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FINAL REPORT

CONFIRMATION STUDY OF FORMER ATLAS MISSILE SITES FOR POTENTIAL TOXIC AND HAZARDOUS WASTE CONTAMINATION

FORMER ATLAS SITE S-6
BLACK BROOK, NEW YORK
CONTRACT NUMBER DACW41-86-D-0115

Prepared for
U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT
700 FEDERAL BUILDING
KANSAS CITY, MISSOURI

Prepared by
LAW ENVIRONMENTAL INCORPORATED
GOVERNMENT SERVICES DIVISION
ATLANTA, GEORGIA
LEGS JOB NO. 604-3

May, 1987

The conclusions and recommendations contained in this report are solely those of Law Environmental Incorporated and do not necessarily reflect the position of the United States Government or any of its departments or agencies.

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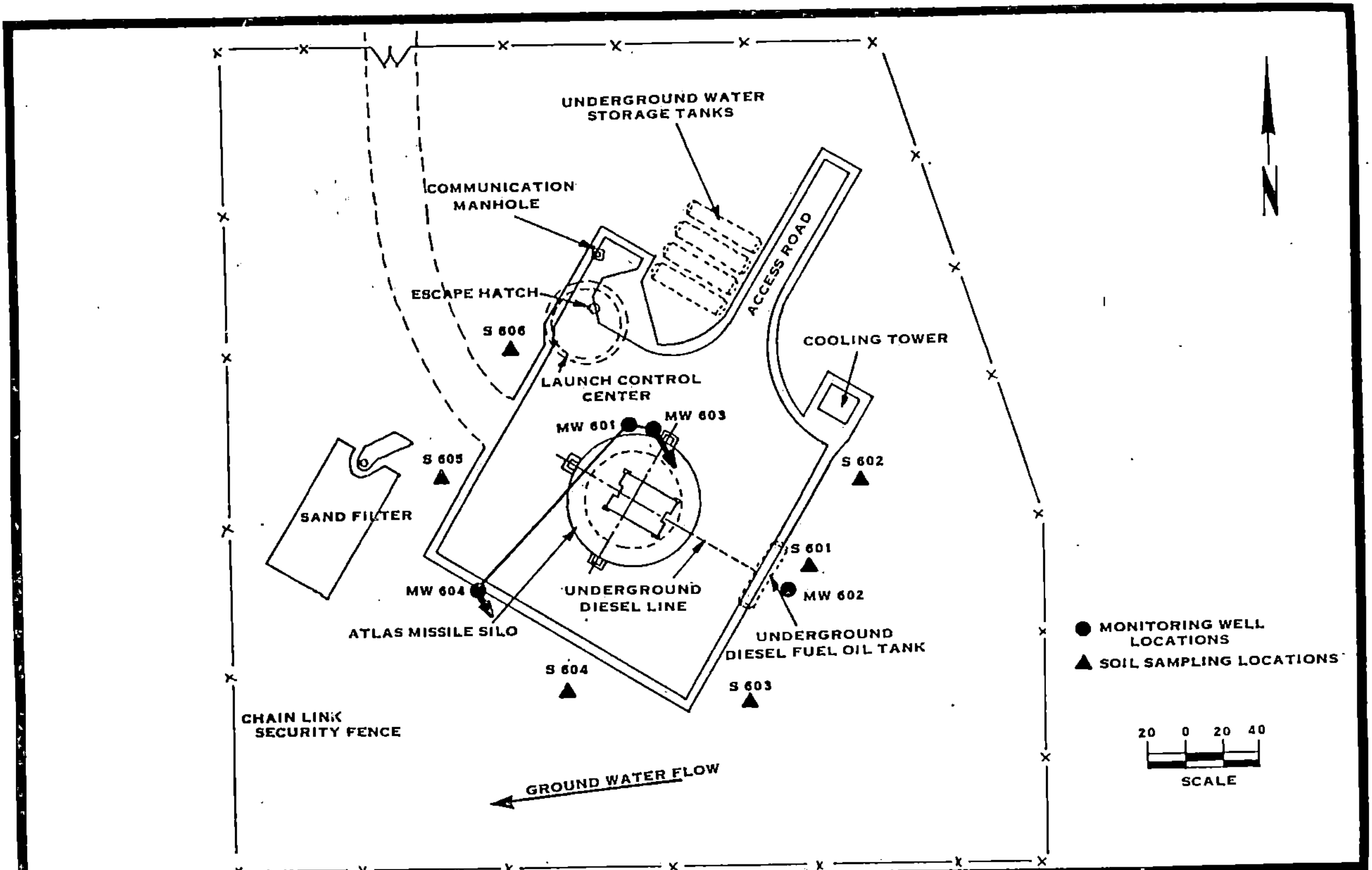
SECTION 1.0 - EXECUTIVE SUMMARY

The Department of Defense (DOD) is investigating former Atlas Missile sites throughout the United States for potential toxic and hazardous waste contamination. This report documents the confirmation study performed at Atlas Site S-6, which is located just east of the Town of Black Brook, New York. The field investigation involved installation and sampling of three shallow and one deep ground-water monitoring wells, and sampling of soils at the site. Figure 1-1 shows the monitoring well and soil sampling locations. In order to detect constituents in the different media at the site, the samples were analyzed for purgeable halocarbons, petroleum hydrocarbons, purgeable aromatics, total and dissolved metals. The analytical data for this study are summarized in Section 4.0 of the report.

The analytical tests performed on ground-water and soil samples were selected by the USACE. These analytical parameters represent likely constituents from Atlas operations. A number of these substances were found in the water and soil on the site; however, in all cases the concentrations were low. Analyses performed to identify chemical constituents at the site included:

Contaminant		Matrix
Purgeable Aromatics		Soil & Water
Purgeable Halocarbons		Soil & Water
Petroleum Hydrocarbons		Soil & Water
Metals (Total)		Soil
(Total & Dissolved)		Water
Arsenic	Lead	
Barium	Mercury	
Cadmium	Selenium	
Chromium	Silver	



ATLAS SITE S-6
BLACK BROOK, NEW YORK

LAW ENVIRONMENTAL SERVICES

MARIETTA, GEORGIA

SITE LAYOUT AND
SAMPLING LOCATIONS

SAMPLED 11/20/86

FIGURE 1-1

Site S-6 is a former Atlas Missile site, which was operated for approximately two years during the early 1960's. The U.S. Air Force (USAF) conveyed the deactivated site to Daniel A. Tarasevich, Frank J. Borges, and William E. Salmon in 1967. Subsequently, the site was transferred to the current owner, the Town of Black Brook.

The Town of Black Brook originally acquired the site for public utility purposes. The Town recently applied to the GSA to modify the deed to allow for the construction of an industrial park on the property. The site is currently being officially used as a borrow pit. The most obvious unofficial activity on the site is its use by ATV vehicles and dirt bikes as a recreation area. The site is uncontrolled and therefore unauthorized access onto the site may occur.

1.1 PRELIMINARY DETERMINATION AND RECOMMENDATIONS

From information gathered during the field investigations and analysis of laboratory results, the following preliminary determination and recommendations are made:

(1) Based upon the ground-water and soil samples and analyses, <u>operation of Atlas Site S-6 has not contributed significant levels of chemical constituents to the ground water or soil at the site.</u>

(2) Based on the media samples and analyses, operation of Atlas Site S-6 most likely did not contribute significant levels of chemical constituents at the site. The existing levels of constituents appear so low, that they are not thought to be a significant health hazard, and therefore, we recommend that no further environmental investigations be performed at the site.

1.2 OVERVIEW OF THE ATLAS MISSILE SYSTEM

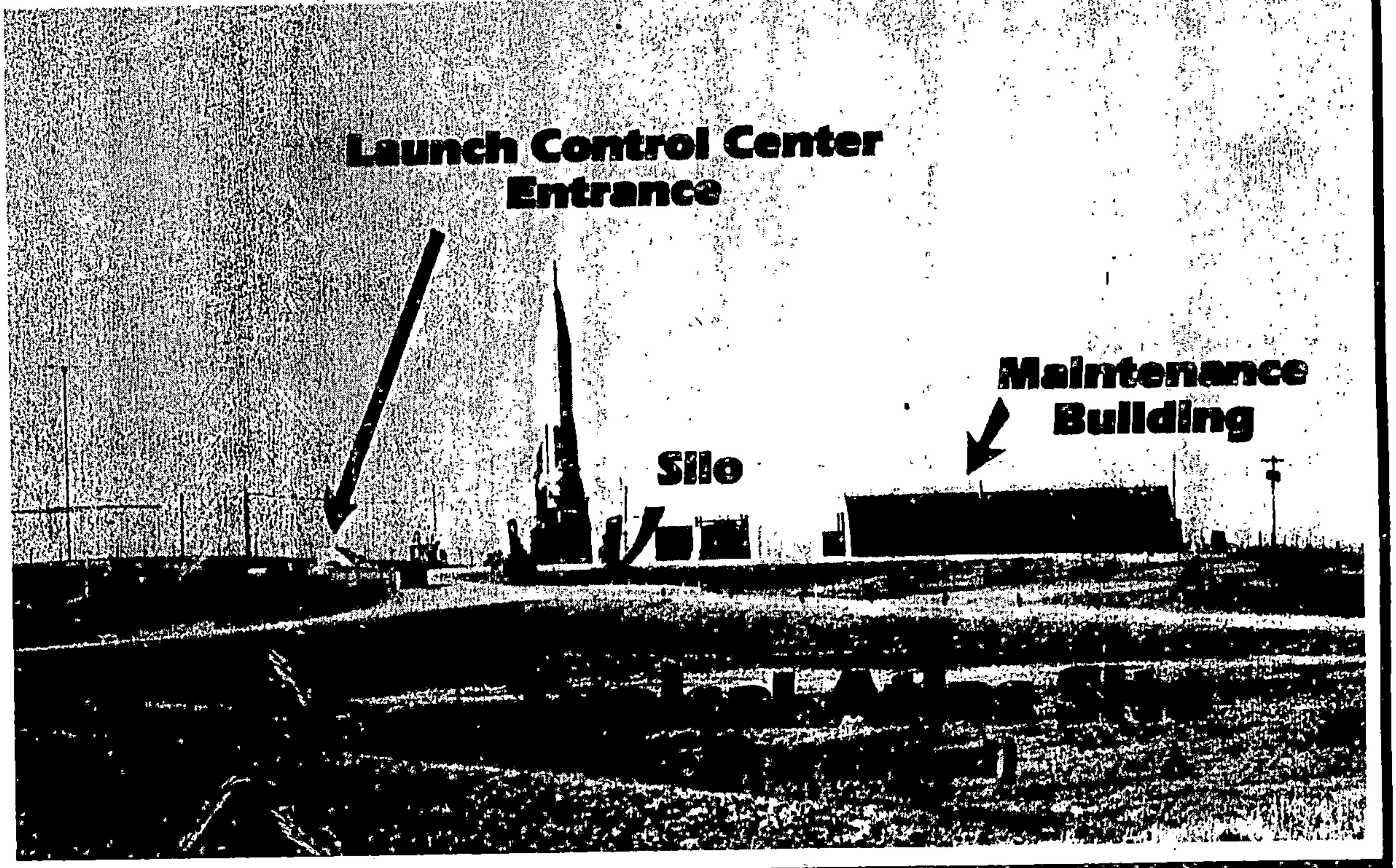
1.2.1 Background

The Atlas Missile System was the foundation for the United States Intercontinental Ballistic Missile (ICBM) and space launch vehicle programs during the late 1950's and early 1960's. The Atlas Missile Program began in 1946 under the code name Project MX774. The program evolved through several phases of improved engines, modified fuels, strategic missile deployment, varied launch configurations, and a space launch vehicle. The phase which influences the Defense Environmental Restoration Program involves the deployment of Atlas missiles at operational sites within the continental U.S.

The Research and Development (R&D) phase of the Atlas Missile Program was conducted at Cape Canaveral, Florida. The most memorable event associated with Atlas during R&D was the December 18, 1958 launch into orbit, and radioing back to earth a Christmas message from President Eisenhower. At that time Atlas was on a high priority track to become an operational part of the ICBM Program. The first two versions of the missile, Atlas A and Atlas B, were produced during this R&D phase.

Atlas D was the first operational version of the missile, it was deployed at Vandenberg AFB, California; Warren AFB, Wyoming, and Offutt AFB, Nebraska. The subsequent E&F versions were also deployed at operational units in the U.S. Figure 1-2 shows typical above ground facilities at an Atlas missile site.

During the evolution of Atlas versions D, E, and F, the launch mode for the missile was also evolving. The R&D versions of Atlas had stationary launch facilities at Cape Canaveral and Vandenburg. However, the operational missile had to be deployed at remote sites, where it was not feasible to provide the stationary launch facilities. Therefore, Atlas D was designed to be moved to the launch pad by a transporter which subsequently



TYPICAL ATLAS MISSILE SITE

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TYPICAL ATLAS SITE

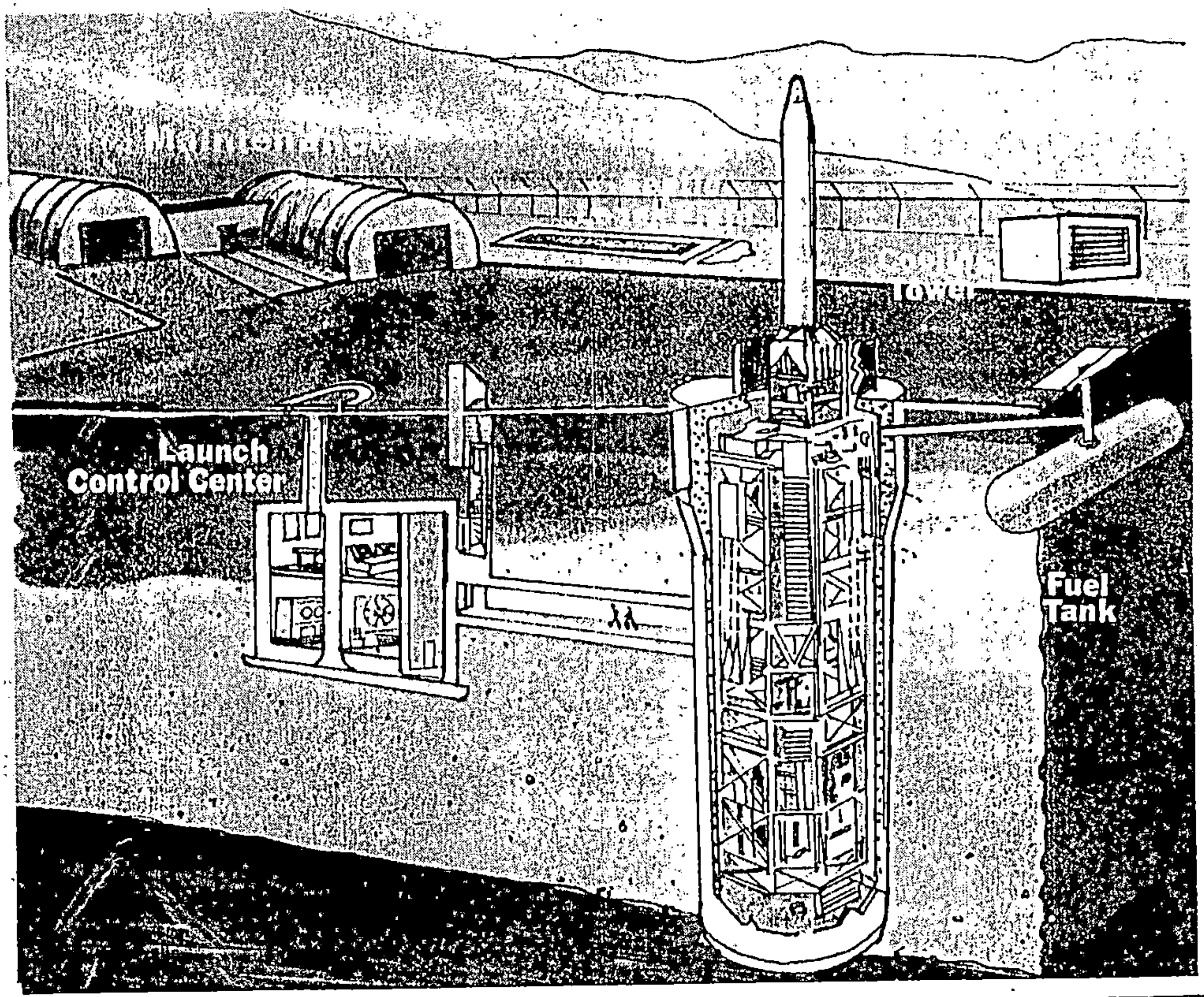
FIGURE 1-2

erected the missile to its vertical launch position and then arched away from the missile at launch. The installations which deployed Atlas D's were above ground facilities and provided no protection from attack.

The next improvement for Atlas was the E version which was designed to survive a nearby nuclear explosion, which would produce up to 25 PSI overpressure to the launch facility. This criteria resulted in enclosing the missiles in "coffin like" vaults and redesigning the lifting truss to position the missile for launch. The missile vaults were partially buried, with protective doors that retracted from above the missile for launching. The launch operations were conducted from a buried control structure. Atlas E sites were considered "semi-hard" sites.

The final improvement to the Atlas Missile System was to harden the facilities to provide protection for 100 PSI overpressure which would be produced by a nearby nuclear explosion. This resulted in emplacing the missile vertically in underground silos and isolating the missile from the silo within a spring mounted crib. The silo was 174 feet deep and 52 feet in diameter. Figure 1-3 is an artist's sketch of the above-ground and below ground facilities at an Atlas site. The silo top was enclosed by heavy doors which were opened for missile launch (Figures 1-4 and 1-5). The Atlas F version was deployed at the hard sites. The launch mode was to elevate the missile above the silo door (top). Integrated Atlas F facilities such as control rooms, crew quarters, propellant storage were buried below ground.

The Atlas D, E and F versions were deployed at 13 squadrons located near 11 Air Force bases. The Atlas deployments are summarized below:



TYPICAL ATLAS
MISSILE SITE

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ATLAS GENERIC SITE

FIGURE 1-3

TYPICAL ATLAS
MISSILE SITE

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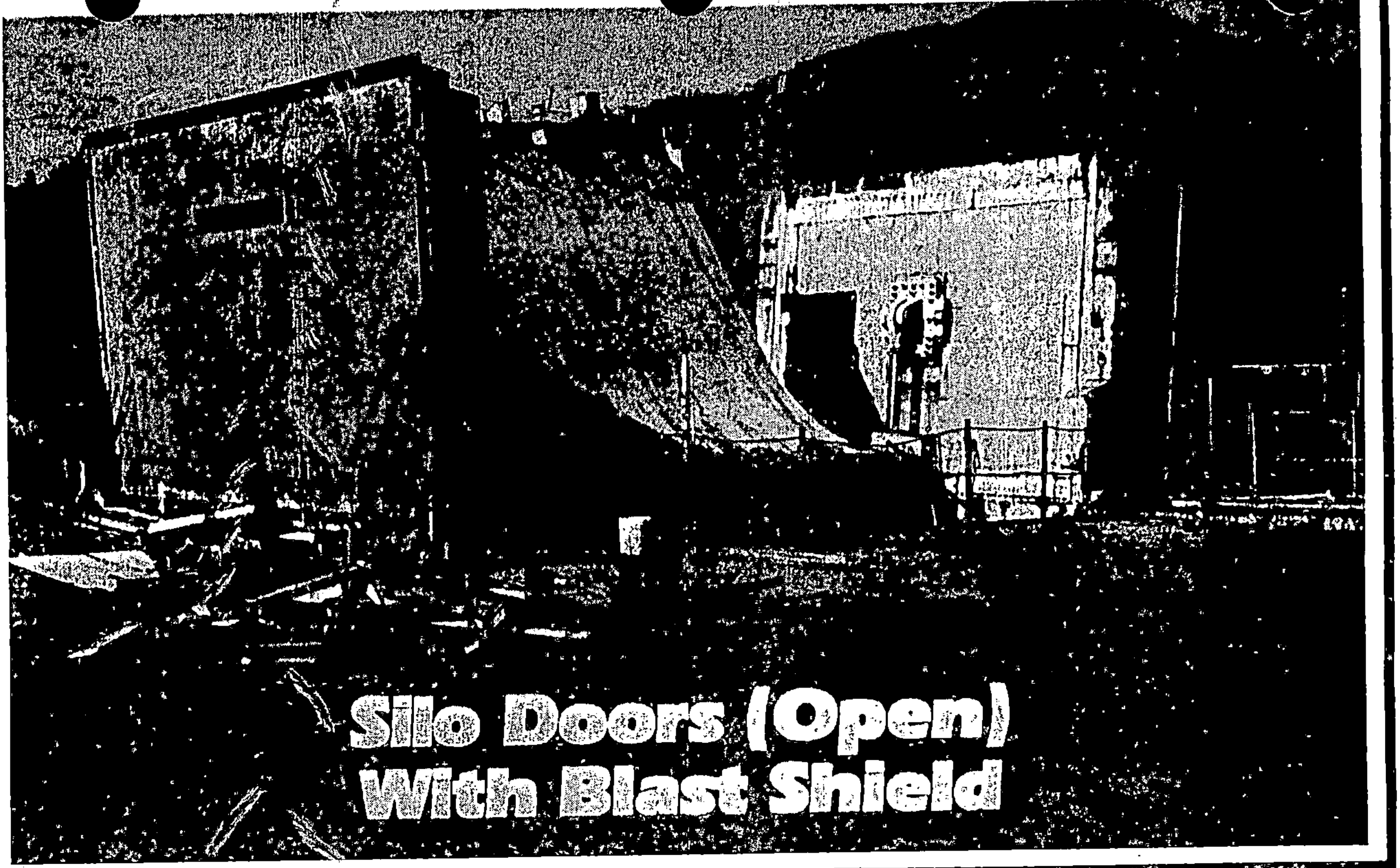
SILO DOORS (CLOSED)

FIGURE 1-4



TYPICAL ATLAS MISSILE SITE	LAW ENVIRONMENTAL INC. GOVERNMENTAL SERVICES DIVISION	SILO DOORS (OPEN) WITH BLAST SHIELD FIGURE 1-5

Air Force Base	Location	Number of Missiles D Model	E Model	F Model
Vandenberg	Lompoc, CA	6		
Warren	Cheyenne, WY	6	9	9
Offutt	Omaha, NE	9		
Fairchild	Spokane, WA		9	
Forbes	Topeka, KS		9	
Schilling	Salina, KS			12
Lincoln	Lincoln, NE			12
Altus	Altus, OK			12
Dyess	Abilene, TX			12
Walker	Roswell, NM			12
Plattsburgh	Plattsburgh, NY			12

In addition to locating the Atlas missile squadrons at scattered Air Force bases, each squadron dispersed its missiles to improve system survivability; except for early "soft" operational units at Vandenberg AFB and Warren AFB, which were not dispersed. The non-dispersed sites allowed multiple (3) missiles to be controlled by a single control room. Subsequent semi-dispersed sites also allowed multiple missile control from a single control room. Extensive communications systems were involved with the semi-dispersed sites. The Fairchild AFB communications system for Atlas incorporated a microwave system that was hardened to withstand 25 PSI overpressure and linked 9 sites dispersed over 8,000 square miles. The preponderance of Atlas sites were Atlas F's which were hardened and dispersed. These "hard" sites each had individual control functions.

The Atlas used liquid propellants - kerosene and oxygen. These were generally stored in below ground tanks remote from the launcher or silo. The Atlas F version utilized a unitary concept of deployment, wherein the missile would use storable propellants which could be stored in its onboard tanks or transferred from adjacent storage in minimal time. The missile also required that a positive pressure be maintained in the interior of the missile to enhance structural rigidity both in prelaunch and during flight. This positive pressure was provided by helium which was stored in the Atlas F silo and on-board the missile.

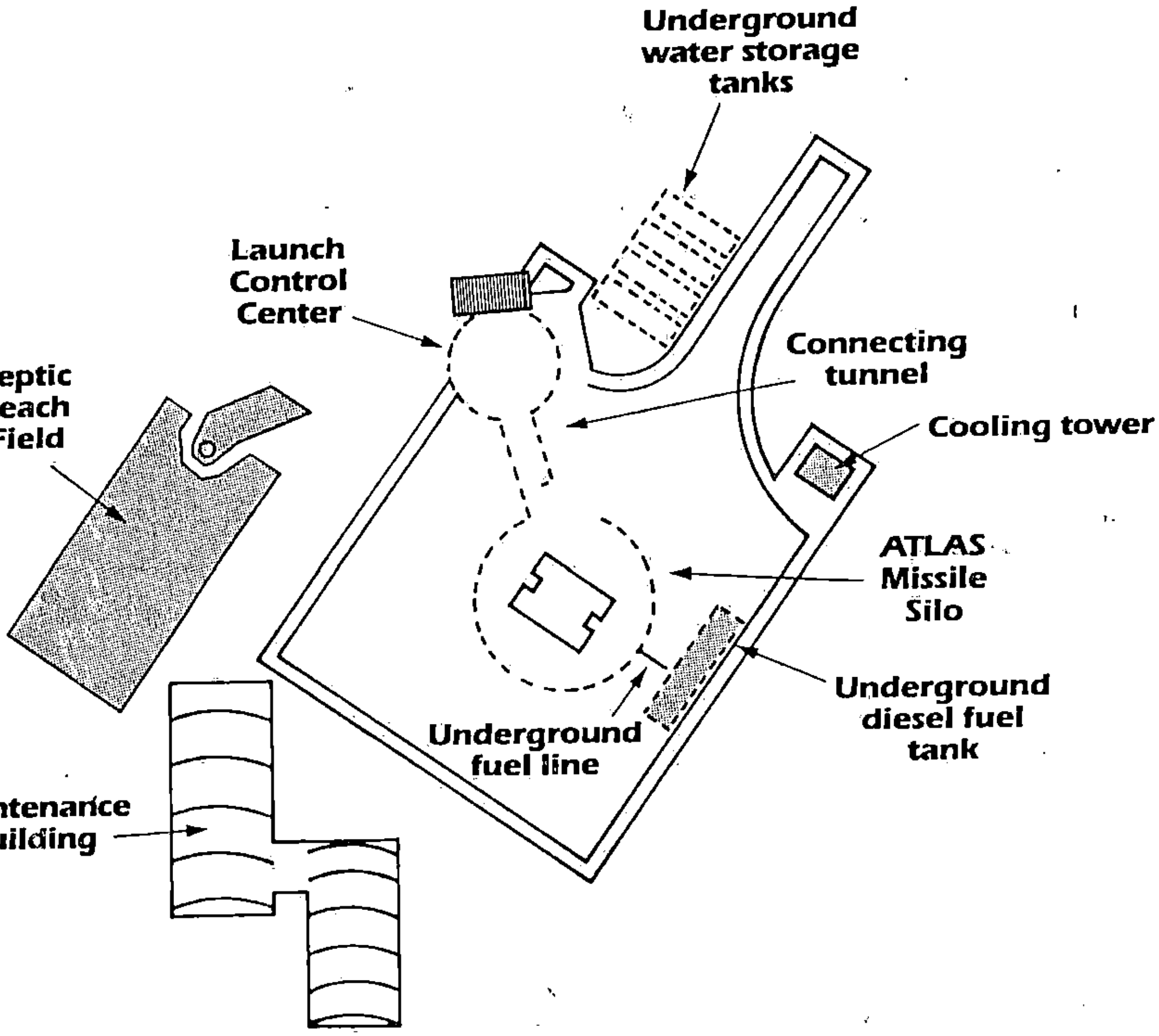
1.2.2 Atlas Missile System Operations

An Atlas F site generally consisted of about 10 acres within the security fence (Figure 1-6). The major facility at the site was the underground silo which was 174 feet deep x 69 feet diameter. The silo was constructed of thick reinforced concrete walls and the missile was supported by a crib that was suspended inside the silo. The missile was 82 1/2 feet long and 10 feet in diameter. The silo space below the missile was used for propellant storage, missile support and fuel loading equipment. The silo also contained seven operations levels adjacent to the missile: lifting system, hydraulic power and air handling, launch control electronics, HVAC, diesel generator/fuel tank, diesel generator, propellant loading. The silo configured in this manner comprised a unitary concept where all critical elements were contained within the silo.

About 150 feet away from the silo, an Atlas F site contained a below grade Launch Control Center (LCC). The LCC was a 2 story structure approximately 40 feet in diameter. It provided personnel quarters and communications to the missile and to command and control centers.

The Atlas F sites included facilities and equipment to maintain the missiles. The maintenance facility (Figure 1-7) was a steel structure located at grade, near the silo. During site operations missile components could be removed from the silo and maintained within this facility. The maintenance building, security systems, and waste treatment facilities were the only above-grade facilities at a site.

TYPICAL ATLAS SITE PLAN



TYPICAL ATLAS MISSILE SITE

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TYPICAL ATLAS SITE PLAN

FIGURE 1-6

TYPICAL ATLAS
MISSILE SITE

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GOVERNMENTAL SERVICES DIVISION

LAUNCH CONTROL ENTRANCE
MAINTENANCE BUILDING

FIGURE 1-7

The waste treatment facilities varied depending on site locations. Spray fields and percolation basins were used in areas where soil and climate was appropriate for sanitary waste treatment.

The unitary silo provided a means for fuel storage within the silo. However, there are indications that fuel may have also been stored in underground tanks remote from the silo at some sites. Another below grade facility was diesel fuel storage for the diesel generators. Generally, steel tanks were provided within about 100 feet of the silo for this purpose.

1.2.3 Waste Generation

The Atlas operational site activities which produced wastes or potential contaminants included:

propellant storage
diesel fuel storage
hydraulic systems
maintenance: petroleum, oil, lubricants, solvents, equipment operations, personnel, sanitary systems

The propellant storage included below grade tanks for kerosene and liquid oxygen. The duration of the Atlas as an operational system was limited to three to five years. Therefore, underground tank leakage due to deterioration was improbable. The most likely contamination mode from storage was probably spillage during tank filling and possibly faulty connections in conveyance lines. The liquid oxygen was stored in cryogenic conditions and spillage or leakage was very improbable. Furthermore, loss of oxygen would not have produced a toxic or hazardous condition. Propellants were also stored on board the Atlas F's and in their silos. As such, spillage of kerosene inside the silo would have been discharged to the silo exterior from the silo discharge system. Kerosene could persist in the environment as a contaminant.

Diesel fuel was stored in below grade tanks for all of the deployed Atlas F sites. Diesel fuel was used by the on-site generator, which supplied power for control room and launch activities. At the most remote Atlas F sites when public electric power was not available, on-site generators supplied normal operating power as well as emergency power. Leakage from underground tanks, spillage during tank filling and escape of fuel during maintenance or repairs of generators could have produced contamination at the diesel storage tank location or adjacent to the silo.

Each Atlas silo contained an enormous hydraulic lift system to move the missile from its cold storage position in the bottom of the silo, to the hot launch configuration at the surface. When the Atlas system was decommissioned, some of the hydraulic fluid may have remained in the storage tanks, pressure lines, pumps and rams. Subsequent deterioration of the system may allow remnant hydraulic fluid to leak into the silo, and ultimately the environment.

Maintenance of the missile and equipment at the launch sites was the most probable source for contamination. The sites contained hydraulic systems, pumps, generators, electronics, heating, ventilating, air conditioning, refrigeration, etc.; systems that required absolute reliability and thus continued maintenance. Maintenance activities undoubtedly used solvents and produced the normal accumulation of petroleum, oil, lubricants (POL) and solvents attendant to maintenance operations. The release of these potential contaminants could have resulted from normal maintenance clean-up activities when floor accumulations were discharged adjacent to the support buildings or from the silo sump discharge line. It is also possible that some POL accumulations which were retained for routine proper disposal were accidentally spilled or intentionally dumped within the site boundaries.

The lowest level in the Atlas F silo was the "Sump Level". Two automatically actuated 100 GPM capacity pumps were located in sumps at this level and were the means of pumping all fluid discharge from the silo. The liquids discharged by the pumps were routed up the silo wall through a discharge line which exited through the silo wall at Level 2. The ultimate disposition of the silo effluent appears to have been to surface discharge, which was located far enough away from the silo to avoid interaction with the silo backfill and to avoid interaction with the launch control center. The USAF Operational Readiness Training Manual designates the Atlas F complex into 4 quadrants with quad I containing the cooling tower and water plant, quad II containing the launch control center, quad III containing the electrical and communication stub-ups and quad IV containing the sump discharge areas. Quad II & IV are diagonally opposite each other. Therefore, it appears that the silo discharge usually occurs on the silo quadrant opposite the launch control center. This discharge may have been integrated with the area storm water management system and carried off-site by surface channels or allowed to infiltrate into dry, permeable soils.

The support crew for the remote sites consisted of about 20 people. Therefore, waste water from sanitary facilities was produced. The Atlas site had a spray field or aeration basin to treat and discharge sanitary sewage. Typically, waste water treatment fields do not result in hazardous or toxic materials that persist in the shallow subsurface zones. Therefore, it is unlikely that this waste stream produced contamination.

1.2.4 Summary

The Atlas program provided an important element of the U.S. defense system during a period of rapid evolution in ICBM systems. However, this evolutionary period was short lived. The first operational Atlas system was at Vandenberg in September 1959. The last operational squadron was at Plattsburgh in December 1962. By 1965, the Plattsburgh squadron was dismantling their silos and the records indicate the silo equipment was sold for salvage. By 1966, the Atlas F's were obsolete and were returned to the Air Force for use as boosters for the military space program.

Therefore, the missile systems were in place for only 3 to 5 years. During operational status the Atlas sites could have contributed to environmental contamination from fuel storage and maintenance activities.

*****

SECTION 2.0 - GENERAL

2.1 INTRODUCTION

The Department of Defense (DOD) conducts a number of industrial processes and manufacturing operations that are similar to private industry. In the late 1970's, DOD became aware of the negative impacts of what were previously considered acceptable disposal practices of waste materials associated with these processes and operations. In response to that knowledge, programs were developed between 1975 and 1978 by each service component to identify and assess potential contamination on active military installations. Authority to address problems of other than active installations was lacking since funds could not be spent on sites not owned by DOD.

The passage of the 1984 Defense Appropriations Act changed this situation. Specific language in the Act directed DOD to extend its efforts to include sites formerly used by DOD. The Act also broadened the definition of "hazard" to include structures and debris which were to be abandoned or had been abandoned upon termination of the site's military use.

The Act directed that the Secretary of Defense assume overall management of the program to assure consistent approach and adequate resource allocation. A Defense Environmental Restoration Account (DERA) was established which provides the resources for the evaluation and characterization of chemical constituents at former DOD Sites.

2.2 PROGRAM COMPARISON

Sites located on active DOD installations are being investigated under the Installation and Restoration Program (IRP). Sites either previously or presently owned by DOD not located on active DOD installations are handled separately from the IRP effort. In order to present a perspective of the formerly used (non-IRP) site investigation program, it is necessary to compare such efforts to the EPA's Superfund program and the DOD's IRP.

Figure 2-1 presents a block diagram illustration of the following investigative programs presently being conducted by various Federal agencies.

- EPA Superfund
- DOD/IRP
- DOD Non-IRP

As seen on Figure 2-1, during a Phase 1 effort, comparable investigations are conducted, i.e. preliminary assessments, real estate survey and record searches.

For Superfund, the Preliminary Assessment (PA) is conducted. It consists of a desk-top study and site visit which leads to a Site Inspection (SI). The SI usually includes limited sampling activities. After completion of the SI, a Hazard Ranking is performed and if the site scores above a certain number, it becomes a candidate for the NPL (National Priority List). Additional site investigations are conducted during the Remedial Investigation (RI), which is a comprehensive study to determine the extent of constituents and their rate of movement.

The DOD's IRP Phase I study consists of a records search and site visit to establish a potential list of sites possibly contaminated at an active installation. A Hazard Ranking System (HRS) is utilized to determine which sites will be investigated in order of environmental and/or public health importance.

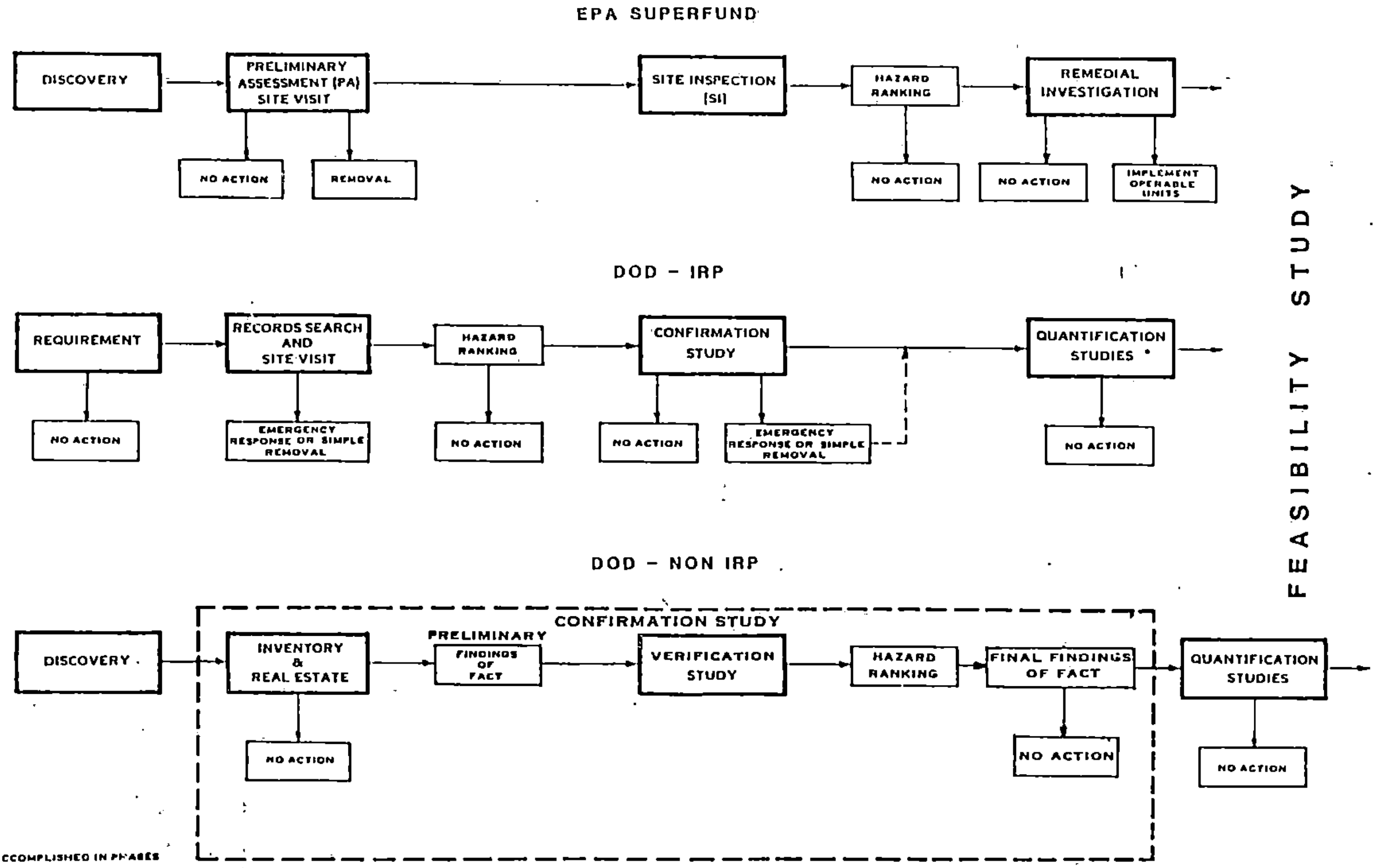
The Non-IRP effort, under which the Atlas Sites are categorized, also has a Phase 1 Inventory Study. Unlike the IRP and Superfund programs, it is a real estate oriented effort to determine ownership of the site. In addition, certain studies are performed dealing with demolition of structures previously used by the DOD.

A similar relationship is evident for each phase of the three programs; the Site Inspection (EPA); the Confirmation Study (IRP) and the Confirmation Study (NON-IRP). All of these studies are similar in terms of investigative depth. Some sampling is accomplished and a few monitoring wells may be installed. The main purposes for the study, however, may be somewhat different. For example, the purpose of a Non-IRP Confirmation Study is to determine if an elevated level of chemical constituents exists and if it was caused by DOD operations.

However, the Remedial Investigation (RI) under the Superfund Program is by far the most complex field investigation effort. It correlates with the Quantification Studies under IRP and Non-IRP efforts.

In summary, the scope of effort for a Confirmation Study of a Non-IRP Site is shown on Figure 2-1 surrounded by the dotted lines. It is apparent that this type of study is very preliminary and in no way can be compared with the project requirements for an RI, especially one with an NPL rating.

The objective of this project is to assess the potential existence of hazardous chemical constituents at former Atlas Missile Sites located in northern New York State. To fulfill this objective, a multi-phase program was initiated by the Corps of Engineers. Phase I of this program involved the performance of a title search, site survey and an estimate of remedial actions at all CONUS Atlas Sites. This Phase has been completed and the <u>DERP Findings of Fact and Determination of DOD Responsibility</u> for this site has been issued. This report is included herein as Appendix F for continuity.



* MAY BE ACCOMPLISHED IN PHASES

ATLAS SITE CONFIRMATION STUDY
USACE KANSAS CITY DISTRICT

LAW ENVIRONMENTAL SERVICES
MARIETTA, GEORGIA

COMPARISON OF GOVERNMENT
ENVIRONMENTAL PROGRAMS
FIGURE 2-1

Phase II of this program involves the Contamination Evaluation of specific Atlas sites that were selected based on varying subsurface conditions and geographic locations throughout the CONUS. This site evaluation is unique in terms of both breadth and complexity as compared with Remedial Investigations (RI) under CERCLA and Confirmation Studies under the IRP (Installation Restoration Program). Although many technical requirements apply, especially in the sampling and analysis area, some latitude is logical because of the preliminary nature of the effort.

This Confirmation Study involved installing and sampling ground-water monitoring wells, collecting silo water samples (if accessible) and soil samples. The samples were then chemically analyzed, so the site could be assessed for potential contamination. This report describes the Confirmation Study performed at former Atlas Missile Site S-6 near Black Brook, New York.

2.3 PROJECT OBJECTIVES

The objective of this investigation was to make a preliminary determination of whether DOD-caused contamination exists at Atlas Site S-6, and whether or not it has the potential to contaminate local ground-water or surface water supplies. To fulfill this objective, the contractor performed the following work elements for Atlas Site S-6:

- conducted site visit to collect background information;
- prepared work and safety plans;
- installed three shallow and one deep ground-water monitoring wells;
- collected and analyzed ground-water and soil samples;
- evaluated physical and chemical data;
- prepared an engineering report including a hazard ranking system (HRS) report (refer to Appendix I)

These work elements are described in the following sections of this report. Detailed descriptions of field and laboratory procedures are presented in the Work Plans. The text of this report contains background information, brief descriptions of field and laboratory activities, and assessment of the analytical data. The final section of the report describes conclusions reached from the site and analytical investigations and recommendations for any additional studies.

2.4 SITE VISIT SUMMARY

LEGS personnel visited Site S-6 on two separate occasions prior to beginning actual field work. The first site visit occurred with representatives from the USACE Kansas City District (MRKED) and Plattsburgh AFB during October 1986. During this visit the site was entered and a reconnaissance around the site was made. Atlas structures still evident on the Site included the missile silo and associated structures such as air vents and escape hatches as shown in Figures 2-2 and 2-3. The other structures like the entrance to the Launch Control Center and the maintenance buildings (Quonset huts) were demolished and removed from the site. The site visit team noted that the site has been used for a borrow pit and recreational activities (ATVs and dirt bikes).

A second site visit was conducted by the LEGS Project Manager, Site Manager and Health and Safety Officer. The field team walked around the site and identified potential locations for ground-water monitoring wells and soil sampling locations. No access was available into the missile silo. The sampling locations are fully described in Section 3.0 of this report.

ATLAS MISSILE SITE S-6
BLACK BROOK, NEW YORK

LAW ENVIRONMENTAL INC.
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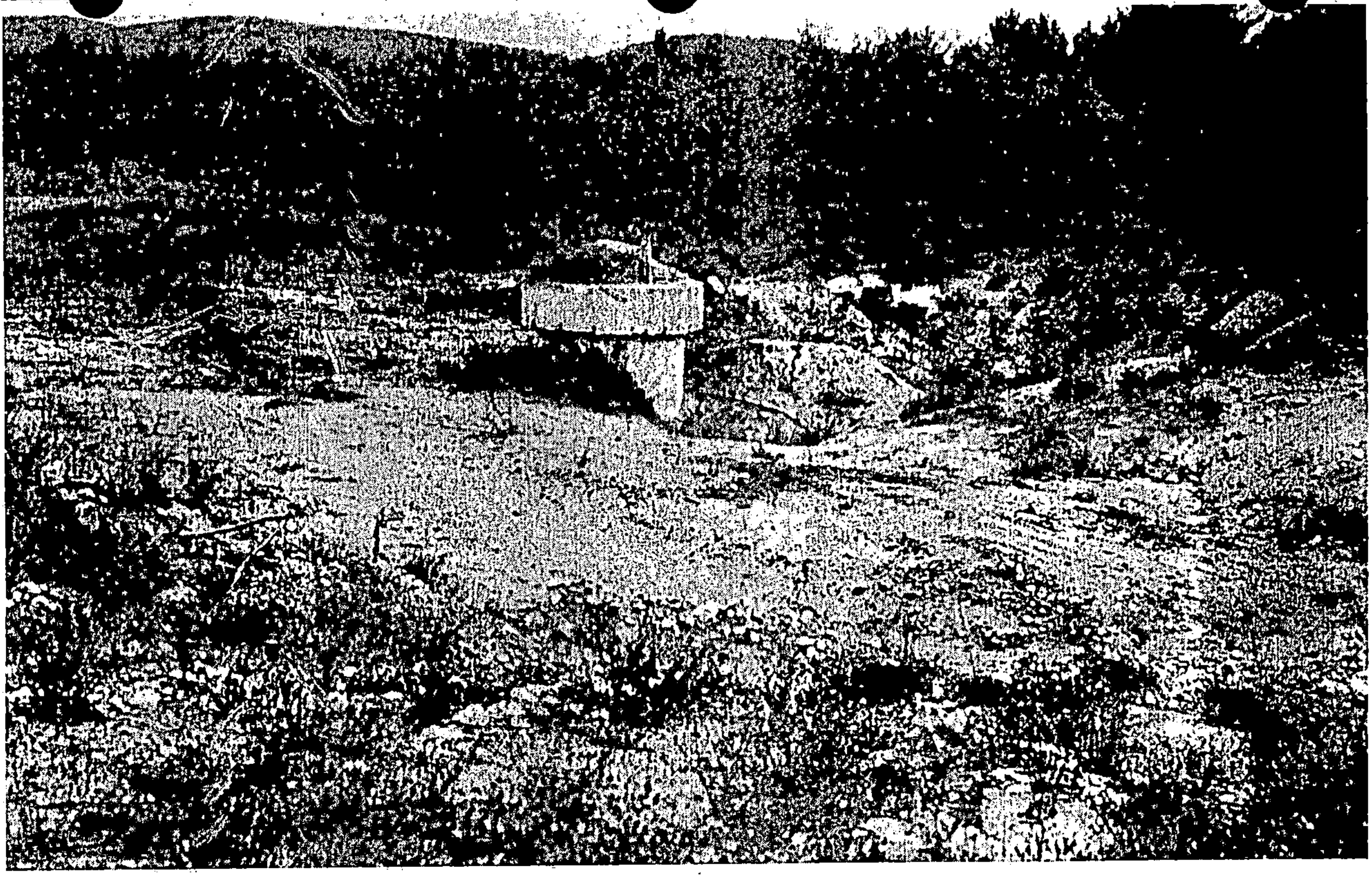
MISSILE SILO
(DOORS CLOSED)

FIGURE 2-2



ATLAS MISSILE SITE S-6
BLACK BROOK, NEW YORK

LAW ENVIRONMENTAL INC.
GOVERNMENTAL SERVICES DIVISION

ENTRY HATCH

FIGURE 2-3

2.5 SITE LOCATION AND PHYSIOGRAPHY

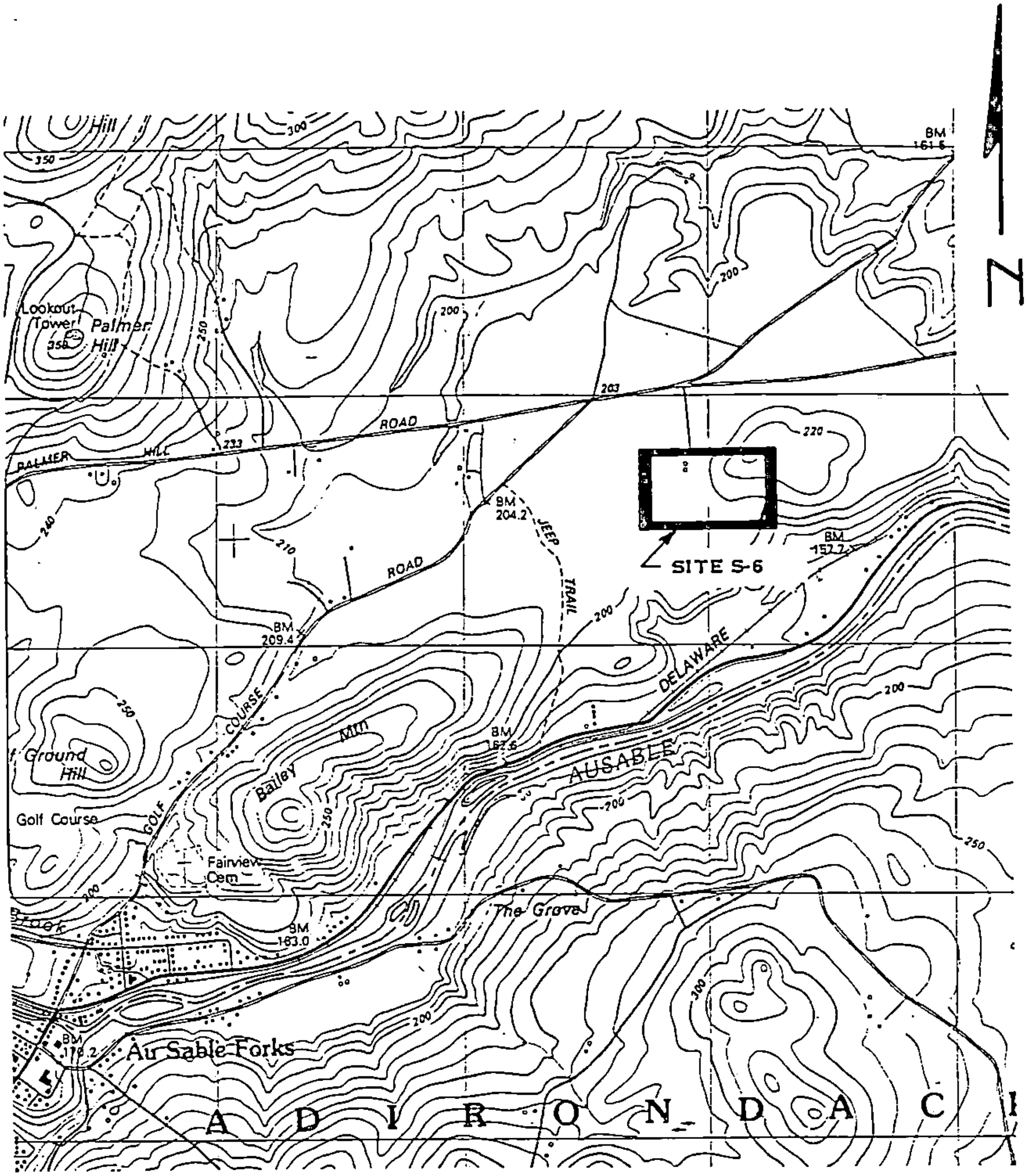
The S-6 missile silo site is located in the Town of Black Brook, New York. It is approximately 34 miles south of the Canadian/United States border, and 16 miles west of the New York/Vermont border (Figure 2-4). It is located in the Adirondack physiographic province, a rugged highland region underlain by a complex sequence of Precambrian igneous and metamorphic rocks.

The advance and retreat of the Wisconsin ice sheet during the close of the Pleistocene epoch modified the bedrock surface in the Adirondack physiographic province. It caused major changes in the drainage systems, created many new lakes and streams, and left behind various unconsolidated deposits such as till, outwash, and glaciolacustrine sediments.

The topographic relief at the site is approximately 65 feet. The general slope of the topography is from the northeast toward the southwest. The highest surface elevation is approximately 720 feet (msl) in the northeast corner with the lowest surface elevation approximately 655 feet (msl) in the southeast corner of the site.

2.6 OWNERSHIP AND PRIOR USE

The Atlas Missile Site S-6 contains approximately 23 acres. Audited records of the usage from the New York District, Corps of Engineers indicate that this installation originally consisted of 145.80 acres of land in fee and was part of the former Plattsburgh Atlas Missile Complex. The site was acquired for USAF use between 1960 and 1961. By July 1965, the missile site was inactive. There was no housing located at this site. The installation was not subject to other than Department of Air Force use and control during its activation.



1 CENTIMETER ON THE MAP REPRESENTS 250 METERS ON THE GROUND

ELEVATIONS ARE IN METERS.

ATLAS SITE S-6 BLACK BROOK, NEW YORK	LAW ENVIRONMENTAL SERVICES MARIETTA, GEORGIA	SITE LOCATION MAP FIGURE 2-4

The Department of Air Force conveyed, by Quitclaim Deed dated 28 June 1967, the 122 acre site to Daniel A. Tarasevich, Frank J. Borges and William E. Salmon. There are no structures on this portion of the site. By Quitclaim Deed dated 27 October 1967, about 23 acres fee were conveyed to the State University of New York. Subsequently, the 23 acres reverted back to General Services Administration (GSA), who assigned it to the U.S. Department of Health and Human Services for conveyance to the Town of Black Brook for public utility purposes. Presently the Town of Black Brook is in the process of transferring the deed through appropriate channels to enable the Town to construct an industrial park rather than a utility. Structures on this site include a typical 70' diameter subsurface concrete and steel missile silo 174' deep with approximately 12' thick walls. All other typical structures have been demolished by the Town of Black Brook. The silo is sealed and possibly flooded. Paving covers a 150' square around the missile silo concrete pad and continues at a 20' width down the 1/4 mile access road to Palmer Hill Road. Figures 2-2 and 2-3 are pictures of the silo area at the Black Brook Site.

*****

3.0 SITE INVESTIGATION

3.1 INTRODUCTION

The objective of the Atlas Site S-6 (hereafter referred to as the SITE) field investigation program is to determine if DOD activities caused contamination in the soil and ground water. In order to accomplish this objective, Law Environmental Incorporated collected representative samples of the site matrices for analysis. The sampling program provided a methodical and controlled procedure for collecting and handling media samples at the SITE. Included are subsections that discuss monitoring well installation, sample site selection, sampling procedures and sample preservation, sample shipping, and the chain-of-custody. Analytical methods and results are discussed in Section 4.0.

Matrices sampled at the SITE included soil and ground water. The samples were environmental (dilute) rather than hazardous (concentrated) samples. Both grab and composite sampling techniques can be used to collect environmental samples depending upon the objective of the investigation. The overall objective of this site investigation program is to assess the SITE to determine if DOD contamination presently exists. Therefore, grab samples were collected from the soil and ground water at the SITE. Table 3-1 shows the field samples collected at the SITE.

Quality Control Samples consisting of duplicates and field controls were taken in the same sample containers and handled in the same manner as the field samples. The number of QC duplicates and QC field controls for each matrix type (water and soil) is specified in Table 3-1. Field controls for water samples were travel blanks and sampling blanks. Travel blanks were containers filled with deionized water, transported to the SITE and handled like a sample. Travel blanks were opened at the site each day of sampling. Deionized water was added to compensate for any loss. Sampling blanks were reagent water which was passed through the sampling equipment and transferred to sample containers. These quality control samples were analyzed for all parameters specified in Section 4.0.

Quality Assurance Samples consisted of duplicates and field controls for each matrix type (water and soil) taken in the same sample containers and handled in the same manner as the field samples. The number of QA duplicates and QA field controls (travel and sampling blanks) for each matrix type is specified in Table 3-1.

The following table stipulates the number and types of samples collected at the SITE:

TABLE 3-1

Number and Types of Samples

Sample Type	Field Samples	Control Samples		Total Samples
		QC (AE lab)	QA (USACE)**	
A. Ground water (wells)	4	1 (duplicate)	1	6
B. Soil	6	1 (split)	1	8
C. QA/QC (field blanks)				
1) travel blank (water)	---	2	2	4
2) sampling blank (water)	---	2	2	4

3.2 MONITORING WELL INSTALLATION

Monitoring wells were installed in a manner to accomplish the following objectives: to collect representative ground-water samples; to prevent contamination of the aquifer by the drilling equipment; to prevent inter-aquifer contamination; and to prevent vertical seepage of surface water into the monitoring well water-intake zone. The Monitoring Well Installation Plan discusses the equipment, procedures and personnel that were used at the SITE to accomplish these objectives.

3.2.1 Drilling Procedures

Prior to setting up the drilling rig on a monitoring well location, the site was checked with appropriate authorities for underground utilities. Drilling only proceeded where no service lines crossed well locations. After the initial site survey, the drill rig was set up on the selected location. Once the drill rig was in position, the following protocol was followed for each well:

- Collect split-spoon sample (ASTM-D 1586-84) from the ground surface to 1.5 feet using standard penetration procedures, i.e., 140 pound weight falling 30 inches to drive 1.375 inch I.D., 2 inch O.D., split-spoon sampler.

- Begin augering and collect split-spoon samples continuously to 10 feet (i.e., standard penetration tests shall bottom at depths of 1.5, 3.0, 4.5, 6.0, 7.5, 9.0, 10.5 feet). From the 10 foot depth, split-spoon samples collected every 5 feet thereafter.

- A soil test boring log was completed during drilling by a qualified geologist or engineer. It recorded the following data:

- Sample number and depth
- Standard penetration test blow counts per 6 inch advance
- Percentage recovered
- Soil classification, color, consistency or density, and moisture content
- Depth of boring
- Boring refusal
- Water losses, if applicable
- Method of advancing boring

- Soil samples were collected from each split-spoon sample, placed in glass jars, and labeled. Records of each sample were entered on a soil boring log by the geologist on each drilling rig. Section 3.3.3 discusses the details of soil sample handling and shipping for analysis.

- The depth of first encountered free water was indicated on the drilling log. When the appropriate depth was reached, a groundwater monitoring well was installed in the borehole.

3.2.2 Rock Coring Procedures

Bedrock encountered during monitoring well drilling was cored by standard diamond core drilling methods. The following protocol was followed for each well:

- The core barrel used for advancing the boring was "NX" size or larger. The coring apparatus was steam-cleaned prior to use.

- Only clean, potable water or formation water from the well being drilled was used as drilling fluid. No drilling fluid additives were used.

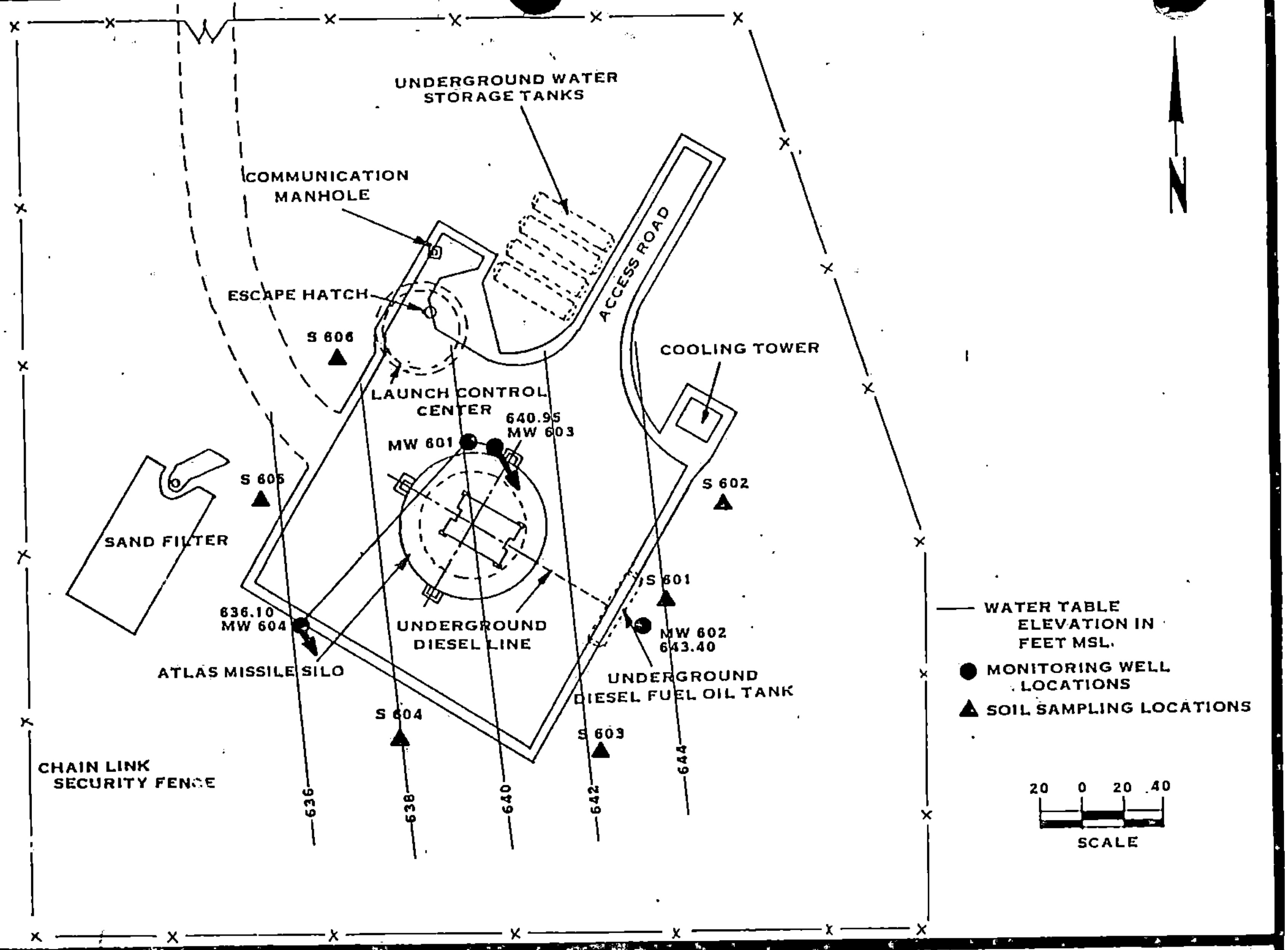
- All rock core recovered was logged by a qualified geologist or engineer. The core was photographed with 35 mm color slides and stored in wooden core boxes. Duplicate slides will be submitted to the CO as part of the completed boring logs. The cores will be stored until the project is completed.

3.2.3 Rationale for Monitoring Well and Other Sampling Locations

Based upon the information gathered from the Phase I report and the initial site visit, the SITE was sampled and is being monitored using the sample locations illustrated on Figure 3-1. The four new wells are positioned around the SITE and in the vicinity of the silo and buried fuel tank, which are suspected potential sources of contamination. The land surface slopes towards the west and south in the area around the SITE. It was assumed that the water table is a subdued replica of the land surface. Therefore, in these cases where it was feasible, the monitoring well locations were placed topographically down-gradient of potential contaminant sources. The specific rationale for each monitoring well location is as follows:

- Monitoring Well MW601
  MW601 is the location of the deep monitoring well. It was drilled adjacent to the silo and to a depth of 200 feet, which is below the bottom of the missile silo. The rationale for drilling a deep well adjacent to the silo was to intercept potential excursions of chemical constituents from the sides and the base of the silo.

- Monitoring Well MW602
  MW602 is one of the shallow monitoring wells. It was drilled and installed near the location of the underground diesel storage tank at the SITE. The monitoring well was situated slightly east of the tank. MW602 is about 125 feet east-southeast of MW601.



ATLAS SITE S-6
BLACK BROOK, NEW YORK

LAW ENVIRONMENTAL SERVICES

MARIETTA, GEORGIA

SITE LAYOUT AND SAMPLING LOCATIONS

SAMPLED 11/20/86

FIGURE 3-1

- Monitoring Well MW603

  MW603 is one of the shallow monitoring wells. It was drilled and installed next to the missile silo approximately 10 feet from MW601. This location was selected to monitor potential excursions of constituents from the upper portions of the silo and to determine the head relationship between the surficial aquifer and the deeper aquifer.

- Monitoring Well MW604

  MW604 is one of the shallow monitoring wells. It was drilled and installed about 60 feet west-southwest of the missile silo. This location was selected because it is topographically down-gradient of the SITE in the assumed direction of ground-water movement. Potential excursions of constituents from the SITE would most likely move in the direction of MW604.

Besides the monitoring wells, soil samples were also taken at the SITE. The soil samples were collected from the locations shown on Figure 3-1. These soil sampling locations were intended to determine if surficial contamination existed around the silo and underground tank area.

The silo doors and other access points into the missile silo were sealed, therefore no silo water samples were obtained.

3.2.4 Results of Monitoring Well Installation Program

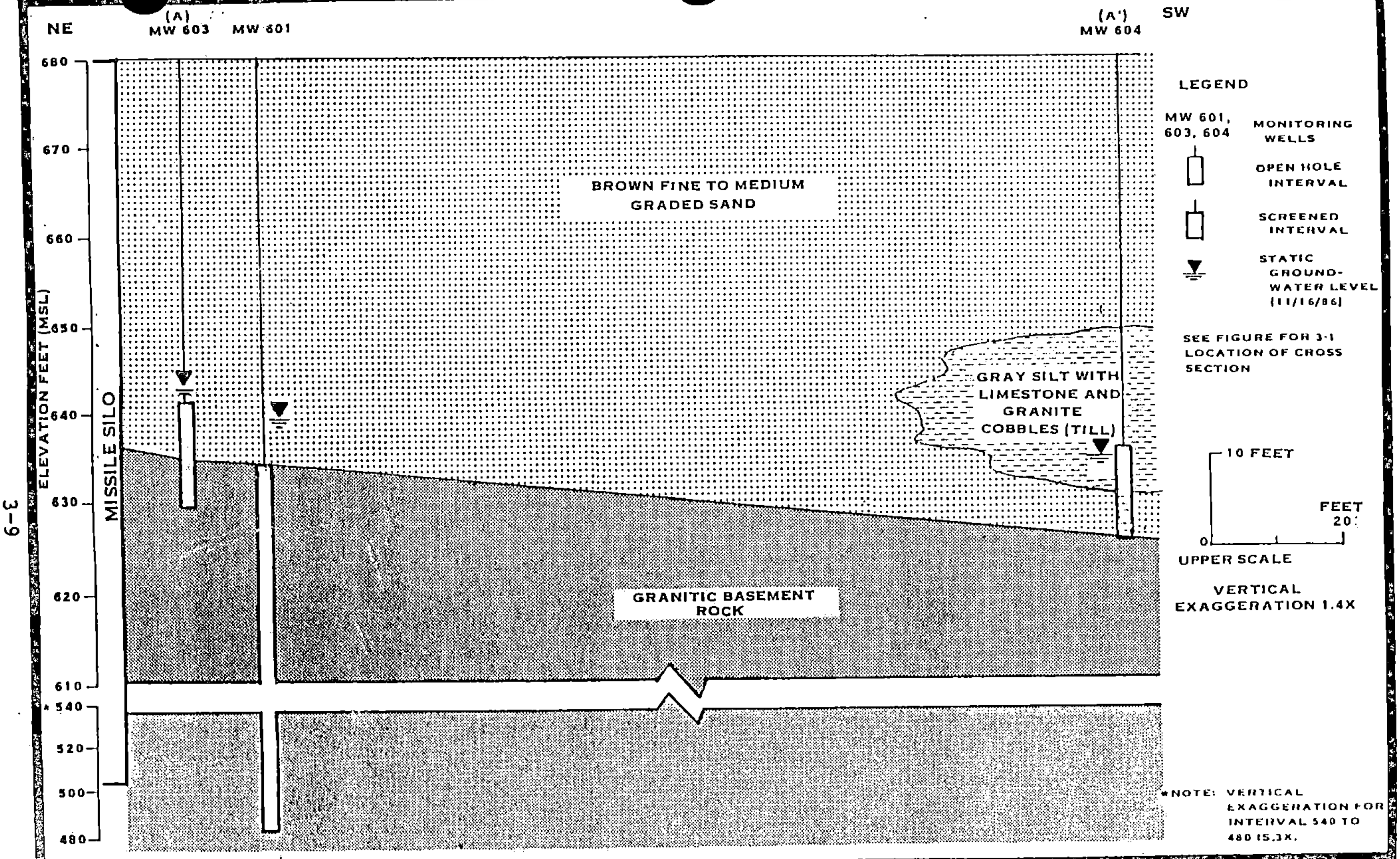
Drilling at the SITE was initiated during November, 1986. The monitoring wells were installed with an Ingersol-Rand TH-55 air rotary drill rig and two auger rigs (Mobile B-61 and CME-55). The depth of each monitoring well was as follows: MW601-200 feet; MW602-51 feet; MW603-51 feet; and MW604-54.5 feet. The deep well was constructed with a 4-inch schedule 80 PVC inner casing grouted inside a 6-inch steel outer casing. The steel outer casing was set to a depth of 18 feet. Below the steel casing, a 6-inch open borehole was drilled to 200 feet. The shallow monitoring wells were constructed of 2-inch Schedule 80 PVC casing and screen. A granular backfill was placed around the screen, and bentonite and grout seals were place above the sand pack. Test boring records and monitoring well construction diagrams for each well are shown in Appendix A and Appendix B.

At the site, glacial deposits of 25-30 feet of clay, sand, and silty sand with gravel are present. Underlying these surficial glacial deposits is an additional 20-30 feet of very stiff, poorly graded silty sand with gravel and cobbles (possibly till). The basement rock beneath these glacial deposits is of Precambrian age. It is highly fractured and consists of granite and gneiss. Depth to bedrock is approximately 50 feet. Figure 3-2 is a cross-section of the site in relation to the missile silo.

Ground water beneath the SITE occurs in the surficial deposits near the interface of the granitic basement rock. It ranges in depth from 41 feet to 46 feet below the land surface. Elevations on the water surface in the shallow wells are presented in Table 3-2. These elevations show that ground water in the surficial aquifer generally does move across the site from the northeast toward the southwest as expected (i.e., it is a subdued replica of the surface topography).

The water surface in the deep well (MW601) is about 1.5 feet lower than the water level in the adjacent shallow well MW603 near the silo (compare in Table 3-2). Therefore, it is likely that leakage of ground water occurs from the surficial aquifer into the rock aquifer through fractures, joints and bedding planes in the sedimentary rocks.

The hydraulic conductivity of the shallow wells, which were screened in the surficial sand and rock, ranged from approximately 1.7×10^{-3} to 1.3×10^{-1} feet per minute (ft/min). The range of measured conductivities is typical for a medium sand. The hydraulic conductivity of the deep well, which as set



ATLAS SITE S-6

BLACK BROOK, NEW YORK

LAW ENVIRONMENTAL SERVICES

MARIETTA, GEORGIA

ATLAS SITE S-6

GEOLOGIC CROSS SECTION

FIGURE 3-2

TABLE 3-2

WATER LEVEL ELEVATIONS

Well No.	TOC[1] (feet, msl)	Water Surface[2] Below TOC	Water Elevation
MW601	683.73	41.23	642.50
MW602	683.00	39.56	643.44
MW603	682.52	41.57	640.95
MW604	682.49	46.36	636.13

NOTES:
(1) TOC - Top of Casing
(2) Static Water Level measurements from Slug Tests performed 11/19/86 (Appendix E)

in rock, was approximately 1.33 x 10^{-2} ft/min. Results of the slug tests performed at the site are contained in Appendix E.

3.3 SAMPLING PROGRAM

3.3.1 Specific Sampling Procedures

Different sample matrices require specific sampling procedures, as described in the Work Plan (under separate cover). Care was taken to determine the best practical sampling procedure that would result in obtaining representative samples; as well as to maintain the integrity of the original sample medium through collection, transportation and delivery to the analytical lab. The SITE samples were collected and packaged as described in the Work Plan. A summary of the specific sampling procedures is presented in the following paragraphs.

3.3.1.1 Ground Water

The subsurface is a unique heterogeneous environment. Gas exchange, biological and other chemical reactions and conditions are different from the surface environment. Ground water is somewhat insulated from surface temperature and pressure variations. Rapid and significant changes can occur in ground-water samples upon exposure to the surface (sunlight, temperature and pressure). Therefore, ground-water sampling was conducted in a manner to minimize interaction of the sample and the surface environment.

3.3.1.1.1 Sampling Equipment

Many variations of ground-water sampling equipment are available depending upon the objective of the program. For the SITE, ground-water samples were obtained with pre-cleaned Teflon bailers. Pre-cleaning was performed in accordance with recommended EPA procedures. Pre-cleaning consisted of: (1)

removing gross contamination from the bailer using scrapers, (2) washing the bailer with a brush in a bucket filled with an Alconox soap solution, (3) rinse in a second bucket containing tap water and a brush, (4) spray bailer with a 10% nitric acid rinse, (5) repeat step 3, (6) spray the bailer with methanol, (7) rinse with deionized water, and (8) air dry.

3.3.1.1.2 Sampling Protocol

The sampling protocol at the SITE was as follows:

a. Measure Water Level - Using clean, non-contaminating equipment, (i.e., an electronic level indicator, or a fiberglass tape) determine the water level in the well and calculate the fluid volume in the casing and screen.

b. Purge Well - Remove at least 5 well volumes with a Teflon bailer, or by pumping.

c. Collect Sample - Lower the Teflon bailer slowly until it contacts the water surface and allow the bailer to sink to the desired depth and fill with a minimum of surface disturbance. Slowly withdraw the bailer, being careful to prevent contact of the bailer line with the ground. Tip the bailer and slowly discharge the contents into the appropriate containers. Repeat the process as necessary to fill each container to the required volume. Samples for volatile organics should be completely filled leaving no air space above the liquid portion (to minimize volatilization). Check that a Teflon-liner is present in the cap and secure the cap tightly. All samples are taken as quickly as possible once the sampling process begins. Sample preservation is discussed in Section 3.5.

d. Label Sample - Once the sample is collected, label each container providing the following data: site name, sample identification number, project number, date, time, and person sampling. Record the information in the bound field note book and complete all chain-of-custody and request for analysis documents. The bound field note book will have prenumbered pages and entries will be made in indelible ink.

e. <u>Custody, Handling and Shipping</u> - Place the properly labeled sample bottle in the appropriate carrying container and maintain the sample at 4°C throughout sampling and transportation period. The shipping container will be a metal cooler. "This Side Up" and "Fragile" labels will be placed on the cooler. Mark liquid level with grease pencil for liquid samples. All sample containers should have sample tags and labels with transparent tap covering each label. The properly marked and tagged bottle should then be sealed in a "ziplock" type bag, closed and placed in a cooler. All writing should be in indelible ink. The lid of the cooler will be taped shut with the custody seals provided with each cooler. Samples are shipped on the day collected from the SITE directly to the laboratory by overnight courier. Chain-of-custody and request for analysis documents are shipped in air-tight plastic bags in each container (taped to the inside of the lid) with applicable samples. The laboratory is notified by phone of the sample shipment. This process is discussed in detail in Sections 3.4 - 3.7.

3.3.1.2 <u>Soils</u>

Soil samples for chemical analysis were obtained at six different locations around the SITE using a hand auger. Split-spoon sampling techniques were used to collect samples for geotechnical classification during drilling. The following sections present a discussion of equipment, procedures, and protocol for soil sampling at the SITE.

3.3.1.2.1 Hand Auger Sampling Equipment

Soil samples for chemical analysis were collected from borings drilled by a stainless steel hand auger. Each piece of stainless steel soil sampling equipment was pre-cleaned before use to minimize potential cross-contamination. Pre-cleaning consisted of: (1) removing gross contamination from the auger using scrapers, (2) washing the auger with a brush in a bucket filled with an Alconox soap solution, (3) rinse in a second bucket containing tap water and a brush, (4) spray auger with a 10% nitric acid rinse, (5) repeat Step 3, (6) spray the auger with methanol, (7) rinse with deionized water, and (8) air dry.

3.3.1.2.2 Hand Auger Boring Procedures

At each specified hand auger boring location the following steps were followed:

- A polyethylene sheet was laid down adjacent to the boring location
- The cleaned, stainless-steel hand auger was placed on the ground and augering begun.
- The contents of each full auger was emptied onto the polyethylene sheet
- After completion of the boring and sampling procedures, the boring location was backfilled with soil.

3.3.1.2.3 Hand Auger Sampling Protocol

a. Collect Sample

- The samples were collected with the hand auger at depths of approximately 2 feet.

- Augering proceeded from the sampling depth until sufficient soil was collected to satisfy sampling requirements. Soil from this interval was mixed in a stainless steel bowl and transferred to an appropriate sample container with a spoon. The sampler checked that a Teflon liner was present in the cap and secured the cap tightly. After each sample was collected, all of the sampling equipment, hand auger, mixing bowl, and spoon, was cleaned to prevent cross contamination.

b. Label Sample - Each sample bottle was labeled with the appropriate sample tag, carefully and clearly, addressing all the categories, or parameters. All chain-of-custody documents were completed and the sampling event was recorded in the bound field notebook in ink.

3.3.1.2.4 Split-Spoon Sampling Equipment

Soil samples for geotechnical classification were collected using split-spoon samplers, in borings drilled with a hollow-stem auger. Specific use of these tools depended upon the sampling location and technique. Each piece of soil sampling equipment was pre-cleaned before use to minimize potential cross-contamination. Pre-cleaning consisted of washing the split spoon in detergent and rinsing in tap water.

3.3.2 Field Characterization of Samples

Certain parameters regarding ground-water samples can vary considerably with time. Those parameters of primary interest regarding the SITE are pH, temperature and conductivity. Therefore, these parameters were measured in the field during well development and when the samples were obtained.

- Field pH was measured with an Orion pH meter. The instrument will be field calibrated with pH 4 and pH 7 buffer solutions at the beginning, middle and end of each days' use. The pH probe was rinsed with deionized water between each use.

- Temperature and specific conductance were measured with a portable YSI (Yellow Springs Instruments) S-C-T (Salinity, Conductivity, Temperature) meter. Calibration of the instrument is performed at the factory periodically. The instrument probe was rinsed with reagent water between each use and set to zero at the beginning of each day use.

3.4 SAMPLE CONTAINERS

Samples for chemical analysis were collected and placed in containers provided by the subcontract laboratory. Appropriate containers for the media under investigation at the SITE are in accordance with the Work Plans. All container caps had Teflon liners. Each container was labeled giving the site name, sample identification number, date, sampler and project number.

Prior to use at the SITE the containers and caps were cleaned by the following procedure: hand-washing in Alconox or equivalent water solution at 150°F, rinse with hot tap water; rinse with cold tap water, and rinse with distilled water. In addition, containers used for collection of samples to be analyzed for EPA organic priority pollutants were cleaned in a manner appropriate to the test procedure. Specific sample bottle preparation procedures are found in the Work Plan for the SITE.

3.5 SAMPLE PRESERVATION METHODS

All of the samples were stored and shipped on ice to maintain the temperature at approximately 4°C. Additionally, monitoring well samples analyzed for dissolved metals were filtered in the field. Total and dissolved metal water samples were acidified to pH< 2 with two milliliters (ml) of nitric acid (HNO_3) per liter of sample. Filtration was accomplished using a stainless steel barrel filter placing a positive pressure on the sample water and forcing it through the filter into the sample bottle at 1 atmosphere. Samples for total recoverable petroleum hydrocarbon analysis (water samples) were preserved with HCl to pH<2. Table 3-2 lists the containers, preservatives, and holding times used.

3.6 SAMPLE SHIPPING

Ecology and Environment, Inc. (E&E) provided coolers to transport the samples from the SITE to their lab in Buffalo, NY. These metal coolers were in good condition.

3.6.1 Chain-of-Custody Record.

Chain-of-Custody records were provided in each sample cooler. The custody record (see Appendix C) was fully completed in duplicate by the field technician responsible for sample handling. The information specified on the chain-of-custody record contained the same level of detail found in the site logbook, with the exception that the on-site measurement data was not recorded. The custody record included, among other things, the following information: name of person collecting the samples; date samples were collected; type of sampling conducted (composite/grab); location of sampling station; number and type of containers used; analysis required, and signature of the E & E person relinquishing samples to a non-E&E person, such as a Federal Express agent, with the date and time of transfer noted.

TABLE 3-3 (1 of 2)

CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

Analytical Test	Container	Preservative or Sample Handling	Holding Time
Purgeable Aromatics			
(water)	2-40 ml glass VOA vials (Teflon-lined lids), no headspace	Cool to 4°C	Analyze within 14 days
(soil)	2-40 ml glass VOA vials (Teflon lined lids)	Cool to 4°C	Analyze within 14 days
Total-Recoverable Petroleum Hydrocarbons			
(water)	1-liter amber glass bottle, filled (Teflon-lined lids)	HCl to pH <2 and cool to 4°C	To hold more than 48 hours, cool to 4°C
Dissolved Metals			
(water)	1-liter high density polyethylene bottle, (with Teflon-lined lids) (filter on-site through .45 um membrane filter)	HNO_3 to pH <2	*6 months

* 28 days for Mercury

TABLE 3-3 Cont'd (2 of 2)

Analytical Test	Container	Preservative or Sample Handling	Holding Time
Total Metals			
(water)	1-liter high density polyethylene bottle (Teflon-lined lids)	HNO_3 to pH <2	*6 months
(soil)	8 oz. wide mouth glass jars, at least 3/4 full (Teflon-lined lids)	none	*6 months
Purgeable Halocarbons			
(water)	2-40 ml glass vials, filled (Teflon-lined lids)	Cool to 4^oC	14 days
(soil)	2-40 ml glass vials, filled (Teflon-lined lids)	Cool to 4^oC	6 months

* 28 days for Mercury

SECTION 4.0 - ANALYTICAL RESULTS

4.1 INTRODUCTION

This section presents the results of the laboratory analysis of ground-water and soil samples collected at Atlas Site S-6, Black Brook, New York.

The soil samples and the ground-water samples were collected by Law Environmental Services (LEGS) personnel and its subcontractors. The sample collection and analysis procedures used are approved by the U.S. Army Corps of Engineers (USACE). Sample identification and location was provided by LEGS. Samples with the prefix "MW" indicates the monitoring well samples, and "S" indicates soil samples.

The laboratory results for ground water were compared to New York State and U.S. Environmental Protection Agency (USEPA) ground-water classifications, quality standards, and effluent standards and/or limitations developed by the New York State Department of Environmental Conservation (NYSDEC), Part 703. The NYSDEC criteria establish Class GA (potable water) the best usage of ground-water. These are fresh ground-waters found in the saturated zone. Class GSA waters are used as a source of potable mineral waters, for conversion to fresh potable waters, or as raw material for the manufacture of sodium chloride or its derivatives of similar products. The quality standards for Class GA and Class GSA waters are contained in Appendix H, as developed by the NYSDEC.

The laboratory results for soil samples are compared to the USEPA 1983 hazardous waste land treatment criteria found in EPA Manual, SW-874 (revised), (Tables 6.47 and 6.46, respectively) and the Total Threshold Limit Concentrations (TTLC) set forth by the California Department of Health Services (DOHS). The TTLC values are concentrations above which uncontrolled disposal of wastes containing constituents could potentially pose a threat to human health or the environment. (See Appendix H for these references.)

Laboratory analysis results for both ground-water and soil samples are presented in Tables 4-2 to 4-8. Quality Control data is included in Appendix G. Ground-water standards and criteria, and soils criteria are presented in Appendix H.

For each analytical method there is a specific method detection limit. Below this value, an amount cannot be quantified. The laboratory convention includes referencing the detection limit by the less than symbol. That is, a value reported as "<0.12 ug/L" means the amount detected was not quantified - but was below 0.12 ug/L. This value was the method detection limit for that specific test.

4.2 GROUND-WATER SAMPLE ANALYSIS RESULTS

The following subsections discuss the analytical results of the ground-water sample testing and compare the results to established NYSDEC and other environmental criteria. Table 4-1 provides a summary of analytical results for all the water samples that had any concentrations of purgeable organic compounds and metals that exceeded the detection limits of the analytical procedure utilized. A water quality standard is also shown in the table for comparison. References for each standard or criteria used are included in the table.

4.2.1 Purgeable Halocarbons

Purgeable halocarbons were analyzed by EPA Method 602. These parameters include the chlorinated ethane and ethene hydrocarbon series. This test should detect the presence of solvent residues and degradation by-products.

TABLE 4-1

SITE S-6 WATER QUALITY SUMMARY AND COMPARISION TO STANDARDS OR CRITERIA

Parameter	Criteria	Monitoring Wells				
		601	602	603	60D	604
Purgeable Halocarbons (ug/L):						
trichloroethylene	10[a]	8.1		3.7	3.2	5.6
Metals (mg/L):						
Total arsenic	0.025[a]			0.012	0.011	
Total barium	1.0[a]	0.015	0.231	0.265	0.219	0.200
Total chromium	0.050[a]		0.031	0.039	0.037	0.022
Total lead	0.075[a]		0.015	0.019	0.015	0.008
Dissolved barium	1.0[a]	0.058	0.034	0.047	0.034	0.100
Dissolved chromium	0.050[a]			0.012		

[a] NY State Department of Environmental Criteria Guidance for Class GA Groundwaters

NOTES: (1) Sample No. 60D was a duplicate sample taken from monitoring well MW603

(2) NYSDEC criteria were utilized as the primary comparison criteria where such standards existed. The U.S. EPA has proposed a Maximum Contaminant Level (MCL) of 5 ug/L for trichloroethylene.

Trichloroethene was detected in monitoring well samples MW60D (MW603 duplicate), MW601, MW603, and MW604 at 3.2 ug/L, 8.1 ug/L, 3.7 ug/L, and 5.6 ug/L respectively (Table 4-1). These levels are below the NYSDEC criteria level of 10 ug/l. The proposed Maximum Contaminant Level (MCL) for trichloroethene is 5 ug/L.

The trip blank and sample rinsate showed the presence of chloroform at concentrations of 120 ug/L and 5.5 ug/L respectively (Table 4-2). The trip blank is above the NYSDEC criterion of 100 ug/L. A Preliminary Protective Concentration Limit (PPCL) for chloroform is 0.5 ug/L. The presence of chloroform in the trip blank appears to be due to contaminated distilled water obtained from the University of Plattsburg chemistry lab, and was not found in the field samples taken from this site. Analysis of the sample rinsate revealed a level of 1.3 ug/L for chlorodibromethane (Table 4-2). This compound was not found in any ground-water samples from this site. Chlorodibromethane has a PPCL of 18 ug/L.

All other purgeable halocarbons tested for, if present were below detection limits for this SITE. The complete list of analyses performed for purgeable halocarbons are shown in Table 4-2.

4.2.2 Purgeable Aromatics

Purgeable aromatics were analyzed by EPA Method 602. The parameters include benzene, toluene, ethylbenzene, and three chlorinated benzenes. Gasoline derivatives, diesel fuel constituents, propellant constituents and their by-products may be detected by this test.

Toluene was detected in the sample rinsate at a level of 0.47 ug/L (Table 4-3). This may be due to contamination in the decontamination solvent.

TABLE 4-2
RESULTS OF WATER ANALYSIS FOR PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in ug/L)

U-4510

Compound	E & E Lab. No. 86-	9979	9980	9981	9982
	Sample Identity	MW-600	MW-601	MW-602	MW-603
carbon tetrachloride		<0.12	<0.12	<0.12	<0.12
1,2-dichloroethane		<0.03	<0.03	<0.03	<0.03
1,1,1-trichloroethane		<0.03	<0.03	<0.03	<0.03
1,1-dichloroethane		<0.07	<0.07	<0.07	<0.07
1,1,2-trichloroethane		<0.02	<0.02	<0.02	<0.02
1,1,2,2-tetrachloroethane		<0.03	<0.03	<0.03	<0.03
chloroethane		<0.52	<0.52	<0.52	<0.52
2-chloroethylvinyl ether		<0.13	<0.13	<0.13	<0.13
chloroform		<0.05	<0.05	<0.05	<0.05
1,1-dichloroethene		<0.13	<0.13	<0.13	<0.13
trans-1,2-dichloroethene		<0.10	<0.10	<0.10	<0.10
1,2-dichloropropane		<0.04	<0.04	<0.04	<0.04
trans-1,3-dichloropropene		<0.34	<0.34	<0.34	<0.34
cis-1,3-dichloropropene		<0.20	<0.20	<0.20	<0.20
methylene chloride		<0.25	<0.25	<0.25	<0.25
chloromethane		<0.08	<0.08	<0.08	<0.08
bromomethane		<1.18	<1.18	<1.18	<1.18
bromoform		<0.20	<0.20	<0.20	<0.20
bromodichloromethane		<0.10	<0.10	<0.10	<0.10
fluorotrichloromethane		<2.0	<2.0	<2.0	<2.0
dichlorodifluoromethane		<1.81	<1.81	<1.81	<1.81
chlorodibromomethane		<0.09	<0.09	<0.09	<0.09
tetrachloroethene		<0.03	<0.03	<0.03	<0.03
trichloroethene		3.2	8.1	<0.12	3.7
vinyl chloride		<0.18	<0.18	<0.18	<0.18
chlorobenzene		<0.25	<0.25	<0.25	<0.25
1,3-dichlorobenzene		<0.32	<0.32	<0.32	<0.32
1,2-dichlorobenzene		<0.15	<0.15	<0.15	<0.15
1,4-dichlorobenzene		<0.24	<0.24	<0.24	<0.24

TABLE 4-2
RESULTS OF WATER ANALYSIS FOR PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in ug/L)

Compound	E & E Lab. No. 86-	9983	9984	9985			
	Sample Identity	MW-604	Trip Blank	Sample Rinsate			
carbon tetrachloride		<0.12	<1.2	<0.12			
1,2-dichloroethane		<0.03	<0.30	<0.03			
1,1,1-trichloroethane		<0.03	<0.30	<0.03			
1,1-dichloroethane		<0.07	<0.70	<0.07			
1,1,2-trichloroethane		<0.02	<0.20	<0.02			
1,1,2,2-tetrachloroethane		<0.03	<0.30	<0.03			
chloroethane		<0.52	<5.2	<0.52			
2-chloroethylvinyl ether		<0.13	<1.3	<0.13			
chloroform		<0.05	120	5.5			
1,1-dichloroethene		<0.13	<1.3	<0.13			
trans-1,2-dichloroethene		<2.0	<1.0	<0.10			
1,2-dichloropropane		<0.04	<0.40	<0.04			
trans-1,3-dichloropropene		<0.34	<3.4	<0.34			
cis-1,3-dichloropropene		<0.20	<2.0	<0.20			
methylene chloride		<0.25	<2.58	<0.25			
chloromethane		<0.08	<0.80	<0.08			
bromomethane		<1.18	<12	<1.18			
bromoform		<0.20	<2.0	<0.20			
bromodichloromethane		<0.10	<1.0	<0.10			
fluorotrichloromethane		<2.0	<20	<2.0			
dichlorodifluoromethane		<1.81	<18	<1.81			
chlorodibromomethane		<0.09	<0.90	1.3			
tetrachloroethene		<0.03	<0.30	<0.03			
trichloroethene		5.6	<1.2	<0.12			
vinyl chloride		<0.18	<1.8	<0.18			
chlorobenzene		<0.25	<2.5	<0.25			
1,3-dichlorobenzene		<0.32	<3.2	<0.32			
1,2-dichlorobenzene		<0.15	<1.5	<0.15			
1,4-dichlorobenzene		<0.24	<2.4	<0.24			

TABLE 4-3
RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in ug/L)

U-4510.2

	E & E Lab. No. 86-	9979	9980	9981	9982
Compound	Sample Identity	MW-600	MW-601	MW-602	MW-603
chlorobenzene		<0.20	<0.20	<0.20	<0.20
1,2-dichlorobenzene		<0.40	<0.40	<0.40	<0.40
1,3-dichlorobenzene		<0.40	<0.40	<0.40	<0.40
1,4-dichlorobenzene		<0.30	<0.30	<0.30	<0.30
benzene		<0.20	<0.20	<0.20	<0.20
total xylenes		<1.0	<1.0	<1.0	<1.0
toluene		<0.20	<0.20	<0.20	<0.20
ethylbenzene		<0.20	<0.20	<0.20	<0.20

TABLE 4-3

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in ug/L)

U-4510.3

Compound	E & E Lab. No. 86-	9983	9984	9985
	Sample Identity	MW-604	Trip Blank	Sample Rinsate
chlorobenzene		<0.20	<0.20	<0.20
1,2-dichlorobenzene		<0.40	<0.40	<0.40
1,3-dichlorobenzene		<0.40	<0.40	<0.40
1,4-dichlorobenzene		<0.30	<0.30	<0.30
benzene		<0.20	<0.20	<0.20
total xylenes		<1.0	<1.0	<1.0
toluene		<0.20	<0.20	<u>0.47</u>
ethylbenzene		<0.20	<0.20	<0.20

All other purgeable aromatic compound tested samples were below detectable limits at this site.

4.2.3 Petroleum Hydrocarbons

Petroleum hydrocarbons were analyzed by EPA Method 418.1. Localized spills of petroleum, oil, or lubricants could be indicated by positive results of this test.

Petroleum hydrocarbons were not found above detection limits in ground-water samples taken from this site (Table 4-4).

4.2.4 Total Metals

Total metals were analyzed by EPA Method 200.7 (ICAP) and Methods 206, 270, 272, and 245 (AA). (Results for dissolved metals are discussed in Section 4.2.5). The suite of analyzed metals included arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver. Metal constituents could have resulted from the following sources: battery electrolyte, metal corrosion, paints, electrical equipment and fuel products. Results for metal analyses are presented in Table 4-4.

Total arsenic was detected in monitoring well samples MW610D, (MW603 duplicate) and MW603 at concentrations of 0.011 mg/L and 0.012 mg/L, respectively (Table 4-4). These levels are below the 0.025 mg/L level established by the NYSDEC. The MCL for arsenic is 0.05 mg/L.

Total barium was detected in all wells, ranging from 0.265 mg/L to <0.01 mg/L (Table 4-4). These levels are below the NYSDEC criteria level of 1.0 mg/L. The MCL for barium is also 1.0 mg/L.

TABLE 4-4

Results of Water Analysis for Petroleum Hydrocarbons and Total Metals

PLATTS/ELM MISSLE SILO

U-4510.4

Job No.:	U-4510		RE:	LW-1020		
Sample Date:	11/20/86		P.O. No.:			
Date Received:	11/21/86		Sampled By:	E & E, Inc.		
Sample Type:	Water		Delivered By:	Federal Express		
E & E Lab. No. 86-	9979	9980	9981	9982	9983	9984
Customer No.	MW-600	MW-601	MW-602	MW-603	MW-604	Trip Blank
Sample Identity						
	Results in: mg/L unless noted					
Petroleum Hydrocarbons	<1	<1	<1	<1	<1	<1
Total Arsenic	0.011	<0.005	<0.01	0.012	<0.005	<0.005
Total Barium	0.219	0.015	0.231	0.265	0.200	<0.01
Total Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Chromium	0.037	<0.01	0.031	0.039	0.022	<0.01
Total Lead	0.015	<0.005	0.015	0.019	0.008	<0.005
Total Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Total Selenium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Analytical References:

"Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983.

Supervising Analyst:

Date: December 31, 1986

TABLE 4-4

PLATTS/ELM MISSLE SILO

U-4510.5

Job No.:	U-4510	RE:	LW-1020
Sample Date:	11/20/86	P.O. No.:	
Date Received:	11/21/86	Sampled By:	E & E, Inc.
Sample Type:	Water	Delivered By:	Federal Express

E & E Lab. No. 86-	9985					
Customer No.	Sample Rinsate					
Sample Identity						
	Results in: mg/L unless noted					
Petroleum Hydrocarbons	<1					
Total Arsenic	<0.005					
Total Barium	<0.01					
Total Cadmium	<0.005					
Total Chromium	<0.01					
Total Lead	<0.005					
Total Mercury	<0.0002					
Total Selenium	<0.05					
Total Silver	<0.01					

Analytical References:

"Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983.

Supervising Analyst:

Date: December 21, 1986

Total chromium was detected in samples MW60D (MW603 duplicate), MW602, MW603, and MW604, ranging from 0.039 mg/L to <0.01 mg/L (Table 4-4). The concentrations of chromium in the ground-water samples did not exceed the NYSDEC criteria of 0.05 mg/L.

Total lead was detected in samples MW60D (MW603 duplicate) MW602, MW603, and MW604 at detectable limits below the 0.025 mg/L NYSDEC criterion level (Table 4-4). The MCL for lead is 0.05 mg/L.

All other Total Metals tested were below detection limits at this site.

4.2.5 Dissolved Metals

Dissolved metals were analyzed by EPA Method 200.7 (ICAP) and Methods 206, 270, 272, and 245 (AA). The same dissolved metals as total metals were analyzed (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver).

Dissolved barium detected in samples MW60D (MW603 duplicate), MW601, MW602, MW603, and MW604, ranging from 0.1 mg/L to <0.01 mg/L (Table 4-5). All are below the 1.0 mg/L NYSDEC criteria level. The MCL for barium is 1.0 mg/L also.

Dissolved chromium was measured in sample number MW603 at a concentration of 0.012 mg/L, which is below the NYSDEC criteria of 0.05 mg/L.

All other dissolved metals tested were below detection limits.

4.2.6 Conclusions

Low concentrations of purgeable aromatics, purgeable halocarbons, total metals, and dissolved metals were found in the ground water at this site. Petroleum hydrocarbons were not detected in ground water at the site. Trichloroethene was found in three of the

TABLE 4-5

Results of Water Analysis for Dissolved Metals

PLATTS/ELM MISSLE SILO

U-4510.6

Job No.:	U-4510		RE:	LW-1020		
Sample Date:	11/20/86		P.O. No.:			
Date Received:	11/21/86		Sampled By:	E & E, Inc.		
Sample Type:	Water		Delivered By:	Federal Express		
E & E Lab. No. 86-	9979	9980	9981	9982	9983	9984
Customer No.	MW-600	MW-601	MW-602	MW-603	MW-604	Trip Blank
Sample Identity						
	Results in: mg/L unless noted					
Dissolved Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Barium	0.034	0.058	0.034	0.047	0.100	<0.01
Dissolved Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Chromium	<0.01	<0.01	<0.01	0.012	<0.01	<0.01
Dissolved Lead	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Dissolved Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Analytical References:

"Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983.

Supervising Analyst:

Date: December 31, 1986

TABLE 4-5

PLATTS/ELM MISSLE SILO

U-4510.7

Job No.:	U-4510		RE: LW-1020			
Sample Date:	11/20/86		P.O. No.:			
Date Received:	11/21/86		Sampled By: E & E, Inc.			
Sample Type:	Water		Delivered By: Federal Express			
E & E Lab. No. 86-	9985					
Customer No.	Sample Rinsate					
Sample Identity						
	Results in: mg/L unless noted					
Dissolved Arsenic	<0.005					
Dissolved Barium	<0.01					
Dissolved Cadmium	<0.005					
Dissolved Chromium	<0.01					
Dissolved Lead	<0.005					
Dissolved Mercury	<0.0002					
Dissolved Selenium	<0.005					
Dissolved Silver	<0.01					

Analytical References:

"Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983.

Supervising Analyst:

Date: December 31, 1986

four wells from which samples were collected. However, the concentrations did not exceed the NYSDEC criteria.

Only chloroform in the trip blank and sample rinsate exceeded any NYSDEC established criteria. However, this is assumed to be related to contaminated deionized water and not media contamination.

4.3 SILO WATER SAMPLE ANALYSIS RESULTS

The silo at Atlas Site S-6 was sealed and not accessible for sampling; therefore no samples were collected. Of the four Atlas sites investigated in this overall program, two silos were sampled. The results from these samples indicate no contamination by purgeable aromatics and halocarbons, or petroleum hydrocarbons. Some metal constituent results were above the guidance criteria. Trichloroethene was also detected in the silo samples taken at other sites at low levels.

4.4 SOIL SAMPLE ANALYSIS RESULTS

The following subsections discuss the analytical results of the soil sample testing, and compare the results to established NYSDEC and other environmental criteria.

4.4.1 Purgeable Halocarbons

Purgeable halocarbons were analyzed by EPA Method 8010. Chlorinated ethanes and ethenes, solvent residues, and degradation by-products could be indicated by positive results of this test.

No purgeable halocarbons compounds were detected in the soil samples collected at this site (Table 4-6).

TABLE 4-6

RESULTS OF SOIL ANALYSIS FOR PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4519.10

Compound	E & E Lab. No. 86- Sample Identity	10064 S505	10065 S506	10066 S600	10067 S601
carbon tetrachloride		<1.0	<1.0	<1.0	<1.0
1,2-dichloroethane		<1.0	<1.0	<1.0	<1.0
1,1,1-trichloroethane		<1.0	<1.0	<1.0	<1.0
1,1-dichloroethane		<1.0	<1.0	<1.0	<1.0
1,1,2-trichloroethane		<1.0	<1.0	<1.0	<1.0
1,1,2,2-tetrachloroethane		<1.0	<1.0	<1.0	<1.0
chloroethane		<1.0	<1.0	<1.0	<1.0
2-chloroethylvinyl ether		<1.0	<1.0	<1.0	<1.0
chloroform		<1.0	<1.0	<1.0	<1.0
1,1-dichloroethene		<1.0	<1.0	<1.0	<1.0
trans-1,2-dichloroethene		<1.0	<1.0	<1.0	<1.0
1,2-dichloropropane		<1.0	<1.0	<1.0	<1.0
trans-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0
cis-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0
methylene chloride		<1.0	<1.0	<1.0	<1.0
chloromethane		<1.0	<1.0	<1.0	<1.0
bromomethane		<1.0	<1.0	<1.0	<1.0
bromoform		<1.0	<1.0	<1.0	<1.0
bromodichloromethane		<1.0	<1.0	<1.0	<1.0
fluorotrichloromethane		<1.0	<1.0	<1.0	<1.0
dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0
chlorodibromomethane		<1.0	<1.0	<1.0	<1.0
tetrachloroethene		<1.0	<1.0	<1.0	<1.0
trichloroethene		<1.0	<1.0	<1.0	<1.0
vinyl chloride		<1.0	<1.0	<1.0	<1.0
chlorobenzene		<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0

TABLE 4-6

RESULTS OF SOIL ANALYSIS FOR PURGEABLE HALOCARBON COMPOUNDS BY GC

(all results in mg/kg as received)

U-4519.11

Compound	E & E Lab. No. 86-	10068	10069	10070	10071	10072
	Sample Identity	S602	S603	S604	S605	S606
carbon tetrachloride		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-tetrachloroethane		<1.0	<1.0	<1.0	<1.0	<1.0
chloroethane		<1.0	<1.0	<1.0	<1.0	<1.0
2-chloroethylvinyl ether		<1.0	<1.0	<1.0	<1.0	<1.0
chloroform		<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloropropane		<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0
methylene chloride		<1.0	<1.0	<1.0	<1.0	<1.0
chloromethane		<1.0	<1.0	<1.0	<1.0	<1.0
bromomethane		<1.0	<1.0	<1.0	<1.0	<1.0
bromoform		<1.0	<1.0	<1.0	<1.0	<1.0
bromodichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0
fluorotrichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0
dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0	<1.0
chlorodibromomethane		<1.0	<1.0	<1.0	<1.0	<1.0
tetrachloroethene		<1.0	<1.0	<1.0	<1.0	<1.0
trichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0
vinyl chloride		<1.0	<1.0	<1.0	<1.0	<1.0
chlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0

4.4.2 Purgeable Aromatics

Purgeable aromatics were analyzed by EPA Method 8020. The parameters include benzene, toluene, ethylbenzene and three chlorinated benzenes. Gasoline derivatives, diesel fuel constituents, propellant constituents and their degradation by-products may be detected by this test.

No purgeable aromatic compounds were detected in the soil samples collected at this site (Table 4-7).

4.4.3 Petroleum Hydrocarbons

Petroleum hydrocarbons were analyzed by EPA Method 418.1. Localized fuel spills (petroleum, oil, etc.) could be indicated by positive results of this test. However, recent guidance from the USACE indicates that EPA Method 418.1 may not be a good analytical procedure when analyzing for hydrocarbons in soil because it gives positive results for natural hydrocarbons in soils.

Soils sample S-602 was the only soil sample from this site that showed a detectable level of petroleum hydrocarbons. The concentration of petroleum hydrocarbons was 89 mg/kg (Table 4-8). This concentration may indicate fuel contamination; but more than likely this level of petroleum hydrocarbon is related to natural hydrocarbons in the soil.

4.4.4 Total Metals

Total metals were tested for by EPA Method 6010. They are the same metals tested for the water samples. Soils normally contain metals concentrations at various levels. Natural background levels and range values for metals are taken from Linsay, 1979 (contained in Appendix H).

TABLE 4-7

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4519.19

	E & E Lab. No. 86-		10,066	10,067	10,068	10,069
Compound	Sample Identity		S600	S601	S602	S603
chlorobenzene			<1.0	<1.0	<1.0	<1.0
1,2-dichlorobenzene			<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene			<1.0	<1.0	<1.0	<1.0
1,4-dichlorobenzene			<1.0	<1.0	<1.0	<1.0
benzene			<1.0	<1.0	<1.0	<1.0
total xylenes			<1.0	<1.0	<1.0	<1.0
toluene			<1.0	<1.0	<1.0	<1.0
ethylbenzene			<1.0	<1.0	<1.0	<1.0

TABLE 4-7

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4519.20

Compound	E & E Lab. No. 86-	10,070	10,071	10,072		
	Sample Identity	S604	S605	S606		
chlorobenzene		<1.0	<1.0	<1.0		
1,2-dichlorobenzene		<1.0	<1.0	<1.0		
1,3-dichlorobenzene		<1.0	<1.0	<1.0		
1,4-dichlorobenzene		<1.0	<1.0	<1.0		
benzene		<1.0	<1.0	<1.0		
total xylenes		<1.0	<1.0	<1.0		
toluene		<1.0	<1.0	<1.0		
ethylbenzene		<1.0	<1.0	<1.0		

TABLE 4-8

Results of Soil Analysis for Petroleum Hydrocarbons

PLATTS/ELM MISSILE SILO

U-4664.3

Job No.: U-4664			RE: LW-1000			
Sample Date: 11/18-21/86			P.O. No.:			
Date Received: 11/22/86			Sampled By: E & E, Inc.			
Sample Type: Soil			Delivered By: Federal Express			
E & E Lab. No. 86-				10066	10067	10068
Customer No.				S600	S601	S602
Sample Identity						
	Results in: mg/kg as received unless noted					
Petroleum Hydrocarbons				<50	<50	89

Note: All samples analyzed beyond holding time due to the delayed request for analysis.

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst:

Date: January 5, 1987

TABLE 4-8

PLATTS/ELM MISSILE SILO

U-4664.4

Job No.: U-4664			RE: LW-1000			
Sample Date: 11/18-21/86			P.O. No.:			
Date Received: 11/22/86			Sampled By: E & E, Inc.			
Sample Type: Soil			Delivered By: Federal Express			
E & E Lab. No. 86-	10069	10070	10071	10072		
Customer No.	S603	S604	S605	S606		
Sample Identity						
	Results in: mg/kg as received unless noted					
Petroleum Hydrocarbons	<50	<50	<50	<50		

Note: All samples analyzed beyond holding time due to the delayed request for analysis.

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst:

Date: January 5, 1987

Arsenic was not detected above detection limits in soil samples taken from this site. Barium was detected in all of the soil samples taken from the site (Table 4-9). The levels are all below the natural background range of 100 to 3,000 mg/kg, and below the average value of 430 mg/kg as set forth in the criteria (Appendix H). Cadmium was not detected in soil samples taken from the site. Chromium was detected in all of the soil samples from the site (Table 4-9). All levels are within the natural background range of 1 to 1,000 mg/kg, and below the average value of 100 mg/kg as set forth in the criteria (Appendix H).

Lead was detected in soil samples S-602, S-603, and S-604 at levels of 15.9 mg/kg, 5.77 mg/kg, and 9.46 mg/kg, respectively (Table 4-9). These values are within the natural background range of 2 to 2,000 mg/kg, but sample S-602 is above the average range of 10 mg/kg set forth in the criteria (Appendix H).

4.4.5 Conclusions

According to the above results, there is slight evidence of petroleum hydrocarbons at the location of soil sample S-602. However, an inappropriate analytical procedure was used. EPA Method 418.1 can give erroneous results due to measuring natural hydrocarbons in soil. No visual contamination was observed at this sampling location. Therefore, the positive results are assumed to be natural hydrocarbons and not contamination. All of the other soil samples did not reveal contamination.

4.5 QUALITY ASSURANCE AND SAFETY CONSIDERATIONS

Quality assurance and safety for this project was controlled by a Work Plan which contained three separate but related volumes:

- Volume I: Sampling/Analysis - QC/QA Plan
- Volume II: Safety, Health and Emergency Response Plan
- Volume III: Monitoring Well Installation Plan

TABLE 4-9

PLATTS/ELM MISSILE SILO

U-4519.3

Job No.:	U-4519		RE:	LW-1000		
Sample Date:	11/18-21/86		P.O. No.:			
Date Received:	11/22/86		Sampled By:	E & E, Inc.		
Sample Type:	Soil		Delivered By:	Federal Express		
E & E Lab. No. 86-				10066	10067	10068
Customer No.				S600	S601	S602
Sample Identity						
	Results in: mg/kg as received unless noted					
Arsenic				<0.5	<0.5	<0.5
Barium				5.19	5.38	13.3
Cadmium				<0.5	<0.5	<0.5
Chromium				1.94	1.55	2.54
Lead				<5.0	<5.0	15.9
Mercury				<0.1	<0.1	<0.1
Selenium				<2.5	<2.5	<2.5
Silver				<1.0	<1.0	<1.0

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst:

Date: January 13, 1987

TABLE 4-9

PLATTS/ELM MISSILE SILO

U-4519.4

Job No.:	U-4519	RE:	LW-1000
Sample Date:	11/18-21/86	P.O. No.:	
Date Received:	11/22/86	Sampled By:	E & E, Inc.
Sample Type:	Soil	Delivered By:	Federal Express

E & E Lab. No. 86-	10069	10070	10071	10072		
Customer No.	S603	S604	S605	S606		
Sample Identity						
	Results in: mg/kg as received unless noted					
Arsenic	<3.0	<3.0	<0.5	<0.5		
Barium	17.0	9.78	6.64	5.61		
Cadmium	<0.5	<0.5	<0.5	<0.5		
Chromium	2.84	2.18	2.13	1.64		
Lead	5.77	9.46	<5.0	<5.0		
Mercury	<0.1	<0.1	<0.1	<0.1		
Selenium	<5.0	<5.0	<2.5	<2.5		
Silver	<1.0	<1.0	<1.0	<1.0		

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst:

Date: January 13, 1987

These plans were prepared before initiating any field activities and were approved by the Corps of Engineers. The field work was conducted in accordance with the Work Plan, and any exceptions to the Work Plan were approved by the Corps of Engineers prior to making the changes. The following paragraphs discuss QA/QC and safety procedures as they were observed during field and laboratory activities.

4.5.1 Quality Assurance

Quality assurance for the project, in addition to preparing and following the Work Plan, consisted of several elements: project organizational responsibility, document control and quality assurance samples in the laboratory. Each element is discussed below.

4.5.1.1 Project Organizational Responsibility

The two primary firms involved in performing the field and laboratory programs are Law Environmental, Inc. and Ecology and Environment. Law Environmental was responsible for management of the entire project including QA considerations. Law Environmental was also responsible for seeing that the monitoring wells were properly installed according to approved protocols. This was accomplished by assigning a Site Manager to oversee the entire field operation, and a geologist or geotechnical engineer to oversee drilling operations on each drilling rig. Experienced professional staff was assigned by Law Environmental to accomplish these tasks. The following personnel were utilized by Law Environmental: Site Manager - Mr. S.L. Shugart, P.G.; Geologists or Engineer - Mr. J.C. LaBastie, P.E.; Ms. C.F. Zauner; and S.W. Hart, P.G. These persons have a combined experience record of about 50 years.

Ecology and Environment (E&E) was responsible for collecting and analyzing the samples from the SITE. E&E provided two experienced field sampling personnel to collect and ship the samples to the laboratory. The sampling was performed under the oversight of Law Environmental's Ms. Zauner, a geochemist.

4.5.1.2 Document Control

Chain-of-custody and request for analysis forms were completed by the field sampling team. Chain-of-custody reports were maintained for all samples that were shipped to the laboratory. The reports were initiated by the field sampling team and completed by the laboratory scientist that received the samples. A copy of the chain-of-custody documents received by the laboratory is attached in Appendix G of this report. The documents indicate that all the samples were received by the laboratory in satisfactory condition for the requested tests.

Request for analysis forms accompanied all sample shipments and copies of the requests were maintained in the project files to verify completion of laboratory analysis. These records show the assigned tests were performed, and comparison of the date on the form and the date when the tests were performed show the tests were performed within the established holding time for each parameter. Below is a comparison of the date sampled and analysis performed.

Sample No.	Parameter	Sampled	Analyzed
MW601	Metals	11/20	12/4-12/26
	Volatiles	11/20	11/26
	Semi-volatile	11/20	11/24
	PETHY	11/20	12/9-12/12
MW602	Metals	11/20	12/4-12/26
	Volatiles	11/20	11/26
	Semi-volatile	11/20	11/24
	PETHY	11/20	12/9-12/12

MW603	Metals	11/20	12/4-12/26
	Volatiles	11/20	11/26
	Semi-volatile	11/20	11/24
	PETHY	11/20	12/9-12/12
MW604	Metals	11/20	12/4-12/26
	Volatiles	11/20	11/26
	Semi-volatile	11/20	11/24
	PETHY	11/20	12/9-12/12

Daily logs were kept in bound log books by the Site Manager and by the field sampling team. These logs are a part of the project file and are available for review upon request.

4.5.1.3 Quality Assurance Samples

Five types of quality assurance samples were analyzed by the laboratory: duplicates, trip blanks, sample rinsates, replicates, and spiked samples. These samples are in addition to other analytical QA samples that the E/E laboratory normally analyzes for method controls, instrument calibration, and internal QA procedures.

Duplicate water and soil samples were collected at the SITE. For the water sample, the duplicate sample was number MW60D. It was a duplicate of sample number MW603. The duplicate data are very consistent for the purgeable halocarbons and metals. For substances which showed concentrations of purgeable halocarbons and metals, the following comparisons were observed:

Parameter	MW603	MW60D
trichloroethene	3.7	3.2
total arsenic	0.012	0.011
total barium	0.265	0.219
total chromium	0.039	0.037
total lead	0.019	0.015

dissolved barium	0.047	0.034
dissolved chromium	0.012	<0.01

The soil duplicate sample was number S60D. It was a duplicate of sample number S601. No purgeable halocarbons, purgeable aromatics or hydrocarbon was detected in the soil samples. Duplicate analyses for metals in soil can be variable due to the non-homogeneity of soil both vertically and horizontally. However, comparison of barium and chromium levels are consistent.

A trip blank consisting of de-ionized water was analyzed for purgeable halocarbons and purgeable aromatics. The only substance detected in the trip blank sample was chloroform at 120 ug/L. Measurement of this quantity of chloroform in the trip blank was most likely due to contaminated deionized water which was obtained locally at the University biology lab. Since chloroform was not present in any of the field samples, it is not believed that chloroform contamination exists at the SITE.

A sample rinsate was collected to monitor the field cleaning techniques. The sample rinsate showed chloroform at 5.5 ug/L, and toluene at 0.47 ug/L. These results again are believed to reflect low-level laboratory contamination from the deionized water that was used to collect the sample rinsate.

Replicate analyses and spiked samples were also analyzed for QA. The results are presented in Appendix G. Both analyses show good reproducibility and recovery rates. These samples verify the analytical laboratory techniques for accuracy and precision.

4.5.2 Safety

The site investigation was performed in accordance with the health and safety plan. Specific safety procedures implemented during the field work included monitoring the geotechnical borings during well installation, wearing appropriate safety clothing and monitoring the wells during sampling. No substance was detected during the safety monitoring procedures that necessitated greater safety precautions than those initially used during the field work.

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SECTION 5.0 - CONCLUSIONS AND RECOMMENDATIONS

Site S-6 is a former Atlas Missile Site, which was built and operated for approximately two years during the early 1960's. Following deactivation, the USAF conveyed the site to Daniel A. Tarasevich, Frank J. Borges, and William E. Salmon in 1967. Subsequently, the site was transferred to the current owner, the Town of Black Brook.

The Town of Black Brook originally acquired the site for public utility purposes. The Town recently applied to the GSA to modify the deed to allow for the construction of an industrial park on the property. The site is currently being used as a borrow pit. The most obvious unofficial activity on the site is its use by ATV vehicles and dirt bikes as a recreation area. The site is uncontrolled and therefore unauthorized access onto the site may occur.

5.1 CONCLUSIONS

No measured constituent exceeded NYSDEC criteria on Site S-6. Trichloroethene (TCE) was measured at 3.2 ug/L, 8.1, 3.7 ug/L and 5.6 ug/L in ground-water monitoring wells MW60D, (MW603 duplicate), MW601, MW603, and MW604, respectively. The NYSDEC criteria for TCE is 10 ug/L for Class GA ground waters.

The source of the low-level concentrations of trichloroethene may be the result of original site construction, Atlas Missile operations, post-operational DOD activities, prior or current site uses. However, the trichloroethene concentrations do not exceed NYSDEC criteria and therefore pose no obvious hazard to public health at Site S-6.

5.2 RECOMMENDATIONS

Based upon the ground-water and soil samples collected at Atlas Site S-6, Black Brook, NY, contamination which would warrant further investigation was not found. Therefore, it is recommended that no further investigations be conducted at Site S-6.

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