"-diameter swab measured about 7⅛" outside diameter after running. The actual pigging began with an 8" 8-lb density scarfed pig, followed by a 10", 2-lb density swab to assure a positive seal.

Discharge of this line was into a receiver, then through two 4" hoses, which were run to discharge points away from an excavation site. The progressive pigging continued for the next five days, averaging three runs per day.

During the second day of pigging, while running the last 8" wire brush pig, the discharge hoses became plugged with tuberculation. Fortunately, the tuberculation allowed flow much like a gravel filter. The door was opened on the receiver to recover the pig and it was found to be packed full of tuberculation. At this time, the pumps again were turned on to push the debris and pigs out of the line. The discharge was a continuous solid mass of iron tuberculation, resembling coal slurry. It was estimated that at least two cubic yards of solids were pushed out at this time.

The next size pigs then were run with no problems. The job was completed six days after it was begun; a total of 17 pig runs were made.

Results

The flows in the two pipelines have increased dramatically since the pig runs were made. This increase in the brine line was from 529 gpm at 90 psi to 969 gpm at 60 psi. This represents a 45% increase in volume and a 25% decrease in pressure requirements. The energy saved is 110.73 kw hr/day.

The flow increase in the water line was from 584 gpm at 72.5 psi to 863 gpm at 58.0 psi. This represents a 31% increase in flow and a decrease of 20% in pressure. It now takes 16.5 hr to pump as much fluid as it did in 24 hr before the line was cleaned; this is a reduction of 90.64 kw hr.

Salgema Industries Quimicas, SA is very pleased with the energy conservation and dollar savings made possible by cleaning its lines in the manner described.

The first pig used in the line cleaning runs was the Scarlet Bare Durafoam, manufactured by Girard Polly-Pig Inc., 6531 Addicks-Fairbanks Road, Houston, TX 77041.

The second pig used in the runs was the Scarlet Criss-Cross, also manufactured by Girard Polly-Pig Inc.

The pig used in the remaining runs was the Gray Hard Scale Wire Brush, also a product of Girard Polly-Pig Inc.

CALCULATION COVER SHEET

LAW ENVIRONMENTAL, INC.

PROJECT	PROJECT No.
GRIFFISS AFB ~ INTERIM REMOVAL DESIGN	11-1564

CALCULATION TITLE
AQUA-SYSTEM PIPELINE PHYSICAL PROPERTIES & SPECIFICATIONS

ORIGINATED BY	DATE	CHECKED BY	DATE
M. BARTENFELD	7/15/92		

SUBJECT: DETERMINE IF "OLD" AQUA-SYSTEM PIPELINE CAN WITHSTAND THE REQUIRED PRESSURES OF CLEANING THE PIPELINE WITH "POLLY-PIG" METHOD.

STATEMENT OF PROBLEM:

SOURCES OF DATA:

- MR. PHIL WUTHER ~ THOMPSON PIPE & STEEL COMPANY
- AMERICAN PETROLEUM INS. (API) SPECIFICATIONS FOR STEEL PIPE
- MR. JIM GAMBILL ~ GIRRARD INDUSTRIES "POLLY-PIG"

* SEE ATTACHED PHONE LOGS & INFO.

SOURCES OF FORMULA & REFERENCES:

INTENDED USE:

☐ PRELMINARY CALC. ☐ SUPERCEDES CALC. No. _____

☐ FINAL CALC. ☑ OTHER _____

REV No.	DESCRIPTION	BY	DATE	CHK	DATE

LAW ENVIRONMENTAL, INC.
a professional engineering and earth science consulting firm

Attachments: ☐ Yes ☐ No

Distribution Priority: ☐ Rush ☐ Routine

CONTACT FORM

Contact made by: M. BARTENFELD Date: 7/14/92 Time: 10:00 Project Related: ☑ Yes ☐ No

If yes, Project Name: GAFB ~ DESIGN Project No: 11-1564 Enter in DBase: ☐ Yes ☐ No. If yes, ☐ New ☐ Existing

IF NEW CONTACT: Provide all information in this section or attach copy of business card.

Person Contacted	Company Name	Phone
Mr. Jim Gambill, P.E.	Girard Industries	
Title		
Vice President		800-231-2361

Street Address (include P.O.B)	City	State	Zip Code
6531 N. Eldridge Pkwy,	Houston	Tx.	77041

"KNOWN BY" (Law Environmental employees who know contact) in priority order:

1) MEB

2)

3)

"TYPE": ☐ Active Client ☐ Inactive Client ☐ Potential Client ☑ Other

"STATUS": ☐ Open ☐ Prior Authorization ☐ Private

MEANS OF COMMUNICATION: ☑ Initiated ☐ Received ☑ Phone Call ☐ Letter ☐ SOQ ☐ Proposal ☐ RFP ☐ In person visit

☐ Other, explain:

SUMMARY: I called Mr. Gambill to ask his opinion concerning the use of "poly-pigs" to clean and dry the old Aqua-System pipeline at GAFB. I told him that concerns had been raised about the status of the old pipeline and possible rupture due to the cleaning operation. Mr. Gambill stated that the cleaning operation would not possibly cause enough pressure in the line to create problems. He said that the pipe, however old, should be in relatively sound condition and capable of withstanding high pressures. Mr. Gambill stated that the cleaning operation rarely needed pressures greater than 50 psi. and the pipe could easily withstand this being designed for much greater pressures.

☐ More Space Over

Action needed? ☑ Yes ☐ No. If so, by whom? MEB What is needed? PREPARE DESIGN

DISTRIBUTE COPIES TO: Project file, 11-1564 // DT, JFL, TLR, MEB

Date of Distribution 7/14 By MEB DBase Date By

FORM #88-1

LAW ENVIRONMENTAL, INC.
a professional engineering and earth science consulting firm

Attachments: ☑ Yes ☐ No

Distribution Priority: ☐ Rush ☐ Routine

CONTACT FORM

Contact made by: M. BARTENFELD Date: 7/16/92 Time: 8:00 Project Related: ☑ Yes ☐ No

If yes, Project Name: GAFB ~ DESIGN Project No: 11-1564 Enter in DBase: ☐ Yes ☐ No. If yes, ☐ New ☐ Existing

IF NEW CONTACT: Provide all information in this section or attach copy of business card.

Person Contacted	Company Name	
Mr. PHIL WUTHER	THOMPSON STEEL & PIPE CO.	
Title		**Phone**
SALES / ENGINEERING		800 - 289 - 4080
Street Address (Include P.O.B)	**City**	**State** / **Zip Code**
P.O. Box 2852	DENVER	CO. 80201

"KNOWN BY" (Law Environmental employees who know contact) in priority order:

1) MEB

2)

3)

"TYPE": ☐ Active Client ☐ Inactive Client ☐ Potential Client ☑ Other

"STATUS": ☐ Open ☐ Prior Authorization ☐ Private

MEANS OF COMMUNICATION: ☑ Initiated ☐ Received ☑ Phone Call ☐ Letter ☐ SOQ ☐ Proposal ☐ RFP ☐ In person visit

☐ Other, explain:

SUMMARY: I called to inquire about specs & capabilities of steel pipe commonly used during the 1940's & 1950's for military fuel distribution pipe networks. The reason for the inquiry was in regards to pipe cleaning the Aqua-System pipeline at GAFB. The following API Specs. provided from Mr. Wuther illustrates the applicable test pressures of the pipe characteristic of the Aqua-System pipeline. All listed pressures of the pipe are greater than the x maximum 50 psi loading required by the pipeline cleaning operation.

☐ More Space Over

Action needed? ☑ Yes ☐ No. If so, by whom? MEB What is needed? PREPARE DESIGN

DISTRIBUTE COPIES TO: Project file, 11-1564//04, TLR, JFL, MEB

Date of Distribution 7/14 By MEB DBase Date By

FORM #88-1

THOMPSON
PIPE & STEEL COMPANY

A Division Of:
Inter-City Products
Steel Pipe & Fittings

5030 North Washington Street • Post Office Box 2852 • Denver, Colorado 80201 • 303-289-4080 • Fax: 303-288-1068

Founded 1878 • Additional Manufacturing Facility: Princeton, Kentucky

DATE: 7/16/92

TOTAL PAGES 5 INCLUDING THIS PAGE

TO: _____

ATTN: MIKE BARTENFIELD

FAX # 404 421-3593

FROM: PHIL WUTHRICH

FAX # (303) 288-1068

COMMENTS/MESSAGE Mike :

...as we discussed :

1) IT IS DIFFICULT to DETERMINE EXACTLY WHAT TYPE OF PIPE might be INSTALLED AT YOUR LOCATION

2) FOR A GAS LINE it might well be API pipe

3) The API spec WAS ENFORCE in 1942 & 1956

4) The ENCLOSED PHOTOCOPIES are for the current VERSION, FOR WHICH WALL THICKNESSES probably haven't CHANGED

5) TEST PRESSURES are USED

6) HOPE THIS HELPS !

PHIL

If you have not received all pages transmitted, please call (303) 289-4080 or (800) 289-4080.

TRANSMITTED BY: _____

DATE: _____

Specification for Line Pipe

API SPECIFICATION 5L (SPEC 5L)
THIRTY-NINTH EDITION, JUNE 1, 1991

American Petroleum Institute
1220 L Street, Northwest
Washington, DC 20005

TABLE 6.2 (Continued)
PLAIN-END LINE PIPE
DIMENSIONS[1], WEIGHTS, AND TEST PRESSURES[2]
See Appendix D for Metric Tables

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Size				Test Pressure, psi, min.											
Outside Diameter in. D	Designation	Weight, lb. per ft w_{pe}	Wall Thickness, in. t	Inside Diameter in. d	Grade A Std.	Grade A Alt.	Grade B Std.	Grade B Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
12¾		41.45	0.312	12.126	880	1100	1030	1290	1790	1910	2160	2330	2500	2700	2910	3000
12¾		43.77	0.330	12.090	930	1160	1090	1360	1850	2020	2290	2480	2640	2850	3000	3000
12¾		45.56	0.344	12.062	970	1210	1130	1420	1930	2110	2390	2570	2750	2980	3000	3000
12¾	Std	49.96	0.375	12.000	1060	1320	1240	1540	2100	2300	2600	2800	3000	3000	3000	3000
12¾		53.52	0.406	11.938	1150	1430	1340	1670	2270	2490	2810	3000	3000	3000	3000	3000
12¾		57.59	0.438	11.874	1240	1550	1440	1800	2450	2690	3000	3000	3000	3000	3000	3000
12¾	XS	65.42	0.500	11.750	1410	1760	1650	2060	2800	3000	3000	3000	3000	3000	3000	3000
12¾		73.15	0.562	11.626	1590	1980	1850	2310	3000	3000	3000	3000	3000	3000	3000	3000
12¾		80.93	0.625	11.500	1760	2210	2060	2570	3000	3000	3000	3000	3000	3000	3000	3000
12¾		88.63	0.688	11.374	1940	2430	2270	2830	3000	3000	3000	3000	3000	3000	3000	3000
12¾		96.12	0.750	11.250	2120	2650	2470	2800	3000	3000	3000	3000	3000	3000	3000	3000
12¾		103.53	0.812	11.126	2290	2800	2670	2800	3000	3000	3000	3000	3000	3000	3000	3000
12¾		110.97	0.875	11.000	2470	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
12¾		118.33	0.938	10.874	2650	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
12¾	XXS	125.49	1.000	10.750	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
12¾		132.57	1.062	10.626	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
12¾		139.67	1.125	10.500	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
12¾		153.53	1.250	10.250	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
*14		27.73	0.188	13.624	480	600	560	700	960	1050	1160	1280	1370	1480	1600	1830
*14		29.91	0.203	13.594	520	650	610	760	---	---	---	---	---	---	---	1970
*14		30.96	0.210	13.580	540	680	630	790	1070	1170	1330	1460	1530	1660	1790	2040
*14		32.23	0.219	13.562	560	700	660	820	1130	1230	1390	1490	1600	1730	1860	2130
*14		36.71	0.250	13.500	640	800	750	940	1280	1400	1580	1700	1820	1970	2130	2430
*14		41.17	0.281	13.438	720	900	840	1050	1430	1570	1770	1910	2050	2220	2390	2730
14		45.61	0.312	13.376	800	1000	940	1170	1590	1740	1970	2120	2270	2460	2650	3000
14		50.17	0.344	13.312	880	1110	1030	1290	1750	1920	2170	2340	2510	2720	2930	3000
14	Std	54.57	0.375	13.250	960	1210	1120	1410	1910	2090	2370	2550	2730	2960	3000	3000
14		58.94	0.406	13.188	1040	1310	1220	1520	2070	2270	2560	2760	2960	3000	3000	3000
14		63.44	0.438	13.124	1130	1410	1310	1640	2230	2460	2770	2990	3000	3000	3000	3000
14		67.78	0.469	13.062	1210	1510	1410	1760	2390	2620	2960	3000	3000	3000	3000	3000
14	XS	72.09	0.500	13.000	1290	1610	1500	1880	2550	2790	3000	3000	3000	3000	3000	3000
14		80.66	0.562	12.876	1450	1810	1690	2110	2870	3000	3000	3000	3000	3000	3000	3000
14		89.28	0.625	12.750	1610	2010	1880	2340	3000	3000	3000	3000	3000	3000	3000	3000
14		97.81	0.688	12.624	1770	2210	2060	2580	3000	3000	3000	3000	3000	3000	3000	3000
14		106.13	0.750	12.500	1930	2410	2250	2800	3000	3000	3000	3000	3000	3000	3000	3000
14		114.37	0.812	12.376	2090	2610	2440	2800	3000	3000	3000	3000	3000	3000	3000	3000
14		122.65	0.875	12.250	2250	2800	2620	2800	3000	3000	3000	3000	3000	3000	3000	3000
14		130.85	0.938	12.124	2412	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
14		138.84	1.000	12.000	2570	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
14		146.74	1.062	11.876	2730	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
14		154.69	1.125	11.750	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
14		170.21	1.250	11.500	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
*16		31.75	0.188	15.624	420	530	490	620	840	920	1040	1120	1200	1300	1400	1600
*16		34.25	0.203	15.594	460	570	530	670	910	990	1120	1210	1290	1400	1510	1730
*16		36.91	0.219	15.562	490	620	570	720	980	1070	1210	1300	1400	1510	1630	1860
*16		42.05	0.250	15.500	560	700	660	820	1120	1220	1380	1490	1590	1730	1860	2130
*16		47.17	0.281	15.438	630	790	740	920	1260	1370	1550	1670	1790	1940	2090	2390
16		52.27	0.312	15.376	700	880	820	1020	1390	1520	1720	1860	1990	2150	2320	2650
16		57.52	0.344	15.312	770	970	900	1130	1540	1680	1900	2050	2190	2390	2580	2920
16	Std	62.58	0.375	15.250	840	1050	980	1230	1670	1830	2070	2230	2390	2590	2790	3000
16		67.62	0.406	15.188	910	1110	1070	1330	1810	1980	2240	2420	2590	2800	3000	3000
16		72.80	0.438	15.124	990	1230	1150	1440	1950	2140	2420	2610	2790	3000	3000	3000
16		77.78	0.469	15.062	1060	1320	1230	1540	2090	2290	2590	2790	2990	3000	3000	3000
16	XS	82.77	0.500	15.000	1120	1410	1310	1640	2230	2440	2760	2980	3000	3000	3000	3000
16		92.66	0.562	14.876	1260	1580	1480	1840	2510	2750	3000	3000	3000	3000	3000	3000
16		102.63	0.625	14.750	1410	1760	1640	2050	2790	3000	3000	3000	3000	3000	3000	3000
16		112.51	0.688	14.624	1550	1940	1810	2260	3000	3000	3000	3000	3000	3000	3000	3000
16		122.15	0.750	14.500	1690	2110	1970	2460	3000	3000	3000	3000	3000	3000	3000	3000
16		131.71	0.812	14.376	1830	2290	2130	2660	3000	3000	3000	3000	3000	3000	3000	3000
16		141.34	0.875	14.250	1970	2460	2300	2800	3000	3000	3000	3000	3000	3000	3000	3000
16		150.89	0.938	14.124	2110	2640	2460	2800	3000	3000	3000	3000	3000	3000	3000	3000
16		160.20	1.000	14.000	2250	2800	2620	2800	3000	3000	3000	3000	3000	3000	3000	3000
16		169.43	1.062	13.876	2390	2800	2780	2800	3000	3000	3000	3000	3000	3000	3000	3000
16		178.72	1.125	13.750	2530	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
16		187.90	1.188	13.624	2670	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
16		196.91	1.250	13.500	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000

TABLE 6.2 (Continued)
PLAIN-END LINE PIPE
DIMENSIONS[1], WEIGHTS, AND TEST PRESSURES[2]
See Appendix D for Metric Tables

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Size				Test Pressure, psi, min.											
Outside Diameter, in. D	Designation	Weight, lb per ft. Plain End	Wall Thickness, in. t	Inside Diameter, in. d	Grade A		Grade B		Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
					Std.	Alt.	Std.	Alt.								
*6⅝		5.80	0.083	6.459	460	580	580	690	790	860	980	1060	1130	1220	1320	1500
*6⅝		7.59	0.109	6.407	590	740	590	880	1040	1140	1280	1380	1480	1600	1730	1970
*6⅝		8.68	0.125	6.375	680	850	790	990	1190	1300	1470	1580	1700	1840	1980	2260
*6⅝		9.76	0.141	6.343	770	960	890	1120	1340	1470	1660	1790	1920	2080	2230	2550
*6⅝		10.78	0.156	6.313	850	1060	990	1240	1480	1620	1840	1980	2120	2300	2470	2830
6⅝		11.85	0.172	6.281	930	1170	1090	1360	1640	1790	2030	2180	2340	2530	2730	3000
6⅝		12.92	0.188	6.249	1020	1280	1190	1490	1790	1960	2210	2380	2560	2770	2980	3000
6⅝		13.92	0.203	6.219	1100	1380	1290	1610	1930	2110	2390	2570	2760	2990	3000	3000
6⅝		14.88	0.219	6.187	1190	1490	1390	1740	2080	2280	2580	2780	2980	3000	3000	3000
6⅝		17.02	0.250	6.125	1360	1700	1580	1980	2380	2600	2940	3000	3000	3000	3000	3000
6⅝	Std	18.97	0.280	6.065	1520	1900	1780	2220	2660	2920	3000	3000	3000	3000	3000	3000
6⅝		21.04	0.312	6.001	1700	2120	1980	2470	2970	3000	3000	3000	3000	3000	3000	3000
6⅝		23.08	0.344	5.937	1870	2340	2180	2500	3000	3000	3000	3000	3000	3000	3000	3000
6⅝		25.03	0.375	5.875	2040	2560	2380	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝	XS	28.57	0.432	5.761	2350	2800	2740	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝		32.71	0.500	5.625	2720	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝		36.39	0.562	5.501	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝		40.06	0.625	5.375	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝		45.35	0.719	5.187	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝		47.06	0.750	5.125	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
†6⅝	XXS	53.16	0.864	4.897	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝		53.73	0.875	4.875	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
*8⅝		11.36	0.125	8.375	520	650	610	760	910	1000	1130	1220	1300	1410	1520	1740
*8⅝		14.11	0.156	8.313	650	810	760	950	1140	1250	1410	1520	1630	1760	1900	2170
8⅝		16.94	0.188	8.249	780	960	920	1140	1370	1500	1700	1830	1960	2130	2290	2620
8⅝		18.26	0.203	8.219	850	1060	990	1240	1480	1620	1840	2000	2120	2290	2470	2820
8⅝		19.66	0.219	8.187	910	1140	1070	1330	1600	1750	1980	2130	2290	2480	2670	3000
8⅝		22.36	0.250	8.125	1040	1300	1220	1520	1830	2000	2260	2430	2610	2830	3000	3000
8⅝		24.70	0.277	8.071	1160	1450	1360	1690	2020	2220	2510	2700	2890	3000	3000	3000
8⅝		27.70	0.312	8.001	1300	1630	1520	1900	2280	2500	2820	3000	3000	3000	3000	3000
8⅝	Std	28.55	0.322	7.981	1340	1680	1570	1960	2350	2580	2910	3000	3000	3000	3000	3000
8⅝		30.42	0.344	7.937	1440	1790	1680	2090	2510	2750	3000	3000	3000	3000	3000	3000
8⅝		33.04	0.375	7.875	1570	1960	1830	2280	2740	3000	3000	3000	3000	3000	3000	3000
8⅝		36.50	0.438	7.749	1830	2290	2130	2670	3000	3000	3000	3000	3000	3000	3000	3000
8⅝	XS	43.39	0.500	7.625	2090	2610	2430	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝		48.40	0.562	7.501	2350	2800	2740	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝		53.40	0.625	7.375	2610	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝		60.71	0.719	7.187	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝		63.08	0.750	7.125	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝		67.76	0.812	7.001	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝	XXS	72.42	0.875	6.875	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝		81.44	1.000	6.625	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
*10¾		17.65	0.156	10.438	520	650	610	760	1040	1130	1290	1380	1480	1600	1730	1970
*10¾		21.21	0.188	10.374	630	790	730	920	1250	1370	1550	1660	1780	1930	2080	2380
*10¾		22.87	0.203	10.344	680	850	790	990	1350	1480	1670	1800	1930	2090	2250	2570
10¾		24.63	0.219	10.312	730	920	860	1070	1460	1590	1800	1940	2080	2250	2420	2770
10¾		28.04	0.250	10.250	840	1060	990	1220	1660	1820	2060	2210	2370	2570	2770	3000
10¾		31.20	0.279	10.192	930	1170	1090	1360	1850	2030	2290	2470	2650	2870	3000	3000
10¾		34.24	0.307	10.136	1030	1290	1200	1500	2040	2230	2520	2720	2910	3000	3000	3000
10¾		38.23	0.344	10.062	1150	1440	1340	1680	2280	2500	2830	3000	3000	3000	3000	3000
10¾	Std	40.48	0.365	10.020	1220	1530	1430	1790	2420	2660	3000	3000	3000	3000	3000	3000
10¾		48.24	0.438	9.874	1470	1830	1710	2140	2910	3000	3000	3000	3000	3000	3000	3000
10¾	XS	54.74	0.500	9.750	1670	2090	1950	2440	3000	3000	3000	3000	3000	3000	3000	3000
10¾		61.15	0.562	9.626	1880	2350	2200	2740	3000	3000	3000	3000	3000	3000	3000	3000
10¾		67.58	0.625	9.500	2090	2620	2440	2800	3000	3000	3000	3000	3000	3000	3000	3000
10¾		77.03	0.719	9.312	2410	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
10¾		86.15	0.812	9.126	2720	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
10¾		92.28	0.875	9.000	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
10¾		96.30	0.906	8.874	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
10¾	XXS	104.13	1.000	8.750	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
10¾		125.83	1.250	8.250	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
*12¾		23.11	0.178	12.406	490	610	570	710	980	1060	1190	1290	1380	1480	1610	1830
*12¾		25.22	0.188	12.374	530	660	620	770	1060	1150	1300	1400	1500	1630	1750	2010
*12¾		27.20	0.200	12.344	570	720	670	840	1140	1250	1410	1530	1640	1780	1900	2170
*12¾		29.31	0.219	12.312	620	770	730	900	1230	1340	1520	1640	1760	1900	2040	2340
12¾		33.38	0.250	12.250	710	880	830	1030	1400	1530	1730	1870	2000	2170	2330	2670
12¾		37.42	0.281	12.188	790	990	930	1160	1570	1720	1950	2100	2250	2440	2620	3000

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Attention Users: Portions of this publication have been changed from the previous edition. The locations of changes have been marked with a bar in the margin, as shown to the left of this paragraph. In some cases the changes are significant, while in other cases the changes reflect minor editorial adjustments. The bar notations in the margins are provided as an aid to users as to those parts of this publication that have been changed from the previous edition, but API makes no warranty as to the accuracy of such bar notations.

Note
This edition supersedes the 38th edition dated May 1, 1990.
This specification was originally adopted as "tentative" in 1927 and as "standard" in 1928. Revised editions were issued in 1929, 1930, 1931, 1934, 1935, 1940, 1942, 1944, 1945, 1949, 1951, 1954, 1955, 1956, 1957, 1958, 1960, 1962, 1963, 1965, 1967, 1968, 1969, 1970, 1971, 1973, 1975, 1977, 1978, 1980, 1982, 1983, 1984, 1985, 1986, 1987, 1988, and 1990.

APPENDIX C

HEALTH AND SAFETY DESIGN ANALYSIS
GRIFFISS AIR FORCE BASE
ROME, NEW YORK

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1.0 HEALTH AND SAFETY DESIGN ANALYSIS

1.1 SCOPE AND PURPOSE

The Health and Safety Design Analysis (HSDA) presents the conditions and hazardous substances known or anticipated to be present at four Installation Restoration Program (IRP) sites at Griffiss Air Force Base (GAFB). This analysis will be used by the Contractor to identify site-specific/task-specific hazards and determine appropriate health and safety considerations and protective measures to be instituted for the tasks/operations to be undertaken during subsequent remedial construction activities at GAFB.

The Contractor shall conduct all on-site activities in accordance with applicable Occupational Safety and Health Administration (OSHA) and other federal, state and local regulations, including the following:

29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
29 CFR 1910.134	Respiratory Protection
29 CFR 1926.200	Accident Prevention Signs and Tags
29 CFR 1910.1028	Benzene Standard
29 CFR 1910	All Other Applicable Regulations
29 CFR 1926.200	Accident Prevention Signs and Tags
29 CFR 1926	All Other Applicable Regulations

40 CFR 61, Subpart A	National Emissions Standard for Hazardous Air Pollutants

The Contractor will be required to prepare a Site-Specific Safety and Health Plan (SSHP) that conforms with the requirements of OSHA 29 CFR 1910.120 and the U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual EM 385-1-1.

This HSDA should be used by the Contractor in developing programs to meet the requirements contained in Section 01400 (Special Safety Requirements) and Section 01730 (Safety, Health and Emergency Response) of the Design Specifications.

1.2 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

Griffiss Air Force Base (GAFB) was established in 1942 as a Strategic Air Command bomber support installation. GAFB is located in central New York State, approximately two miles northeast of Rome, Oneida County, New York (refer to Figure C-1). The base proper covers approximately 2,900 acres and is situated in the broad, relatively flat valley of the Mohawk River at an average elevation of 504 feet, National Geodetic Vertical Datum (NGVD).

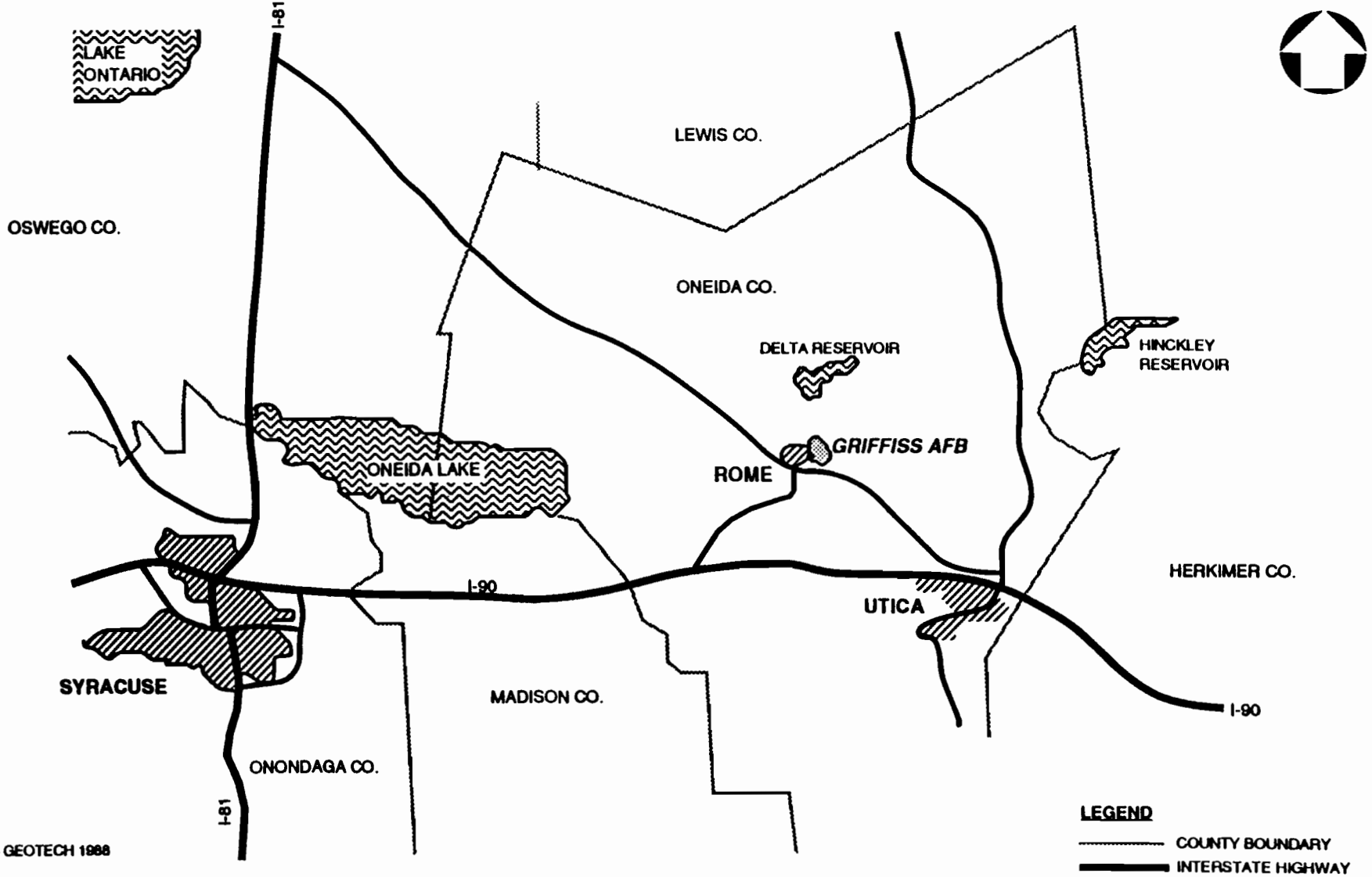
The 416th Bomb Wing is the host unit at GAFB under the supervision of the United States Air Combat Command (ACC). The Wing's mission is to maintain and implement effective air refueling operations, while providing long-range bombardment capability on a global scale. The 416th Bomb Wing is composed of two operational squadrons, six maintenance and support squadrons, and the 416th Combat Support Group.

This HSDA pertains to future remedial activities to be performed at each of the four IRP sites located at GAFB are described in subsequent subsections. Figures C-2 and C-3 show the site locations.

FIGURE C-1

LOCATION MAP OF GRIFFISS AIR FORCE BASE AND VICINITY

GRIFFISS AIR FORCE BASE, NEW YORK



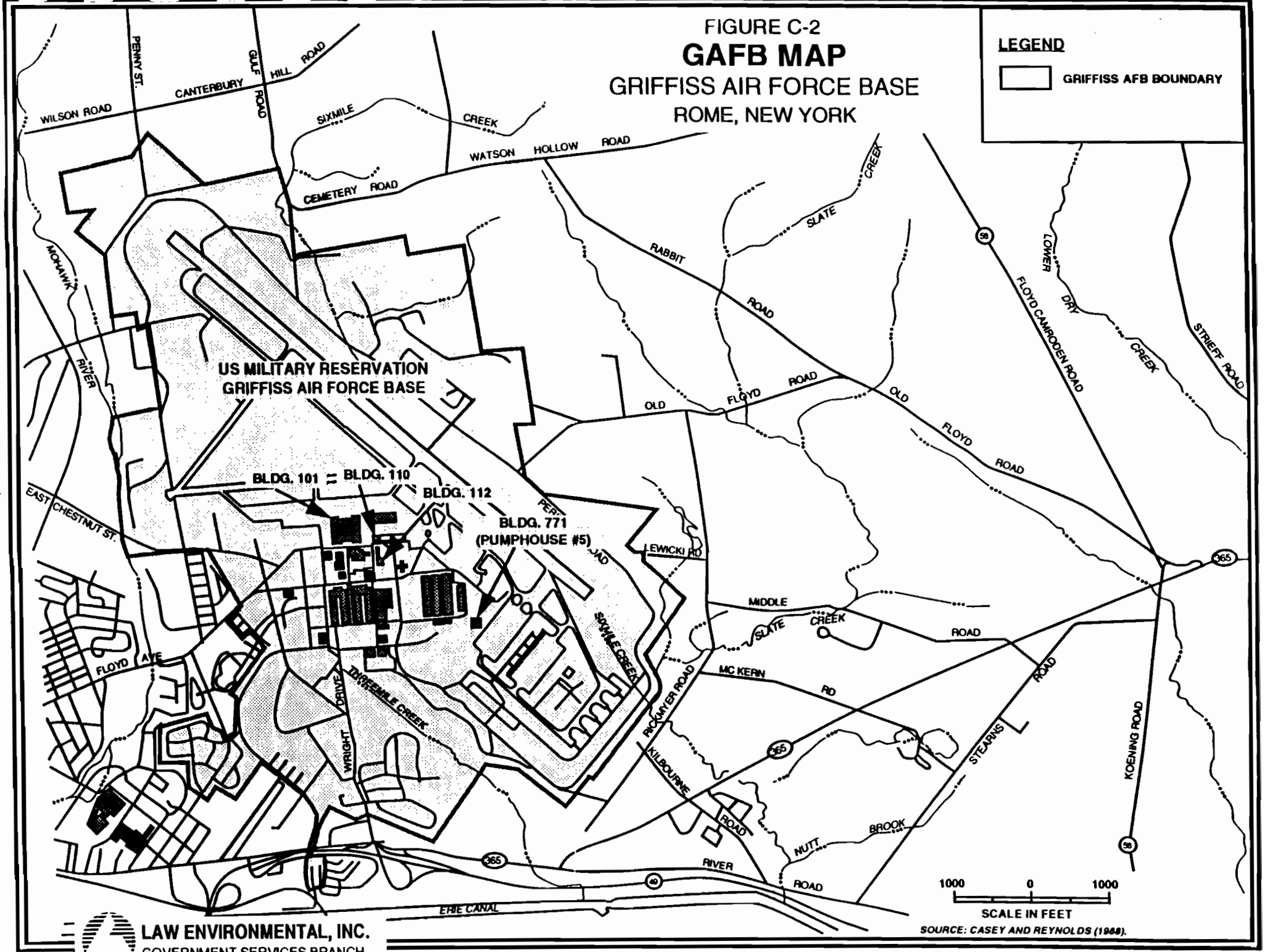
SOURCE: UNC GEOTECH 1988

FIGURE C-2

GAFB MAP

GRIFFISS AIR FORCE BASE

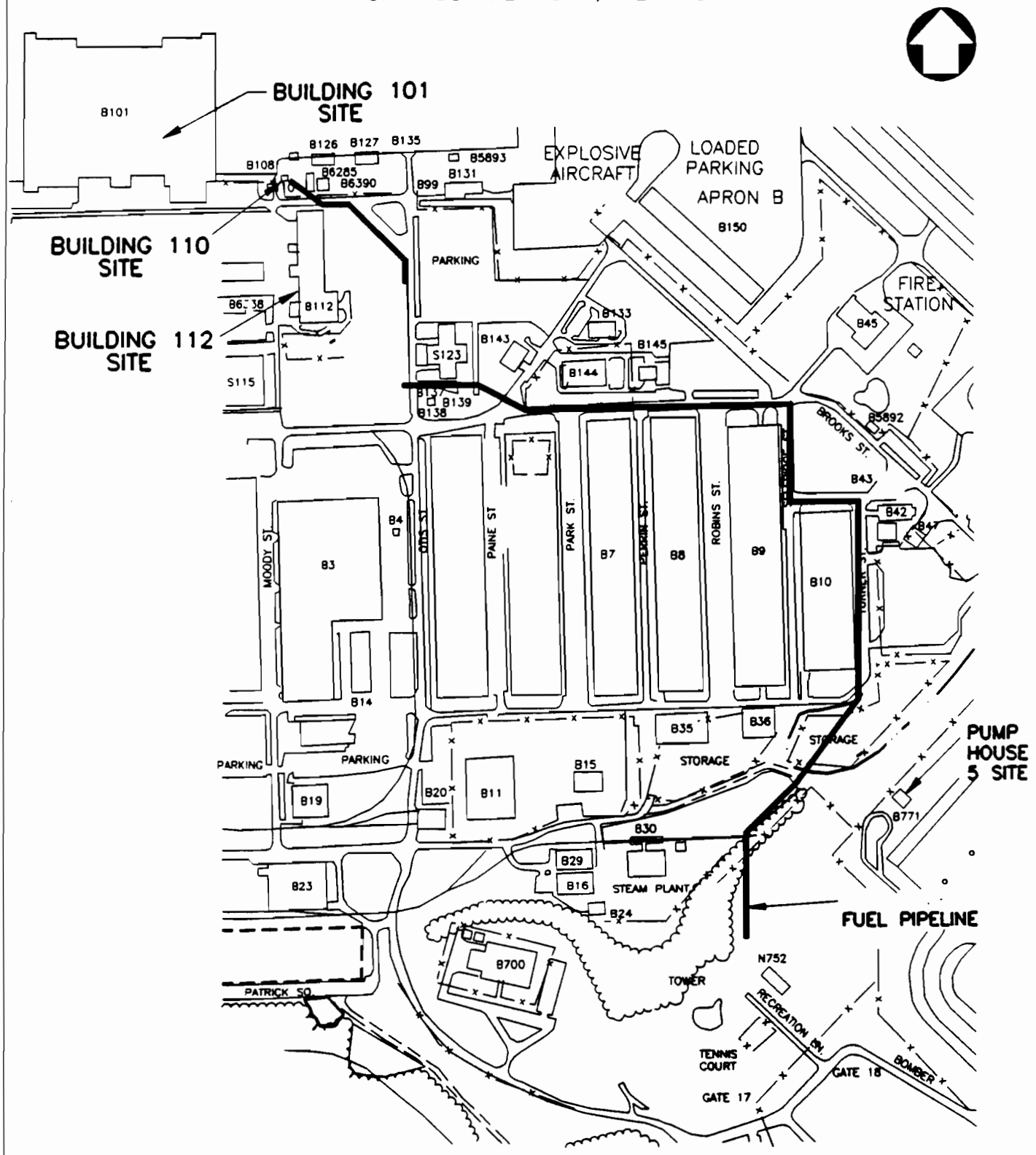
ROME, NEW YORK



SOURCE: CASEY AND REYNOLDS (1988).

LAW ENVIRONMENTAL, INC.
GOVERNMENT SERVICES BRANCH

FIGURE C-3
SITE MAP
GRIFFISS AFB ROME, NEW YORK



NOTE: AQUA-SYSTEM IS APPROXIMATELY 5600' IN LENGTH.

600 0 600

SCALE IN FEET

IRP Site ID	Location
Site St-06	Building 101 ("Yellow Submarine" UST)
Site St-36	Building 110 (Jet Fuel Transfer Pipeline, USTs)
Site SS-08	Building 112 (USTs)
Site OT-37	Building 771 (Pumphouse 5)

1.2.1 On-Site Tasks to Be Performed

Tasks to be performed at each of the four sites at GAFB are discussed in this section.

1.2.1.1 IRP Site ST-06 - Building 101 - The remedial activity at Building 101 will be the removal of a 12,000-gallon capacity UST, identified as the "Yellow Submarine."

The Yellow Submarine is approximately fifteen feet from the south edge of Building 101 and is located within a small graveled area approximately 20 feet by 30 feet adjacent to the personnel parking area for the building. The Yellow Submarine received metal plating wastes from plating shop activities from 1973 to 1987. Organic and inorganic constituents have been found in both the aqueous and sludge phases in the UST. Chromium, cadmium, nickel, lead, and trichloroethylene were the constituents identified.

Removal of the UST will involve draining the tank, removal of residues, and inerting the tanks of vapors. Excavation will be performed to the top of the tank to expose the upper half of the tank. Soils from the excavation will be placed on an HDPE liner and a sample will be chemically analyzed to determine if the soils should be handled and disposed of as a hazardous waste. Visibly contaminated (tarry-black, stained) excavated soils will be covered with an HDPE liner after each episode of excavation and a sample

will be chemically analyzed. The fill tube, gauges, product, and vent lines will be removed and the open lines will be capped or plugged. All tank openings should be replugged. Completion of the excavation will be performed and each tank will be removed from the trench, placing the tank in a secure position to prevent rolling or other movement. Potential flammable or hazardous vapors will be removed by one of the following methods:

- Addition of dry ice (1.5 pounds per 100 gallons)
- Addition of CO_2 gas (75 pound cylinder per 2,000 gallons)
- Addition of nitrogen gas (one storage tank volume of nitrogen gas)

The tank will then be replugged and is ready for disposal. Disposal of the tank may be at a scrap yard or a sanitary landfill but additional steps may need to be taken for the tank to be accepted at either. Such steps may be cleaning the interior of the tank or cutting the tank into smaller pieces. The contents of the tank will be collected in 55-gallon drums and labeled appropriately for disposal in accordance with solid and/or hazardous waste regulations based on the results of the chemical analyses. Excavated soils deemed to be non-hazardous will be used to backfill the open trenches. If necessary, clean topsoil will be brought in to complete backfilling of the trenches.

1.2.1.2 IRP Site ST-36 - Building 110 - Remedial activities at Building 110 include the in place cleaning/closure of the 5,600 foot Jet Fuel Transfer Pipeline including removal of aboveground pumps and piping in Building 110; the demolition of Building 110, the truck fill stand, and the truck fill stand concrete island; and the removal of four 25,000-gallon capacity USTs, two 500-gallon capacity oil-water separator tanks, and one 100-gallon UST.

Building 110 served as a pumphouse and fuel storage station along the fuel distribution system known as the "Jet Fuel Transfer Pipeline." This system consists of a steel pipe network that provided aviation gasoline (AVGAS) and JP-4 (jet fuel) to various areas of the flight line and aircraft parking aprons. Building 110 houses pumps and piping associated with the Jet Fuel Transfer Pipeline along with two 500-gallon oil-water separator tanks located in the basement. Building 110 piping is connected to four 25,000-gallon capacity USTs. Chemical analysis of the contents of the USTs identified constituents common to fuels (benzene, ethylbenzene, toluene, xylenes, diesel, gasoline, oil and grease) to be present. A truck filling stand and island and a 100-gallon capacity UST are also associated with the Jet Fuel Transfer Pipeline in the vicinity of Building 110.

The Jet Fuel Transfer Pipeline will be cleaned using a hydraulically propelled polyurethane pipeline cleaner (pig). Drying of the pipeline will be accomplished using a hydraulically propelled polyurethane pipeline drying pig. The propellant will be pressurized nitrogen gas or another inert gas which will not cause the potential for explosion or fire during the cleaning operation. Liquid propellants should not be used. After the cleaning and drying of the pipeline, pumps and associated pipeline apparatus will be removed from Building 110. Open pipeline ends will then be plugged using Mechanical Joint SSB-Ductile Iron Class 350 plugs or caps and SBR Rubber Transition gaskets.

Building 110 contents (boxes, supplies, etc.) will be moved to other appropriate areas and the demolition of Building 110 will occur. Demolition of the building will be done by a Tracked Loader with care to prevent damage to the oil-water separator tanks located in the basement. The truck fill stand and associated concrete island will also be demolished using the Tracked Loader. Debris from the building and the truck fill stand area will be disposed of appropriately.

Removal of the USTs will involve draining the tanks, removal of residues, and inerting the tanks of vapors. Excavation will be performed to the top of each tank to expose the upper half of the tank. Soils from the excavation will be placed on an HDPE liner and a sample will be chemically analyzed to determine if the soils should be handled and disposed of as a hazardous waste. Visibly contaminated (tarry-black, stained) excavated soils will be covered with an HDPE liner after each episode of excavation and a sample will be chemically analyzed. The fill tubes, gauges, product, and vent lines will be removed and the open lines will be capped or plugged. All tank openings will be replugged. Completion of the excavation will be performed and each tank will be removed from the trench, placing the tank in a secure position to prevent rolling or other movement. Potential flammable or hazardous vapors will be removed from each tank by one of the following methods:

- Addition of dry ice (1.5 pounds per 100 gallons)
- Addition of CO_2 gas (75 pound cylinder per 2,000 gallons)
- Addition of nitrogen gas (one storage tank volume of nitrogen gas)

The tanks will then be replugged and will be ready for disposal. Disposal of the tanks may be at a scrap yard or a sanitary landfill but additional steps may need to be taken for the tanks to be accepted at either. Such steps include cleaning the interior of the tanks or cutting the tanks into smaller pieces. The contents of the tank will be collected in 55-gallon drums and labeled appropriately for disposal in accordance with solid and/or hazardous waste regulations based on the results of the chemical analyses. Excavated soils deemed to be non-hazardous will be used to backfill the open trenches. If necessary, clean topsoil will be brought in to complete backfilling of the trenches.

1.2.1.3 IRP Site SS-08 - Building 112 - Remedial activities at Building 112 include the removal of three 500-gallon capacity USTs.

The three USTs are located approximately fifteen feet from the east edge of Building 112 and are under a concrete paved area used as a basketball court by Base personnel. There is no historical data concerning the contents or uses of these three USTs, but given the proximity to Building 112 (an engine test cell), it is believed the three tanks may have been used to store AVGAS (aviation gasoline) and/or JP-4 (jet fuel). Two of the tanks currently contain water and one is filled with sand. The two containing water were sampled for chemical analysis. Hazardous substances were identified as being in the two tanks, primarily trichloroethylene, methylene chloride, tetrachloroethylene, and oil and grease.

Removal of the USTs will involve draining the tanks containing liquid, removal of residues, and inerting the tanks of vapors. The tank filled with sand will be removed with the sand in the tank. Excavation will be performed to the top of each tank to expose the upper half of the tank. Soils from the excavation will be placed on an HDPE liner and a sample will be chemically analyzed to determine if the soils should be handled and disposed of as a hazardous waste. Visibly contaminated (tarry-black, stained) excavated soils will be covered with an HDPE liner after each episode of excavation, and a sample will be chemically analyzed. The fill tubes, gauges, product, and vent lines will be removed and the open lines will be capped or plugged. All tank openings will be replugged. Completion of the excavation will be performed and each tank will be removed from the trench, placing the tank in a secure position to prevent rolling or other movement. Potential flammable or hazardous vapors will be removed from each tank by one of the following methods:

- Addition of dry ice (1.5 pounds per 100 gallons)

- Addition of CO_2 gas (75 pound cylinder per 2,000 gallons)

- Addition of nitrogen gas (one storage tank volume of nitrogen gas)

The tanks will then be replugged and will be ready for disposal. Disposal of the tanks may be at a scrap yard or a sanitary landfill but additional steps may need to be taken for the tanks to be accepted at either. Such steps include cleaning the interior of the tanks or cutting the tanks into smaller pieces. The contents of the tanks will be collected in 55-gallon drums and labeled appropriately for disposal in accordance with solid and/or hazardous waste regulations, based on the results of the chemical analyses. Excavated soils deemed to be non-hazardous will be used to backfill the open trenches. If necessary, clean topsoil will be brought in to complete backfilling of the trenches.

1.2.1.4 IRP Site OT-37 - Building 771 (Pumphouse #5) - The remedial activity at Building 771 (Pumphouse #5) is the removal of free floating product.

Building 771 (Pumphouse #5) serves as a fuel storage and transfer station for aircraft refueling operations and is approximately 100 feet northwest of Parking Apron #1. Pumphouse #5 increases pressure in the piping system to distribute fuel. This fuel/defueling system parallels the northwest edge of Parking Apron #1 and leads to the Lateral Control Pits (LCPs). The LCPs control fuel flow through the pipe under the apron to the hydrant outlet within the parking apron. Pumphouse #5 is still operational with no plans for use to be discontinued at this time by GAFB. The free floating product is JP-4 (jet fuel).

Free floating product will be recovered using a skimmer pump and collected in 55-gallon drums for appropriate disposal under solid and/or hazardous waste regulations.

1.3 HAZARD ASSESSMENT/RISK ANALYSIS

Chemical constituents detected at the sites during previous investigations, the hazards posed by chemical exposure, and action levels for PPE selection based on available monitoring results are discussed in the following sections.

1.3.1 Contamination Characterization

Petroleum fuel constituents and solvents have been found in the UST's and ground water (Pumphouse 5) during previous investigations at GAFB. Table C-1 indicates the contaminants detected and range of concentrations found in the UST's and ground water during previous investigations at each of the sites. Intrusive activities such as recovery well installation, trench and pipeline excavation, and UST closure activities will increase the potential for personnel exposure to contaminated media (soils, ground water and UST residual materials). Probable routes of personnel exposure are inhalation of vapors, contaminated soils and/or dust, and direct skin contact.

1.3.2 Hazard Potential

Potential hazards that may be encountered during work at GAFB sites include the following:

- Chemical Exposure: The chemicals identified at the sites are petroleum fuel constituents and solvents. Because of their likelihood to become airborne at hazardous levels

TABLE C-1

CONCENTRATION RANGES FOR SOURCE CHEMICAL CONSTITUENTS IN USTs AND GROUND WATER
Griffiss Air Force Base
Rome, New York

Chemical	Units	BUILDING 101 UST 1 Aqueous Phase	BUILDING 101 UST 1 Sludge Phase	BUILDING 110 UST 1	BUILDING 110 UST 2	BUILDING 110 UST 3	BUILDING 110 UST 4	BUILDING 112 UST 1	BUILDING 112 UST 2	BUILDING 771 (Pumphouse #5) MW4	MW5	MW6	MW8	MW9
INORGANICS														
Barium	(mg/L or mg/kg)	NA	NA	NA	NA	NA	NA	0.0168	1.01	NA	NA	NA	NA	NA
Cadmium	(mg/L or mg/kg)	0.131	140	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
Chromium	(mg/L or mg/kg)	0.836	670	NA	NA	NA	NA	ND	0.034	NA	NA	NA	NA	NA
Cyanide	(mg/L or mg/kg)	0.094	8.64	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	(mg/L or mg/kg)	NA	NA	14.8	393	521	21.6	NA	NA	NA	NA	NA	NA	NA
Lead (Total)	(mg/L or mg/kg)	2.46	1060	0.156	0.0375	0.0384	0.0235	0.03	0.262	0.0376	0.0057	0.0416	0.0536	0.0247
Lead (Dissolved)	(mg/L or mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	0.0023	ND	ND	ND	ND
Mercury	(mg/L or mg/kg)	NA	NA	NA	NA	NA	NA	ND	0.0076	NA	NA	NA	NA	NA
Nickel	(mg/L or mg/kg)	0.065	71.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ORGANICS (ug/L or ug/kg)														
Anthracene	(ug/L or ug/kg)	NA	NA	NA	NA	NA	NA	2 J	ND	NA	NA	NA	NA	NA
Benzene	(ug/L or ug/kg)	ND	ND	5700 *	15000 *	210 *	3000 *	ND	36	5200 *	ND *	ND *	750 *	ND
Bis(2-ethylhexyl) phthalate	(ug/L or ug/kg)	NA	NA	NA	NA	NA	NA	2 JB	ND	NA	NA	NA	NA	NA
Butylbenzyl phthalate	(ug/L or ug/kg)	NA	NA	NA	NA	NA	NA	2 JB	ND	NA	NA	NA	NA	NA
Diesel	(ug/L or ug/kg)	NA	NA	>90%	>90%	19000	36800	NA	NA	ND	ND	ND	13400	ND
Ethylbenzene	(ug/L or ug/kg)	ND	190	660 *	790 *	170 *	720 *	ND	ND	610 *	ND *	ND *	1100 *	ND
Ethylene glycol	(ug/L or ug/kg)	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND
Fluorene	(ug/L or ug/kg)	NA	NA	NA	NA	NA	NA	15	ND	NA	NA	NA	NA	NA
Gasoline	(mg/L or mg/kg)	NA	NA	619	214.6	9.6	49	NA	NA	28.5	0.2	0.2	99.5	0.6
Isophorone	(ug/L or ug/kg)	NA	NA	NA	NA	NA	NA	ND	31 J	NA	NA	NA	NA	NA
Methyl chloride	(ug/L or ug/kg)	ND	ND	NA	NA	NA	NA	ND	17 J	NA	NA	NA	NA	NA
Methylene chloride	(ug/L or ug/kg)	160 JB	190	NA	NA	NA	NA	200 JB	110000	NA	NA	NA	NA	NA
Naphthalene	(ug/L or ug/kg)	NA	NA	NA	NA	NA	NA	1 J	ND	NA	NA	NA	NA	NA
Oil and Grease	(mg/L or mg/kg)	NA	NA	2930	3010	31.5	314	16	97.2	NA	NA	NA	NA	NA
Phenantrene	(ug/L or ug/kg)	NA	NA	NA	NA	NA	NA	8 J	ND	NA	NA	NA	NA	NA
Pyrene	(ug/L or ug/kg)	NA	NA	NA	NA	NA	NA	1 J	ND	NA	NA	NA	NA	NA
Tetrachloroethylene	(ug/L or ug/kg)	7300	6000000 #	NA	NA	NA	NA	ND	160	NA	NA	NA	NA	NA
Toluene	(ug/L or ug/kg)	ND	820	170 *	12000 *	2.5 *	2800 *	125 J	47	610 *#	ND *	ND *	250 *	ND
Trichloroethylene	(ug/L or ug/kg)	1800	960000	NA	NA	NA	NA	ND	51000	NA	NA	NA	NA	NA
Xylenes	(ug/L or ug/kg)	NA	NA	13000 *	15000 *	3900 *	9400 *	NA	NA	7500 *	ND *	ND *	6600 *	ND
1,1-Dichloroethylene	(ug/L or ug/kg)	ND	600	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
1,2-Trans-Dichloroethylene	(ug/L or ug/kg)	240 J	79000	NA	NA	NA	NA	ND	440	NA	NA	NA	NA	NA
2,4-Dimethylphenol	(ug/L or ug/kg)	NA	NA	NA	NA	NA	NA	6 J	ND	NA	NA	NA	NA	NA
4,6-Dinitro-o-cresol	(ug/L or ug/kg)	NA	NA	NA	NA	NA	NA	1 J	ND	NA	NA	NA	NA	NA
4-Nitrophenol	(ug/L or ug/kg)	NA	NA	NA	NA	NA	NA	9 J	ND	NA	NA	NA	NA	NA

NA – Not analyzed
ND – Not detected
J – Denotes concentration is estimated.
B – Denotes analyte also found in the Method Blank.
* – Denotes results are from the diluted sample.
# – Concentration over the upper range limit (URL).

Source: Chemical Sampling and Analysis Report, Griffiss AFB, April 1992.

under ambient conditions, the primary chemicals of concern are the volatile petroleum constituents (benzene, toluene, ethylbenzene and xylenes (o,m,p) (BTEX)), tetrachloroethylene and trichloroethylene. The probability that personnel will be exposed to these chemicals during work at the sites is high during intrusive activities.

- Oxygen deficient and/or toxic levels of gases in confined spaces (USTs, trenches and pipelines).

- Explosion and/or flammability of contaminants present in trenches, USTs, pipelines.

- Heat or cold stress, depending on season of work.

- Physical hazards associated with working in vicinity of overhead power lines and/or underground utilities.

- Physical hazards associated with the use of heavy equipment such as backhoes and drilling rigs.

  - Drilling hazards include the possibility of being struck by objects, cable snapping, and drill mast coming in contact with overhead utility wires.

  - Trench excavation hazards include the trench walls caving in, tripping and falling into an open trench, and the possibility of being struck by moving equipment or objects during excavation.

- Physical hazards associated with working in high traffic areas and limited spaces.

- Excessive noise level from heavy equipment operations and/or aircraft.

1.3.3 Toxicological Properties of Constituents

Chemical and physical properties of the chemicals identified at the sites are presented in Table C-2.

The following sections present the toxicological properties of primary constituents of concern identified at the sites.

1.3.3.1 Benzene - Benzene is a colorless, watery liquid with a gasoline-like odor. Acute exposure to benzene vapors can produce dizziness, excitation, pallor, flushing, weakness, headache, breathlessness, and chest constriction. Continuous skin contact may cause irritation and reddening of the skin. Coma and death may follow acute exposures at or above 2,000 ppm. Chronic exposure to benzene vapors is associated with hematological impairment and leukemia. Benzene is classified as a Class A human carcinogen by the U.S. Environmental Protection Agency.

OSHA PEL-TWA:	1 ppm
ACGIH TWA-TLV:	10 ppm
IDLH Level:	2,000 ppm
Odor Threshold:	4.68 ppm
Odor:	Like gasoline
Routes of Entry:	Inhalation, skin contact

Note: Since the odor threshold for benzene is above the OSHA PEL-TWA, this characteristic should not be used as a warning sign for benzene exposure. Monitoring instruments should be closely observed for levels indicating the potential presence of this contaminant and chemical detector tubes should be used to confirm its presence and concentration.

TABLE C-2

PHYSICAL AND CHEMICAL PROPERTIES OF DETECTED CHEMICALS
REMEDIAL DESIGN - FOUR IRP SITES
Griffiss AFB, Rome, New York

Chemical	LEL/UEL (%)	ACGIH TLV TWA (ppm)	ACGIH STEL (ppm)	OSHA PEL TWA (ppm)	OSHA STEL (ppm)	IDLH LEVEL (ppm)	ODOR THRESHOLD (ppm)	MONITORING	RESPIRATOR CARTRIDGE	RESPIRATOR BREAKTHROUGH TIME (min) @ 1,000 ppm	CHEMICAL RESISTANT MATERIAL
INORGANICS											
Barium	NA/NA	0.5 mg/m³	–	0.5 mg/m³	–	1100	–	None	HEPA/Dust	–	PVA, Viton
Cadmium	NA/NA	0.05 mg/m	–	0.2 mg/m³	–	50 mg/m³	–	None	HEPA/Dust	–	PVA, Viton
Chromium	NA/NA	0.05 mg/m	–	1 mg/m³	–	–	–	None	HEPA/Dust	–	PVA, Viton
Cyanide	NA/NA	5 mg/m³	–	5 mg/m³	–	50	–	None	HEPA/Dust	–	PVA, Viton
Iron	NA/NA	1 mg/m³	–	10 mg/m³	–	–	–	None	HEPA/Dust	–	PVA, Viton
Lead (Total)	NA/NA	0.015 mg/r	–	.05 mg/m³	–	700 mg/m³	–	None	HEPA/Dust	–	PVA, Viton
Lead (Dissolved)	NA/NA	0.015 mg/r	–	.05 mg/m³	–	700 mg/m³	–	None	HEPA/Dust	–	PVA, Viton
Mercury	NA/NA	0.1 mg/m³	–	.01 mg/m³	0.03 mg/m³	10 mg/m³	–	None	HEPA/Dust	–	PVA, Viton
Nickel	NA/NA	1 mg/m³	–	1 mg/m³	–	–	–	None	HEPA/Dust	–	PVA, Viton
ORGANICS (ug/L or ug/kg)											
Anthracene	0.6%LEL	–	–	–	–	–	–	None	–	–	–
Benzene	1.3/7.9	10	–	1	5	3000	4.68	PID/FID/DR	Org. vapor	73	PVA, Viton
Bis(2-ethyhexyl) phthalate	–	–	–	–	–	–	–	None	–	–	PVA
Butylbenzyl phthalate	–	–	–	–	–	–	–	None	–	–	–
Diesel	–	–	–	–	–	–	–	PID/FID/DR	Org. vapor	–	Nitrile, PVA
Ethylbenzene	1.0/6.7	100	125	100	125	2000	0.092 - 0.6	PID/FID/DR	Org. vapor	84	–
Ethylene glycol	NA/NA	.05	–	0.1 mg/m³	0.1 mg/m³	1000	–	None	–	–	–
Fluorene	–	–	–	–	–	–	–	None	–	–	–
Gasoline	1.2/7.4	300	500	300	500	–	0.25	PID/FID/DR	Org. vapor	–	Nitrile, PVA
Isophorone	0.8/3.8	5	–	4	–	800	–	PID/FID/DR	Org. vapor	–	–
Methyl chloride	8.1/17.4	50	100	50	100	10000	–	PID/FID/DR	Org. vapor	–	–
Methylene chloride	14/22	50	–	500	–	5000	–	PID/FID/DR	Org. vapor	NA	PVA
Naphthalene	0.9/5.9	10	15	10	15	500	–	PID	Org. vapor	–	Nitrile, PVA
Oil and Grease	–	–	–	–	–	–	–	None	–	–	Nitrile, PVA
Phenantrene	–	–	–	–	–	–	–	None	–	–	–
Pyrene	–	–	–	–	–	–	–	None	–	–	–
Tetrachloroethylene	NA/NA	50	200	25	–	500	–	PID/FID/DR	Org. vapor	107	–
Toluene	1.2/7.1	100	150	100	150	2000	0.17	PID/FID/DR	Org. vapor	94	PVA
Trichloroethylene	8.0/10.5	50	–	50	200	1000	–	PID/FID/DR	Org. vapor	107	PVA
Xylenes	1.0/7.0	100	150	100	150	1000	–	PID/FID/DR	Org. vapor	99	PVA, Nitrile
1,1-Dichloroethylene	–	5	20	–	–	–	–	None	–	–	–
1,2-Trans-Dichloroethylene	5.6/12.8	10	–	200	–	4000	500	None	–	33	–
2,4-Dimethylphenol	–	–	–	–	–	–	–	None	–	–	–
4,6-Dinitro-o-cresol	NA/NA	.2mg/m³	–	.2mg/m³	–	5 mg/m³	–	None	–	–	–
4-Nitrophenol	–	–	–	–	–	–	–	None	–	–	–

– = No data available
NA – Values not available
PID/FID/DR = Photionization Detector, Flame Ionization Detector, Draeger Tubes

PVA = Polyvinyl alcohol
PVC = Polyvinyl chloride
NP = Neoprene

REFERENCES:

29 CFR 1920.120
NIOSH Pocket Guide to Chemical Hazards
Chemical Hazard Response Information System
ACGIH Threshold Limit Value for Chemical Substances

1.3.3.2 Ethylbenzene - Ethylbenzene is a colorless, watery liquid. Exposure to its vapor form may irritate eyes, nose and throat. Corneal injury may result from eye exposure. If inhaled at high concentrations, it can cause anesthetic effects with symptoms of nausea, dizziness, difficulty breathing and lethargy.

OSHA PEL-TWA:	100 ppm
ACGIH TWA-TLV:	100 ppm
IDLH Level:	2,000 ppm
Odor Threshold:	0.092 - 0.60 ppm
Odor:	Sweet, gasoline-like
Routes of Entry:	Inhalation, skin contact

1.3.3.3 Tetrachloroethylene - Tetrachloroethylene or perchloroethylene is a clear, colorless, non flammable liquid that has a characteristic odor. In confined, poorly ventilated areas, single exposures to high concentrations of tetrachloroethylene can result in dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, and possibly unconsciousness and death. The consequences of long-term exposure to tetrachloroethylene by breathing or ingesting low levels of the chemical are not known. The USEPA classifies tetrachloroethylene as a B2 carcinogen (probable human carcinogen but inadequate or no evidence in humans).

OSHA PEL-TWA:	25 ppm
ACGIH TWA-TLV:	50 ppm
IDLH Level:	500 ppm
Odor Threshold:	Not Available
Odor:	Sharp, sweet
Routes of Entry:	Inhalation, skin contact

1.3.3.4 Toluene - Toluene is a colorless, watery liquid. Acute exposures to toluene vapors irritate the eyes and upper respiratory tract. Exposure to higher concentrations of vapors cause dizziness, headache, anesthesia, and respiratory arrest. Liquid toluene irritates the eyes and dries the skin. Aspiration causes coughing, gagging, distress, and rapid pulmonary edema. Ingestion causes vomiting, diarrhea and depressed respiration. Kidney and liver damage may result from ingestion.

OSHA PEL-TWA:	100 ppm
ACGIH TWA-TLV:	100 ppm
IDLH Level:	2,000 ppm
Odor Threshold:	0.17 ppm
Odor:	Aromatic, benzene-like
Routes of Entry:	Inhalation, skin contact

1.3.3.5 Trichloroethylene - Trichloroethylene is a colorless liquid at room temperature with an odor similar to ether. Trichloroethylene is not acutely toxic by the inhalation or oral routes. Oral and inhalation exposures effect the bone marrow, central nervous system, liver and kidney. Human epidemiology studies have not shown a clear connection between exposure to trichloroethylene and increased cancer risk. The USEPA classifies trichloroethylene as a group B2 carcinogen (probable human carcinogen but inadequate or no evidence in humans).

OSHA PEL-TWA:	50 ppm
ACGIH TWA-TLV:	50 ppm
IDLH Level:	1,000 ppm
Odor Threshold:	Not Available
Odor:	Ether-like
Routes of Entry:	Inhalation, ingestion

1.3.3.6 Xylene - Xylene is a colorless, watery liquid. Exposure to xylene vapors may irritate the eyes, nose and throat. If inhaled, xylene will cause headache, difficult breathing or lass of consciousness. Liquid xylene irritates the eyes and skin. If swallowed, it will cause nausea, vomiting, or loss of consciousness. Kidney and liver damage may follow ingestion. One isomer of xylene (m-xylene) can be absorbed by the skin.

OSHA PEL-TWA:	100 ppm
ACGIH TWA-TLV:	100 ppm
IDLH Level:	10,00 ppm
Odor Threshold:	0.05 ppm
Odor:	Like benzene, aromatic
Routes of Entry:	Inhalation, skin contact

1.3.4 Chemical Indicator of Hazard

Benzene should be considered as the chemical indicator of hazard. OSHA regulations are more stringent for benzene exposure than other volatile petroleum constituents or solvents expected at the sites. Protective measures taken to mitigate benzene exposure should also provide adequate and appropriate protection against ethylbenzene, tetrachloroethylene, trichloroethylene, toluene and xylene exposure as well as other airborne chemicals. Protective measures taken to address physical hazards (i.e., explosion, fire) posed by benzene should also provide adequate and appropriate protection against other volatile constituents present at the sites.

1.3.5 Action Levels

This section describes the criteria upon which personal protective equipment will be selected, upgraded or downgraded; work practice controls will be used; emergency evacuation of on-site personnel

will be implemented; and prevention and/or minimization of public exposures to hazards created by site activities will be accomplished. Air monitoring/sampling shall be performed in accordance with Section 1.9, the resulting data compared with the action levels described below, and appropriate actions taken as necessary to ensure worker safety and the safety of the public. Section 1.15.8 describes actions to be taken if conditions potentially hazardous to the safety or welfare of occupants of nearby areas or buildings are identified.

1.3.5.1 Action Levels: Organic Vapors - Ambient air shall be monitored at least once per hour during site operations and with every change in task or location. Vapor monitoring instrumentation to be used is described in Section 1.9.1. Continuous monitoring should be conducted during confined space entry and at locations where vapor buildup is a potential hazards. Continuous monitoring should also be conducted during treatment system servicing, maintenance or equipment removal because of an increased potential for liquid/vapor releases from the system and personnel contact with contaminated system components. Action levels for organic vapors are presented below.

PID/FID Reading or Detector Tube Reading	Action/PPE
0-5 ppm for 5 minutes and Benzene < 0.5 ppm	Level D or Mod. Level D
5-1,000 ppm for 5 minutes and/or Benzene 0.5 to ≤ 25 ppm	Level C, full-face respirator
≥ 1,000 ppm for 1 minute and/or Benzene ≥ 25 ppm	Stop work/ evacuate site; notify Contractor HSO

1.3.5.2 Action Levels: Combustible Gases - Combustible gas monitoring should be performed continuously during intrusive site activities, activities in confined spaces, at locations where vapor accumulation is possible, and during treatment system maintenance/ servicing using a calibrated combustible gas level indicator. Action levels based on Lower Explosive Limit (LEL) readings are as follows:

Explosimeter Reading	Action
<10% LEL	None; proceed with work and continue monitoring
10 - 25% LEL	Potential explosion hazard; proceed with caution and monitor LEL levels closely
>25% LEL	Explosion hazard exists; stop work; evacuate site and ventilate area until levels of combustible gases fall below 25% LEL

1.3.5.3 Action Levels: Oxygen - Oxygen levels should be monitored continuously during intrusive activities, activities in confined spaces, during work at locations where vapor accumulation is a potential hazard, and during treatment system maintenance and servicing. Action levels, based on oxygen levels, are presented below.

Oxygen Monitor Reading	Action
19.5 - 22.0%	None; normal oxygen level
<19.5%	Oxygen deficient atmosphere; stop work, ventilate area until normal oxygen levels are present; or upgrade to Level B PPE
>23.0%	Fire/explosion hazard; stop work, ventilate area until normal oxygen levels are present

1.4 ACCIDENT PREVENTION

The Site Safety and Health Plan (SSHP) will serve as the Accident Prevention Plan and activity hazard analyses required by Federal Acquisition Regulation (F.A.R.) Clause 52.236-13 and Paragraphs 01.A.03 through 01.A.06 and Appendix 1 of the U.S. Army Corps of Engineers (USACE) document EM 385-1-1.

Daily safety and health inspections should be conducted to determine if operations are being performed in accordance with the SSHP, USACE, OSHA regulations and contract requirements. In the event of an accident/incident or emergency, the Contractor should immediately notify the Contracting Officer (CO). Within two working days of any reportable incident, the Contractor should complete and submit to the CO an Accident Report on ENG Form 3394 in accordance with AR385-40 and USACE Supplements to that regulation.

The Contractor Health and Safety Officer should be responsible for investigating the details of on-site any accident or injury. Based on the findings of the investigation, the Contractor HSO should recommend corrective actions relative to field procedures to prevent recurrence. Follow-up training should be provided by the Contractor HSO at least weekly on problems observed during the previous week. Occupational health and safety deficiencies and corrective measures taken to address deficiencies should be identified and recorded in the Contractor's Quality Control report.

1.5 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

The Contractor HSO is responsible for formulating, implementing and enforcing health and safety requirements during field activities at GAFB. These responsibilities are outlined in detail in 29 CFR 1910.120, the U.S. Army Corps of Engineers Safety and Health

Requirements Manual (EM 385-1-1), and the NIOSH/OSHA/USCG/EPA document "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities" (October 1985). These responsibilities include ensuring the following:

- All site personnel and supervisors satisfy the training requirements described herein.
- All site personnel have completed the required medical examination and meet the qualification criteria for site work as specified in 29 CFR 1910.120 and ANSI Z-88.2.
- All site personnel and visitors have received appropriate site-specific safety and health training prior to site entry.
- All equipment is suitable and adequate for its intended use.
- Supervisors meet at least once per week to review past activities and incidents and to plan ahead for new or changed operations and to establish safe working procedures. A written summary of these meetings is to be prepared and kept on file.
- A site safety meeting with all site personnel is conducted at least once per week and a written record is maintained which notes the date, time, attendees, subjects discussed and person conducting the meeting.
- Site Standard Operating Procedures are followed at all times.

The Contractor HSO may appoint one or more Site Safety Officers to assist in implementing the safety program at GAFB.

1.6 TRAINING REQUIREMENTS

The following minimum hazard training requirements should be met by on-site personnel.

1.6.1 Comprehensive Training Requirements

All personnel at the site should be required to have participated in a 40-hour comprehensive training course that complies with OSHA 29 CFR 1910.120. This training should consist of off-site classroom instruction and field exercises to demonstrate the worker's familiarity with personal protective equipment and potential hazards to which they may be exposed. This initial training should include, but not necessarily be limited to the following:

- Review of OSHA 29 CFR 1910.120 Regulations
- Chemical Hazards
- Physical Hazards
- Health Hazards
- Compatibility of Chemicals
- Toxicology (Acute Exposure, Chronic Exposure, Carcinogens)
- Medical Surveillance
- First Aid
- Physical Hazards (Radiation, Heat/Cold Stress, Noise)
- Site Control
- Safe Work Practices
  - OSHA Standards
  - Common Work Injuries
  - Common Work-Site Hazards
  - Drum Handling
- Air Monitoring
- Protective Clothing

- Respiratory Protection
- Confined Spaces
- Decontamination
- Contingency and Emergency Planning
- Hands-On Training on SCBAs, PPE, Respirators, Air Monitoring, and Decontamination

In addition to the initial off-site training described above, all general site workers must have minimum of three days actual field experience under the direct supervision of a trained, experienced supervisor.

1.6.2 Refresher Training

Refresher training is an integral part of training and should also be required for all on-site personnel. Personnel should have participated in a minimum of eight hours of refresher training meeting OSHA 29 CFR 1920.120 requirements on an annual basis following completion of the comprehensive training requirements described above.

1.6.3 Supervisor Training Requirements

The following sections describe the minimum training requirements for health and safety team supervisory personnel.

1.6.3.1 Contractor Health and Safety Officer (HSO) - An ABIH Certified Industrial Hygienist (CIH) should serve as the Contractor HSO. The Contractor HSO should have a minimum of three years experience in the chemical or hazardous waste industry, and have completed the 40-hour comprehensive training course, 8 hour refresher course on an annual basis, and minimum of 8 hours

additional training in supervision and management of operations at hazardous waste sites meeting the requirements of OSHA 29 CFR 1910.120.

1.6.3.2 Site Safety Officer - One or more Site Safety Officers (SSOs) should be designated by the Contractor to assist the HSO in implementing the training and safety requirements at GAFB. On-site supervisors responsible for, or who supervise personnel engaged in field activities should meet the comprehensive training requirements and annual refresher training requirements described above, and should have at least eight additional hours of specialized training pertaining to hazardous waste site management meeting the requirements of OSHA 29 CFR 1920.120. The Contractor SSO should also have a minimum of one year experience in working with hazardous waste at Level C sites, of which no less than fifty percent of the time was devoted to safety and occupational health.

1.6.4 CPR/First Aid Training Requirements

At a minimum, one individual having current certification in CPR/First Aid procedures by the American Red Cross (or equivalent agency) should be present on-site at all times during site operations.

1.6.5 Site-Specific Training and Safety Briefing

Site-specific training covering site hazards, procedures and all contents of the Site Safety and Health Plan should be conducted by Contractor health and safety personnel for all on-site employees, subcontractors and CO-approved visitors prior to site entry or commencement of work. Hazards specific to the site and the tasks to be performed, and specification of the proper level of PPE for each work area and task should be discussed. Emergency response

procedures and contacts should be reviewed. The Standard Operating Procedures (SOPs) for activities at the site should be outlined. It will be the responsibility of the Contractor health and safety personnel to ensure that all workers are thoroughly familiar with specific SOPs and the overall chain of command at the site. Follow-up training should be performed at least weekly and prior to each change in operations.

1.6.6 Visitor Training

Visitors to the work site shall receive training to inform them of the hazards associated with the site, to explain emergency procedures and instruct them in the use of PPE during the visit. With the exception of prescription safety glasses, respirators and safety footwear, the Contractor shall provide PPE as needed for site visitors.

1.6.7 Training Records

Records should be maintained and available for each person working at the site to verify compliance with training requirements. Records of individuals trained, type of training performed (initial, refresher, supervisory and site-specific), duration, and dates of training (including visitor training) performed should be maintained.

1.7 PERSONAL PROTECTIVE EQUIPMENT

A personal protective equipment (PPE) program in accordance with 29 CFR 1910.120(g)(5) and 29 CFR 1910.134 is required. The level of protection to be used at GAFB will be determined based upon the type of chemical(s) and concentrations present, chemical toxicity characteristics and potential routes of worker exposure. Personal

protective equipment (PPE), in conjunction with site entry, safety, and decontamination procedures will reduce the potential for worker contact with hazardous substances present at the site. It should be noted that the use of PPE can itself create hazards such as heat stress, impaired vision and mobility, and communications difficulties. Equipment and clothing should be selected that provides an adequate level of protection, but avoids the potentially adverse effects that can occur with overprotection. PPE levels and equipment are described below.

1.7.1 Level D PPE

Level D PPE is the minimum protection level for conditions not requiring special respiratory skin protection. Level D PPE includes:

- Distinct work clothing.
- Safety goggles or glasses (as required).
- Sturdy work boots with steel shanks and toes providing good traction (meeting ANSI Z41.1 requirements).
- Hearing protection (as required).
- Work gloves.
- Hard hat meeting OSHA Standard 29 CFR Part 1910.135.

Modified Level D PPE

- Distinct work clothing.

- Hard hat meeting OSHA Standard 29 CFR Part 1910.135 (mandatory during excavation, drilling or work around other heavy equipment).

- Safety goggles or glasses (as required).

- Neoprene or rubber chemical resistant boots or sturdy work boots with steel shanks and toes providing good traction (meeting ANSI Z41.1 requirements).

- Disposable outer boot covers (as required).

- Tyvek or Saranex-coated coveralls.

- Chemical resistant gloves (material selected based on anticipated chemicals) with latex undergloves (additional cotton glove liners are optional).

- Full-face shield to be worn by members of drilling and excavation crew during activities that may promote eye injury as specified by the Contractor Health and Safety Officer.

- Hearing protection (as required).

1.7.2 Level C PPE

Level C PPE should be used when the substance and concentration of contaminants are known, and the criteria for using air-purifying respirators can be met (Refer to Section 1.7.4). Level C PPE includes the following:

- Full-face air-purifying respirator, with combination organic vapor and dust and mist filter cartridges,

depending on measured concentration of contaminants (**Note:** Half-face masks do not provide eye protection; safety goggles should be worn. Also, half-face masks do not provide the same protection factor as a full-face respirator, therefore if half-face respirators are used, the action levels should be revised.

- Tyvek or Saranex-coated Tyvek coveralls or chemical splash suits, depending on splash hazard.

- Neoprene or rubber chemical resistant boots or sturdy work boots with steel shanks and toes (meeting ANSI Z41.1 requirements).

- Disposable outer boot covers (as required).

- Chemical resistant (material selected based on anticipated chemicals) gloves with latex undergloves (additional cotton glove liners optional).

- Hard hat (mandatory during drilling and excavation operations).

- Hearing protection (as required).

- All joints between various garments should be securely sealed with duct tape.

1.7.3 Level B PPE

Level B should be used when a maximum level of respiratory protection but a lesser degree of skin protection are needed. Level B PPE ensemble includes:

- Positive pressure, full-face self-contained breathing apparatus (SCBA) or positive pressure supplied air respirator with emergency escape bottle.

- Chemical-resistant clothing (Tyvek or Saranex-coated Tyvek suit with hood; chemical splash suit).

- Chemical resistant gloves (material selected based on anticipated chemicals), with optional latex undergloves (cotton glove liners are optional).

- Neoprene or rubber chemical resistant boots or sturdy work boots with steel shanks and toes (meeting ANSI Z41.1 requirements) and outer boot covers.

- Hard hat (mandatory during drilling and excavation operations).

- Hearing protection (as required).

1.7.4 Respiratory Protection

A respiratory protection program should be established in accordance with the requirements of 29 CFR 1910.134. Respirators should be selected on the basis of hazards to which the worker is exposed. Air-purifying respirators should not be used under the following conditions:

- Oxygen deficient atmospheres.

- IDLH concentrations of specific substances.

- Entry into unventilated or confined area where the exposure conditions have not been characterized.

- Contaminant concentrations are unknown or exceed designated maximum use concentrations for respirators.

- Identified gases or vapors have inadequate warning properties and the sorbent service life is not known and the unit has no end-of-service indicator.

- High relative humidity may reduce the protection offered by the sorbent.

- By personnel wearing beards or contact lenses.

- By personnel deemed unfit by a physician.

1.7.4.1 Respirator Maintenance/Inspection Storage - Air-purifying respirators should be stored and maintained properly and checked before and after each use. Respirators should be dismantled, washed and disinfected after each use. Clean respirators should be stored individually in sealable plastic bags or in their original cartons in a clean, convenient location. Respirators should be inspected before each use for material damage (pliability, deterioration or distortion, cracks, crazing or fogginess). Worn or deteriorated parts should be replaced. Respirator cartridges should be checked to ensure that they are proper for the intended use, the expiration date has not passed, and that they have not been opened or used previously.

1.7.4.2 Fit Testing - Fit testing procedures should be performed to ensure the proper fit of the respirator, and personal comfort of the user. Fit testing involving a chemical challenge should be performed as part of the initial respirator selection process. Fit testing methods are contained in 29 CFR 1926.58 and include isoamyl acetate and irritant fume testing protocols. Fit testing

should be performed at least every 6 months, or if physical changes in face structure have occurred or significant weight gain or loss (> 20 pounds) has occurred.

Prior to entry into the Exclusion Zone at the start of each work day, the respirator user should perform a positive and negative pressure test upon donning the respirator to ensure a tight face-to-facemask seal. Adjustments should be made until a proper fit is achieved. The respirator should not be used if a proper seal is not achievable.

1.7.5 Task-Specific Initial PPE Level

Initial levels of protection that should be used for tasks to be performed at GAFB are described in this section. Levels of protection should be upgraded or downgraded based on the results of real-time monitoring activities (described in Section 1.6) and an assessment of actual conditions encountered at each site at the time of work.

1.7.5.1 Jet Fuel Transfer Pipeline Cleaning/Closure and Apparatus Removal - Initial PPE that should be used by personnel working in the Exclusion Zone during the cleaning, capping, and removal of pipeline apparatus and the sites where these activities will be performed are indicated below.

IRP Site		Initial PPE
ST-36	Building 110	Mod. Level D

1.7.5.2 Demolition of Building 110 and Truck Fill Stand and Island - Initial PPE that should be used by personnel working in the Exclusion Zone during the excavation and removal of debris and

the sites where these activities will be performed are indicated below.

IRP Site		Initial PPE
ST-36	Building 110	Mod. Level D
	Truck Fill Stand	Mod. Level D

1.7.5.3 Underground Fuel Tank Closure - Initial levels of protection for activities performed in the open air at a UFT sites are described below. Equipment for contingency upgrade (respirators) should be readily available at the site.

IRP Site	Initial PPE
St-06 UST Building 101	Modified Level D
St-36 USTs Building 110	Modified Level D
SS-08 USTs Building 112	Modified Level D

1.7.5.4 Confined Space Entry (Section 1.10.4) - Activities performed in the course of UST removal may involve the entry of confined spaces by personnel. The following initial PPE should be used, and continuous monitoring of the atmosphere be performed in the confined space while personnel are inside to evaluate changing conditions.

IRP Site	Confined Space	Initial PPE
St-06 UST Building 101	UST*	Level C
	UST**	Level B
St-36 UST Building 110	UST*	Level C
	UST**	Level B
	UST*	Level C
	UST**	Level B

* - Work in vicinity of tank openings during vapor purging activities

** - Any task involving personnel entry into tank

1.8 MEDICAL SURVEILLANCE

All personnel involved in on-site operations should participate in an ongoing medical surveillance program meeting the requirements of OSHA 29 CFR 1920.120 and ANSI Z-88.2 before working at the site. The medical surveillance protocols and examination results should be reviewed by a licensed physician who is certified in Occupational Medicine by the American Board of Preventative Medicine, or who, by necessary training and experience, is Board-eligible. At a minimum, each person who wears respiratory protection must meet the requirements of 29 CFR 1910.134. A written certification from the examining physician should be required stating the person is "fit for duty" to wear the required PPE, including respirator or SCBA, and perform the required work.

In consultation with the occupational physician, and based upon probable site conditions, potential occupational exposures and required protective equipment, the minimum content and frequencies of required medical examinations are as follows:

- Baseline Physical - Performed prior to potential exposure to hazardous/toxic substances. The baseline examination should establish data to subsequently verify the efficacy of protective measures and to later determine if exposures have adversely affected the worker. The medical examination shall include, at a minimum, a medical and work history and a physical examination that includes vital signs and an evaluation of all major organ systems, an audiometric test, a vision screening, a chest X-ray (every four years unless otherwise indicated), an

EKG, a CBC plus differential, a blood chemistry screen (AM 24 test survey or equivalent), heavy metal screen (includes analysis of blood for the presence and quantity of lead), a urinalysis, a pulmonary function test (which includes forced expiratory capacity at one second ($FEV_{1.0}$), and a forced vital capacity test (FVC).

- Annual Examination - Same as Baseline Physical.

- Special Medical Surveillance Parameters - Additional examinations and tests may be performed following exposure to hazardous substances, or if deemed necessary by the examining physician, as indicated by the medical history and/or initial examination results. The evaluation should be repeated as indicated by substandard performance or evidence of particular stress evidenced by injury or time loss due to injury by the worker.

- Final Examination - A final examination should be performed for any employee terminating employment.

1.8.1 Medical Surveillance Records

Records certifying the participation of the worker in the medical surveillance program, the date of the last examination, and name of reviewing occupational physician should be maintained for each employee. The written medical opinion from the attending physician required by 29 CFR 1910.120 should be made available upon request to the CO for any site employee.

1.9 EXPOSURE MONITORING/AIR SAMPLING PROGRAM

Monitoring for the presence of hazardous conditions should be performed during work to prevent personnel exposure to chemical and

physical hazards. Information gathered from air monitoring will be used to determine appropriate protective measures to be taken and assess off-site migration of contaminants released during construction activities or subsequent operation of remedial systems so that appropriate contingency plans and/or control measures can be implemented. Monitoring activities and equipment are described in the following sections.

1.9.1 Exposure Monitoring/Air Sampling

Monitoring instruments to be used at the site should include a photoionization detector, and/or a flame ionization detector, a combustible gas indicator, an oxygen level indicator, and chemical detection tubes able to quantify benzene at levels ranging from 0.5 ppm to greater than 50 ppm. Limitations on the use and application of monitoring instruments should be reviewed prior to use at the site. All atmospheric monitoring equipment should be calibrated three times daily in accordance with the manufacturer's instructions: before work begins; after lunch; and at the end of the work shift.

1.9.1.1 Time-Integrated Monitoring - Time-integrated personal monitoring is not considered necessary during work at the site for the following reasons:

1. Time-integrated personal monitoring is appropriate to quantify exposure when the constituents of concern are not detectable with real-time monitoring instruments, or the instruments are not of sufficient sensitivity to quantify concentrations. At the GAFB sites, however, the chemical constituents anticipated at the site are detectable with available direct reading (i.e., PID, FID) instruments. The use of chemical-specific detector tubes to confirm concentrations of the chemicals of

concern at the site will reduce uncertainty of measurements obtained with real-time monitoring equipment.

2. Health and safety decisions need to be made immediately as site conditions change to ensure worker safety. The time lag between time-integrated sampling and obtaining analysis results is significant and would not allow the health and safety team to make on-site decisions in a timely fashion. Site activities would probably have progressed to a different stage or location by the time analysis results are received, and the analysis results would not reflect current site conditions (i.e., chemical concentrations).

1.9.1.2 Vapor Monitoring - Monitoring for organic/inorganic vapors should be performed to determine appropriate levels of PPE to be used during work. A photoionization detector (PID) or flame ionization detector (FID) should be used in conjunction with chemical specific detector tubes to detect and quantify benzene levels.

Atmospheric monitoring results should be compared with OSHA Permissible Exposure Limits (PELs) and/or ACGIH Threshold Limit Values, whichever is lower. Action criteria based on the results of vapor monitoring are contained in Section 1.3.5.

1.9.1.3 Combustible Gas Monitoring - Monitoring for combustible gas levels should be performed to determine the potential for fire and/or explosion and action to be taken in response to a fire/explosion hazard. Monitoring instruments should be calibrated using a standard of known concentration three times daily: before work begins; after lunch; and at the end of the work shift. It should be noted that instrument response may be affected by the presence of oxygen deficient or rich atmospheres, and combustible

gas readings should, therefore, be taken in conjunction with oxygen level measurements.

Action criteria based on levels of combustible gases present are contained in Section 1.3.5.

1.9.1.4 Oxygen Monitoring - Monitoring for oxygen levels should be performed to determine the presence of oxygen deficient or oxygen enriched (explosive/ flammable) atmospheres. Instrument response should be checked periodically during use. Air-purifying respirators do not protect against oxygen deficient atmospheres and should not be used when these conditions are present. Action criteria based on oxygen level measurements are presented in Section 1.3.5.

1.9.2 Radiation Monitoring

A radiation hazard has not been identified at the site during previous investigations. Radiation monitoring will not be required during work at the site.

1.9.3 Heat Stress Monitoring

Heat stress can be a major hazard for personnel wearing PPE. Depending upon the ambient conditions and the work being performed, onset of heat stress can be rapid. Heat stress monitoring should be initiated when ambient air temperatures exceed 70 degrees Fahrenheit.

Early signs of heat stress include heat rash, heat cramps (muscle spasms), discomfort and drowsiness. Continued heat stress can result in heat exhaustion, with symptoms including pale, cool, moist skin, heavy perspiration, dizziness, nausea and fainting.

Extreme heat stress can result in heat stroke, as body temperature regulation fails and the body temperature rises to critical levels. Symptoms of heat stroke include red, hot, usually dry skin, absence of or reduced perspiration, nausea, dizziness and confusion, strong, rapid pulse and coma. Measures to prevent the occurrence of heat stress consist of avoiding overprotection, training and monitoring of personnel wearing PPE, scheduling of work and rest periods, and frequent replacement of fluids.

If symptoms of heat stress are exhibited by workers, the pulse rate and body temperature will be monitored during all tasks (as deemed appropriate by the Contractor HSO). Action guidelines are as follows:

- Pulse rate: Determine normal resting pulse rate. Monitor pulse rate as soon as possible at beginning of rest period. If the rate exceeds the determined normal resting pulse rate by 40 beats per minute (BPM), shorten the next work period by one-third without changing the rest period. If the pulse rate is greater than 40 BPM above the resting pulse rate at the start of the next rest period, shorten the following work cycle again by one-third. Repeat until pulse rate at beginning of rest period is less than 40 BPM above resting pulse rate.

- Body Temperature: Determine the body temperature at the end of the work cycle and before drinking. If the temperature is greater than 99.6 degrees Fahrenheit (37.6 degrees Celsius), shorten the next work cycle by one-third without changing the rest schedule. Repeat. DO NOT permit a worker to wear semipermeable or impermeable clothing when his/her body temperature exceeds 100.6°F (38.1°C).

ACGIH permissible heat exposure TLVs for work where impervious clothing is <u>not</u> worn are presented in Table C-3.

TABLE C-3

ACGIH PERMISSIBLE HEAT EXPOSURE THRESHOLD LIMIT VALUES

Work/Rest Regimen	Work Load		
	Light	Moderate	Heavy
Continuous Work	86°F (30.0°C)	80°F (26.7°C)	77°F (25.0°C)
75% Work 25% Rest (each hour)	87°F (30.6°C)	82°F (28.0°C)	78°F (25.9°C)
50% Work 50% Rest (each hour)	89°F (31.4°C)	85°F (29.4°C)	82°F (27.9°C)
25% Work 75% Rest (each hour)	90°F (32.2°C)	88°F (31.1°C)	86°F (30.0°C)

Reference: 1990-1991 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists.

1564.52

Hearing Protection:

- Expandable foam earplugs should be worn whenever personnel are exposed to noise levels that exceed 90 dB (i.e., working in proximity of operational aircraft).

- Minimum Noise Reduction Rating (NRR) for earplugs or muffs ≥25.

- Hand signals should be used when noisy conditions exist and/or when hearing protection equipment is used. The hand signals to be used should be discussed and agreed upon by site personnel before continuing work with hearing protection.

1.9.6 Dust Control

When soil contamination exists, the potential exists for inhalation and/or skin exposure to contaminated fugitive dusts re-suspended by mechanical disturbance or wind. Prior to performing field activities in dry, dusty areas where contaminated soils are likely to be encountered, workers should wet down the area of activity with water in order to decrease dust generation. If the wetting process is expected to result in potentially contaminated runoff, measures to contain runoff should be undertaken. In the event that dust suppression measures are not possible, workers in such areas should wear air-purifying respirators with appropriate dust control cartridges.

1.9.7 Monitoring Records

Instrument calibration information and the results of monitoring should be documented daily in the field log for each site.

1.10 STANDARD OPERATING PROCEDURES/ENGINEERING CONTROLS AND WORK PRACTICES

The following procedures should be used during work at the site to protect the health and safety of personnel.

1.10.1 General Site Rules/Operating Procedures

- A buddy system should be used at all times when working at the site. Work teams should be established prior to site entry. The buddy should be able to provide his/her partner with assistance; observe his/her partner for signs of chemical or physical exposure; periodically check the integrity of his/her partners PPE; and notify the Contractor HSO if emergency help is needed.

- Hand signals will be established to maintain communications when noisy conditions are present. These signals will be reviewed by the Contractor HSO prior to the start of work each day.

- During site operations, each worker should consider himself/herself as a safety backup to his/her partner. Arrangements should be made for off-site personnel to provide emergency assistance prior to site entry and commencement of work. All personnel should be made aware of dangerous situations that may develop in the course of work.

- Visual contact should be maintained between buddies on-site when performing hazardous tasks.

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth

transfer and ingestion of hazardous material is prohibited at the site. A rest area in which eating/drinking/smoking will be permitted will be established in a clean area in the Support Zone.

- Use of illegal drugs should be prohibited at the site. Prescription drug usage should be permitted if approved by the medical consultant. Prescription drugs should not be taken by personnel where the potential for contact with hazardous substances exists. Alcoholic beverage intake is prohibited during the work day.

- Personnel should not be permitted to work when sick or injured, whether on or off the job. Personnel sick for greater than one day should be required to have a medical examination, and the examining physician should certify the person's fitness for work prior to his/her resuming job activities.

- Any facial hair which interferes with the face to face-piece seal of the respirator will not be permitted on personnel required to wear such equipment. Contact lenses will not be allowed to be worn in conjunction with the use of respiratory protection. Arrangements should be made prior to site mobilization to obtain spectacle kits for those who need them.

- Each worker should be fit-tested for respirators by the Contractor HSO using an OSHA-approved technique (i.e., irritant smoke challenge, isoamyl acetate challenge) prior to field use of a respirator. A positive and negative pressure test should be performed each day prior to respirator use. Respirators and spare cartridges should be available on-site. Respirator cartridges should be changed at once per shift, when used, or upon contaminant breakthrough.

- Procedures for entering and leaving the Exclusion Zone should be planned and reviewed prior to entering the site.

- No personnel should be admitted to the site without proper safety equipment and training. Authorized visitors will be briefed by the Contractor HSO on the site safety and health plan and emergency procedures before entering work areas. PPE for authorized site visitors should be provided by the Contractor, with the exception of respirators and boots.

- All personnel should comply with established safety procedures. Any person who does not comply with safety policy, as established by the Contractor HSO, will be immediately dismissed from the site.

- Any medical emergency supersedes routine safety and decontamination requirements. A plan should be in place to determine if decontamination is necessary prior to medical treatment or transport to a medical facility.

1.10.2 Before Entering Site

Before entering the work site, all field personnel should review site-specific information and work procedures for:

- Expected hazards

- Special conditions such as natural disasters or multiple person injuries

- Procedures related to proper performance of task

- Hand/Horn signals
- Decontamination facility location and procedures
- Locations of telephones and emergency equipment
- Emergency medical information, including hospital location
- Level(s) of initial PPE required and action levels for upgrade
- Location of supplies and equipment
- Check safety gear and equipment condition and function. The following equipment will be used at the site or be available for issue, depending on site-specific conditions:
  - Standard Tyvek or Saranex-coated Tyvek coveralls and coverall hoods
  - Hard hats
  - Goggles or Safety Glasses
  - Chemical-resistant gloves, latex gloves, cotton underliner gloves
  - Steel-toed neoprene safety boots meeting ANSI Z41.1 standards
  - Disposable outer boot covers
  - Face shields
  - Full-face, air-purifying respirator with combination cartridges suitable for organic vapors, dusts, mists
  - Emergency Eyewash
  - First Aid Kit(s)

- Field Standard Operating Procedures and Safety References
- Plastic bags to keep spare equipment clean

- Backup equipment and spares should be maintained, including, but not necessarily limited to:

  - Duct tape
  - Respirator wipes or isopropyl alcohol swabs
  - Disinfectant spray for boots and gloves
  - Trash containers, plastic bags and drop cloths
  - Decontamination supplies (tubs, brushes, decontamination solutions
  - Paper towels
  - Extra PPE supplies
  - Extra air monitoring supplies

- General Site Rules/Operating Procedures should be reviewed.

- Set up buddy system and work teams prior to entering site. If any person develops any physical discomfort, such as lightheadedness, the worker must stop work, notify his buddy, return to the designated contamination reduction zone and report to the Contractor HSO.

- Use caution - go slowly.

1.10.3 Material Handling Procedures

Material handling should be performed in accordance with the requirements of 29 CFR 1910.120. Drums and containers should meet the DOT, OSHA, and EPA regulations for the materials that they are to contain.

1.10.4 Confined Space Entry

Confined space is any space having limited openings for entry and exit, not intended for continuous occupancy, and unfavorable natural ventilation which could contain or have produced dangerous concentrations of airborne contaminants or asphyxiants (EM-385-1-1, Paragraph 27.A.01). Confined spaces include open-top spaces more than 4 feet in depth. Confined spaces that may be encountered at GAFB during field activities include fuel recovery and ground water infiltration trenches, pipelines and USTs. The risk to personnel entering a confined space must be weighed against the need for entering. Confined spaces should not be entered unless an assessment of the variables involved and the risk to personnel has been performed.

1.10.4.1 Confined Space Permit - A Confined Space Permit should be required for entry into confined spaces. No site personnel should enter a confined space unless this permit has been obtained. It is the responsibility of site personnel to obtain this permit. The Confined Space Permit should be signed by the Contractor HSO and explained to each worker prior to entry. Worker signatures will be required as part of the permit to indicate their understanding of the rules and procedures outlined in the permit.

The Confined Space Permit should include, but not be limited to, location of work, description of work, personnel assigned to perform the work, entry date and time, isolation checklists, hazardous work, hazards expected, fire safety precautions, personnel safety, results of atmospheric tests performed (and person performing them), permit authorization and expiration time.

The Confined Space Permit should be renewed at the beginning of each work shift. Permits (initial and renewal) should be posted at the specific work site. Upon completion of work, the Contractor

HSO should place the Confined Space Permit(s) in the job file. The Contractor HSO should be responsible for developing and implementing the Confined Space Entry permit requirements and ensuring that workers comply with permit requirements.

1.10.4.2 Safety Procedures - Each confined space should be tested for combustible gas and oxygen levels as well as PID/FID and benzene Draeger tube readings prior to entry. Remote sampling methods should be used (i.e., extension probe for monitoring device). Testing should be performed prior to entry and on a continuous or frequent basis as stipulated in the Confined Space Entry Permit. Readings should be performed throughout the vertical and horizontal extent of the confined space to be entered.

- Mechanical ventilation sufficient to maintain a non-hazardous atmosphere will be required. If mechanical ventilation is not sufficient to provide safe conditions, appropriate PPE should be used.

- No one should enter a confined space where a known explosive or oxygen deficient atmosphere exists. Oxygen levels must be between 19.5% and 22%. Combustible gas levels, indicated as %LEL, must be less than 25%. If these levels can not be met, or the atmosphere can not be determined by testing, Immediately Dangerous to Life and Health (IDLH) conditions are to be assumed. A supplied air supply with an alarm and emergency escape air supply will be required for confined space entry under IDLH conditions.

- The buddy system should be used during entry into confined spaces. One member of the work team should be designated as the Standby Person who should remain outside the confined space in a safe area. A

communications system will be established. The Standby Person must be CPR/First Aid certified. A backup for the Standby Person should be designated and available to assist the Standby Person in case of an emergency. The Standby Person should not enter the confined space until the Standby backup arrives.

- Emergency rescue and first aid equipment should be readily available at the site prior to the start of work. Rescue equipment should include extra rope, safety harnesses, stretchers and emergency SCBA. No one should enter a confined space until adequate safety equipment is available for removal of an unconscious person.

- Emergency first aid and rescue equipment must be readily available to the Standby Person. A rescue test should be performed to ensure that rescue equipment will fit through the confined space entryway and to test the effectiveness of communications procedures.

- Only explosion-proof lighting/equipment (including mechanical ventilating equipment) should be used in confined spaces.

- Before the start of work in a confined space, all product lines and electrical lines should be locked and tagged.

- An access ladder is required in all confined spaces deeper than 4 feet. The ladder should extend from the bottom of the space to not less than 3 feet above the surface. Lateral travel to an exit ladder should not exceed 25 feet.

- All employees entering a confined space deeper than 4 feet should wear an approved safety harness with attached approved lifeline.

1.10.5 Hot Work

Before starting hot work involving welding, cutting or other high heat-producing operations, the tank or pipe shall be purged to ensure that all combustible vapors have been removed, and monitoring for combustible gases and oxygen should be performed. The measurements and general requirements for hot-work are discussed below. All welding and cutting equipment and operations should be in accordance with standards and recommendations of the American Welding Society, Safety in Welding and Cutting, ANSI Z49.1, and the NFPA.

1.10.5.1 Hot Work Permit - A task-specific site-specific Hot Work Permit will be required for all hot work. The Contractor HSO should be responsible for developing and implementing the Hot Work permit requirements and ensuring that workers comply with permit requirements. No site personnel should begin hot work until such a permit has been obtained from the Contractor HSO. The Hot Work permit should be signed by the supervisor and foremen and explained to each person working on the hot work task. Worker signatures will be required as a demonstration of their understanding of the rules and procedures contained in the permit.

The Hot Work permit will be valid for a single workshift and specified task only and should be renewed at the beginning of each work shift. Permits (initial and renewal) should be posted at the specific work site. Upon completion of work, the Contractor HSO should place the Hot Work permit(s) in the job file.

1.10.5.2 Safety Procedures - The Contractor HSO should complete the following procedures before authorizing the start of hot work.

- Conduct visual inspection of area. Remove any combustible material surrounding the work area. Special

attention should be given to areas where hot slag may fall or splatter.

- Any combustible material that can not be readily removed should be covered or otherwise protected from hot materials. Covering a combustible surface with 1 inch of soil or wetting it may be sufficient.

- Designate a Fire Watch. The sole responsibility of the Fire Watch should be to monitor the hot work operation and have immediate access to fire extinguishing equipment. This person should also be briefed on the location of nearest phone and emergency contacts and emergency signal and evacuation procedures.

- Monitoring of all spaces, pipes, sumps for the presence of combustible gases and oxygen. All hollow spaces should be vented to permit the escape of air or gases before hot work. If combustible gas levels exceed 10% LEL, or oxygen levels exceed 22%, measures must be taken to reduce these levels. As a rule, no hot work should be performed when any combustible vapor is present.

- Check integrity and condition of all equipment for wear or damage before starting work.

- Other personnel working in the area of hot work should be alerted to the performance of hot work.

1.10.5.3 Personal Protective Equipment - The "normal" PPE worn when working in hazardous environments does not provide adequate protection against flames or heat. PPE for the worker performing hot work should be supplemented with the following:

- Welding gloves made of leather or other fire-resistant material
- Fire-resistant apron or jacket
- Eye protection and face protection with darkened lenses
- Flash-fire protection

1.10.6 Excavation Safety - Procedures should be established in accordance with 29 CFR 1926.650 to ensure worker safety during excavation operations. Excavation operations at the GAFB will include trenching and removal of underground storage tanks. The following safety procedures should apply during site excavation work:

- Underground utilities (i.e., sewer, water, gas, electric, fuel) should be located and locations marked prior to starting any excavation work.
- Trench banks more than 5 feet high should be shored, laid back to a stable slope, or provided with equivalent protection where personnel may be exposed to moving ground or cave-ins. A qualified person should determined the safe angle of repose.
- Bracing or shoring of trenches should be carried along with the excavation and should comply with the requirements of EM-385-1-1 Section 23.B.
- Trenches left open should be cordoned off or marked using safety fencing, tape, traffic cones or by other appropriate means.

1.10.7 Demolition of Building 110 and Truck Fill Stand and Island

In addition to those previously described, the following safety and operating procedures should be followed at all times during demolition operations:

- Equipment furnished for use on the site should be maintained in safe operating condition and be operated by qualified operators. Tracked loader and large earth-moving equipment should have valid certificates and logs of inspection and maintenance. All equipment used on-site will be inspected daily at the start of each work shift.

- Portable electric tools shall be protected with ground fault circuit interrupters.

- Hand tools should be kept clean and serviceable and shall be neatly arranged on tool racks.

- Worn or otherwise defective tools should be immediately repaired and/or replaced.

- Pipe and casing joints should be dragged up one at a time, not in bundles.

- Adequate provisions should be made to prevent pipe, drill collars, drill stems, or similar round material from accidentally rolling off a storage rack.

- In using chains, avoid sudden or abrupt application of loads. Take up slack slowly and see that every link in the chain seats properly.

- Where toxic materials are used, only authorized personnel should handle the materials, and safety equipment should be specified and used.

- All excavation drilling operations should be monitored, either by area testing or personnel testing, for organics and inorganics (hydrogen sulfide). In addition, the lower explosive limit for combustible gases should be monitored. If elevated readings are encountered above action levels, appropriate action must be taken to provide personnel with appropriate protection.

1.10.8 Safe Working Distances From Power Lines

Safe working distances from power lines are indicated below.

- When operating near high voltage power lines:

Normal Voltage (phase-to-phase)	Minimum Required Clearance
< 50 kV	10 ft. (3.05 m)
50 to 200 kV	15 ft. (4.60 m)
200 to 350 kV	20 ft. (6.10 m)
350 to 500 kV	25 ft. (7.62 m)
350 to 500 kV	35 ft. (10.67 m)
750 to 1000 kV	45 ft. (13.72 m)

- While in transit with no load and boom or mast lowered:

Normal Voltage (phase-to-phase)	Minimum Required Clearance
0.75 kV	4 ft. (1.22 m)
0.75 to 50 kV	6 ft. (1.83 m)
50 to 345 kV	10 ft. (3.05 m)

345 to 750 kV	16 ft. (4.87 m)
750 to 1000 kV	20 ft. (6.1 m)
750 to 1000 kV	45 ft. (13.72 m)

1.10.9 Machine Guarding

The following requirements for machine guarding should be followed:

- All self-propelled construction equipment, except light service trucks, panels, pickups, station wagons, crawler cranes, power shovels, and draglines, whether moving alone or in combination, should be equipped with a reverse signal alarm. The alarm should operate automatically upon commencement of backward motion and continue throughout the duration of backward motion.

- All reciprocating, rotating or moving parts should be guarded when exposed to contact by persons or otherwise create a hazard.

- All equipment hot surfaces, including exhaust pipes, should be guarded or insulated to prevent personnel injury or fire.

- Protection against the elements, falling or flying objects, swinging loads and similar physical hazards should be provided for operators of all machinery equipment.

- Overhead protection should be provided for the operators of fork lifts or material handling equipment.

- Riding on hoisting equipment (i.e., backhoe buckets) not intended for personnel handling should be prohibited. Equipment should have appropriate guard rails and hand grabs when workers are required to ride for operating purposed outside the operator' cab or compartment.

- Getting on or off any equipment while in motion should be prohibited.

1.10.10 Fall Protection

The activities to take place at GAFB will not take place over water, machinery, dangerous operations or more than 25 feet above the surface. Safety nets will not be required during work at the site.

1.10.11 Illumination

Supplemental illumination will not be needed for most of the work at GAFB, as the work will be taking place out-of-doors during daylight hours. If entry into confined spaces is to take place, or work is to continue after sunset, artificial lighting will be necessary. Where artificial light is used, it should be intrinsically safe and maintained until all personnel have exited the area.

1.10.12 Sanitation - Sanitation facilities, including potable water, toilets and washing facilities, should be available in the Support Zone.

1.10.13 Exiting the Exclusion Zone

- The buddy system should be maintained at all times.

- Inform work partner (buddy) of intent to leave Exclusion Zone.

- Work partners must leave Exclusion Zone together, or team must wait for replacement personnel to arrive. Under no circumstances should a person be left alone in the Exclusion Zone.

- Proceed directly to Contamination Reduction Zone and follow decontamination procedures.

1.11 SITE CONTROL MEASURES

Delineation of work zones, communications procedures and site access procedures should be implemented at the site.

1.11.1 Work Zones

Each site should be divided into three zones, based on the potential for exposure to hazardous conditions and activities to be performed:

- Exclusion Zone
- Contamination Reduction Zone (CRZ)
- Support Zone

The Exclusion Zone is the area of greatest contamination and presents the highest potential for worker exposure to hazardous conditions. The Exclusion Zone should include all active work areas (i.e., trenching operations, installation of treatment equipment, locations of UFT abandonment operations). The outer boundary of the Exclusion Zone should be clearly marked and access restricted to personnel performing tasks at the site. Personnel

entering the Exclusion Zone must wear the mandated level of PPE designated for the task to be performed and upgrade PPE as conditions warrant. The determination of the boundaries of the Exclusion Zone will be specific for each site.

The Contamination Reduction Zone (CRZ) serves as a transition area between the Exclusion Zone and Support Area. Personnel and equipment decontamination facilities should be located in the CRZ.

The Support Zone serves as a clean control area. This area should serve as the safety center where the following safety equipment can be obtained:

- Fire extinguishers
- First Aid Kit
- Emergency Eye Wash
- Safety Shower
- Emergency Oxygen Unit
- Emergency SCBA equipment
- Stretcher
- Ice
- Orange traffic cones, markers and/or tape for cordoning off work areas

The Support Zone should include a change room for personnel to change into street clothes after decontamination, a break area where food and beverages can be consumed, and equipment storage and maintenance areas. The change room should include lockers for storage of personnel belongings and clothes.

1.11.2 Site Access

A check-in and check-out system should be used so that there is a written record of all personnel, including visitors, in each work zone at all times.

1.11.3 Communications

Emergency telephone numbers and reporting instructions for ambulance, physician, hospital, fire and police should be conspicuously posted at the work site. All field personnel should be briefed concerning emergency response procedures and chain of command during emergencies. A mobile telephone should be available in a support vehicle to eliminate delays in contacting emergency personnel.

An internal communication system consisting of hand signals as well as voice communications should be adopted by field personnel when noisy conditions exist at the site. The Contractor HSO should coordinate the choice and use of hand signals during on-site safety briefings. Sample hand signals are presented below.

HAND SIGNAL	MEANING
Hands on top of head	Need Assistance
Grip partner's wrist or place both hands around partner's arm	Leave Area Immediately
Thumbs up	OK; I'm alright
Thumbs down	No; Negative
Hand gripping throat	Cannot breathe; out of air
Pointed finger on extended arm Wave hands over head from side	Look in that direction Attention; to side Standby for next signal
Swing hand from direction of person receiving signal to directly overhead and through in a circle	Come here

A system of horn signals should be developed for communicating with personnel in work areas from the Contamination Reduction Zone or

Support Zone. Examples of horn signals are presented below. Additional signals should be developed as necessary.

SIGNAL	MEANING
Three short blasts	Caution or look here
Long blast	Leave area

1.12 PERSONAL HYGIENE AND DECONTAMINATION

The purpose of decontamination is to minimize the risk of exposure to hazardous substances. All personnel should complete appropriate decontamination prior to leaving the site in a manner that is responsive to actual site conditions. A decontamination area shall be set up at the Contractor's Staging Area as shown on the drawings. The decontamination process should consist of a series of procedures performed in a specific sequence. Each procedure should be performed at a separate station in order to prevent cross-contamination.

The following decontamination procedures will apply to hand augers, stainless steel bowls and spoons, and ground water bailers. The decontamination steps are as follows:

1) Hand wash with a bristle brush and a solution of Alconox (or equivalent);
2) Rinse with tap water;
3) Spray-rinse with 10% HNO_3 solution (teflon bailers only)
4) Rinse with tap water;
5) Spray-rinse with spectroscopic grade methanol; (for volatile organics sampling material only)
6) Spray-rinse with Hexane, then methanol (for all other except volatile organics sampling material)
7) Rinse twice with deionized water; and
8) Air dry.

The sampling equipment will be cleaned prior to each use in accordance with this procedure. All decontamination solutions will be placed in a drum and maintained at the site.

Trash receptacles should be provided for all disposable items. The receptacles may be conventional trash cans lined with heavy duty polyethylene trash bags.

Personal hygiene primarily entails washing and is not strictly considered decontamination. Each individual should conduct proper personal hygiene, which includes washing of hands, face and any exposed skin for 3 to 5 minutes prior to eating, drinking, smoking and leaving the site. It is recommended that each person should shower at the end of each work day. OSHA 29 CFR 1910.120 requires that shower facilities be provided when the remediation exceeds six months in duration.

Supplies that should be available for personnel decontamination procedures include:

- Tubs for washing and rinsing equipment
- Detergent (i.e., Alconox)
- Scrub brushes (soft bristle)
- Potable water source
- Drying rack for equipment drying
- Aluminum foil for wrapping clean equipment
- Respirator wipes and bags for clean respirator storage
- Paper towels
- Trash receptacles and polyethylene bags
- Hand soap
- Receptacle for storage of decontamination liquid wastes pending disposal
- Drop cloths

1.12.1 Level D Decontamination

A minimum decontamination for Level D site work should consist of cleaning and removal of boots and gloves, changing into street shoes before leaving the site, and washing hands and face. A hand and face washing station should be provided for personnel working in Level D PPE.

1.12.2 Level C Decontamination

The decontamination layout should be adjusted to accommodate actual site conditions. Decontamination procedures for Level C should include the following:

- Field equipment should be placed at the first drop site for later decontamination.
- Boots/boot covers and gloves should be washed with detergent solution and rinsed in clean water.
- Boot covers and outer gloves should be removed. Boots and/or safety suit (nondisposable) should be washed.
- Disposable clothing should be removed and discarded into the trash receptacle.
- Boots should be deposited at a second drop site.
- Nondisposable inner gloves and hard hats should be removed and left at the second drop site.
- Respirators should be removed, washed, swabbed down with respirator wipes and bagged for storage. Used respirator cartridges should be removed and disposed. Respirators

should be left at the third drop site for cleaning. A disinfectant solution (i.e., CIDEX) should be used on a regular basis to disinfect the respirators. (Note: Personnel with respiratory tract infections, however minor they may seem, should disinfect their respirator at least weekly).

- Street shoes can be put on. All personnel should thoroughly wash face and hands before exiting the site.

1.12.3 Level B Decontamination

- Field equipment should be placed at the first drop site for later decontamination.

- Nondisposable boots/boot covers, gloves and outer garments should be washed with detergent solution and rinsed in clean water.

- Boot covers and outer gloves should be removed and disposed at second drop location. Boots and/or safety suit (nondisposable) should be washed.

- For site exit, clothing, boots, inner gloves and hard hats should be removed and deposited at a third drop site. SCBA equipment should be removed and segregated for decontamination. Street shoes can be put on. All personnel should thoroughly wash face and hands before exiting the site.

- For SCBA tank change-out, SCBA tank should be replaced following decontamination of outer garments and removal of contaminated boot covers and outer gloves. Redress, including clean boot covers and outer gloves should be performed following tank change. Return to work site.

Note: An occasional CIDEX or Chlorox wash of inside of boots is recommended to alleviate odor problems. A thorough rinse is required after such use.

1.13 EQUIPMENT DECONTAMINATION

Heavy equipment should be decontaminated after use to prevent cross-contamination of sites and transport of contaminants off-site. Equipment requiring decontamination during remedial activities at GAFB would include drilling and excavation equipment. This equipment should be cleaned using a high-pressure water washer and steam cleaner when it shows signs of gross contamination and prior to leaving the site. Areas in the CRZ should be designated for equipment decontamination and maintenance. All equipment should be decontaminated prior to maintenance or leaving the site.

1.14 EMERGENCY EQUIPMENT AND FIRST AID REQUIREMENTS

The following emergency equipment should be available on-site at all times during field operations. A wooden pallet for transporting emergency safety equipment from the Support Zone to the Exclusion Zone should be available in the Support Zone.

1.14.1 Fire Extinguishers

Because of the possibility of fire and explosion at the sites, portable fire extinguishers (ABC-type) meeting the standards of the National Fire Protection Association (NFPA 10) should be readily available (within 100 feet) to field personnel during all on-site work. Foam, dry chemical or CO_2 type extinguishers should be inspected for proper charge, pressure and physical integrity before field operations begin and after each use. All personnel should be trained in the use of fire extinguishers before commencing work at the site.

1.14.2 First Aid Kits

Industrial first aid kits with sufficient supplies and meeting the standards of the National Safety Council Data Sheet No. 202 and approved by the consulting physician should be readily available within the Support Zone. The first aid kit containers should be weatherproof. At a minimum, first aid kits should be provided in the ratio of one per 25 persons or less. Smaller kits should be kept in the clean areas and with field crews. The contents of the first aid kit(s) should be checked by the Contractor HSO before being sent out to the job site, and rechecked at least once weekly and immediately after each emergency to ensure that expended items are replaced.

1.14.3 Emergency Eye Wash/Showers

A portable emergency eye-wash and shower meeting ANSI Z-358.1 standards and sufficient potable water for copious flushing (for 15 minutes) should be available in the Support Zone.

1.14.4 Emergency Use Respirators/Supplied Air

Two SCBAs designated for emergency use should be located in the Support Zone.

1.14.5 Stretcher

A stretcher for transporting injured personnel should be located in the Support Zone.

1.14.6 Emergency Air Horn

An air horn for use in signaling in the case of emergencies should be located in the Exclusion Zone and Support Zone. The air horn should be of sufficient loudness to be audible above operating machinery and/or aircraft. Horn signals and their meanings should be established and reviewed prior to site entry (refer to Section 1.11.3 for sample horn signals).

1.14.7 Spill Control Materials and Equipment

Absorbent material, shovels, poly sheeting and overpack containers should be available for containing materials that may be spilled during site operations.

1.15 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

The remedial activities to be performed at GAFB will involve handling of petroleum product and contaminated media (ground water, soils, UST sludges). Air monitoring, use of PPE (protective clothing and respiratory protection), and careful work practices should limit the incidence of accidents and emergencies. In order to effectively handle emergency situations, planning is essential. An emergency response and contingency plan should be developed in accordance with 29 CFR 1910.120 which includes measures to prevent accidents and emergencies and to limit the adverse impact of these incidents when they occur. The contingency plan should also include evacuation plans in case of an emergency. Specific aspects that should be addressed in the contingency plan are discussed below.

1.15.1 Prenotification

Local fire/police/rescue authorities and nearby hospital personnel should be contacted by the Contractor and briefed prior to site entry or work regarding the scope of the study and hazardous chemicals and conditions that may be encountered at the site by personnel that post potential emergency situations, to ascertain their response capabilities and to obtain a response commitment. In addition, off-site emergency personnel should be informed about site emergency procedures and decontamination procedures.

1.15.2 Personnel Roles and Lines of Authority

The contingency plan should identify all individuals and teams who will participate in emergency response and define their roles. All personnel should know their own responsibilities in an emergency, as well the names of those in authority and the extent of that authority. Changes in the contingency plan in response to new or changing site conditions, new information or personnel changes should be reviewed periodically.

1.15.3 Training

All field personnel should be briefed by the Contractor HSO prior to site entry concerning personnel and equipment which will be available and summoned during an emergency and concerning their responsibilities during an emergency situation. Personnel should be briefed on evacuation routes, assembly points, and the person to report to when an alarm sounds. Visitors should be briefed on basic emergency procedures such as decontamination, emergency signals, and evacuation routes.

Personnel who are assigned specific emergency responsibilities should be thoroughly trained in their duties. This training should include the emergency chain of command, available off-site support, how/where to call for help, what information to provide to emergency response agencies, location and use of emergency equipment, and emergency evacuation while wearing PPE.

1.15.4 Communications

A system of communicating emergency situations to on-site personnel should be included in the contingency plan. The communication program should describe audible signals (i.e., air horn signals) to be used during an emergency, as well as hand signals to be used when noisy conditions exist. Signals used should be brief and exact and limited in number so that they are easily remembered (refer to Section 1.11.3 for sample hand and horn signals). Communications devices (i.e. flags, lights, radio) appropriate to site-specific conditions should be used.

1.15.5 Posted Instructions and Emergency Contacts

Names and phone numbers of all emergency response personnel and the route to the nearest prenotified medical facility should be conspicuously posted at the work site. Instructions on actions for personnel to take in an emergency should also be posted and reviewed frequently.

1.15.5.1 Emergency Telephone Numbers - Emergency telephone numbers should include, but not necessarily be limited to, the following:

- Hospital
- Physician
- Police

- Fire Department
- Base Environmental Coordinator
- Base Emergency Contact
- GAFB Commander
- Environmental Response Teams
  - Federal and State Environmental Protection Agencies
  - U.S. Coast Guard National Response Center
- Poison Control
- Contractor Site Safety Officer(s)
- Contractor Health and Safety Officer
- USACE Contracting Officer
- Local Utilities 24 Hour Contact

1.15.5.2 Hospital - A nearby medical facility should be used for emergency treatment. (The GAFB Hospital has been able to provide emergency medical services during previous site activities). A map should be posted conspicuously at the work site(s) showing the location of the hospital and indicating the fastest route to the hospital from the work site. Figure C-4 shows the location of the GAFB Hospital and the Rome Hospital.

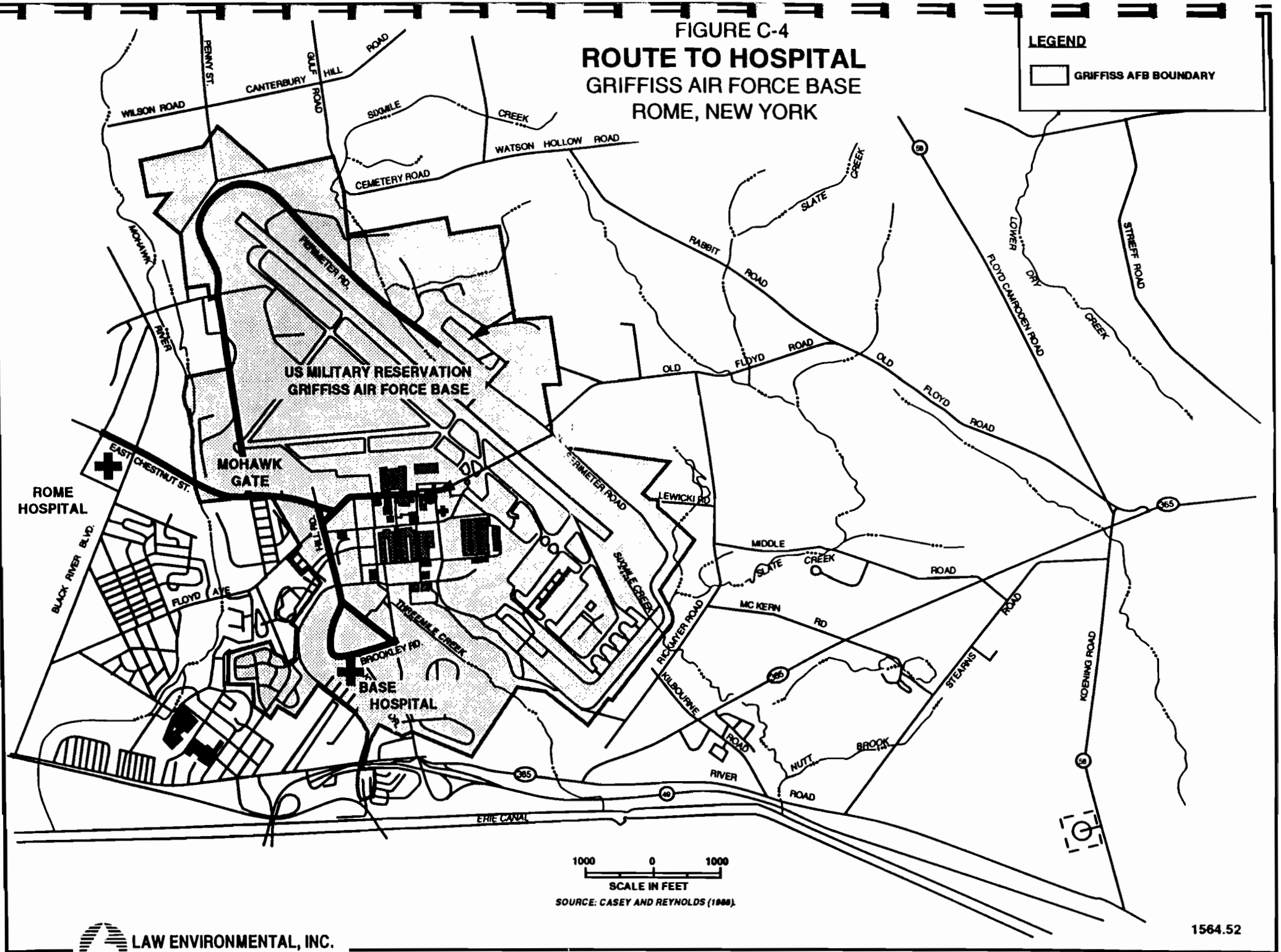
1.15.6 Emergency Planning and Recognition

Personnel should be alert for potentially hazardous situations and symptoms in themselves and others that warn of hazardous conditions and exposures. (Refer to Sections 1.3 and 1.9 for symptoms of chemical exposure and heat/cold stress). Safety briefings should be conducted to review site-specific hazards and/or changing conditions so that dangerous situations can be rapidly recognized and appropriate response taken.

FIGURE C-4

ROUTE TO HOSPITAL

GRIFFISS AIR FORCE BASE
ROME, NEW YORK



SOURCE: CASEY AND REYNOLDS (1988).

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1.15.7 Site Map

A site map should be maintained on site showing the locations of personnel, equipment, buildings, terrain, roadways, off-site populations, medical facility, fire station, evacuation routes and assembly points. The map should be updated as site conditions change (i.e., if access or evacuation routes are blocked). Other pertinent information, such as wind conditions, temperature and forecast should be added.

1.15.8 Criteria and Procedures for Site Evacuation

Criteria for site evacuation are contained in Section 1.3.5. There are three stages of site evacuation, based upon the hazard posed by the incident:

1. Withdrawal from the immediate work area
2. Evacuation of site
3. Evacuation of potentially affected facilities in vicinity

1.15.8.1 Withdrawal from Work Area - Withdrawal to a safe upwind location outside the Exclusion Zone will be required should any of the following occur:

- Concentrations of volatile organics, combustible gases or toxic gases exceed action guidelines. Work will be temporarily stopped until concentrations fall below the action levels, or PPE upgrade will be implemented in accordance with the guidelines presented in Section 1.3.5.

- If an incident such as a containable fire or minor accident occurs, field operations will resume after

appropriate response is completed and the Contractor HSO has cleared the site.

- Equipment malfunctions.

1.15.8.2 Site Evacuation - The work site should be evacuated under the following conditions:

- Levels of contaminants are detected in excess of action guidelines (Section 1.3.5).

- The oxygen content measured by an oxygen level monitor drops below 19.5 percent in the ambient breathing zone or the oxygen content in the air rises above 22 percent (explosive atmosphere) for two consecutive minutes.

- A major accident or injury occurs.

- Fire and/or explosion occurs.

1.15.8.3 Evacuation of Facilities in Vicinity of Site

The Contractor HSO is responsible for determining if circumstances exist for adversely affecting areas or facilities surrounding the site, and should always assume worst-case conditions until conditions are demonstrated to be otherwise. If air concentrations of vapors exceed the work area site action levels contained in Section 1.3.5, monitoring will be performed at the edge of the Exclusion Zone and Contamination Reduction Zone to be protective of personnel in nearby areas and/or buildings. If action levels are encountered at these locations, measurements should be performed at the edges of nearby buildings. If action levels are encountered at the edges of nearby buildings, the buildings should be evacuated.

Under such circumstances, the Contractor HSO should convey this information immediately to the GAFB Fire Chief for further action.

1.15.9 Site Control During Emergencies

The buddy system should be adhered to during response to emergencies. Control checkpoints through which all personnel entering or exiting the site must pass should be designated to maintain a record of personnel present in the emergency area. Written records of the names and affiliation of off-site personnel, status, time of entry/exit, areas to be entered, team or "buddy", task being performed, PPE (air time left if SCBA), and rescue and response equipment should be maintained during emergency response.

1.15.10 Medical Emergency Response and Decontamination

Depending upon the severity of the injury, first aid treatment may be given at the site by trained and certified personnel. Additional assistance from emergency medical technicians may be required at the site, and/or the victim may require transport to the hospital for treatment.

The Contractor SSO should be notified immediately of the medical emergency situation and provide him/her with the following information:

- Location of victim
- Nature of emergency
- Whether victim is conscious

After being notified of the medical emergency, the Contractor HSO should determine whether the victim requires assistance from the Emergency Medical Team (EMT). Actions required depend upon the

seriousness of the emergency. If a life-threatening condition exists, the EMT should be called immediately. The HSO should appoint a person to meet the EMT when it arrives and lead it to the victim.

When possible, normal decontamination procedures should be followed. In life-threatening situations, care must begin WITHOUT considering decontamination. Outside protective clothing can be removed if it will not delay or aggravate the victim's condition. The area surrounding an accident site must not be disturbed until changes to the site have been cleared by the Contractor HSO.

1.15.11 Fire

The potential for fire is possible when dealing with flammable materials during activities at the site. The local and base fire departments should be alerted to the nature and location of any field investigation activities to take place at the site. The following preventative procedures should be followed during site activities:

- Before work is started in an area, the Contractor HSO should review fire prevention and response procedures and identify personnel assembly points and site evacuation procedures.

- Potential sources of ignition should be identified and kept way from areas in which potentially flammable materials will be encountered.

- Air monitoring should be performed during subsurface operations or operations in confined spaces using combustible gas, oxygen level indicators and organic vapor monitoring equipment.

- Field personnel should be briefed on action levels for combustible gases and oxygen prior to starting work at a site.

- No smoking signs should be conspicuously posted at the work site.

- Fire extinguishers should be kept readily available (within 100 feet) of the work site.

The following procedures for responding to a fire should be followed during work at the site:

- The buddy system should be adhered to during response to a fire. Work teams should exit the work area together if evacuation is necessary.

- All personnel in the immediate work area should be alerted to the presence of a fire. Personnel should disconnect all electrical equipment in use at the site and move other equipment, if possible, away from the fire.

- Field personnel are not trained fire-fighters and should not attempt to combat fires that can not be quickly contained with the available fire extinguishers.

- If there is any doubt that a fire can not be quickly contained and extinguished with available fire extinguishers, personnel should sound the fire alarm and proceed to the designated assembly point.

- When a small fire has been extinguished, the Contractor HSO and HSO should be informed of the incident.

In the event of a fire that can not be rapidly extinguished using available equipment, the following personnel should be contacted immediately:

- Personnel in the immediate work area.
- Fire Department
- Contractor HSO
- Contracting Officer

1.15.12 Follow-up Response

The following actions should be taken prior to the resumption of normal site activities:

- The Contractor HSO should notify appropriate government agencies, as required.

- All equipment and supplies should be restocked and damaged equipment replaced or repaired.

- The Contractor Health and Safety Team should review all aspects of the contingency plan according to new site conditions and lessons learned from the emergency response.

- Personnel should be briefed on revisions to the contingency plan and emergency procedures and other information pertinent to future emergency response activities.

1.16 LOGS, REPORTS AND RECORDKEEPING

The following logs, reports and records should be developed and maintained by the Contractor HSO and submitted to the CO at the conclusion of site work:

- Training logs (site-specific, visitor)
- Daily safety inspection logs
- Employee/visitor register
- Environmental and personal exposure monitoring/ sampling results

1.17 REFERENCES

The following documents were available as reference sources in the preparation of this HSDA.

1. U.S. Army Corps of Engineers, 1987. Safety and Health Requirements Manual, EM 385-1-1.

2. Occupational Safety and Health Administration (OSHA) Construction Industry Standards, 29 CFR 1926, and General Industry Standards, 29 CFR 1910; especially 29 CFR 1910.120 - "Hazardous Waste Site Operations and Emergency Response."

3. NIOSH/OSHA/USCG/EPA, 1985. "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities."

4. NIOSH, "NIOSH Pocket Guide to Chemical Hazards, U.S. Dept. of Health and Human Services, Publication No. 90-117.

5. U.S. Coast Guard, 1985. Chemical Hazard Response Information System.

6. Sittig, M. 1979. Hazardous and Toxic Effects of Industrial Chemicals. Noyes Data Corp., Park Ridge, NJ.

7. ACGIH 1990-1991. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.