FINAL REPORT

CONFIRMATION STUDY OF FORMER ATLAS MISSILE SITE FOR POTENTIAL TOXIC AND HAZARDOUS WASTE CONTAMINATION FORMER ATLAS SITE S-10 HARRIGAN'S CORNER, NEW YORK

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GLOSSARY OF ABBREVIATIONS

AWQC - Ambient Water Quality Criteria
CERCLA - Comprehensive Environmental Response Compensation and Liability Act
CONUS - Continental United States
DAA - Defense Appropriations Act
DERA - Defense Environmental Restoration Account
DERP - Defense Environmental Restoration Program
DOD - Department of Defense
EPA - Environmental Protection Agency
GSA - General Services Administration
HRS - Hazardous Ranking System
ICBM - Intercontinental Ballistic Missile
IRP - Installation and Restoration Program
MCL - Maximum Contaminant Level
MCLG - Maximum Contaminant Level Goal
NON IRP- Non Installation and Restoration Program
NPL - National Priority List
PA - Preliminary Assessment
PAH - Polynuclear Aromatic Hydrocarbon
POL - Petroleum, Oils, and Lubricants
R & D - Research and Development
RCRA - Resource Conservation and Recovery Act
RI - Remedial Investigation
RI/FS - Remedial Investigation Feasibility Study
SI - Site Inspection
USACE - United States Army Corps of Engineers
USEPA - United States Environmental Protection Agency
USGS - United States Geological Survey

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 Missile Site S-10, located in Harrigan's Corner, New York (see Figure 2-1). The field investigation consisted of installing and sampling three ground-water monitoring wells, sampling six surface soils locations, and sampling water from the missile silo at the installation. The water and surficial soil samples were analyzed for purgeable aromatics, purgeable halocarbons, total metals, and base/neutral extractables. The analytical data for this inventory study are summarized in Section 4.0 of the report and are fully presented in the Appendices.

Evaluation of the field and laboratory data indicate the following results from the site investigation performed at ATLAS Site S-10:

- Ground-water analyses reported toluene and trichloroethylene present below detection limits in the sample from monitoring well MW-1001-D. Additionally, these concentrations are below federal standards and do not represent contamination as defined in the Statement of Work.

- The silo water sampled is not contaminated by the parameters analyzed.

- Analytical results from sample S-3 contained two constituents, phenanthrene and pyrene, present below detection limits.

- Results of metals analyses in the soil samples were all below or within the average background range (Bowen, 1966). Barium in sample S-6 was the only anomalous level reported

in comparison within the other soil samples. The level of barium is within the average background range.

Based on these results we conclude the following:

- Trace concentrations of toluene and trichloroethylene were detected below detection limits in the ground water collected from monitoring well MW-1001-D. These concentrations are below Federal standards.

- Water in the missile silo is uncontaminated by the parameters analyzed.

- Detectable concentrations of phenanthrene and pyrene, both constituents in gasoline and coal tar, were found in soils at location S-3. There are no federal standards for these compounds in soil.

- The barium level reported in soil sample S-6 was anomalously higher than levels in the other soil samples analyzed. However, this concentration is within the average background range for barium and is not considered to be indicative of contamination at the site.

Based on the preceding conclusions, we recommend ATLAS Site S-10 in Harrigan's Corner, New York not be referred to the Missouri River Division (MRD) for additional investigation.

1.0 PROGRAM BACKGROUND

The U.S. Army Corps of Engineers (USACE) has contracted with Law Environmental, Inc., Government Services Division (Contract No. DACW 41-86-D-0115) to perform a contamination evaluation investigation at former ATLAS Site S-10 in Harrigan's Corner, New York. This report documents the investigation that was performed at that site. The report is divided into six sections that discuss background information, existing site conditions, field investigation program, analytical results, data interpretation and preliminary determinations. The following material in this section of the report presents an overview of the ATLAS missile program and a comparison of this investigation program on formerly used sites with other similar Federal investigation programs for hazardous waste contamination at active facilities.

1.1 OVERVIEW OF THE ATLAS MISSILE SYSTEM

1.1.1 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 United States.

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 the R&D phase was the December 18, 1958, launch into orbit. During this mission, the missile radioed 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.

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 Vandenberg. 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 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 Missiles 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 69 feet in diameter. The silo top was enclosed by heavy steel and concrete doors which were opened for missile launch. The ATLAS F version was deployed at the hard sites. The launch mode was to elevate the missile above the silo door (top). Figure 1-1 shows a typical hardened ATLAS site with the missile in the launch position. Facilities at the surface of the hardened ATLAS sites included one or two quonset huts used for maintenance, and the launch control center entrance. Integrated ATLAS F facilities such as control rooms, crew quarters, and propellant storage were buried below ground. Figure 1-2 is an artist's sketch of a hardened ATLAS site showing the underground and surface facilities.

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

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	Silina, KS			12
Lincoln	Lincoln, NE			12
Altus	Altus, OK			12
Dyess	Abilene, TX			12
Walker	Roswell, NM			12
Plattsburgh	Plattsburgh, NY (Includes ATLAS Site S-10 at Harrigan's Corner, New York)			12

FIGURE 1-1

TYPICAL ATLAS SITE

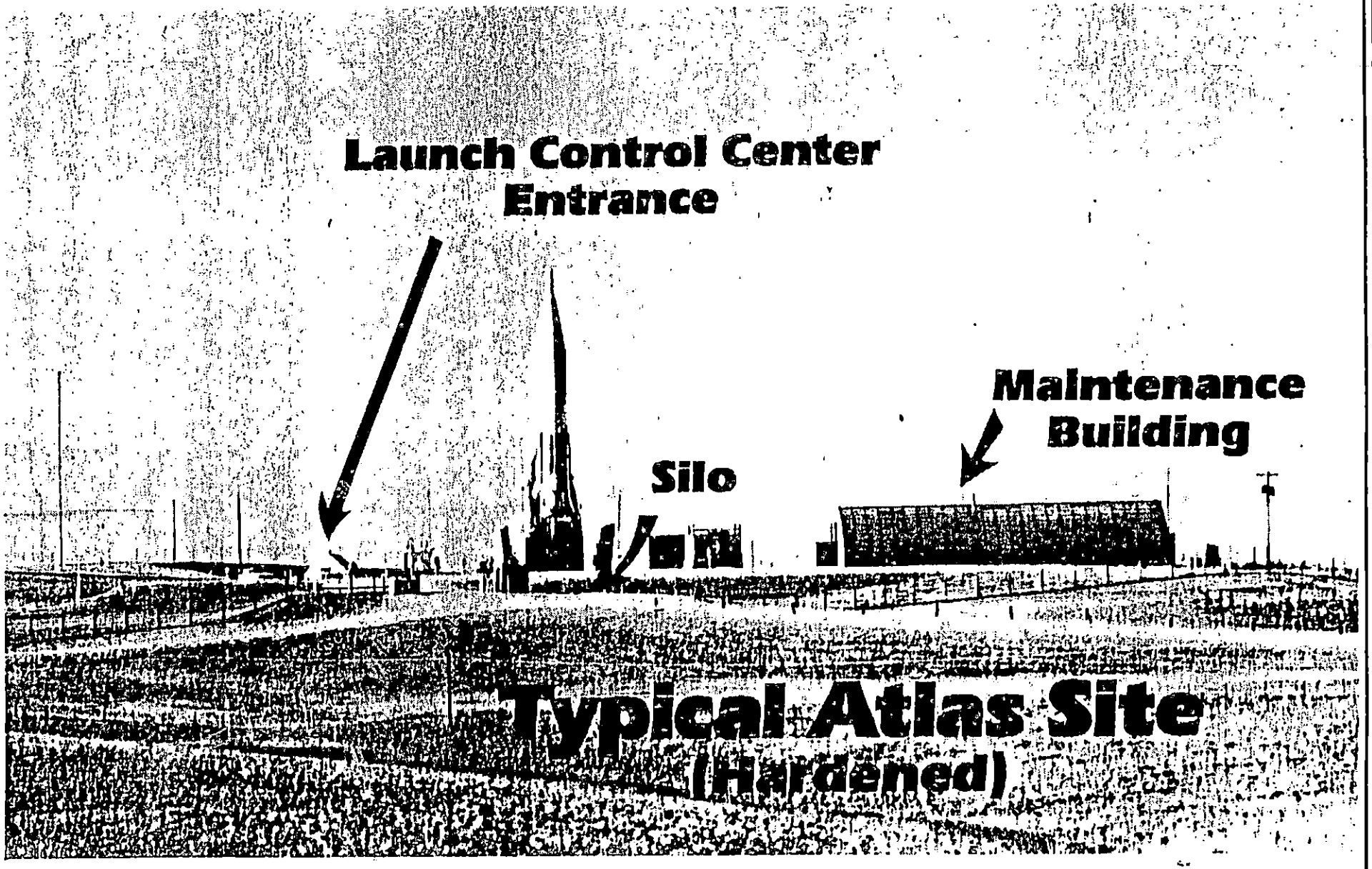
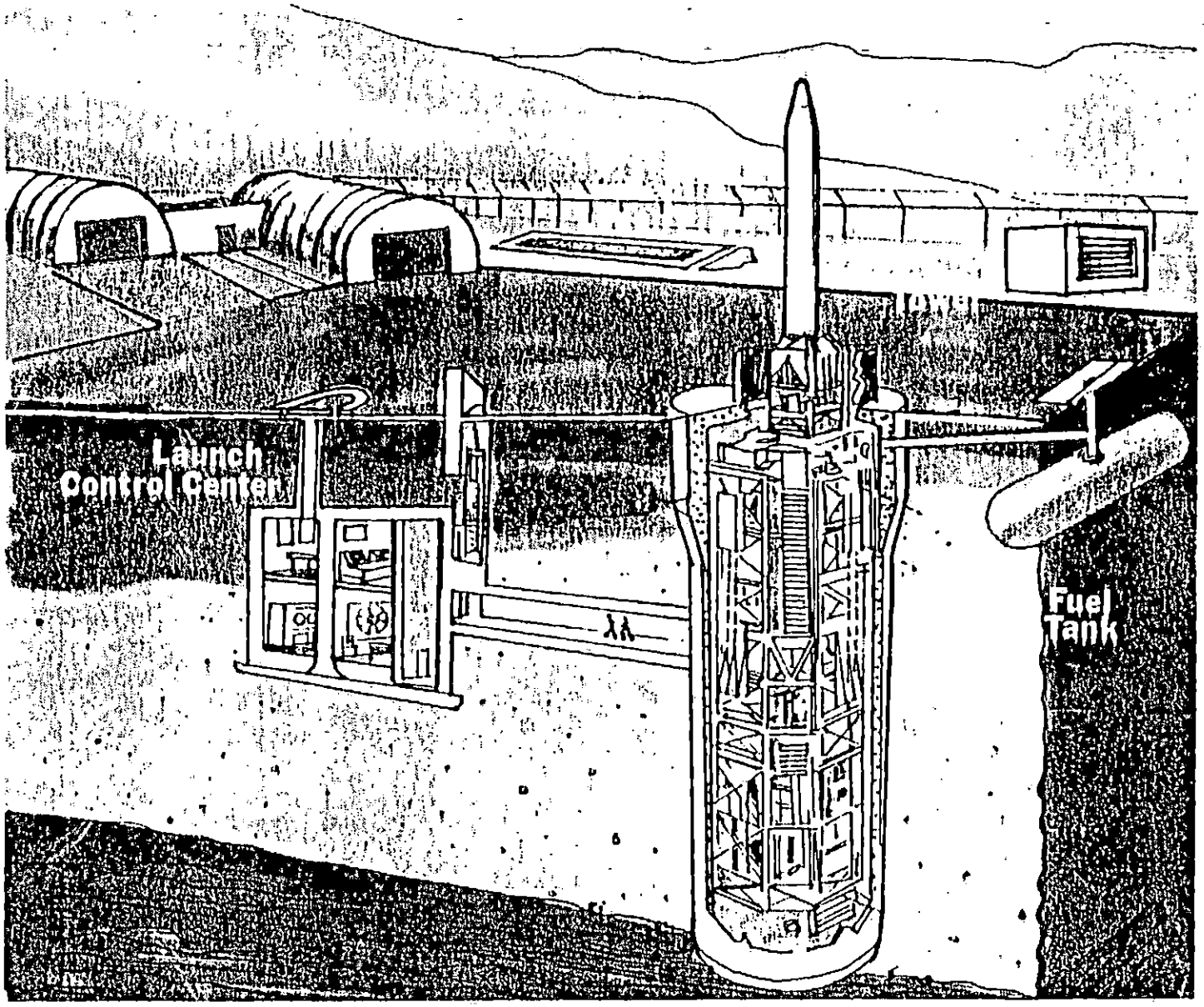


FIGURE 1-2

ATLAS GENERIC SITE

ATLAS SITE S-10 - HARRIGAN'S CORNER, NEW YORK



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 up to three 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 nine 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 propellant - 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; that is the missile was equipped with on-board tanks and the propellant 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 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.

The ATLAS Missile 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 USAF for use in the military space program. Therefore, the missile system was 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.

1.1.2 ATLAS Missile System Operations

A typical ATLAS F site (Figure 1-3) generally consisted of about 10 acres within a security fence. 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. Two hydraulically-operated doors sealed the top of the silo. These doors were made of steel reinforced concrete, designed to withstand a nearby nuclear blast. The silo doors remained closed (Figure 1-4) during normal operation but were opened (Figure 1-5) to raise the ATLAS missile into firing position.

The ATLAS missile was supported in a spring-mounted crib which was suspended in 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 day 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. A reinforced concrete enclosed stairway (Figure 1-6) led down to the LCC.

The ATLAS F sites included facilities and equipment to maintain the missiles. The maintenance facility was a steel structure located at grade, near the silo (Figure 1-6). During site

FIGURE 1-3

TYPICAL ATLAS SITE PLAN

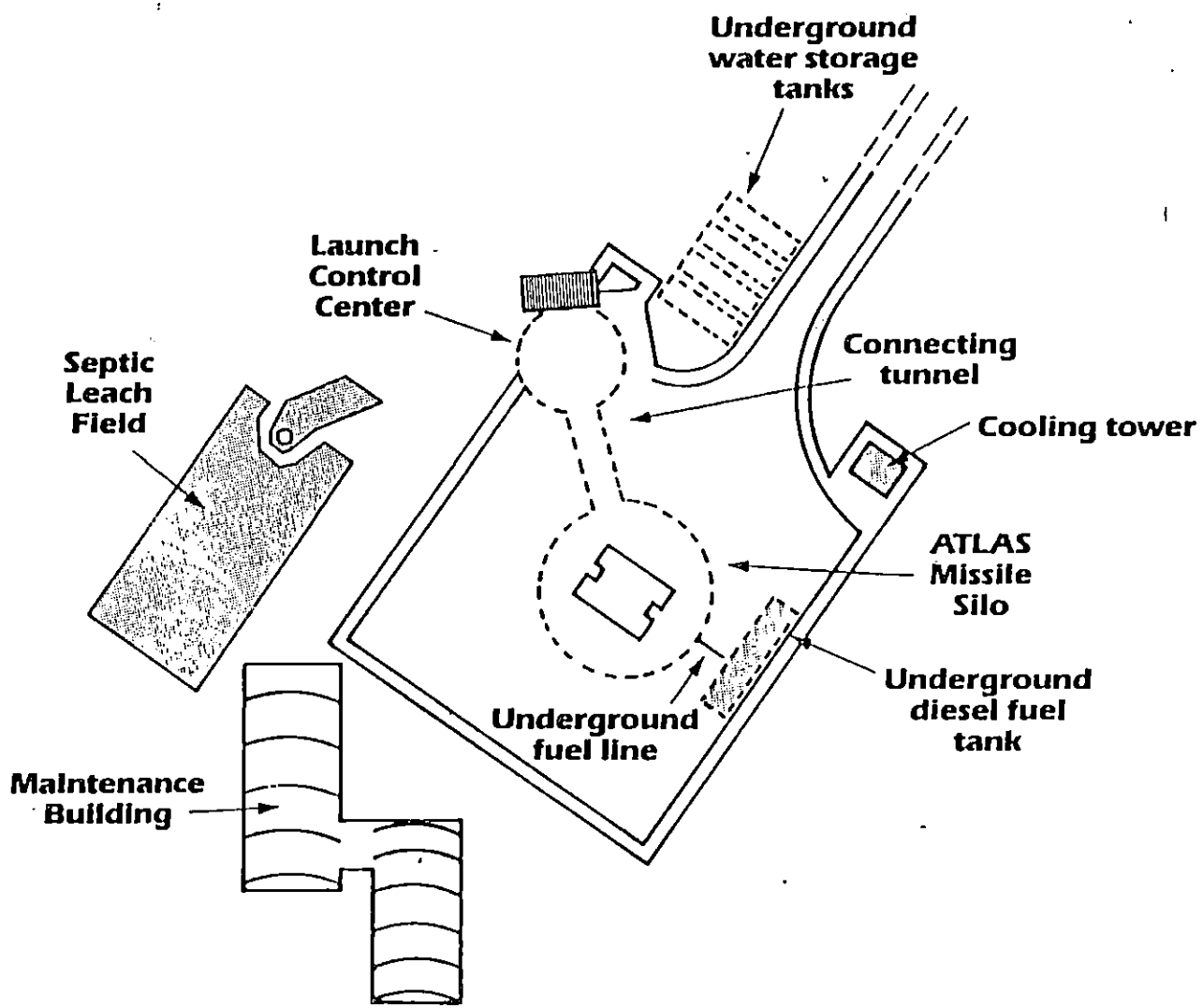


FIGURE 1-4

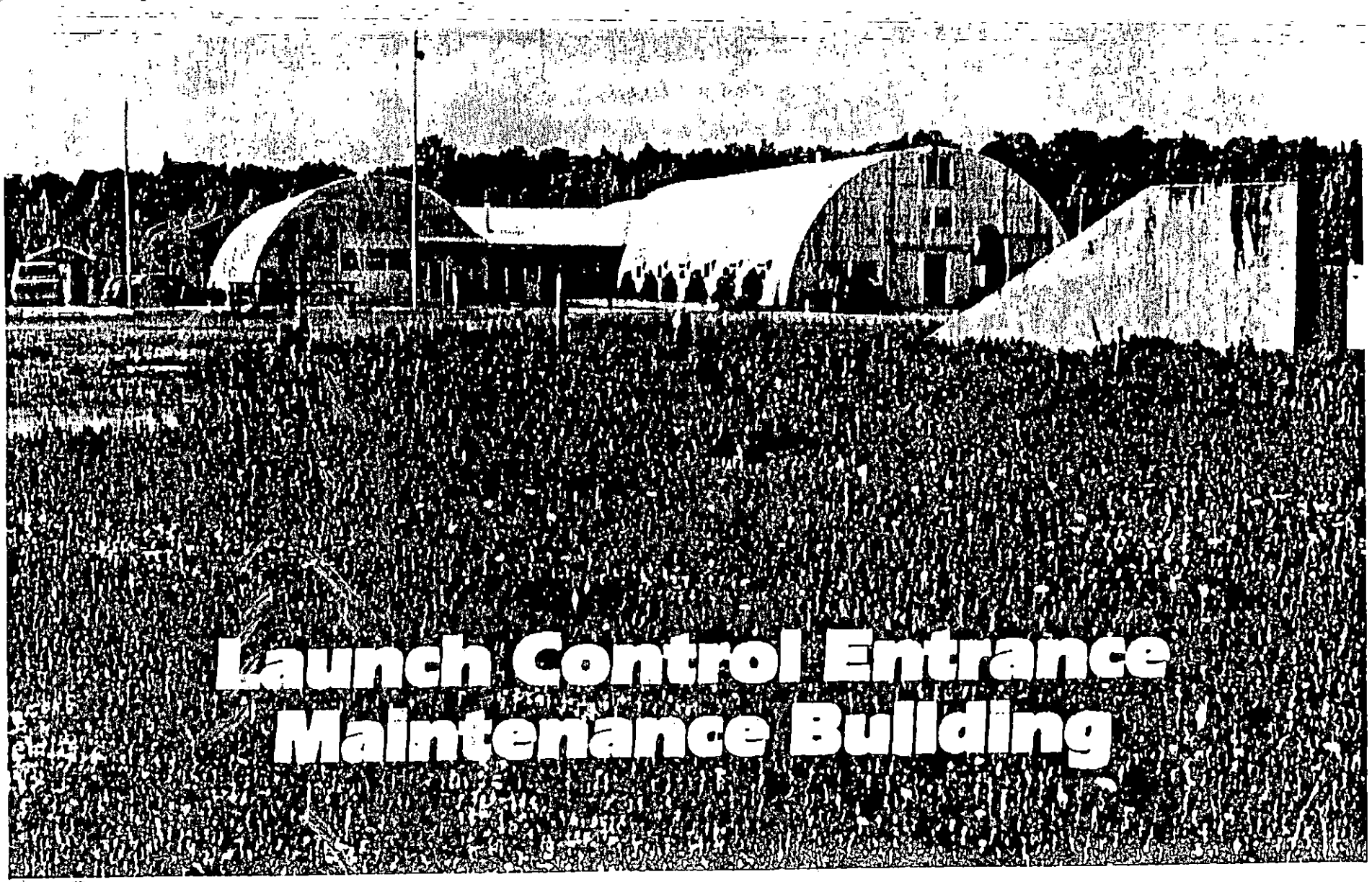
SILO DOORS (CLOSED)

FIGURE 1-5

SILO DOORS (OPEN) WITH BLAST SHIELD

FIGURE 1-6

LAUNCH CONTROL ENTERANCE MAINTENANCE BUILDING



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.

The waste-water treatment and disposal practices were different at each site. 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 tank was the diesel fuel storage for the diesel generators. Generally, steel tanks were provided within about 100 feet of the silo for this purpose.

1.1.3 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 unlikely. The most likely source of contamination from storage was spillage during tank filling and possibly faulty connections in conveyance lines. The liquid oxygen was stored under cryogenic conditions and spillage or leakage was very improbable. Furthermore, loss of oxygen would not have produced a toxic 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 through the silo discharge system.

Diesel fuel was stored in underground tanks for all of the deployed ATLAS F sites. Diesel fuel was used in the on-site generator to supply power for control room and launch activities. At remote ATLAS F sites, where 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 into 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, and other systems that required continuous maintenance to maintain operational reliability. Maintenance activities included the use of solvents, petroleum, oil, and lubricants (POL). The release of these potential contaminants could have resulted from the discharge of these materials when the floors were cleaned or from the silo sump discharge line. It is also possible that some POL accumulations which were retained for routine proper disposal

were accidentally or intentionally spilled within the site boundaries.

The support crew for the remote sites involved about 20 people, producing sanitary waste that was treated on site. The ATLAS sites commonly had a spray field or aeration basin to treat and discharge sanitary sewage. Typically, sanitary sewage disposal 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.

The lowest level in the ATLAS F silo was the "Sump Level." Two automatically actuated 100 GPM capacity sump pumps located at this location remove liquids from the silo. The liquids were pumped through pipes that were routed up the silo wall and exited through the silo wall at level 2. The ultimate disposition of the silo effluent appears to have been to a drainage ditch, which was located far enough away from the silo to avoid interaction with the silo backfill and the launch control center. The USAF Operational Readiness Training Manual designates the ATLAS F complex into four quadrants, quadrant I contains the cooling tower and water plant, quadrant II contains the launch control center, quadrant III contains the electrical and communication stub-ups and quadrant IV contains the sump discharge areas. Quadrants II and IV are diagonally opposite each other. Therefore, it appears that the sump 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.

1.2 PROGRAM COMPARISON

The Department of Defense (DOD) conducts a number of industrial processes and manufacturing operations that are similar to those of 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 potential chemical contamination at former DOD Sites.

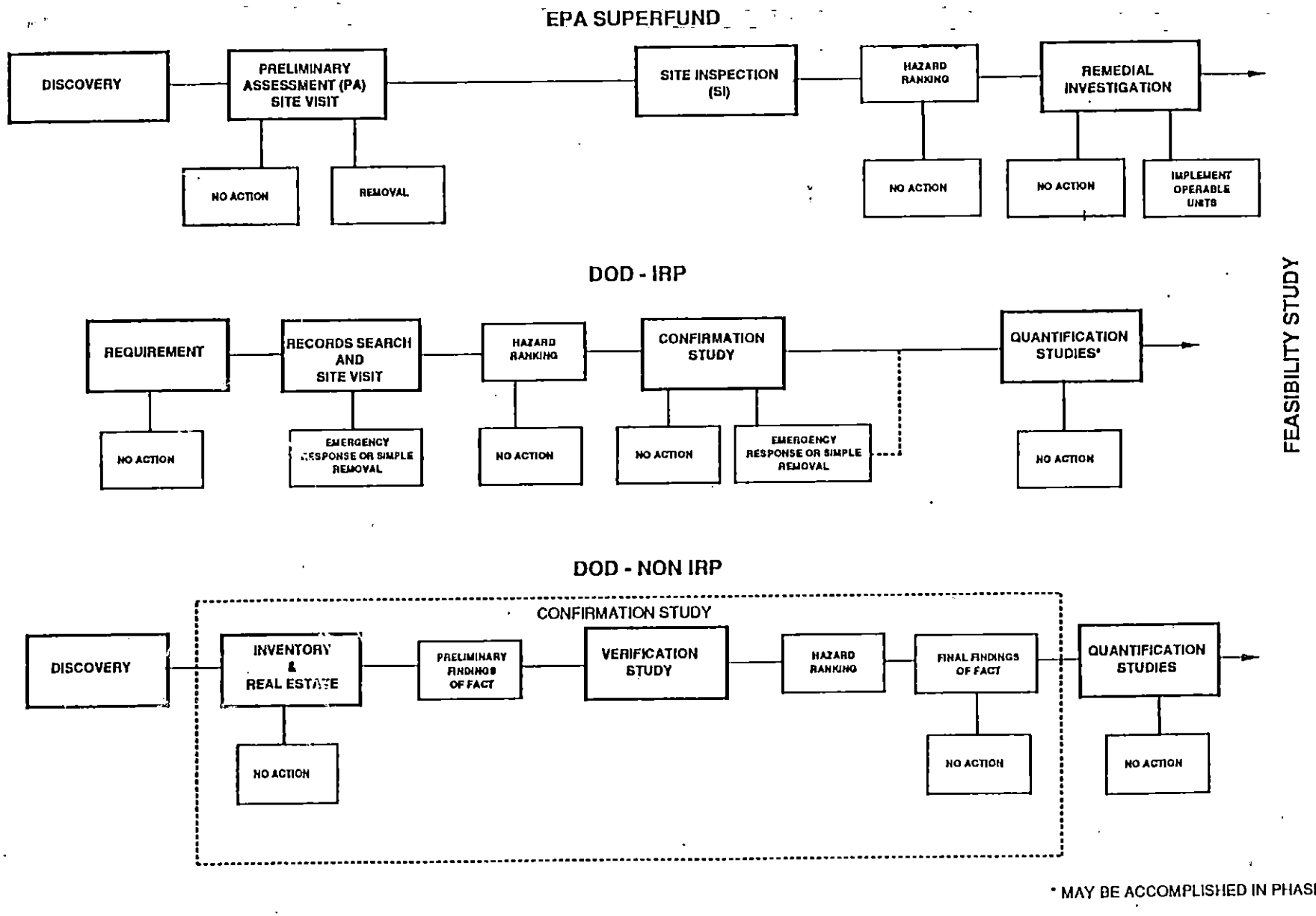
Sites located on active DOD installations are being investigated under the Installation and Restoration Program (IRP). Sites either previously or presently owned by DOD not located on active DOD installations are handled separately from the IRP effort. In order to present a perspective of the formerly 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 1-7 presents a block diagram illustration of the following investigative programs presently being conducted by various Federal agencies.

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

FIGURE 1-7

GOVERNMENT ENVIRONMENTAL PROGRAMS



* MAY BE ACCOMPLISHED IN PHASES

The investigations performed during the Phase I studies under EPA, DOD/IRP, and DOD Non-IRP programs are shown in Figure 1-7. During Phase 1 effort, comparable investigations are conducted under each program, that is, preliminary assessments, real estate survey and record searches.

For Superfund, a 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 National Priority List (NPL). Additional site investigations are conducted during the Remedial Investigation (RI), which is a comprehensive study to determine the extent of contaminants 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 task is evident for each phase of the three programs; that is, the Site Inspection (EPA); the Confirmation Study (IRP) and the Confirmation Study (NON-IRP). Each of these studies are similar in terms of investigative depth. Some soil and water sampling is accomplished and a few monitoring wells may be installed. The principle purposes for each study, however, may be somewhat different from the others. For example, the purpose of a Non-IRP Confirmation Study is to make a preliminary

determination of whether contamination exists and if it was caused by DOD operations.

The Remedial Investigation (RI) under the Superfund Program is 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 1-7 surrounded by the dotted lines. It can easily be seen that this type of study is very preliminary and cannot be compared with the project requirements for an RI, especially one with an NPL rating.

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2.0 SITE CONDITIONS

2.1 PURPOSE

The text of the Scope of Work (SOW) for this contamination evaluation authorized on May 20, 1987, is contained in Appendix L of this report. Item 2.0 of the SOW describes the purpose of this project as follows: "to make a preliminary determination of whether chemical contamination which may have resulted from Department of Defense activities, is present at the site." Contamination as defined in the SOW, has been interpreted to mean concentration of chemical constituents, which exceed applicable federal standards. This interpretation would not determine concentrations of chemical constituents detected in the sample(s) below federal standards as "contamination." To fulfill this purpose, the Law Environmental, Inc., Government Services Division performed these following work elements:

- conducted site visit to collect background information;
- prepared work plan and safety plan;
- installed ground-water monitoring wells;
- collected and analyzed ground-water, silo water and soil samples;
- evaluated physical and chemical data;
- prepared an engineering report including a hazard ranking system (HRS) report

Details of the work performed in each of these elements are described in the following sections of this report, including a write-up of the site visit, site location information, site physiography, land use, and current and past ownership and use of the site. Work Plans with detailed descriptions of field and laboratory procedures are presented in Appendix H, Appendix I and Appendix J, respectively.

2.2 SITE VISIT SUMMARY

An initial site visit was performed by Law Environmental, Inc. with personnel from USACE as required in Section 2.0 of the SOW. Data was collected on the general site conditions to assist in locating the proposed groundwater monitoring wells. The following is a summary of information obtained during the preliminary site investigation:

- The site is located on the south side of State Route 5 (old Route 190) in an agricultural area. The site is in the town of Harrigan's Corner in northwestern Clinton County. Access to the site from Plattsburgh is west on State Route 3, north on State Route 374, and east on State Route 5 (old Route 190). Total distance from Plattsburgh is approximately 40 miles (see Figure 2-1).

- The site (see Figure 2-2) was acquired by taking for use as a missile installation between 1960-1962. The site was deactivated and conveyed to the Town of Ellenburg by quit claim deed in 1967. The site was then purchased in 1982 by Nancy Presta from the town. The site is presently (1987) used for storage of agricultural equipment.

- Currently, one 70' diameter subsurface concrete and steel missile silo 187' deep with approximately 12' thick walls, exists on the site. The silo is closed and probably filled with water. Paving covers a 150' square around the missile silo concrete pad (see Figure 2-3).

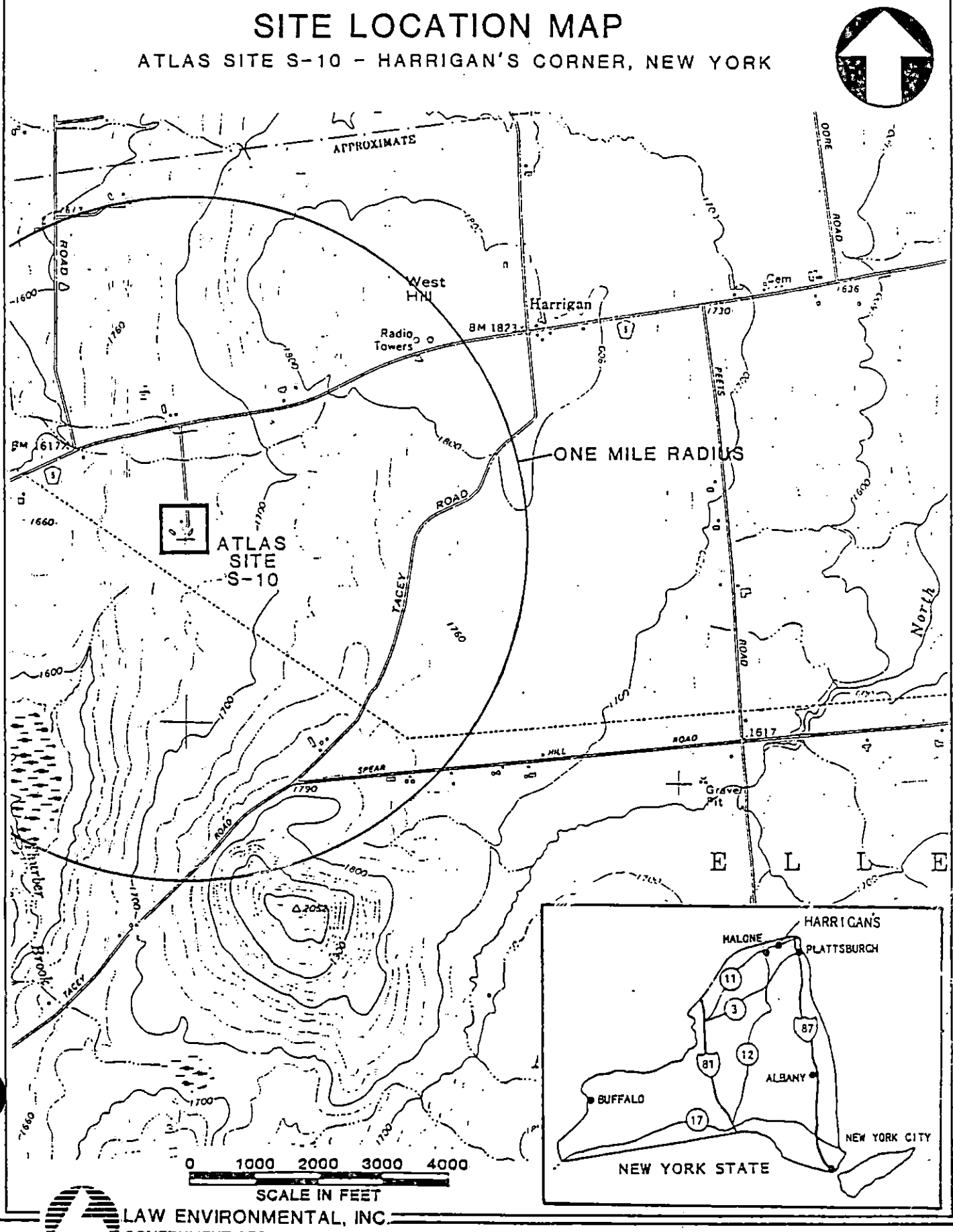
- Structures and buildings still present on the site include: the silo, empty underground fuel tanks, a buried concrete launch control center, two quonset huts, two pump houses, and a liquid nitrogen fueling station (see Figure 2-4).

- The soil sump discharge line is located southwest of the silo and runs to the southwest.

FIGURE 2-1

SITE LOCATION MAP

ATLAS SITE S-10 - HARRIGAN'S CORNER, NEW YORK



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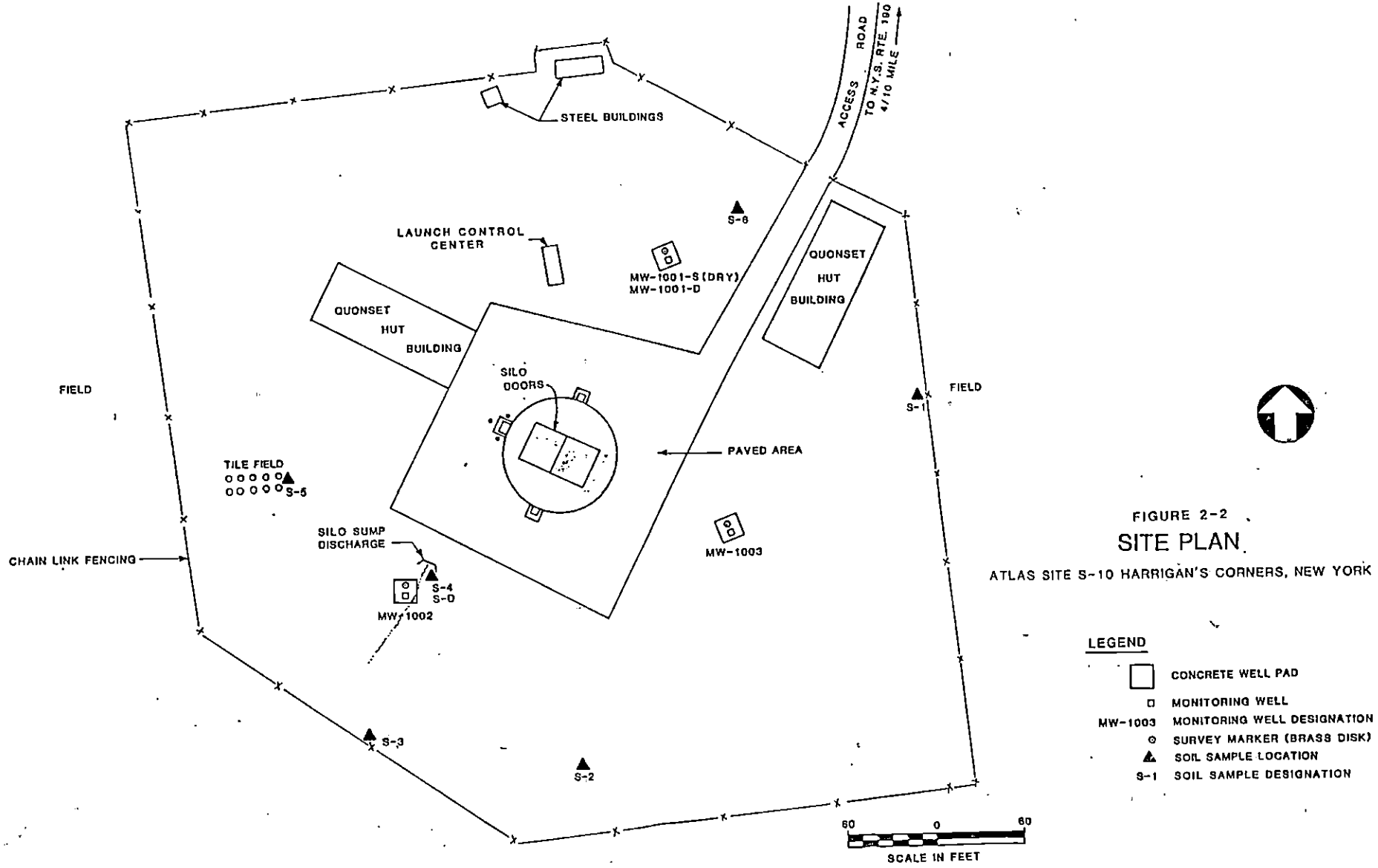

FIGURE 2-2

SITE PLAN

ATLAS SITE S-10 HARRIGAN'S CORNERS, NEW YORK

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FIGURE 2-3

MISSILE SILO LOOKING SOUTH

ATLAS SITE S-10 - HARRIGAN'S CORNER, NEW YORK

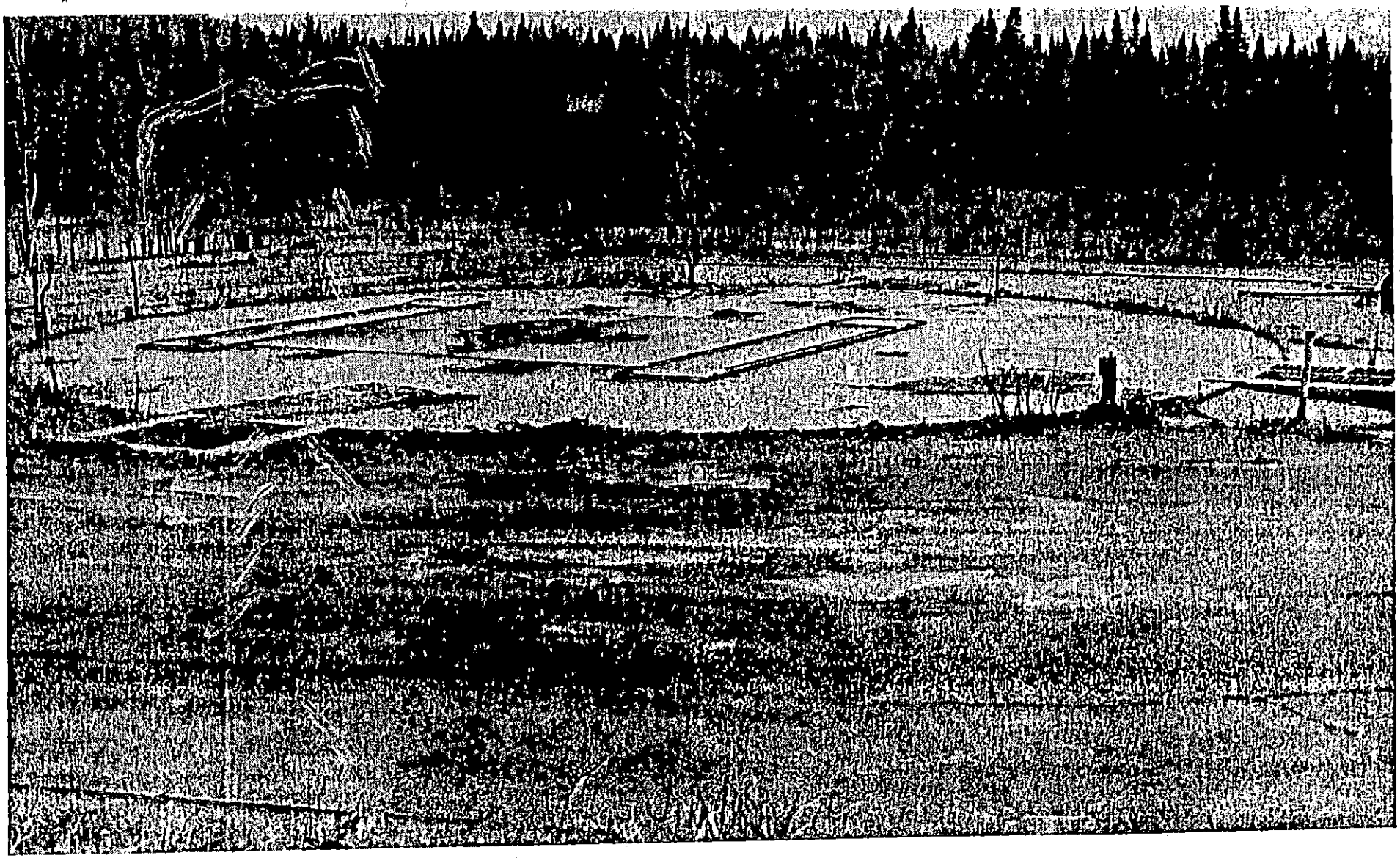

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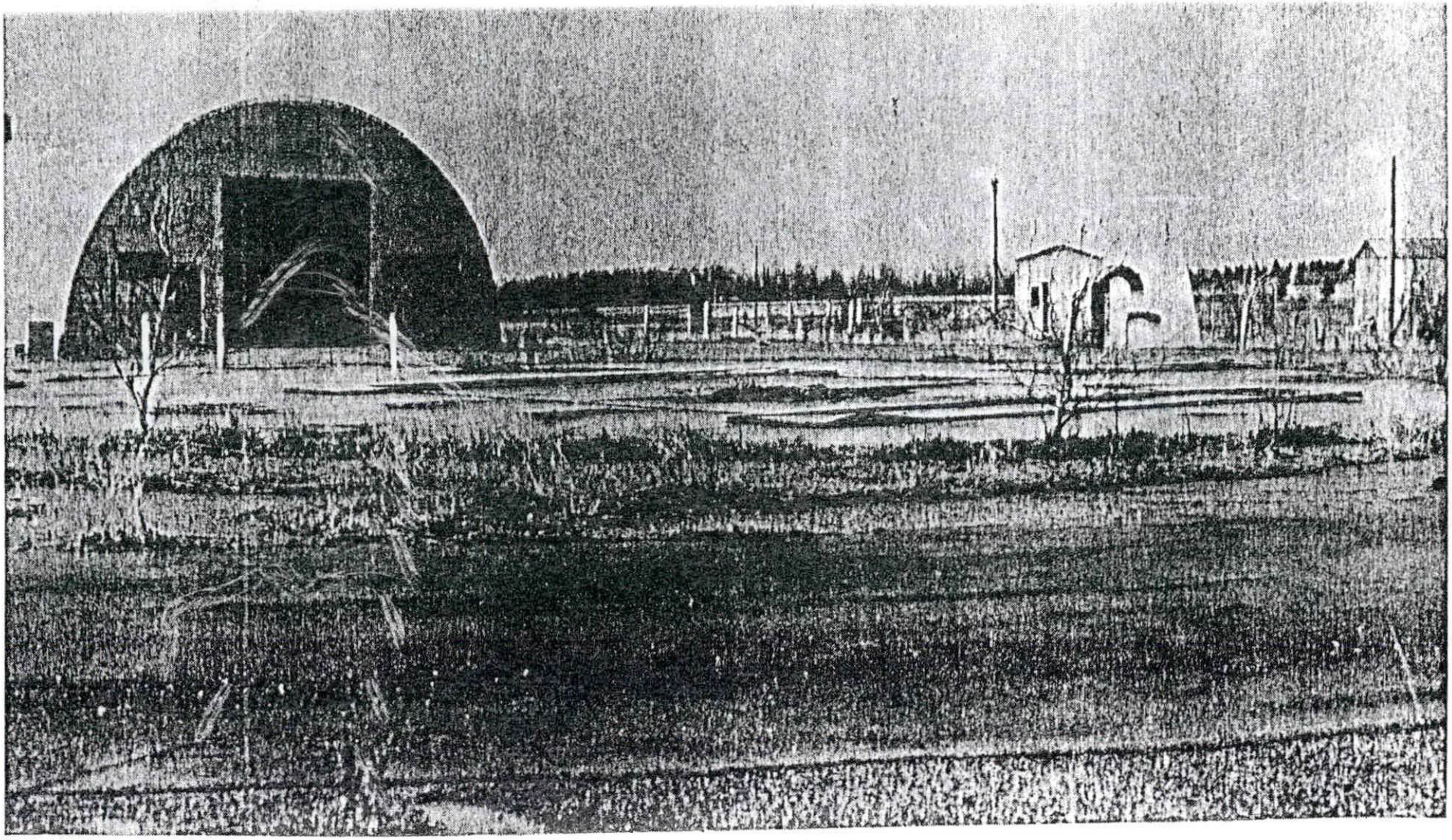
FIGURE 2-4

WESTERN VIEW OF THE SITE

ATLAS SITE S-10 - HARRIGAN'S CORNER, NEW YORK



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- The surficial geology at the site consists of glacial deposits over metamorphic and sedimentary rock of unknown origin (based on Isachen, Y. and Fisher, D., 1970). Fill material will also be present around the site and specifically near the missile silo.

- Ground water is expected to occur at depths greater than 40 feet below the surface based on the topography at the site and the elevation of intermittent streams in the area. Ground-water flow is probably southwest towards an intermittent stream leading to Thurber Brook.

2.3 SITE LOCATION AND ENVIRONMENTAL FEATURES

The community of Harrigan's Corner lies in the northeast Adirondack region of New York State (Figure 2-1). This area is comprised of foothills underlain by Cambrian age sedimentary rocks (Denny, 1974). The sedimentary rocks, chiefly consisting of the Potsdam formation, form a broad east-west trending belt which borders the mountains to the south. Consisting of beds of silica cemented quartz sandstone, arkosic sandstone and occasional beds of shale the Potsdam formation exhibits crossbedding and ripple marks with glacial striae where exposed (Denny, 1974).

Ground moraine consisting of glacial till overlie the sandstone bedrock. The till of Holocene age is generally a mix of silty fine to coarse sands with cobbles and boulders of mainly sedimentary rock. Thickness of the till deposits are highly variable and dependent on depositional environment.

Ground water occurs both in the sandstone bedrock and in the surficial till deposits in the study area. Due to the impermeable nature of the silica cemented sandstone, ground-water movement is mainly through joints, fractures or faults in the rock. Where the sandstone is cemented by carbonate, ground-water

movement can occur through weathered beds, fractured beds or bedding planes. When lateral movement of ground water is greater than vertical movement artesian conditions occur in the sandstone aquifer. Yields of wells screened in the bedrock range from 2-100 gallons per minute (gpm). The use of ground water is primarily domestic and agricultural in the area (Giese and Hobba, 1970).

Ground water also occurs in the glacial till deposits often as distinct perched zones relying on the semi-impermeable layers of silts and fine sands. Yields range <1-20 gpm from wells screened in the till deposits (Giese and Hobba, 1970).

As a part of the site investigation program three ground-water monitoring wells were installed at Site S-10. Site specific soil stratigraphy and shallow ground-water conditions encountered are discussed in greater detail in Section 5.1 of this report.

The Adirondack region climate is affected by cold fronts from Canada and warm fronts from the west or the Gulf of Mexico. Climate varies greatly between seasons. The summers are generally warm and humid and the winters cold with moderate to large accumulations of snow. The yearly mean temperature is 44° F. The warmest month is July with an average of two days at 90° F or above while the coolest month is January with an average of 31 days at 32° F or below. The average annual precipitation is 33.2 inches of water with a mean annual snowfall depth of 81.7 inches (1951 - 1980).

Topographic relief at the site is relatively flat with the only notable ground surface anomaly being the built up area around the missile silo and the west quonset hut. Surface drainage follows topography generally to the south towards a low-lying marshy area and Thurber Brook. In addition, the silo discharge is located south of the silo. A drainage swale extending approximately north-south is located on the eastern section of the property. Elevations in the vicinity of the site range from 1660 to 1680

feet above mean sea level (msl) with the highest elevations occurring northeast and south-southeast of the site.

2.4 LAND USE

Land use in the area around the site is comprised chiefly of agricultural and residential. Dairy farming is prevalent in the foothills region north into the St. Lawrence River Delta of Canada. The area is sparsely populated with an estimated 60 persons living with a one-mile radius of the site. The Adirondack Park lies just south of Site S-10 approximately 1.5 miles.

2.5 OWNERSHIP AND PRIOR USE

The site was formerly owned by the Department of Defense (DOD) and was used as an Atlas missile site from about 1960 until about 1967, at which time it was conveyed by the Department of the Air Force to the Town of Ellenburg. The primary tract of interest contained about 8.71 acres. Facilities at the site included one 70' diameter subsurface concrete and steel missile silo 187' deep, with 12' thick walls, one launch control center, two quonset buildings and two pump house buildings. By deed dated April 1982, the site was sold to Nancy Presta and is now used for storage of agricultural equipment. The environmental impact of the land owners subsequent to DOD activities has not been evaluated.

SECTION 3.0 - SITE INVESTIGATION

3.1 INTRODUCTION

Monitoring well and other sampling locations selected during the site visit are shown in Figure 2-2. These locations were selected as monitoring stations based upon data gathered during the initial site visit. The location of one of the monitoring wells (MW-1001) was slightly changed during the field program to improve the likelihood of detecting contamination; these changes are discussed in Section 3.3.

3.2 WORK PLANS

After the site visit and selection of proposed sampling stations, work plans were developed to describe planned site investigation procedures. Specific work plans developed for ATLAS Site S-10 were:

- Monitoring Well Installation Plan (Appendix H)
- Sampling and Analytical- QA/QC Plan (Appendix I)
- Safety, Health/Emergency Response Plan (Appendix J)

These documents provided guidance for the field investigation procedures. The work plans were sent to the Kansas City District Corps of Engineers for review and approval. The notice to proceed with field work was received in October, 1987 and the actual field investigation program began October 27, 1987.

For convenience, a brief outline of field techniques are presented in the following paragraphs along with field data gathered during the monitoring well installation activities, and the sampling program. Specific details regarding field methods are presented in the Appendices.

3.3 MONITORING WELL INSTALLATION

Three ground-water monitoring wells were installed to investigate specific subsurface areas at ATLAS Site S-10. Soil samples were taken during the drilling of each monitoring well borehole. The monitoring wells were installed and completed according to the approved Monitoring Well Installation Plan. The following sections briefly discuss monitoring well drilling, construction, development and hydraulic conductivity testing.

3.3.1 Monitoring Well Locations

The location of monitoring wells installed at Site S-10 are shown in Figure 2-2. Each location is discussed below:

- Monitoring well MW-1001 was installed west of the access road near the launch control center. This location was chosen monitor ground-water quality and elevation north of the silo. The original location specified in the work plan (near the tile field) was inaccessible by a truck mounted rig. This change in location was approved by USACE.

- Monitoring well MW-1002 was installed adjacent to the silo sump discharge to monitor possible contaminants pumped from the silo.

- Monitoring well MW-1003 was installed in the eastern area of the site in the shallow drainage swale discussed in Section 2.3. This location was chosen to monitor contaminants which may have exited the site in this swale.

3.3.2 Monitoring Well Construction

The Monitoring Well Installation Plan for ATLAS Site S-10 states that the soil test boring should be terminated after penetrating approximately 10 feet into the water table. A 2-inch polyvinyl chloride (PVC) well was constructed after drilling the borehole

to the specified depth. The monitoring well was constructed in each borehole with the following materials: 2-inch inside diameter (ID) Schedule 40 PVC (threaded, flush-joint), No. 10 (0.010 inch) pre-manufactured PVC screen and riser pipe; No. 1 non-carbonate silica sand; bentonite pellets; grout mixture (cement, bentonite, and water); steel security cap with lock; and protective steel posts. A concrete well pad (4 in. x 3 ft. x 3 ft.) was constructed around each well.

One Failing F-10 drill rig and one Acker "Soil Max" drill rig were used to install the monitoring wells at Site S-10. The rigs were equipped with 12-inch outside diameter (OD) (6.25 inch ID) hollow stem augers, NW rock core barrels and 5 - 7/8 inch tricone bits. Due to problems associated with weather, equipment failure and extremely slow drilling progress, installation of monitoring wells MW-1001 and MW-1003 required several weeks to complete. One alteration in the Scope of Work was made prior to the installation of well MW-1001. This alteration was made with the concurrence of the USACE and involved installing two monitoring wells in the borehole. One monitoring well (MW-1001-D) was installed in the six-inch rock borehole at a total depth 77.6 feet and the second well (MW-1001-S) installed at a total depth of 25.2 feet. This modification of the scope of work was necessary in order to help avoid installing a dry monitoring well because the actual depth of the water table was unknown (monitoring well MW-1001-5 was dry at the time of the field investigation, 1987).

Each well was installed as follows: complete the boring with tricone bit, hollow stem augers or rock coring to a depth of 10 feet into the first water zone encountered, sampling the soil with a split spoon sampler continuously for the first 10 feet of the boring, every five feet to the top of ground water, then continuously 10 feet into the water table; remove the drill rods and core barrel from the borehole assemble the 2-inch PVC screen and riser inside the hollow stem augers; add the sand pack and bentonite seal through the annular space between the augers and

the PVC casing well; remove the auger from the borehole; wet the bentonite pellets at 10 minute intervals and allow swelling for 30 minutes; mix and add cement-bentonite grout; and construct surface protection system (pad, steel casing, protective posts, etc.). Table 3-1 shows when each monitoring well was drilled and completed, and other pertinent information on well construction details.

A copy of the daily log of activities is contained in Appendix A along with the final test boring records, field boring logs, and geotechnical analytical data. The daily logs contain information regarding quantities and types of material used at the site; the test boring records show relevant stratigraphic data on each well and well construction information; the field boring logs are copies of the actual log completed by the field geologist; and the geotechnical analytical results contain grain size analyses, moisture content and Atterberg limits (where applicable) for two samples for each boring. These data are discussed in greater detail in Section 3.6.1.

3.4 MONITORING WELL DEVELOPMENT

Well development was accomplished in intervals from November 18 through December 8. After allowing the grout seal and pad to cure, each well at ATLAS Site S-10 was developed manually first using a PVC surge block, then a PVC bailer and finally a PVC hand pump. These three techniques were utilized to ensure that the wells were developed as fully as possible considering the hydrogeology of each well. Development occurred no sooner than 24 hours after installation. The purpose of well development is to remove fine particles (silt and clay) that were introduced into the well during the drilling process and moreover to improve the hydraulic connection between the aquifer and the monitoring well. Well development data are summarized in Tables 3-2 and 3-3. Forms completed in the field during well development are presented in Appendix C. Data recorded in the field included: date, static water level, quantity of water standing in well

TABLE 3-1

WELL CONSTRUCTION DATA
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

WELL[2] NO.	TOTAL[1] DEPTH (FT)	SCREEN[1] INTERVAL (FT)	THICKNESS			DATE INSTALLED
			SAND PACK (FT)	BENTONITE SEAL (FT)	GROUT SEAL (FT)	
MW-1001-S[3]	25.2	5.2 - 25.2	21.0	1.1	3.1	11-20-87
MW-1001-D	77.67	67.67 - 77.67	17.67	6.0	54.0	11-20-87
MW-1002	15.0	5.0 - 15.0	10.8	2.2	2.0	10-27-87
MW-1003	56.4	44.1 - 54.1	16.4	2.0	38.0	11-09-87

NOTES:

(1) Approximate depth below ground surface.

(2) Monitoring wells MW-1001-S and MW-1001-D were installed in the same borehole.

(3) MW-1001-S was a dry well.

TABLE 3-2

WELL DEVELOPMENT DATA
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

WELL NO.	DEVELOPMENT METHOD USED	QUANTITY OF GROUND-WATER IN WELL(gallons)	QUANTITY OF GROUND-WATER REMOVED(gallons)	TIME FOR REMOVAL (hours)	DATE
MW-1001-D	1,2,3	7.5	41	----	11-25 - 12-08-87
MW-1002	1,2,3	4.3	24	2.0	11-19-87
MW-1003	1,2,3	5.0	5.5	----	11-18 - 12-08-87

NOTES:

---- Time for removal not recorded
1 - Surge block
2 - Bailer
3 - Hand Pump
Monitoring well MW-1001-S was dry at the time of development.

TABLE 3-3

GROUND WATER QUALITY MEASUREMENTS
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK[1]

WELL NO.	pH	SPECIFIC CONDUCTANCE (umchs/cm)	TEMPERATURE (°C)	DATE
MW-1001	7.0	140[2]	8.0[2]	11-25 - 12-08-87
MW-1002	6.3	160	8.5	11-19-87
MW-1003	7.8[2]	325	8.5[3]	11-18 - 12-08-87

NOTES:

(1) Readings taken at the end of well development, unless noted otherwise.
(2) Readings taken during development.
(3) Readings taken at start of development.

(including the sand pack), water quality data, physical characteristics of water, development equipment, surge techniques and water quantity removed. Table 3-3 shows measurements for specific parameters used to monitor the development water (pH, specific conductance, temperature) during different stages of well development. The only notable variation in the measurements was the specific conductance reading in well MW-1003 which was slightly higher than the other two wells but not anomalous.

The monitoring wells at ATLAS Site S-10 (MW-1001-D, MW-1002, and MW-1003) all contained ground water which was very turbid prior to development. Monitoring well MW-1001-S was dry at the time of development. However, at the conclusion of development ground water in each monitoring well was only slightly to moderately turbid. A photograph of the well development water was submitted to the USACE-Kansas City District as required by the SOW.

3.4.1 Water Levels

Static water level measurements were obtained during the hydraulic conductivity testing. These data in conjunction with surveyed well-head elevations are presented in Table 3-4. The water levels in the monitoring wells at the site range from 8.36 to 61.60 feet below the top of the PVC casings. These water level measurements represent site relative elevations ranging from 39.33 feet to 85.66 feet. Ground-water elevations at Site S-10 do not appear to represent the same water bearing zone across the site but rather ground water at a shallow perched zone (MW-1002), at the top of bedrock interface (MW-1003) and in bedrock (MW-1001-D). Due to the variation in ground-water zones screened by the monitoring wells it is not feasible to compute a reliable ground-water flow direction at the site.

3.4.2 Site Survey

Surveying of the site was performed by Laberge Engineers, Inc. in Plattsburgh, New York under subcontract with Law Environmental,

TABLE 3-4

GROUND-WATER ELEVATION SUMMARY
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK
December 28, 1987

WELL NO.	TOP OF PVC RISER ELEVATION (ft.)[1]	DEPTH TO GROUND WATER (ft.)	GROUND WATER ELEVATION (ft.)[1]	COORDINATES[2] NORTHING	EASTING
MW-1001-D	100.93	61.60	39.33	8392.198	10096.505
MW-1002	94.02	8.36	85.66	8175.395	9920.569
MW-1003	98.44	51.70	46.74	8213.608	10136.144
SILO	99.76	86.60*	13.16	----	----

NOTES:

(1) Elevations are relative to arbitrary, datum established on site.
(2) New York State Coordinates.
* Depth to water in silo measured 11-02-87.

Inc. - Government Services. Survey operations included determining the top of PVC riser (without cap) and ground surface elevations relative to an arbitrary permanent object on site, horizontal control relative to the state grid system and in addition, survey the top of the open silo door for use in calculating the ground-water elevation in the silo. Survey data for Site S-10 is presented in Appendix K. Survey data are presented in Appendix K.

3.5 HYDRAULIC CONDUCTIVITY TESTING

A hydraulic conductivity test was performed on each well following well development and prior to ground-water sampling. The hydraulic conductivity test performed at this site is known as a slug-in or slug-out test. This test method involves inserting a slug (solid PVC rod) into the water column in the well to raise the water level. The recovery of the ground water back down to static water level is then recorded over time. Monitoring wells which did not have fully saturated screens were tested by the slug out test only. Test data were recorded using an In-Situ SE1000B Data Logger hydrologic monitoring device. Data was evaluated using the Bouwer and Rice (1976) technique to calculate the hydraulic conductivity for each monitoring well. The actual field data and hydraulic conductivity calculations for each well test are presented in Appendix D.

Table 3-5 shows the range of hydraulic conductivity values computed from data from each monitoring well at ATLAS Site S-10. Values ranged from 1.5×10^{-3} to 7.8×10^{-4} centimeters/second (cm/s) among all test results at the site. The values are typical of the silty fine to medium sands, sandy silts and the fractured sandstone bedrock encountered at the site when drilling.

TABLE 3-5

HYDRAULIC CONDUCTIVITY DATA SUMMARY
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

WELL NO.	TYPE TEST[1]	DEPTH TO GROUND WATER (feet from TOC)	HYDRAULIC CONDUCTIVITY[2] (cm/sec)	DATE TEST PERFORMED
MW-1001	Slug in	61.60	1.5×10^{-3}	12-28-87
	Slug out	61.60	2.0×10^{-3}	12-28-87
MW-1002	Slug out	8.36	6.3×10^{-3}	12-28-87
MW-1003	Slug out	51.70	7.8×10^{-4}	12-28-87

NOTES:

(1) Test Performed using In-Situ SE 10008 Data Logger hydrologic monitoring device.

(2) Hydraulic conductivity values calculated using Bouwer and Rice Method (1976).

3.6 SAMPLING PROGRAM

Geotechnical soil sampling at ATLAS Site S-10 was performed during the drilling program, surficial soil quality sampling was performed on November 11, 1987, and silo and ground-water quality samples were collected on December 11, 1987. Specific sampling protocol are contained in Appendix I - the Sampling and Analytical - QA/QC Plan. Information relative to drilling and sampling activities is presented here.

3.6.1 Geotechnical Data

Drilling at ATLAS Site S-10 was initiated during the week of October 27, 1987. The wells were drilled with a Acker "Soil Max" and a Failing F-10 truck mounted drilling rigs. Overburden samples were obtained with a split spoon sampler at predetermined depths. Two samples from each boring were analyzed for grain size distribution, moisture content, and Atterberg limits. The data are presented in Table 3-6.

3.6.2 Ground-Water Sampling

A total of five well volumes of ground water were purged from each monitoring well with a 1.5" x 3' Teflon bailer prior to sampling according to work plan specifications. Table 3-7 shows purging data for the site.

A Field Sampling Report, (included in Appendix F), was kept for each well during sampling. The ground-water samples were designated corresponding to the monitoring well designations, except for the ground-water sample from well MW-1001-D which was designated MW-1001. The duplicate ground-water sample collected from monitoring well MW-1002 was designated MW-100D. A sample of potable water used during drilling was collected on November 17, 1987. Table 3-8 lists the number of samples and types of water samples taken at ATLAS Site S-10 and the parameters for analysis.

TABLE 3-6

SOIL LABORATORY DATA SUMMARY
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

WELL NO.	SAMPLE NO.	SAMPLE INTERVAL (ft)	PERCENTAGE SAND/GRAVEL	PERCENTAGE SILT/CLAY	UNIFIED SOIL CLASSIFICATION	PERCENTAGE MOISTURE CONTENT	ATTERBERG LIMITS LL	PL	PI
MW-1001	BS-3	4.0 - 6.0	83.1	16.9	SM	9.3	- NON PLASTIC -		
MW-1001	BS-5	8.0 - 10.0	64.4	35.6	SM	7.8	- NON PLASTIC -		
MW-1002	BS-3	4.0 - 6.0	62.1	37.9	SM	16.8	- NON PLASTIC -		
MW-1002	BS-6	10.0 - 12.0	61.2	38.8	SM	14.6	- NON PLASTIC -		
MW-1003	BS-6	10.0 - 12.0	59.1	40.9	ML	9.2	14	11	3
MW-1003	BS-11	46.5 - 48.0	74.4	25.6	SM	9.2	- NON PLASTIC -		

NOTES:

LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index

CLASSIFICATION	% SILT/CLAY
SP or SW	< 5
SP - SM	5 - 12
SP - SC	5 - 12
SM	> 12
SC	> 12
ML or CL	> 50
MH	> 50

TABLE 3-7

WELL PURGING DATA SUMMARY
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

Well No.	SWL[1] (feet)	Well Total Depth Below TOC (feet)	Casing Volume[2] (gallons)	Quantity Purged (gallons)	Well Volumes Purged	Date
MW-1001-D	62.2	79.7	2.9	14.5	5.0	12/11/87
MW-1002	7.28	17.0	1.4	5.7(bailed dry)	4.1	12/11/87
MW-1003	51.48	58.4	0.8	0.8(bailed dry)	1.0	12/11/87

NOTES:

(1) SWL - Depth in feet from Top of Casing (TOC) to Static Water Level (SWL) measured 12/11/87.
(2) One casing volume = (Total depth of well - SWL) x 0.16 gal/ft.

TABLE 3-8

GROUND-WATER
SAMPLES AND PARAMETERS FOR ANALYSIS
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

Sample Type	Number of Samples	Parameters		
		Purgeable Aromatics and Halocarbons	Base/Neutral Extractables	Total Metals
Field Sample	3	x	x	x
Quality Control (AE)				
Duplicate	1	x	x	x
Sampling blank	1	x	x	x
Trip blank	1	x	-	-
Quality Assurance (USACE)				
Duplicate	1	x	x	x
Sampling blank	1	x	x	x
Trip blank	1	x	-	-
Potable Drilling Water	1	x	-	x

NOTES:

AE - Law Environmental, Inc.
USACE - United States Army Corps of Engineers
x - Indicates sample was collected for chemical analysis.
- - Indicates no sample was collected.

Sampling ground water from the wells included collecting the following samples: field samples (3), a duplicate field sample (for this site the duplicate was from well MW-1002), a ground water equipment rinsate, and trip blank (filled in the laboratory before shipment to the site). Quality control samples were also collected for the USACE. Following collection of the sample, the equipment was cleaned to prevent cross-contamination between boreholes. Analytical results of the ground-water samples are contained in Section 4.2.

3.6.3 Silo Water Samples

A sample was collected from the underground missile silo with a 1.5" x 3' teflon bailer. The samples were designated SW to SWD corresponding to the sample and duplicate. A travel (or trip) blank was also analyzed in the sample batch and quality assurance samples were collected for the USACE. Table 3-9 lists all of the silo water samples taken from the site. Analytical results for the silo water samples are presented in Section 4.3.

3.6.4 Shallow Soil Sample Locations S-1 through S-6

Shallow soil samples were collected at six locations on the site using a stainless steel hand auger. The sample depths ranged between 0.3 to 1.5 feet for all soil samples. Analytical results for these samples are presented in Section 4.4. Figure 2-2 shows the sampling locations. Table 3-10 lists numbers and types of soil samples collected and the parameters for analysis. Below is a description of the location and the rationale for each location.

- Soil sample S-1 was taken north-east of Monitoring Well MW-1003 and east of the quonset hut on the east side of the site near the perimeter fence. This location was selected to monitor potential contaminants in the soil near MW-1003 and the quonset hut.

TABLE 3-9

SILO WATER
SAMPLES AND PARAMETERS FOR ANALYSIS
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

Sample Type	Number of Samples	Parameters: Purgeable Aromatics and Halocarbons	Parameters: Base/Neutral Extractables	Parameters: Total Metals
Field Sample	1	x	x	x
Quality Control (AE)				
Duplicate	1	x	x	x
Sampling blank	1	x	x	x
Trip blank	1(a)	x	-	-
Quality Assurance (USACE)				
Duplicate	1	x	x	x
Sampling blank	1	x	x	x
Trip blank	1(a)	x	-	-

NOTES:

AE — Law Environmental, Inc.
USACE — United States Army Corps of Engineers
x — Indicates sample was collected for chemical analysis.
- — Indicates no sample was collected.
(a) — One trip blank was analyzed for both ground and silo water samples.

TABLE 3-10

SOIL SAMPLES AND
PARAMETERS FOR ANALYSIS
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

		Parameters		
Sample Type	Number of Samples	Purgeable Aromatics and Halocarbons	Base/Neutral Extractables	Total Metals
Field Sample	6	x	x	x
Quality Control (AE)				
Duplicate	1	x	x	x
Sampling blank	1	x	x	x
Trip blank	1	x	-	-
Quality Assurance (USACE)				
Duplicate	1	x	x	x
Sampling blank	1	x	x	x
Trip blank	1	x	-	-

NOTES:

AE Law Environmental, Inc.
USACE United States Army Corps of Engineers
x Indicates sample was collected for chemical analysis.
- Indicates no sample was collected.

- Soil sample S-2 was collected in a small drainage area in the south corner of the site. This location was chosen to monitor soil quality in the drainage area.

- S-3 is located at the perimeter fence on the south-west side of the site. This location was intended to monitor potential contaminants at the site boundary.

- S-4 is located adjacent to Monitoring Well MW-1002 in the silo sump discharge. Possible contaminants from operation of the silo would have been discharged into this sump and could be monitored by this sample.

- S-5 is in the tile field on the western area of the site. This sample location was intended to monitor possible releases from the tile field area.

- Soil sample S-6 is the background sample. Results from the background sample are the basis for comparison of soil analytical results. The sample was taken on the north side of the site entrance road on high ground.

3.6.4.1 Sampling Procedure

Soils for chemical analysis were collected with a stainless steel hand auger. The auger portion itself was about a foot long and three inches wide. At approximately one to two foot depth, the filled auger was put in a stainless steel bowl. Using a stainless steel spoon, the 40-ml vials for purgeable aromatics and purgeable halocarbon (volatile organics) were filled directly from the hand auger. There was no mixing of the soil at this point. After all samples for volatile organics were taken, the rest of the auger was emptied into the bowl. At sampling locations which were chosen for duplicate samples, a second auger-full of soil was required. This soil was mixed with the remains of the first auger in the stainless steel bowl using a stainless steel spoon. Samples for total metals and base neutral

extractables were taken from this mixed soil. Specific sampling procedures are outlined in the Sampling and Analysis Plan (Appendix I). Figure 2-2 shows all site sampling locations.

Soil sampling included collection of the following samples: field samples (6); a duplicate field sample (duplicate at S-4), soil equipment rinsate, and a trip blank (filled in the laboratory before shipment to the site). Quality control samples were also collected for the USACE. Following collection of the sample, the equipment was cleaned in accordance with procedures stipulated in the work plan to prevent cross-contamination between sampling locations.

*****

4.0 - TEST RESULTS

Three phases of sampling were performed at ATLAS Site S-10, including: (1) ground-water quality sampling (2) silo water sampling and (3) surficial soil quality sampling. All sampling events were completed in accordance with the Sampling and Analytical QC/QA Plan, presented in Appendix I. Laboratory analytical reports are presented in Appendix E and QA/QC data, field sampling reports and chain-of-custody records presented in Appendix F.

The analytical results are presented in this section. Discussions of the data evaluation are presented in Section 5.0.

4.1 GROUND WATER ANALYTICAL RESULTS

Three monitoring wells were sampled in accordance with the Work Plan specifications (Appendix I). Table 4-1 lists the analytical methods used for ground-water samples and the detection limits for these methods. Samples from the wells were analyzed for purgeable aromatics, purgeable halocarbons, base/neutral extractables, and metals. Table 4-2 lists all the analytical results for ground-water samples, including the rinsate, the duplicate and the travel blanks.

The ground-water results in Table 4-2 show that a total of four purgeable organic compounds were detected in the ground-water samples. Three of these constituents, trichloroethylene, chloroform and toluene, were detected below laboratory detection limits. The fourth constituent, methylene chloride, was reported above the detection limit in two of the samples and the method blank. Three base/neutral extractable compounds, di-n-butyl phthalate, di-n-octyl phthalate and bis (2-ethyl hexyl) phthalate were detected below the detection limits. Total Barium, and total lead were detected, but the values were below regulatory criteria. These analytical results are evaluated in Section 5.0. QA/QC results are discussed in Section 4.5.

TABLE 4-1
ANALYTICAL METHODS FOR WATER SAMPLES
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

Parameter	Method[1]	Detection Limit (mg/L)[2]
Purgeable Aromatics	8240 (GC/MS)	0.005
Purgeable Halocarbons	8240 (GC/MS)	0.005 - 0.01
Base/Neutral Extractables	8270 (GC/MS)	0.01 - 0.05
Metals:		
Ag	6010 (ICP)	0.010
As	7060 (Furnace AA)	0.005
Ba	6010 (ICP)	0.010
Cd	6010 (ICP)	0.005
Cr	6010 (ICP)	0.010
Hg	7470 (Cold Vapor)	0.0002
Pb	6010 (ICP)	0.005
Se	7740 (Furnace AA)	0.010

NOTES:

(1) Statement of Work, Project No. C02NY021500 and EPA SW-846, 1986

(2) For Ecology and Environment, Inc., laboratory equipment and analytical procedures.

TABLE 4-2
SUMMARY OF POSITIVE ANALYTICAL RESULTS FOR GROUND WATER
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK
ALL RESULTS IN MG/L
SAMPLED DECEMBER 12, 1987

Parameter	Sample Designation							
	MW-1001	MW-1002	MW-1000[1]	MW-1003	MWR Rinsate	Trip Blank	Method Blank	Potable Drilling Water
Purgeable Aromatics and Halocarbons								
Methylene chloride	0.020	0.013	<0.005[2]	<0.005	<0.005	<0.005	0.058	ND
Trichloroethylene	<0.005	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	<0.005	ND	ND
Toluene	<0.005	ND	ND	ND	<0.005	<0.005	ND	ND
Base/Neutral Extractables								
Di-n-butyl phthalate	<0.010	<0.010	<0.010	<0.010	ND	NT	<0.010	NT
Di-n-octyl phthalate	ND	ND	ND	<0.010	ND	NT	ND	NT
Bis (2-ethyl hexyl) phthalate	<0.010	<0.010	<0.010	<0.010	<0.010	NT	<0.010	NT
Metals (Total								
Barium (Ba)	0.089	0.022	0.022	0.073	ND	NT	NT	0.04
Lead (Pb)	0.006	ND	ND	0.013	ND	NT	NT	ND

NOTES:

(1) Ground water duplicate sample from MW-1002.
(2) < indicates compound present below listed measurable detection limit.
ND = Constituent not detected in sample
NT = Sample not analyzed for constituent.

4.2 DRILLING WATER RESULTS

A grab sample of potable drilling water collected from the water truck used during drilling operations was analyzed for total metals and purgeable aromatics and purgeable halocarbons. This was done due to the large volume of drilling water used at the site. Results showed only total barium above detection limits, at 0.04 mg/l. Analysis of the water collected from the water track used during drilling wells MW-1001-D and MW-1003 indicates no contaminants from the water truck influenced water quality in the monitoring wells.

4.3 SILO WATER RESULTS

A silo water sample was obtained through an access hole drilled through one of the concrete silo doors. Analytical methods utilized for the ground-water samples were also used on the silo water samples. Table 4-3 presents the analytical results for the silo samples.

Table 4-3 shows three purgeable organic compounds, methylene chloride, chloroform ethyl benzene, and toluene were detected below laboratory detection limits. Additionally, three base/neutral extractable compounds, di-n-butyl phthalate, di-n-octyl phthalate and bis (2-ethyl hexyl) phthalate, were detected below detection limits. Of the total metals, only barium and lead were detected in the samples. These analytical results are evaluated in Section 5.0.

4.4 SOIL ANALYTICAL RESULTS

Six shallow soil samples were collected at ATLAS Site S-10 and analyzed for purgeable aromatics, purgeable halocarbons, base/neutral extractables, and metals. The analytical methods used are shown in Table 4-4.

TABLE 4-3
SUMMARY OF POSITIVE ANALYTICAL RESULTS FOR SILO WATER
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK
ALL RESULTS IN MG/L
SAMPLED DECEMBER 12, 1987

Parameter	Sample Designation				
	SW	SWD[1]	SWR Rinsate	Trip Blank	Method Blank
Purgeable Aromatics and Halocarbons					
Methylene chloride	<0.005[2]	<0.005	<0.005	<0.005	0.058
Chloroform	ND	ND	<0.005	<0.005	ND
Ethyl benzene	ND	ND	<0.005	ND	ND
Toluene	ND	ND	<0.005	<0.005	ND
Base/Neutral Extractables					
Bis (2-ethyl hexyl) phthalate	<0.010	<0.010	<0.010	NT	<0.010
Di-n-butyl phthalate	<0.010	<0.010	<0.010	NT	<0.010
Di-n-octyl phthalate	<0.010	ND	ND	NT	ND
Metals (Total)					
Barium (Ba)	0.029	0.028	ND	NT	NT
Lead (Pb)	0.025	0.027	0.006	NT	NT

NOTES:

(1) Silo duplicate sample.
(2) < indicates compound detected but below the listed measurable detection limit.
ND = Constituent not detected in the sample.
NT = Sample not analyzed for constituent.

TABLE 4-4
ANALYTICAL METHODS FOR SOIL
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

Parameter	Method[1]	Detection Limit (mg/kg)[2]
Purgeable Aromatics	8240 (GC/MS)	0.5 - 1.0
Purgeable Halocarbons	8240 (GC/MS)	0.5 - 1.0
Base/Neutral Extractables	8270 (GC/MS)	0.33 - 1.6
Metals:		
Ag	6010 (ICP)	2.0
As	7060 (Furnace AA)	1.0
Ba	6010 (ICP)	1.0
Cd	6010 (ICP)	1.0
Cr	6010 (ICP)	1.0
Hg	7471 (Cold Vapor)	0.1
Pb	6010 (ICP)	0.5
Se	7740 (Furnace AA)	1.0

NOTES:

(1) Statement of Work, Project No. C02NY021500 and EPA, SW-846, 1986.
(2) For Ecology & Environment, Inc., laboratory equipment and analytical procedures.

Test results are shown in Table 4-5. No purgeable aromatics were found above the detection limit in the soil samples. One purgeable halocarbon, methylene chloride and one base neutral compound, di-n-octyl phthalate were detected in the samples at low levels. Four additional base/neutral compounds were reported present in the soil samples but concentrations below the method detection limit. Detectable levels of arsenic, barium, chromium and lead were observed in some samples. However, all concentrations of metals were within the normal range of metals in soil (Bowen, 1966) and all were within the same order of magnitude as the background sample S-6.

4.5 QUALITY ASSURANCE/QUALITY CONTROL RESULTS

Quality Assurance/ Quality Control (QA/QC) criteria for this site was delineated in the Work Plans contained in Appendix H and I of this report. QA/QC criteria are established for sampling methods and testing procedures as well as documentation of control and organizational responsibility.

Five types of QA/QC samples for ATLAS Site S-10 were analyzed by the laboratory. These samples consisted of duplicates, replicates, spikes, travel blanks and sampler rinsates. In addition to these samples, the laboratory has established internal QA samples which are used to analyze method controls, instrument calibration and internal QA procedures. Complete analytical results and QA/QC results are in Appendices E and F, respectively.

Duplicates of a ground-water sample and a soil sample were collected at the site. The ground-water sample duplicate was taken at monitoring well MW-1002. No purgeable aromatics, or base/neutral extractables were detected in the ground-water duplicate. Results from the ground-water duplicate are consistent with the field sample. The following results were

TABLE 4-5
POSITIVE ANALYTICAL RESULTS FOR SOIL
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK
ALL RESULTS IN MG/KG
SAMPLED NOVEMBER 10, 1987

	Sample Designation									
Parameter	S-1	S-2	S-3	S-4	S-D[1]	S-5	S-6[2]	Rinsate	Trip Blank	Method Blank
Purgeable Halocarbons										
Methylene chloride	2.2	2.2	2.3	1.8	1.9	2.1	2.1	0.008	0.008	1.6
Base/Neutral Extractables										
Di-n-butyl phthalate	<0.33[3]	<0.33	<0.33	0.35	<0.33	<0.33	<0.33	ND	NT	0.010
Bis(2-ethyl hexyl) phthalate	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	NT	ND
Di-n-octyl phthalate	ND	ND	ND	ND	ND	ND	ND	0.060	NT	0.092
Pyrene	ND	ND	<0.33	ND	ND	ND	ND	ND	NT	ND
Phenanthrene	ND	ND	<0.33	ND	ND	ND	ND	ND	NT	ND
Metals										
Arsenic (As)	2.14	2.64	2.83	1.64	2.36	1.87	3.23	ND	NT	NT
Barium (Ba)	35.3	48.7	39.3	28.0	25.9	47.4	358	ND	NT	NT
Chromium (Cr)	7.48	4.66	6.41	8.82	5.31	8.90	6.61	ND	NT	NT
Lead (Pb)	33.5	13.4	8.56	17.2	10.2	4.08	8.15	ND	NT	NT

NOTES:

(1) Duplicate sample from S-4
(2) Background soil sample.
(3) < indicates compound present below measurable detection limit.
ND - Constituent not detected in sample.
NT - Sample not analyzed for constituent.

obtained for ground-water parameters present above the detection limits in MW1 and the duplicate.

Parameter	MW-1002	MW-100D (duplicate)
Methylene chloride	0.02 mg/l	0.01 mg/l
Barium	0.022 mg/l	0.022 mg/l

A silo water duplicate was taken. Good comparison of detected analytical results was evident between the field sample and the duplicate sample:

Parameter	SW	SWD (duplicate)
Barium	0.029 mg/l	0.028 mg/l
Lead	0.025 mg/l	0.027 mg/l

The soil sample duplicate was collected from the S-4 field sample. No purgeable aromatics, were detected in the soil samples. The consistency between duplicate and field sample were good for all parameters. Results which were present above the detection limit in S-4 and the duplicate are noted as follows:

Parameter	S-4	S-D (duplicate)
Methylene chloride	1.8 mg/kg	1.9 mg/kg
Arsenic	1.64 mg/kg	2.36 mg/kg
Barium	28.0 mg/kg	25.9 mg/kg
Chromium	8.82 mg/kg	5.31 mg/kg
Lead	17.2 mg/kg	10.2 mg/kg
Di-n-butyl phthalate	0.35 mg/kg	<0.33 mg/kg
Bis (2-ethyl hexyl) phthalate	<0.33 mg/kg	<0.33 mg/kg

Replicate samples are aliquots of a single sample that is split on arrival at the laboratory or when analyzed. Replicates are analyzed as separate samples and compared to the original samples, yielding a relative percent difference. One water samples (MW-1001) was replicated, and the relative percent difference was 0.28 percent. Two soil samples (S-4 and S-D) were replicated as well as the soil rinsate. The relative percent difference for all of the soil-related samples was zero.

Spikes are known amounts of analyte that are added to a sample. Both the sample and the spiked sample are analyzed and the results compared. Percent recoveries are calculated to determine the amount of analyte added. If the spike analyses is accurate, the percent recovery should equal the amount of analyte actually added. The spike technique is routinely used in the laboratory to calibrate equipment. Table 4-6 shows the results of the spike analyses. For total metals in water, percent recovery for spiked samples ranged from 78 to 115 percent. Percent recovery for total metals in soils ranged from 90 to 110 percent. EPA Quality Control Advisory Limits (EPA, 1984) have been established to

TABLE 4-6
QUALITY CONTROL: PERCENT RECOVERY
FOR SPIKE SAMPLES
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

Parameter	Medium	Percent Recovery (range)	EPA QC Limits (1) (range)
MATRIX SPIKE			
Total Metals	Water	78 - 115	80 - 125
Total metals	Soil	90 - 110	24 - 127

NOTES:

(1) EPA advisory limits expressed as a percentage.
Source: Inorganics - EPA, 1984
Organics - EPA, September, 1986

determine acceptable spike percent recoveries for various parameters. All samples analyzed were within the EPA QC advisory limits.

Surrogate spikes are compounds which are similar to the analyte in chemical composition, extraction and chromatography, but which are not normally found in the field sample (EPA, September 1986). A common tracer element used in surrogate spikes is deuterium. The surrogate spike sample is analyzed and the percent recovery of the added chemical is computed. Percent recoveries for base/neutral organics in water ranged from 47 to 93 percent. Purgeable organics in water percent recoveries range from 72 to 110 percent. Low recoveries were due to slightly low addition of the surrogate. Base/neutral percent recoveries in soil range from 67 to 107. Percent recoveries for purgeable organics (aromatics and halocarbons) in soil range from 94 to 114 percent. Percent recoveries from purgeable organic and base/neutral compounds for the soil rinsate surrogate ranged from 92 to 102 and 49 to 92, respectively. The surrogate analyzed for purgeable organics from the potable drilling water sample reported a percent recovery of 94 to 100. The above percent recoveries are all within the EPA QC Limits. The surrogate spike recoveries are listed on Table 4-7.

A travel or trip blank consisting of de-ionized water was analyzed for purgeable organic compounds (purgeable aromatics and halocarbons) in ground water and soils. Only one constituent methylene chloride, was detected in the soil trip blank. This chemical was also detected in the laboratory method blank, thus it is unlikely that contamination was introduced during sample collection and shipment. Analytical data for the travel blanks is included in Appendix F of this report.

A sampler rinsate was collected from the ground-water and silo water sampler (Teflon bailers) and soil sampler (stainless steel hand auger) to monitor field cleaning techniques. Sampler rinsates consisted of de-ionized water which was passed through

TABLE 4-7
QUALITY CONTROL: PERCENT RECOVERY
FOR SURROGATE SPIKE SAMPLES
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

Parameter	Medium	Percent Recovery (range)	EPA QC Limits (1) (range)
PURGEABLE ORGANICS	Water	72 - 110	24 - 127
	Soil	94 - 114	28 - 142
	Water (2)	92 - 102	24 - 127
	Water (3)	94 - 100	24 - 127
BASE/NEUTRAL EXTRACTABLES	Water	47 - 93	24 - 127
	Soil	65 - 107	28 - 142
	Water (2)	49 - 92	24 - 127

NOTES:

(1) EPA advisory limits expressed as a percentage.
Source: Organics - EPA, Contract Laboratory Programs, September 1986
(2) Surrogate sample from soil rinsate results.
(3) Percent recovery of surrogate spike value taken from potable drilling water analytical report.

the sampler and subsequently analyzed for the same parameters as the field samples. Results from the sampler rinsate sample showed concentrations of methylene chloride, toluene and bis (2-ethyl hexyl) phthalate below the quantifiable detection limit. The silo water rinsate sample contained concentrations of methylene chloride, chloroform, ethyl benzene, bis (2-ethyl hexyl) phthalate and di-n-butyl phthalate below detection limits. Total lead was detected at 0.006 mg/l in the silo rinsate. The soil rinsate contained low levels of methylene chloride and di-n-octyl phthalate, both of which were found in the method blank and bis (2 ethyl-hexyl) phthalate below the detection limit.

Document control was used in this investigation to provide QA/QC for sampling protocol and sample Chain-Of-Custody. Documents were completed and signed in the field by the sampling personnel to assure adherence to QA/QC guidelines.

Field Sampling Reports were completed at each sampling location. These documents included sample identification, number and type of sample containers, and the preservation method. The Field Sampling Reports also record the sampling personnel, the sampling method, and specific sampling protocol. The Field Sampling Reports for ATLAS Site S-10, contained in Appendix F, record the QA/QC data for sampling.

Chain-of-Custody Reports were maintained for each cooler used to ship samples to the analytical laboratory. The reports were completed by field sampling personnel and the scientist who received the samples at the laboratory. These reports indicate that all the samples were received by the laboratory in satisfactory condition for the requested tests. Chain-of-Custody Reports are contained in Appendix F.

A sample tracking record is shown in Table 4-8. All samples were analyzed within specified holding times. Specified holding times were dictated by the Work Plan contained in Appendix I.

TABLE 4-8
SAMPLE TRACKING RECORD
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

ANALYSIS	MEDIA	DATE SAMPLED	LAB RECEIPT	DATE ANALYZED	MAXIMUM HOLDING TIMES SPECIFIED BY METHOD[1]	MAXIMUM HOLDING TIMES ACTUAL
METALS	Soil	11/11/87	11/12/87	11/17 - 18/87	6 months	7 days
	Ground water	12/11	12/12	12/15 - 1/6/88	6 months	26 days
	Silo water	12/11	12/12	12/15 - 1/6/88	6 months	26 days
EXTRACTABLES	Soil	11/11	11/12	11/17 (ext),12/1-2	7 days until extrac-	6 (ext), 21 days
	Ground water	12/11	12/12	12/18 (ext),1/5/88	tion & 40 days after	7 (ext), 24 days
	Silo water	12/11	12/12	12/18 (ext),1/5/88	extraction	7 (ext), 24 days
PURGEABLE ORGANICS	Soil	11/11	11/12	11/21 - 22	14 days	11 days
	Ground water	12/11	12/12	12/23	14 days	12 days
	Silo water	12/11	12/12	12/25	14 days	12 days

NOTES:

(1) Mercury specified maximum holding time 28 days.

4.6 FACTORS INFLUENCING RESULTS

Low concentrations of methylene chloride, chloroform and toluene were found in selected samples. The concentrations of methylene chloride in the samples were consistent with the concentrations detected in the method blank. Equivalent detectable concentrations in the laboratory method blank indicate the introduction of low level contamination during sample preparation in the laboratory or laboratory analysis procedures. Concentrations of chloroform and toluene were reported in the rinsate and trip blank samples of the ground and silo water analyses. The presence of these constituents in these samples and not the monitoring well samples suggests the de-ionized water supplied by the laboratory for rinsate samples and the de-ionized water in the trip blank were contaminated in the laboratory.

An inquiry to the chemical laboratory, Ecology and Environment, Inc., into the source of the phthalate compounds (di-n-butyl phthalate, di-n-octyl phthalate and bis (2-ethyl hexyl) phthalate) in the laboratory was made subsequent to sample analyses. Results indicate the phthalate compounds were being exposed to the sample through a technician's plastic gloves. Therefore, samples which reported the presence of phthalate compounds which were similar to levels reported in the method blank should be evaluated as contaminated by the laboratory and not the present at the site (verbal, Tony Bogolin, Ecology and Environment, Inc., January 26, 1988). A letter from the laboratory commenting on this source of contamination is included in Appendix F.

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5.0 INTERPRETATION OF TEST RESULTS

5.1 EVALUATION OF SITE CHARACTERISTICS

ATLAS Site S-10 is located in the community of Harrigan's Corner of the northeast Adirondack region of New York State (see Figure 2-1). The area is chiefly comprised of foothills underlain by Cambrian age sedimentary rocks and deposits of glacial till. Ground water occurs primarily in secondary openings of bedrock and in the till deposits.

Monitoring wells installed at Site S-10 were screened in the till overburden and in bedrock at varying depths. Soils encountered ranged from silty sands to sandy silts with cobbles and boulders. Rock encountered was generally a competent quartz sandstone occasionally becoming arkosic with weathered fractures zones. Hydraulic conductivity test results correspond to materials screened ranging from 1.5×10^{-3} to 7.8×10^{-4} cm/sec.

Ground water was encountered at varying depths ranging from 8.36 to 61.60 below the top of the PVC riser. These depth to water measurements indicate perched zones of ground water at the site. The direction of ground-water flow could not be calculated due to the wide variation of water levels in the wells.

Topography at the site is a gentle grade with the only notable relief being the built up area around the missile silo. Surface drainage follows the topography to the south towards Thurber Brook. A drainage swale exists in the eastern area of the site which also drains to the south.

5.2 EVALUATION OF TEST RESULTS

The analytical results for this study are summarized in Tables 4-2, 4-3, and 4-5 of this report. Tables 5-1, 5-2, and 5-3 lists

TABLE 5-1

SUMMARY OF GROUND WATER CONTAMINANT
LEVELS COMPARED TO CURRENT STANDARDS
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

Parameter	Maximum Concentration (mg/l)	Sample Location	MCL[1] (mg/l)
Purgeable Aromatics and Halocarbons			
Trichloroethylene	<0.005	MW-1001-D	0.005
Toluene	<0.005	MW-1001-D	2.0[2]
Metals (Total)			
Barium	0.089	MW-1001-D	1.00
Lead	0.013	MW-1003	0.05

NOTES:

(1) Maximum Contaminant Level, EPA, 1985.
(2) Maximum Contaminant Level Goal (MCLG), EPA, 1985.

TABLE 5-2

SUMMARY OF SILO WATER CONTAMINANT
LEVELS COMPARED TO CURRENT STANDARDS
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

Parameter	Maximum Silo Water Concentration (mg/l)	MCL[1] (mg/l)
Metals (Total)		
Barium	0.029	1.00
Lead	0.027	0.05

NOTES:

(1) Maximum Contaminant Level, EPA, 1985.

TABLE 5-3
SUMMARY OF SOIL CONTAMINANT
CONCENTRATIONS COMPARED TO AVERAGE BACKGROUND LEVELS
ATLAS SITE S-10
HARRIGAN'S CORNER, NEW YORK

Parameter	Maximum Concentration (mg/kg)	Sample Location No.	Typical Concentrations of Soil[1]
Base Neutral Extractables			
Phenanthrene	<0.33	S-3	NA
Pyrene	<0.33	S-3	NA
Metals (Total)			
Arsenic	3.23	S-6	6 (1-40)
Barium	358.	S-6	500 (100-3000)
Chromium	8.9	S-5	100 (5-3000)
Lead	33.5	S-1	10 (2-200)

NOTES:

(1) Average concentrations and range of concentrations, (Bowen, 1966).

(2) < = Detected but below measurable detection limit.

NA = No Typical soil concentration has been established for this constituent in soil.

the maximum ground water, silo water and soil concentrations for the parameters detected at Site S-10. For comparison, the two tables containing silo and ground water results also list the federal regulatory criteria. The table containing the soil results list typical background levels (Bowen, 1966) for naturally occurring metals in soils.

5.2.1 Ground Water

Two purgeable organic compounds, trichloroethylene and toluene, were reported present below the detection limits. Both constituents were detected in monitoring well MW-1001-D. The toluene concentration was below the Maximum Contaminant Level Goal (MCLG) of 2.0 mg/l and trichloroethylene was below the Maximum Contaminant Level (MCL) of 0.005 mg/l. These constituents may be the result of DOD activities, however, their concentrations are below federal standards and do not constitute contamination as defined in the Statement of Work (SOW).

Total barium was reported in each of the three monitoring well samples and the duplicate. The highest concentration, 0.089 mg/l, detected in well MW-1001-D is below the MCL of 1.0 mg/l. The highest total lead concentration reported (MW-1003) was below the MCL of 0.05 mg/l. These concentrations of total metals are believed to represent background levels.

5.2.2 Silo Water

The silo water results indicate no purgeable organic or base/neutral compounds related to the site. Two total metals, barium and lead, were detected in the samples but the concentrations were below the MCL's of 1.0 and 0.05 mg/l, respectively. Based on the analysis the silo water is not contaminated.

5.2.3 Soil

Analytical results of surficial soil sampling indicated no purgeable organic compounds related to the site. Base/neutral extractable results indicate two compounds, phenanthrene and pyrene, present in soil sample S-3 both below the detection limits. Phenanthrene and pyrene are constituents in gasoline and coal tar may be the result of DOD activities. There are currently no federal or state standards for these constituents in soil.

Four metals were also detected in the soil samples. These metals include arsenic, barium, chromium and lead. All concentrations reported are below or within the average background range (Bowen, 1966). Barium in sample S-6 was anomalously elevated (358 mg/kg) but still within the typical average background range. These concentrations are believed to be background and not indicative of contamination.

6.0 PRELIMINARY CONCLUSIONS AND RECOMMENDATION

The purpose of this investigation was to assess the presence of contaminants in the ground water, silo water and soils at the site which may be related to DOD activities.

Based on evaluation of the test results collected from the investigation, the data can be summarized as follows:

- Ground-water analyses reported toluene and trichloroethylene present below detection limits in the sample from monitoring well MW-1001-D. These concentrations are below federal standards and do not represent contamination.

- The silo water is not contaminated for the parameters analyzed.

- Soil analyses from sample S-3 indicate two constituents, phenanthrene and pyrene present below detection limits.

- Results of metals analyses in the soil samples were all below or within the average background range (Bowen, 1966). Barium in sample S-6 was the only high value reported in comparison within the other soil samples. The level of barium is within the normal background range.

The following conclusions and recommendation are based on data collected and evaluated at ATLAS Site S-10:

- Low level contamination is suspected in the ground water at well location MW-1001-D due to the detectable presence of toluene and trichloroethylene. These unquantifiable concentrations are below federal standards and pose no great environmental concern.

- Water in the missile silo is uncontaminated for the parameters analyzed.

- Detectable concentrations of phenanthrene and pyrene, both constituents in gasoline and coal tar, were found in soils at location S-3. There are no federal standards for these compounds in soil.

- An anomalous barium level was reported in soil sample S-6. This concentration is within the typical average background range for barium and is not considered to be indicative of environmental contamination at the site.

Based on the preceding conclusions, we recommend ATLAS Site S-10 in Harrigan's Corner, New York not be referred to the Missouri River Division (MRD) for further investigation.

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