DRAFT FINAL

SITE INSPECTION WORK PLAN
RSA-94, 95, 96, 97, 98

EPA ID NO. AL7 210 020 742

REDSTONE ARSENAL
MADISON COUNTY, ALABAMA

FEBRUARY 1996

DRAFT FINAL TECHNICAL SCOPE OF WORK

FOR

SITE INSPECTIONS

RSA-94, 95, 96, 97, 98
EPA ID NO. AL7 210 020 742

REDSTONE ARSENAL
MADISON COUNTY, ALABAMA

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1.0 INTRODUCTION

The U.S. Army is evaluating past hazardous waste management practices at Redstone Arsenal (RSA) in Madison County, Alabama. The U.S. Army Corps of Engineers (USACE), Savannah District, on behalf of the U.S. Army Missile Command at RSA has contracted Rust Environment & Infrastructure (Rust) for the required work at five sites (RSA 94, 95, 96, 97, and 98) under contract number DACA 2193-D-0029, delivery order 025.

These evaluations are being performed in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) following RSA's placement on the National Priorities List (NPL) on June 30, 1994. The evaluation activities will be structured as Site Inspections (SIs) in accordance with CERCLA guidance (EPA, September 1992).

This Work Plan has incorporated the CERCLA SI requirements of a work plan, a field sampling plan, and an Investigation Derived Waste (IDW) plan into a single document which will be referred to as a Technical Scope of Work (TSOW). The detailed field procedures to be used in this SI are presented in Appendix A of this TSOW. This work plan also includes a Site Safety and Health Plan (SSHP) to establish the guidelines to protect the health and safety of investigative personnel and any nearby public.

1.1 OBJECTIVES

The objectives of the SI will be to determine whether or not releases have occurred at the associated project sites and to provide information to be used in accessing the threat to human health and the environment, thus determining the need for further action. This Work Plan presents the investigative approach, detailed task, and rationale for conducting the SIs at the five locations on RSA.

Specifically the work will be conducted to:

- Determine shallow site stratigraphy to the depth of the soil borings,
- Verify the presence or absence of site specific contaminants in the soil,
- Verify the presence or absence of site specific contaminants in the shallow groundwater, and
- Determine the optimum approach for future investigation, if warranted.

1.2 SCOPE OF WORK

The data required to achieve the project objective will be collected during two separate field events. The first event is designed to provide screening level data which will be used to tailor the additional investigation proposed for the site. This initial event will include a soil gas survey to help determine the ideal placement for sample collections, which will be conducted during the second field event. The second event will include intrusive activities such as soil borings by drill rig to collect soil samples, and the collection of groundwater samples by Hydropunch II™ (HPII) or from open boreholes, if groundwater samples can not be obtained with the HPII. Specific site activities are described in Section 4.2 and are listed in Table 4-1.

The results from the second field event will be evaluated to determine the next step in the investigative process. If the field data from a site results in no detection of contamination, then more data collection still may be required for a decision that no further evaluation is necessary at that site. If contamination is found at a site, then additional site inspection activities may be warranted at the site. In the event that the site inspection at a site needs to be expanded, additional investigation activities are proposed in Section 4.3. The purpose for including these additional investigation activities is to allow these activities to proceed without having to generate a new work plan. It should be noted, however, that the actual type, location, and number of additional samples needed at a site will be decided jointly between the U.S. Army Missile Command, the USACE, the U.S. Environmental Protection Agency (EPA), and the Alabama Department of Environmental Management (ADEM).

2.0 BACKGROUND INFORMATION

This section presents background information relevant to this SI. Included is a general description of the RSA installation, its vicinity and environmental setting, and a description of the five sites included in this project.

2.1 INSTALLATION DESCRIPTION

The following sections provide a description of RSA and the five sites to be investigated in terms of location and historical operations. Information contained in this section was obtained from the USACE Scope of Services dated March 1995, a site visit by Rust personnel on July 19, 1995, and a literature review.

2.1.1 Historical Data Review

The information provided by USACE's Scope of Services was confirmed and some new information was generated by a Rust historical review/archive search. This search centered around general information on the locations and past practices at the five sites now identified as Solid Waste Management Units (SWMUs), which are the focus of this investigation. The review for each site consisted of interviews with installation officials and review of previous investigations, if available, as well as historical documents.

2.1.2 Location

RSA is a U.S. Army facility located in southern Madison County, Alabama (Figure 2-1). RSA occupies approximately 38,000 acres. It is bounded on the north and east by the City of Huntsville, on the southwest by Wheeler National Wildlife Refuge (WNWR), on the south by the Tennessee River Valley Authority (TVA) property and the Tennessee River, and on the west by agricultural, residential, and light industrial property (Figure 2-2).

2.1.3 History and Operation

The majority of land within RSA is controlled by the Department of the Army; however, several tenants have operational facilities on the installation. The National Aeronautics and Space Administration's (NASA's) Marshall Space Flight Center (MSFC) has leased 1,841 acres of land since 1960, which was formerly used by the Army. At that time, the Army had

transferred their civilian rocket and missile activities to NASA. Today, MSFC is involved in the development, testing, and manufacturing of space vehicles and components. Thiokol Chemical Corporation, a government contractor, began development of various types of rocket propellant at RSA in 1949. Presently, Thiokol continues to manufacture rocket motors at a leased facility located in the southeast portion of the installation. International Specialty Products (ISP), formerly the General Aniline and Film (GAF) Corporation, which also began operations in 1949, leases approximately 10 acres of land in the central portion of RSA for the production of iron carbonyl. Other areas located within the boundaries of RSA are 2,900 acres of land owned by TVA and 4,100 acres of land owned by the Department of Interior and designated as WNWR.

The present day boundaries of RSA include what was originally three separate Army facilities. The land for the three facilities was originally owned by TVA but was made available to the Army by a Land Use Management document signed by Franklin D. Roosevelt in 1941. The facilities; the Redstone Ordnance Plant, the Huntsville Arsenal, and the Gulf Chemical Warfare Depot; worked together from 1942 to 1945 producing conventional and chemical munitions for use during World War II. At the height of the chemical agent production between 1942 and 1943, six mustard gas manufacturing plants and four lewisite manufacturing plants were active at the installation. Following the war, a series of reductions in the operational capacities of the facilities placed them on standby status. In 1947, the functions of the Gulf Chemical Warfare Depot were incorporated into those of the Huntsville Arsenal which was eventually declared surplus. Eventually, Redstone Ordnance Plant became the caretaker for the Huntsville Arsenal properties and was recognized as Redstone Arsenal. RSA was reactivated in 1949 and tasked with research and development of rocket and missile systems. More land was needed to continue this work so the Army incorporated all land that was previously used by the Huntsville Arsenal and the Gulf Chemical Warfare Depot into one installation and also established a land use agreement with TVA, the Department of the Interior, and WNWR to use their land. This entire area is currently recognized as RSA.

2.2 ENVIRONMENTAL SETTING

This section provides a general description of the physiography, topography, drainage, demography, land use, climate, ecology, geology, and hydrogeology of RSA and vicinity.

2.2.1 Physiography, Topography, and Drainage

RSA is located in the Highland Rim section of the Interior Low Plateau Physiographic Province which bounds the Cumberland Plateau section of the Appalachian Plateau Physiographic Province (ESE, 1993).

The topography of RSA is gently rolling and slopes from north to south toward the Tennessee River. The highest elevations are located in the Weeden and Madkin Mountains which are erosional remnants of the Cumberland Plateau. The lowest elevations are found in valleys and flood plains of the Tennessee River and its tributaries. Elevations of RSA range from 556 feet mean sea level (msl) along the Tennessee River to 765 feet msl along the northern boundary (ESE, 1993).

Surface drainage at each site included in this investigation is controlled by local topography which may have been altered during historical operations. The Tennessee River, comprising the southern boundary of RSA, is the major drainage feature in the area and flows west (Figure 2-3). Huntsville Spring Branch, McDonald Creek, and Indian Creek are major tributaries flowing southward to the Tennessee River. Approximately 90 percent of the drainage from RSA passes through Wheeler lake before entering the Tennessee River. Wetlands are associated with the Tennessee River, its tributaries, and creeks (ESE, 1993).

The 100-year flood level of the Tennessee River is at an elevation of approximately 572.5 feet msl. Much of the southern part of the facility is topographically below this elevation (ESE, 1993).

2.2.2 Demography and Land Use

RSA is located in the southern portion of Madison County, Alabama, which has a population of over 233,000. The City of Huntsville, a metropolitan area with a population of approximately 175,000, is located adjacent to the northeast corner of RSA. The facility employs nearly 21,000 government workers and contractors with approximately 1,000 military families residing in government quarters on the installation (ESE, 1993).

Huntsville was established as a textile center in the late 1800s. In 1941, with the location of RSA, Huntsville became a leading science and technology center. Presently, Huntsville comprises approximately 154 square miles of the 806 square miles which make up Madison

County. The population of Huntsville has more than quadrupled since 1950. Except for the emergence of a number of industrial parks and RSA, rural and agricultural areas surround Huntsville (PELA, 1988).

Approximately 15,500 acres of woodlands and 9,200 acres of land contained within RSA have been leased for agricultural use. The U.S. Department of Agriculture's Soil Conservation Service has classified the land leased for agricultural use as prime farmland or lands of state importance. Prime farmland is land that is agriculturally most productive with the least impacts and adverse environmental effects. Approximately 10 percent of RSA has been developed with maintained grassy areas, buildings, roads, and RSA facilities (ESE, 1993).

2.2.3 Climate

RSA is located in a temperate climate with hot summers and mild winters. Based on climatological data obtained between 1986 and 1992 from the Redstone meteorological service, the average annual temperature was 61 degrees Fahrenheit (°F). The average temperature in summer was 76°F and the average temperature in winter was 44°F. Precipitation at RSA is generally in the form of rain with an average annual rainfall of 50.83 inches and an average annual snowfall of 2.68 inches. The highest amounts of rainfall averaged approximately 5.3 inches for both the months of November and December. The lowest amount of rainfall occurred in October with an average of 3.35 inches. Snowfall generally occurs in the months of December, January, February, and March. The first freeze generally occurs in late October and the last freeze generally occurs in late March and early April (PELA, 1988).

Autumns at RSA are generally dry with the first freeze occurring about late October. Winters at RSA are generally cool but may vary from year to year. Extremely cold weather is rare. During winter, cold, dry air masses prevail over the area, however, mild air occasionally moves northward from the Gulf of Mexico and may create several days of warmer conditions. Extensive periods of cloudiness and rain may occur in winter when contrasting air masses interact. Flooding is most common during this time of year; however, extensive flooding is not common (ESE, 1993).

Warm moist air gradually replaces cold air during the transition from winter to spring and thunderstorms commonly develop at the interface of these two air masses. Spring

thunderstorms may become intense and generate locally severe weather. Warm, humid weather and frequent thunderstorms occur during summer with temperatures often reaching the mid to upper 90°F range (ESE, 1993).

2.2.4 Ecology

RSA is made up of three primary ecological units; upland forests, grass lands, and wetlands. Upland forests are comprised of lands above an elevation of approximately 570 feet msl. Grass lands are generally leased agricultural land and are also generally above an elevation of approximately 570 feet msl. Wetland areas consist of permanently and occasionally inundated land and associated areas. These areas are primarily controlled by the TVA's Wheeler Dam flood control program and secondarily controlled by other factors including beaver activity.

Upland forest land consists of pine plantations, mixed hardwood and pine, and hardwood forests (ESE, 1993). These forests contain deciduous and evergreen trees including loblolly, shortleaf and Virginia pines, oaks, gums, and ash. Vines and shrubs associated with the mostly young plantations include honeysuckle, blackberry and trumpet creeper. Forested land provides good habitat for mammals, birds, and other wildlife including white-tailed deer, rabbits, squirrels, fox, woodcock, turkey, owls, woodpeckers, turtles, snakes, and frogs.

Grassed lands are primarily leased agricultural land used for grazing cattle. This habitat is host to mostly shrubs, vines, and grasses including elderberry, sumacs, poison ivy, kudzu, fescue, broomsedge, white clover, ragweed, and poke weed. Grass lands provide food and cover for mammals, birds, and other wildlife including opossum, woodchuck, coyote, dove, falcons, hawks, starlings, and snakes.

Wetland areas at Redstone include portions of the Tennessee River, WNWR, creeks, lakes, swamps, and adjacent associated areas. The water level in the Tennessee River fluctuates seasonally according to the flood control mission of Wheeler Dam. Water levels rise in the spring and decrease throughout the rest of the year causing fluctuations in its tributary system. Beaver activity also influences low lying areas with periodic and sometimes permanent inundation.

Wetlands support a variety of plant life including water oaks, black gum, Eastern cottonwood, black willow, lily pads, and aquatic grasses. Wetland areas host an abundant

array of mammals, reptiles, amphibians, fishes, and invertebrates including beaver, muskrat, cottonmouth moccasin, water snakes, frogs, salamanders, turtles, bluegill, bass, crappie, catfish, and carp. Insect life is abundant including dragonfly, horsefly, mosquito, gnats, ticks, and chiggers. WNWR attracts many species of waterfowl including ducks and geese and provides wintering habitat for migrating flocks.

RSA provides suitable habitat for three endangered species to include the bald eagle (*Haliaeetus leucocephalus*), gray bat (*Myotis grisescens*), and Alabama Cave shrimp (*Palaemonias alabamae*). The U.S. Department of the Interior has identified areas where each may be found at RSA as follows: the bald eagle and the gray bat along the Tennessee River and the Alabama Cave shrimp is native to Bobcat Cave on the installation.

2.2.5 Regional Geology

RSA is underlain by metamorphic and plutonic mid-Precambrian age basement rocks which are overlain by sedimentary rocks ranging in age from Ordovician to Pennsylvanian (ESE, 1993). The Nashville Dome influences the regional structure of these units. Consequently, the sedimentary rock units dip approximately 20 feet per mile to the south and southwest. Vertical fracture zones related to stress relief are present within the sedimentary units. Surface features related to these fracture zones are not obvious at land surface in the Highland Rim Section due to the presence of thick residual soils. The presence of these fracture zones has resulted in the formation of solutionally developed linear caves (USGS, 1987).

The sedimentary rock units underlying RSA are predominantly Mississippian in age. These units include the Monteagle Limestone, Pride Mountain Formation, Hartselle Sandstone, and Bangor Limestone, which underlie mountainous areas, and the Tuscumbia Limestone which underlies the greatest portion of the installation. The Fort Payne Chert of Mississippian age and the Devonian age Chattanooga Shale underlie the Tuscumbia Limestone. A geologic map of RSA is shown in Figure 2-4.

The Fort Payne Chert is a dark gray siliceous limestone with abundant beds of up to 50 percent chert (USGS, 1987). The Fort Payne Chert is 155 to 185 feet thick and contains many solutional features (USGS, 1987). The surface of the Fort Payne Chert is marked by a consistent layer of residual weathered material known as regolith which is mostly clay and

may be as much as 100 feet thick. The regolith may contain layers of chert rubble near bedrock (USGS, 1987).

The Chattanooga Shale is composed of dark gray to black, thinly bedded shale with sandstone layers occurring at the base. It is typically 10 feet thick (USGS, 1987).

The Tuscumbia Limestone is composed of gray, thin to thick bedded, fossiliferous limestone with chert layers and nodules. Enlarged openings have developed in the limestone along joints, fractures, bedding planes, and faults. Caves and cavities have formed from dissolution of the limestone and contributed to the formation of sinkholes and depressions in the land surface (PELA, 1988).

Residual soils composed of sandy clay and of chert and limestone fragments in a clay matrix overlie the Tuscumbia Limestone. Composition of the overburden is dependent upon the composition of the parent rock from which it was derived. Therefore, clayey sand lenses are present where overburden soils were formed from limestone containing significant amounts of sand.

2.2.6 Hydrogeology

The residual soil overburden, Tuscumbia Limestone, Fort Payne Chert, and Chattanooga Shale are the principal hydrogeologic units in the study area.

The Tuscumbia Limestone and the Fort Payne Chert compose the limestone aquifer. The top of the Chattanooga Shale is considered the lower confining unit for the limestone aquifer. The overburden may act locally as the upper confining unit for the limestone aquifer. Water in the limestone aquifer generally occurs under artesian conditions (PELA, 1988). Recharge to the limestone aquifer is generally derived from water in the overburden and occurs more rapidly where the overburden contains greater percentages of permeable chert debris. Water in the limestone aquifer is generally stored and transmitted in the upper 100 feet where solutionally enlarged bedding planes, fractures, and cavities are more common. This water generally moves to lowland areas where it is discharged as springs or to streams. The general direction of groundwater flow is toward the Tennessee River; however, it may be influenced by other surface water bodies or pumping.

The overburden generally acts as an overall confining unit above the limestone aquifer. However, more permeable zones containing sand or chert may contain groundwater under water-table, confined, or semi-confined conditions. These permeable zones may be isolated or interconnected. The lower portion of the overburden is more permeable due to the greater percentage of chert and limestone fragments it contains. This zone is in hydraulic connection with the underlying limestone aquifer. Groundwater flow in the overburden generally follows topography and moves toward lower elevations where it is discharged to streams and swamps or lost through evapotranspiration.

3.0 SITE DESCRIPTIONS/PREVIOUS INVESTIGATIONS

The five sites, RSA-94, 95, 96, 97, and 98, will be described briefly in this section. All five sites are located in the Thiokol North Plant area (Figures 3-1 and 3-2). There have been no previous investigations conducted specifically at these sites that directly address the solvents/degreaser/distillation units in question; however, a previous RFI for RSA-142 was conducted in the immediate vicinity of RSA-96 (Building 7740).

3.1 RSA-94 (SOLVENT DEGREASER/STILL)

RSA-94 is a solvent degreaser/distillation unit located in Building 7625 (Figure 3-3). The solvent degreaser/distillation system is centrally located within the building and set inside a concrete pit. The degreaser is currently being used for degreasing rocket motors using a vapor degreasing method. This method employs a technique which volatilizes the solvent fluid with heating coils and circulates the vapor through the rocket motors. Cooling coils condense the solvent vapor and recirculates the solvent through the system. The solvent is then circulated into an adjacent still for solvent reconditioning and waste removal. The solvents reportedly used in this system were trichloroethene (TCE), from 1984 to 1989, and 1,1,1 trichloroethane (TCA), from 1989 to present. The system is self contained, preventing solvent spills or releases into the concrete pit. However, if a solvent release occurred, the concrete pit is equipped with a sump pump to recover any solvent released in the pit.

The site is situated at an elevation of approximately 580 feet msl and located in an upland area where surface runoff flows into small drainage features that flow northwest toward a tributary of Huntsville Spring Branch. Groundwater flow is presumably to the west-northwest. No documented releases have occurred. However, if a release did occur, the primary avenue for solvent migration would likely be through the concrete pit to soils underlying the building.

3.2 RSA-95 (SOLVENT DEGREASER/STILL)

RSA-95 is a solvent degreaser/distillation unit located in Building 7368 (Figure 3-4). Although the degreaser/distillation system has been removed, the solvent degreaser/still pit remains in the southeast wing of the building. The degreaser was reportedly used for degreasing rocket motors using a vapor degreasing method (see degreaser/still description in Section 3.1). No documented releases have occurred. However, if a release did occur,

the primary avenue for solvent migration would likely be through the concrete pit to soils underlying the building.

RSA-95 is situated at an elevation of approximately 575 feet msl and is located on or near a drainage divide with surface runoff flowing into shallow drainage features that discharge to palustrine wetlands either to the east or west of the site. A previous investigation of RSA-142 (approximately 600 feet to the south) indicates that this area lies above a groundwater divide with shallow groundwater flowing either toward the east or west from the site.

3.3 RSA-96 (SOLVENT DEGREASER/STILL)

RSA-96 is a closed solvent degreaser/distillation unit located in Building 7740 (Figure 3-5). The closed degreaser/distillation system remains in the southeast corner of the building. The degreaser was reportedly used for degreasing rocket motors using a spray degreasing method with a design similar to that of the vapor degreaser (as described in Section 3.1).

Six monitoring wells, RS-447, RS-448, RS-449, RS-450 RS-455, and RS-456, exist adjacent to the outside walls of Building 7740 (Figure 3-5). These wells were installed as part of a Resource Conservation and Recovery Act (RCRA) Facility Investigation of RSA-142 (Engineering-Science, May 1994). Four of the wells (RS-447, RS-449, RS-455 and RS-456) are shallow wells completed in the water table aquifer that occurs in the near-surface residual materials. Well RS-448 is a bedrock well paired with the shallow well RS-447, and well RS-450 is a bedrock well paired with the shallow well RS-449. The water table in the area occurs approximately 10 feet below land surface. Groundwater flow in the water table aquifer is toward the east in the direction of a wetland area located southeast of Building 7740. Groundwater samples collected from the six wells have contained low to high concentrations of TCE. Some of the highest TCE concentrations were detected in the two bedrock wells, RS-448 and RS-450. The TCE concentrations detected in groundwater samples collected from the six wells in September 1993 are tabulated below.

Well Identification Number	TCE Concentration (micrograms per liter, ug/L)
RS-447	13J
RS-448	19,000
RS-449	21,000J
RS-450	12,000J
RS-455	3,400
RS-456	3,800

J - Means estimated concentration below the quantitation limit

The actual source of the TCE in the groundwater beneath the Building 7740 currently is not known, but may be related to past activities at the building. The possibility also exists that the TCE in the groundwater beneath Building 7740 migrated to the site from an upgradient source, possibly RSA-142.

The RSA-96 site is situated at an elevation of approximately 575 feet msl. Surface runoff empties into several small drainage features that eventually discharge into a forested palustrine wetland adjacent to the site. The wetland exists approximately 200 feet to the southeast of the Building 7740 within the floodplain of an unnamed tributary that flows south to a confluence with the Tennessee River.

3.4 RSA-97 (SOLVENT DEGREASER/STILL)

RSA-97 is a closed solvent degreaser/distillation unit located in Building 7726 (Figure 3-6). The degreaser/distillation system and concrete pit were located in the northwest wing of the building; however, the system has been removed and the pit backfilled with gravel and a concrete cap. The degreaser was reportedly used for degreasing rocket motors using a spray degreasing method with a design similar to that of the vapor degreaser (as described in Section 3.1). No documented releases have occurred. However, if a release did occur, the primary avenues for solvent migration would likely be through the concrete pit to soils underlying the building.

The site is situated at an elevation of approximately 585 feet msl and is located near a drainage divide with surface runoff and groundwater flow presumably flowing to the east or

southeast toward an unnamed tributary which flows south to a confluence with the Tennessee River.

3.5 RSA-98 (SOLVENT DEGREASER/STILL)

RSA-98 is an active solvent degreaser/distillation unit located in Building 7346 (Figure 3-7). The solvent degreaser/distillation system and concrete pit remain in the southern end of the building. The degreaser is used for degreasing rocket motors using a vapor degreasing method (see Section 3.1 for degreaser/still description). An aboveground storage tank is located on the exterior of the building adjacent to the solvent degreaser/distillation unit. If a release were to occur from the solvent degreaser/distillation unit, the released material would be pumped from the sump beneath the unit through subsurface piping to the aboveground tank for temporary storage. No documented releases have occurred from the unit or associated above ground tank. However, if a release did occur, the primary avenues for solvent migration would likely be sump to soils underlying the building.

The site is situated at an elevation of approximately 580 feet msl and located near a drainage divide with surface runoff and shallow groundwater flowing presumably to the west toward a drainage which discharges into Huntsville Spring Branch.

4.0 SAMPLING LOCATIONS AND RATIONALE

Contaminant release scenarios have been considered for each site based upon Rust's knowledge of past operations and waste management practices, results of previous investigations, and observations made during a site visit. An investigation strategy and site-specific sampling plans have been developed based upon these scenarios. The main objective of the investigations is to identify the presence of a release at a site or determine the source of contamination at a site, if already detected. The sampling plans are designed to address the media and locations where a release would most likely be detected. Specific site activities are described in Section 4.2 and are listed in Table 4-1. If contamination is detected, then subsequent investigations will be used to assess the extent of contamination, the risk posed by the contamination, and finally to recommend the next appropriate action. These subsequent investigations, if warranted, are proposed in Section 4.3. The purpose for including these additional investigative activities in this work plan is to allow these activities to proceed without having to generate a new work plan. The actual type, location, and number of additional samples needed at a site, however, will be decided jointly between the U.S. Army Missile Command, USACE, EPA and ADEM.

Based upon the history of use of the sites under investigation, the most likely media impacted by a release would be the underlying soils and groundwater. Therefore, soil gas screening, and soil and groundwater sampling are the investigative activities selected for this site inspection. Soil contamination can result from leakage from the surface concrete sump or from subsurface drain piping which received solvent discharge from the degreaser/distillation units. Groundwater contamination can result from percolation of liquid contaminant to the water table or contact between contaminated soils with infiltrating waters in the unsaturated zone.

RSA-94, 95, 97, and 98 have no documented soil or groundwater contamination. In these areas, soil gas surveys, as described in Section 4.1.1, will provide a screening tool to target areas where subsurface investigations are needed. Based on the results of the soil gas survey, proposed subsurface soil and groundwater sampling locations will be relocated, if necessary, for a more accurate characterization of impacted soils. If subsurface contamination is detected at any of these four sites and it is determined that additional site inspection activities are warranted, then additional soil and groundwater sampling be conducted at the site or sites as described in Section 4.3.

As discussed in Section 3.3, soil and groundwater contamination, primarily by TCE, have been documented in the area of RSA-96, which is located within Building 7740. A soil gas survey, as described in Section 4.1.1, will be used as a screening tool to possibly identify areas where contaminants may have been released around Building 7740. The proposed subsurface soil and groundwater sampling locations will be placed around Building 7740 in an effort to determine whether the TCE detected in the groundwater beneath the building originated from the immediate vicinity of the building, possibly from the solvent degreaser/distillation unit, or migrated to the area from an upgradient source. The additional site inspection activities proposed in Section 4.3 are not appropriate for the RSA-96 site, because groundwater contamination has already been confirmed at the site.

4.1 TECHNICAL APPROACH

This section describes the sampling equipment, sampling procedures, and sampling methods which will be used in the field sampling program. The methods of investigation described in the following sections will be applied to all five sites being investigated during this project. All field investigative procedures and methods to be employed during this project are summarized in Table 4-1.

4.1.1 Soil Gas Survey

A PETREX soil gas survey will be conducted at all five sites in order to screen for the presence of volatile organic compound (VOC) and semivolatile organic compound (SVOC) vapors. Soil gas survey results will be used to finalize soil boring and HPII sampling locations.

Each PETREX soil gas sampler consists of two or three collectors which are ferromagnetic wire coated with an activated charcoal adsorbent within a resealable glass tube. Soil gas sample collection will be performed by unsealing the sampler and placing the collector open end down in a shallow (14 to 18 inches) hand-augured borehole. The borehole will be backfilled with an aluminum foil plug and excavated soil. The location will be marked with ribbon flagging and a numbered pin flag. The sample location will be documented in the field log book and plotted on a field map. The sample will be collected via free vapor diffusion through the opening of the uncapped sampler. Following a controlled period of time (estimated to be three weeks), the sampler will be retrieved from the borehole using

a trowel and a pair of tongs, resealed, labelled, and submitted for analysis. The borehole will be backfilled with original excavated soil.

One collector from each sampler will be analyzed by thermal desorption/mass spectrometry (TD/MS). Selected second collectors, QA samples, may be analyzed by thermal desorption/gas chromatography/mass spectrometry (TD/GC/MS) in order to confirm results from TD/MS analyses. A third collector, a quality control (QC) wire, will be present in approximately ten percent of the total survey samplers and will be used by the laboratory to set instrument sensitivity prior to analysis and to compare the reproducibility of analytical results.

Additional samplers will be used to determine the optimum exposure period for sample collection. Two sets of three to five time calibration samplers will be installed at survey sample locations that best represent the range of soil gas response for the area, based on previous studies and site-specific conditions. The first set of time calibration samplers will be retrieved within one week of installation and analyzed, and the second set will be retrieved one week later. The length of exposure of the survey samplers will be determined by the results of the time calibration samplers. At the first indication of significant VOC and/or SVOC collection, the survey samplers will be retrieved. If there is no indication of significant VOC and/or SVOC collection for the second set of time calibration samplers, then the survey samplers will be retrieved following a maximum time period of 30 days.

Two PETREX samples containing a single collector wire will accompany the survey samplers as travel blanks. These blanks will be analyzed with the survey samplers to indicate whether contamination was introduced during installation or shipment.

Relative response values will be reported as ion counts for each VOC and/or SVOC. A color-coded contour map will be prepared for each VOC and/or SVOC based on ion count distribution and physicochemical considerations. Ion counts will be plotted on the contour map at their respective locations.

4.1.2 Site Land Survey

Following all the geophysical activities, the survey team will begin operations by locating RSA control and then establishing a minimum of one permanent monument to third order accuracy (1/100) on each RSA site. The survey will establish key boundaries with visual

reference markers. Also, the survey will provide locations for each anomaly and monitoring well. The survey data will be processed into a CADD file for incorporation into the site maps. All benchmarks will be tied into the State Planar Coordinate System. The procedure described above will be utilized to locate each borehole location following the field sampling effort.

4.1.3 Drilling and Subsurface Soil Sampling

Subsurface soil sampling will be accomplished using a truck mounted or all terrain vehicle mounted drilling rig equipped with 3 1/4-inch inside diameter (I.D.) hollow-stem augers (HSAs). The drill rig, HSAs, drilling tools, and down-hole equipment will be steam cleaned prior to mobilization to RSA, prior to drilling each boring, and prior to demobilization from RSA. Specific decontamination procedures are provided in Section 4.1.6.

Prior to drilling, the depth to the water table will be determined by one of the following methods. First, if the soil boring location is located on a site with existing monitoring wells, a water table surface map will be drawn based on the most recent water level measurements. Second, if monitoring wells do not exist near the boring location, the depth to the water table will be estimated based on the nearest surface water body and topographic features. When the depth of the estimate is approached, the drill cuttings and split spoon samples will be observed closely to determine when the first saturated zone is encountered.

Subsurface soil samples will be collected using a stainless-steel, 24-inch long, 2-inch outside diameter (O.D.) split-spoon sampler. Relatively undisturbed soil samples will be collected by driving the split-spoon sampler 24 inches with a 140-pound hammer free falling through 30 inches. Soil samples for lithologic classification will be taken continuously on 1.5 foot centers through the first 10 feet and sampled every 5 feet or change in soil type thereafter. Three soil samples from each soil boring will collected for laboratory analysis. The first soil sample will be taken from a depth of 0 to 1 feet, the second sample will be taken at half the anticipated depth to the water table, and the third sample will be taken from just above the water table. No sample collected below the water table will be submitted for chemical analysis. The soil samples will be analyzed for VOCs by SW-846 Method 8260. One representative soil sample will be collected from each soil boring for geotechnical analysis. The geotechnical parameters that will be tested include moisture content (American Society for Testing and Materials, ASTM, D-2216), Atterburg limits (ASTM D-4318), and grain size

(ASTM C-117 and C-113b). The total number of soil samples to be submitted for chemical and geotechnical analysis for each boring at each site is shown in Table 4-2.

Soil samples will be classified in the field by a geologist according to the Unified Soils Classification System (USCS) and ASTM D-2487 and D-2488 (ASTM, 1994). HTW Drilling Logs will be completed for each soil boring. Examples of HTW Drilling Log forms are provided in Appendix B.

On recovery from the boring, the split spoon sampler will be disassembled, and the soil sample will be divided into two aliquots- one for headspace screening/soil classification and the other for the laboratory sample. The sample will be placed in the jar in a manner to eliminate headspace to the degree possible. The balance of the soil collected will be homogenized in a decontaminated stainless steel bowl then placed into the remaining sample containers. Excess soil will be removed from the container mouth before the lid is placed on the container. The containers will be labeled properly as described in Section 4.1.7 and placed on ice in a cooler as described in Section 5.3. During sample collection, field personnel will wear clean, new disposable gloves. Care will be taken to prevent contact between the soil and the gloves.

If the expected sample interval is not reached due to auger refusal, then reasonable attempts to off-set the borehole and reach the desired depth will be made. However, if the depth cannot be achieved, then a substitute sample, collected from a shallower depth, will be considered, and the USACE will be notified. The substitute sample's acceptability will be based on sample screening and the probability of being exposed to the same contaminant transport mechanisms. If the substitute is acceptable, then the borehole will be considered complete.

Selection of soil samples for geotechnical analysis will be based primarily on lithologic changes across the area, and secondarily on depth. If a change in lithology is encountered, a representative sample of each lithological type will be submitted for geotechnical analysis as permitted within the constraints of the number of samples to be submitted from each area. The results from the geotechnical analysis are expected to provide information on various physical properties which assist in determining likely contaminant migration routes.

All soil cuttings from the soil boring will be placed adjacent to the borehole on plastic or other suitable material capable of precluding contact with the ground surface. All cuttings will be covered daily or during a rainfall event to prevent contact with moisture.

Following soil sampling (and groundwater sampling, see Section 4.1.4), the borehole will be left open for 24 hours to obtain groundwater elevations, and then the borehole will be backfilled using the soil cuttings from the boring. Replaced cuttings will be compacted to the extent practical and a 1 foot by 1 foot by 3 inches thick grout cap will be placed over the top of the borehole to prevent vertical migration of surface water. The abandoned borehole will then be surveyed into the State Planar System utilizing third order control as described in Section 4.1.2. The soil boring protocol is illustrated in Figure 4-1.

4.1.4 Hydropunch Groundwater Sampling

The HPII will be used as a groundwater sampling tool. HPII sample locations were determined based on available water table data and are located near suspected source areas. The depth to groundwater for HPII sampling will be determined prior to drilling as described in Section 4.1.3. HPII sampling will be conducted as described below.

1. HSAs (typically 3 1/4-inch I.D.) will be used to advance a borehole to the static water table level.

2. Organic vapor monitoring during drilling activities will proceed as outlined in Section 4.1.5. Organic vapor readings from the drill cuttings, auger hole, split spoon samples, and breathing zone will be recorded in the field logs (Appendix B).

3. The HPII will be attached to the EW casing and lowered through the HSAs. The EW casing will be used in place of standard AW drill rod because it has a greater internal diameter. This will allow a .66 inch diameter bailer to be used to collect groundwater samples. The HPII will be driven or pushed hydraulically five feet, if possible, below the bottom of the augers. The HPII will be pulled back six inches less than the amount it was pushed, in order to expose the internal four-foot PVC screen. The bailer will be attached to disposable nylon cord and lowered through the EW casing into the exposed HPII screen to collect the sample.

4. The HPII and the bailer used to collect the sample, as well as the EW casing through which the sample is collected, will be decontaminated according to the procedures outlined in Section 4.1.6. The one-time-use HPII screen is factory cleaned and packaged and does not require field decontamination.

5. Groundwater samples collected with the HPII will follow the sample custody procedures presented in Section 5.4.

If lithologic conditions preclude the use of HPII, representative groundwater samples will be collected from the open borehole using a Teflon bailer.

4.1.5 Air Monitoring

Air monitoring will be conducted for personal safety by monitoring for volatile organic emissions in the work area. Air monitoring will be performed using a flame ionization detector (FID), such as a Foxboro 128 Organic Vapor Analyzer (OVA), or a photoionization detector (PID), such as a HNu Model PI 101 (HNu). This instrument is a direct reading instrument. All results will be recorded in the field logbook, boring logs, and/or Headspace Analyses Form (Appendix B) depending on the type of media being screened (i.e., air or soil). The SSHP contains specifics of air monitoring, trigger levels and personal protective equipment (PPE).

4.1.6 Decontamination

Decontamination will be performed in an area of each site considered to be free from contamination. Equipment and personnel decontamination activities will be centralized in this location at each area. Within the decontamination area, a pad will be constructed which will be lined with polyethylene sheeting and trenched around its perimeter. If the site will not support a trenched pad, the alternative method would involve using straw bails with the polyethylene liner. The pad will be designed to promote run-off of decontamination fluids into a retention sump where all expended decontamination fluids will be collected. All cleaning activities will take place on the designated decontamination pad. The fluids from the sump will be containerized prior to leaving the site each day. The decontamination fluid will be handled as described in Section 5.5. Upon completion of utilization of the decontamination pad, the liner will be taken up as it is washed down with the on-site steam cleaner. The expended decontamination fluid will be pumped off and

containerized, and the liner will be placed into the solid, non-hazardous waste stream established for the project as described in Section 5.5.4.

Prior to arrival on-site, all down-hole drilling equipment will be steam cleaned. Equipment used for drilling and sampling will be decontaminated prior to each use in accordance with the following procedures:

1. Drill rigs and all support equipment will be free from excess grease, oils, and caked on mud from previous work prior to arrival to the site. Equipment which leaks fuel, coolant, and/or lubricants will be removed from the site and repaired prior to use. All drill rigs will be steam cleaned upon arrival to the site.

2. Equipment or materials not used immediately after decontamination will be placed on plastic sheeting, covered with plastic, and secured to avoid potential contamination.

3. All equipment will be thoroughly cleaned using a high pressure steam cleaning unit.

4. All non-plastic or acrylic sampling tools (e.g., teflon bailers, split spoons, mixing bowls, etc.) will be scrubbed using non-phosphate detergent and tap water, rinsed twice with de-ionized water, rinsed twice with isopropanol, rinsed with organic-free water, and finally allowed to air-dry, if practical. Sampling equipment will be wrapped in aluminum foil (polished side out) to prevent contamination if equipment is to be stored or transported.

5. Sampling equipment constructed of plastic or acrylic will be decontaminated using the procedures outlined previously with the exception of the isopropanol rinse.

Clean, disposable gloves will be worn while handling sampling equipment or downhole tools during final stages of decontamination. De-ionized water will be stored in its original containers and applied via Teflon squeeze bottles. Isopropanol will be stored in either glass or Teflon containers and applied via Teflon squeeze bottles, decanted directly, or applied via stainless steel sprayers. Organic-free water will be stored in glass or stainless steel containers and applied similarly.

4.1.7 Sample Designation

The sample identification format contains specific information about the sample matrix and location. Each sample is sequentially designated according to site, location, and matrix. Additional designation letters and numbers may be used to denote sample depths or identify QC samples. Prior to collecting each sample, the sample containers will be labeled with the following information: date and time, a sample identification designation, sampling personnel, preservatives (if any), and analytical parameters. All information pertaining to a particular sample is referenced by the sample identification designation which is recorded on the sample bottle(s), in the field log book, and on the Custody Chain and Analytical Request Form (Appendix B). The sample identification format is discussed in the following sections.

4.1.7.1 Soil Gas

Soil gas samples obtained from a passive soil gas collector will be identified differently than all other samples in this project. The designation will be different because the samples will result in screening level data only and should be evaluated differently than the analytical samples. Therefore, to avoid any mistaken comparison, the soil gas sample identification will begin with the designation "SG". This will be followed by a three digit site identification number or the site identification letter, followed by the two digit sequential sample number. An example designation of the fourth soil gas sample location at RSA-94 would have a sample ID as follows:

SG-094-04

4.1.7.2 Soils

Subsurface soil samples obtained from a soil boring or hand auger boring will be identified by the three digit site identification number or the site identification letter, followed by the two digit sequential boring number and the designation "SB". This will be followed by the actual depth of the bottom of the sample interval in feet. QC sample designations are discussed in 4.1.7.4. An example of a subsurface soil sample designation taken from RSA-95 boring number 4, from a sample interval 13 to 15 feet would have a sample ID as follows:

09504-SB-15

4.1.7.3 Ground Water (Hydropunch II™)

Groundwater samples will be collected from soil borings using HPII techniques or from open boreholes. HPII and open borehole samples will be identified by the three digit site identification number or the site identification letter, followed by the two digit sequential boring number and the designation "HP." For example, a groundwater sample collected using HPII techniques or from an open borehole from site RSA-98, boring number 3 would have a sample ID as follows:

09803-HP

4.1.7.4 Quality Assurance/Quality Control

QC samples will include duplicates, trip blanks, and field splits. Split samples will be sent to South Atlantic Division Laboratory, Marietta, Georgia, for analysis and will be designated as a split from a particular location. QC samples are denoted by adding a lower case character extension to the end of the Sample ID. A hyphen "-" must precede the extension. The extensions are as follows:

Extension	Description
-a	field duplicate
-b	field split (to quality assurance laboratory)
-c	trip blank

4.2 SITE-SPECIFIC SAMPLING PLANS AND RATIONALE

This section presents a brief history of the use of each site as it relates to the development of a contaminant release scenario. These site-specific scenarios provide the rationale for a focused sampling plan. All the sites are located in the Thiokol North Plant Area and either currently has or previously had an indoor solvent degreaser/distillation unit. Tables and figures are provided to summarize and illustrate each site's sampling plan.

4.2.1 RSA-94

RSA-94 is located inside the central portion of Building 7625 and consists of an active solvent degreaser/distillation unit within a concrete pit. Surface soils, subsurface soils, and shallow groundwater underlying the pit have been determined to be at the greatest risk for contamination. Sampling activities proposed for this site include collecting soil gases using PETREX passive soil gas collectors, collecting subsurface soil samples from soil borings, and collecting groundwater samples using a HPII or bailer. All sample locations are shown in Figure 4-2.

To help determine if the shallow water table is a transport means for volatile organic contamination, six PETREX passive soil gas collectors, SG-094-01 through SG-094-06, will be placed around the outside perimeter of Building 7625. To determine if any solvent releases have occurred from the sewer system, three passive soil gas collectors, SG-094-07 through SG-094-09, will be placed in the soils overlying the sanitary sewer line where it exits the building. In addition, three collectors, SG-094-10 through SG-094-12, will be placed in close proximity to a sump leading to the sewer on the northern end of the building. Following evaluation of soil gas data, soil borings 09401 through 09406 will be advanced to the water table in the locations shown in Figure 4-2, unless the soil gas data determines that other locations are more appropriate. The soil borings will be placed along the outside perimeter of Building 7625 to determine the impact to vadose zone soils. As described in Section 4.1.3, samples will be collected from three depth intervals and submitted for VOC analysis. In addition, one representative soil sample will be collected from just above the saturated zone for geotechnical analysis. A HPII groundwater sample will be collected from each soil boring and submitted for VOC analysis to determine impact to the water table. If a groundwater sample can not be collected at a location with the HPII, then a sample will be collected from the open borehole using a bailer (see Section 4.1.4).

4.2.2 RSA-95

RSA-95 is located inside the southeast wing of Building 7368 and is the former location of a solvent degreaser/distillation unit. Surface soils, subsurface soils, and shallow groundwater underlying the unit have been determined to be at the greatest risk for contamination. Sampling activities proposed for this site include collecting soil gases using PETREX passive soil gas collectors, collecting subsurface soil samples from soil borings, and collecting groundwater samples using a HPII or bailer. All sample locations are shown in Figure 4-3.

To help determine if the shallow water table is a transport means for volatile organic contamination, nine PETREX passive soil gas collectors, SG-095-01 through SG-095-09, will be placed around the southern perimeter of Building 7368. To determine if any solvent releases have occurred from the sewer system, three passive soil gas collectors, SG-095-10 through SG-095-12, will be placed in the soils overlying the sanitary sewer line where it exits the building. Following evaluation of soil gas data, soil borings 09501 through 09506 will be advanced to the water table in the locations shown in Figure 4-3, unless the soil gas data determines that other locations are more appropriate. The soil borings will be placed along the southern outside perimeter of Building 7368 to determine the impact to vadose zone soils. As described in Section 4.1.3, samples will be collected from three depth intervals and submitted for VOC analysis. In addition, one representative soil sample will be collected from just above the saturated zone for geotechnical analysis. A HPII groundwater sample will also be collected from each soil boring and submitted for VOC analysis to determine impact to the water table. If a groundwater sample cannot be collected at a location with the HPII, then a sample will be collected from the open borehole using a bailer (see Section 4.1.4).

4.2.3 RSA-96

RSA-96 is located inside of Building 7740 and consists of a closed solvent degreaser/distillation unit within a concrete pit. As discussed in Section 3.3, soil and groundwater contamination, primarily by TCE, has been documented in the immediate vicinity of Building 7740. Sampling activities proposed for this site include collecting soil gases using PETREX passive soil gas collectors, collecting subsurface soil samples from soil borings, and collecting groundwater samples using a HPII or bailer. All sample locations are shown in Figure 4-4.

A PETREX soil gas survey will be used as a screening tool to possibly identify areas where VOCs, such as TCE, may have been released around Building 7740. Nine PETREX passive soil gas collectors, SG-096-01 through SG-096-09, will be placed around the perimeter of Building 7740. To determine if any VOCs have been released from the sewer system at the building, three passive soil gas collectors, SG-096-10 through SG-096-12, will be placed in the soils overlying the sanitary sewer lines where they exit the building.

Soil borings 09601 through 09606 will be advanced to the water table in the locations shown in Figure 4-4, unless the soil gas data determines that other locations are more appropriate.

The proposed subsurface soil and groundwater sampling locations will be placed around Building 7740 in an effort to determine whether the TCE detected in the groundwater beneath the building originated from the immediate vicinity of the building, possibly the solvent degreaser/distillation unit, or migrated to the area from an upgradient source. As described in Section 4.1.3, samples will be collected from three depth intervals and submitted for VOC analysis. In addition, one representative soil sample will be collected from just above the saturated zone for geotechnical analysis. A HPII groundwater sample will be collected from each soil boring and submitted for VOC analysis to determine impact to the water table. If a groundwater sample can not be collected at a location with the HPII, then the sample will be collected from the open borehole using a bailer (see Section 4.1.4).

4.2.4 RSA-97

RSA-97 is located inside the northwest wing of Building 7726 and is the former location of a solvent degreaser/distillation unit. The degreaser unit has been removed and the concrete pit formerly beneath the unit has been backfilled with gravel and capped with concrete. Surface soils, subsurface soils, and shallow groundwater underlying the pit have been determined to be at the greatest risk for contamination. Sampling activities proposed for this site include collecting soil gases using PETREX passive soil gas collectors, collecting subsurface soil samples from soil borings, and collecting groundwater samples using a HPII or bailer. All sample locations are shown in Figure 4-5.

To help determine if the shallow water table is a transport means for volatile organic contamination, six PETREX passive soil gas collectors, SG-097-01 through SG-097-06, will be placed around the northern outside perimeter of Building 7726. In addition, three soil gas collectors, SG-097-07 through SG-097-09 will be placed next to the outside wall immediately adjacent to the former location of the degreaser unit. To determine if any solvent releases have occurred from the sewer system, three passive soil gas collectors, SG-097-10 through SG-097-12, will be placed in the soils overlying the sanitary sewer line where it exits the building. Following evaluation of soil gas data, soil borings 09701 through 09706 will be advanced to the water table in the locations shown in Figure 4-5, unless the soil gas data determines that other locations are more appropriate. The soil borings will be placed near the northern outside perimeter of Building 7726 to determine the impact to vadose zone soils. As described in Section 4.1.3, samples will be collected from three depth intervals and submitted for VOC analysis. In addition, one representative soil sample will

be collected from just above the saturated zone for geotechnical analysis. A HPII groundwater sample will be collected from each soil boring and submitted for VOC analysis to determine impact to the water table. If a groundwater sample can not be collected at a location with the HPII, then the sample will be collected from the open borehole using a bailer (see Section 4.1.4).

4.2.5 RSA-98

RSA-98 is located inside the southern end of Building 7346 and includes an active solvent degreaser/distillation unit within a concrete pit. Surface soils, subsurface soils, and shallow groundwater underlying the pit have been determined to be at the greatest risk for contamination. Sampling activities proposed for this site include collecting soil gases using PETREX passive soil gas collectors, collecting subsurface soil samples from soil borings, and collecting groundwater samples using a HPII or bailer. All sample locations are shown in Figure 4-6.

To help determine if the shallow water table is a transport means for volatile organic contamination, nine PETREX passive soil gas collectors, SG-098-01 through SG-098-09, will be placed around the outside perimeter of Building 7346. To determine if any solvent releases have occurred from the sewer system, three passive soil gas collectors, SG-098-10 through SG-098-12, will be placed in the soils overlying the sanitary sewer line where it exits the building. Following evaluation of the soil gas data, soil borings 09801 through 09806 will be advanced to the water table in the locations shown in Figure 4-6, unless the soil gas data determines that other locations are more appropriate. The soil borings will be placed along the outside perimeter of Building 7346 to determine the impact to vadose zone soils. As described in Section 4.1.3, samples will be collected from three depth intervals and submitted for VOC analysis. In addition, one representative soil sample will be collected from just above the saturated zone for geotechnical analysis. A HPII groundwater sample also will be collected from each soil boring and submitted for VOC analysis to determine impact to the water table. If a groundwater sample cannot be collected at a location with the HPII, then the sample will be collected from the open borehole (see Section 4.1.4).

4.3 ADDITIONAL SITE INSPECTION ACTIVITIES

If contaminants are found in either the soil or groundwater during the initial site inspections of RSA-94, 95, 97, and 98, then additional site inspection activities may be warranted to further characterize the nature and extent of the contamination at the sites. This section describes additional site inspection activities which may be conducted at a site, if such activities are deemed necessary. The activities proposed in this section are not appropriate for the RSA-96 site, because groundwater contamination has already been confirmed at the site. The purpose for including these additional site inspection activities is to allow these activities to proceed without having to generate a new work plan. It should be noted, however, that the actual type, location, and number of additional samples needed at a site will be decided jointly between the U.S. Army Missile Command, USACE, EPA and ADEM.

4.3.1 Drilling and Soil Sampling

If additional site inspection activities are needed at a site, then an additional soil boring or additional soil borings may be completed in the overburden at the site using the methods described in Section 4.1.3. Two soil samples will be collected from each soil boring and analyzed for VOCs by SW-846 Method 8260. One of the two soil samples will be collected near the surface (0-1 foot depth) and other will be collected at depth to delineate the possible vertical extent of the contamination. Air monitoring and decontamination procedures are described in Sections 4.1.5 and 4.1.6, respectively. IDW management is described in Section 5.5.

4.3.2 Hydropunch Groundwater Sampling

A groundwater sample will collected from each additional soil boring using a HPII sampler, as described in Section 4.1.4. The groundwater sample will analyzed for VOCs using SW-846 Method 8260.

4.3.3 Shallow Bedrock Well Installation

It may be necessary to install one or more shallow bedrock monitoring wells at a site that is determined to need additional site inspection activities. Each well will be completed approximately 15 feet into the bedrock and have a protective surface casing installed to

prevent contamination in the overburden from spreading into the underlying bedrock. A well will be completed as an open-hole bedrock well if the bedrock is competent enough to support an open borehole and yields low turbidity groundwater samples. Otherwise, the well will be completed as a double-cased well by constructing a "typical" 2-inch I.D. PVC monitoring well inside the open borehole. Figure 4-7 shows the typical construction of an open-hole bedrock well. Figure 4-8 shows the typical construction of a double-cased bedrock well. The procedures that will be used for installing a shallow bedrock monitoring well at a site are described below. Well development procedures and groundwater sampling methods for monitoring wells are described in Sections 4.3.4 and 4.3.5, respectively. Air monitoring and decontamination procedures are described in Sections 4.1.5 and 4.1.6, respectively. IDW management is described in Section 5.5.

The shallow bedrock monitoring wells will be completed with a truck-mounted drill rig using HSA and air-rotary drilling techniques. When using air-rotary techniques, the air from the compressor on the rig will be filtered to prevent oil from the compressor from being introduced into the subsurface.

Protective surface casing will be installed according to the following procedures:

- Drilling and soil sampling in the overburden will be performed using HSA drilling techniques. Drilling will be performed using 8-inch I.D. augers which will create a 12-inch diameter borehole. Two soil samples will be collected from the overburden and analyzed for VOCs by SW-846 Method 8260. One of the two soil samples will be collected near the surface (0-1 foot depth) and other will be collected at depth to delineate the possible vertical extent of the contamination.

- Once auger refusal is encountered at the top of the bedrock, a 7 7/8-inch diameter air hammer will inserted through the auger stem and used to drill an approximately 3-foot to 5-foot socket into the bedrock.

- A 6-inch I.D. Schedule 80 PVC casing will then be lowered to the bottom of the borehole. Grout will be pumped into the annular space via the tremie method from the bottom of the borehole to the ground surface. The cement/bentonite grout will be comprised of potable water, Portland Type I cement and 3-5 % bentonite powder by weight.

- After allowing a minimum of 24 hours for the grout to set, HQ coring (3.8-inch O.D.) will resume into the bedrock to a termination depth of approximately 15 feet into bedrock. A decision will then be made whether to complete the well as an open-hole bedrock well or as a double-cased well.

- If the well is completed as an open-hole bedrock well, then the well will be completed by installing an 8-inch I.D. steel locking protective cover and constructing a 3-foot square by 6-inch thick concrete pad around the well. Identically keyed locks will be provided for all wells.

If it is determined that a double-cased well will be constructed, then the corehole will be reamed to approximately 6 inches using a 5 7/8-inch diameter air hammer. The monitoring well will be constructed in the 6 inch borehole. All monitoring well screens and casings installed in the bedrock will be 2-inch I.D., Schedule 40 PVC. Screens will be 10 feet in length, have a 0.010-inch slot size, and be placed in the upper 15 feet of the bedrock aquifer. All well materials will be new, and are to be delivered to the site in factory packaging. Well materials will be decontaminated by steam cleaning prior to installation.

Each well will be installed according to the following procedures:

- Measure and record the lengths of all screen, riser pipe sections, and bottom plugs.

- Assemble the well screen, bottom plug, riser pipe and centralizers, and lower the well to the target depth.

- Install washed silica filter sand via the tremie method using potable water. The depth of the filter pack will be frequently monitored using the tremie pipe and verified using a decontaminated stainless-steel tag bar. The filter pack will be installed to extend approximately 2-feet above the top of the screen.

- Install a 1-foot-thick layer of very fine silica sand via the same method.

- Install a minimum 2-foot-thick bentonite pellet seal above the fine sand via the tremie method using potable water. The bentonite seal will be emplaced slowly and will be allowed to hydrate for a minimum of 8 hours, or per manufacture's instructions, whichever is longer, prior to the emplacement of grout.

- Grout will be pumped via the tremie method from the top of the bentonite seal to within two feet of ground surface with cement/bentonite grout (potable water, Portland Type I cement and 3-5% bentonite powder by weight). The remaining two feet of the annular space will be filled with concrete while constructing the pad.

- A temporary locking cap will be installed to secure the well prior to surface completion.

- After allowing the grout to set a minimum of 24 hours, the well will be completed by installing a 8-inch I.D. steel locking protective cover and constructing a 3-foot square by 6-inches thick concrete pad around the well. Identically keyed locks will be provided for all wells.

All soil and rock cuttings generated during the monitoring installation activities will be containerized in Department of Transportation (DOT) approved 17H 55-gallon drums. The drums will be managed as described in Section 5.5. Ultimate disposal of drummed soil/rock cuttings will be determined pending analytical results from associated soil and groundwater sample.

Final well construction details will be provided on Ground Water Monitoring Installation Detail forms as shown in Appendix B. Upon completion, each well will be developed according to procedures described in Section 4.3.4.

4.3.4 Well Development

Well development will be conducted within two weeks after a well has been constructed but no sooner than 48 hours after grouting. Each well will be developed to the fullest extent practical to remove sediments or other materials introduced during drilling activities. The development process will also augment the filter-pack and borehole wall of the installation to minimize infiltration of fine-grained formation materials.

Development will be accomplished by one or a combination of methods including bailing, surging, continuous pumping or air lifting. Field personnel will monitor ground water temperature, pH, specific conductivity, and turbidity as indicator parameters during the development process. Indicator parameters will be recorded approximately every 30 minutes during development. A Monitoring Well Development Log (Appendix B) will be completed

for each installation that is developed. Development will continue until indicator parameters have stabilized and the turbidity has been minimized. Ground water generated during development will be containerized in DOT-approved 17H 55-gallon drums. Ultimate disposal of the drummed development water will be determined pending analytical results from the associated groundwater samples and managed as described in Section 5.5.

4.3.5 Groundwater Sampling

Groundwater samples will be collected from any shallow bedrock monitoring well that is installed. The sampling procedure will consist of groundwater level measurements, field monitoring of indicator parameters (groundwater temperature, pH, specific conductivity, and turbidity) during well purging, completion of a Field Data Information Log for Ground Water Sampling (Appendix B) and collection of groundwater samples for laboratory analysis.

Each well will be purged prior to sample collection to ensure that the samples collected are representative of the groundwater quality in the aquifer at each well. The volume of water to be evacuated from each well will be calculated in the field; a minimum of three well volumes will be purged before sampling can occur. The volume of water to be evacuated from each well is calculated using the following equation:

$$V = 0.041\ d^2h$$

where:

d	=	diameter of well casing, in inches
h	=	height of water column, in feet
V	=	volume of water in well, in gallons

Minimum Purge Volume = V x 3

The height of the water column in the well is determined by subtracting the depth to water from the total well depth. The depth to water will be measured using an electronic water level tape. The total well depth will be measured using a stainless-steel tag bar attached to a graduated tape.

Specific conductance (SC), water temperature, and pH will be measured periodically during the well purging process. When the indicator parameters are stable and three well volumes have been evacuated, the well will be sampled. SC and temperature are considered stabilized if the last three consecutive measurements are within ten percent of the average of the last three measurements. The pH is considered stabilized when a variation in measurement of +/- 0.2 units is achieved.

Well purging will be accomplished by pumping or bailing. After each well has been purged, ground-water sample collection will occur within three hours. If a well is purged dry before three well volumes can be removed, then well purging will be considered complete and the well will be sampled following adequate recovery. Groundwater samples will be collected from the top of the water column using a disposable teflon bailer. Sample containers will be filled directly from the bailer. VOA vials will be filled first. The VOA vials will be filled so that a positive meniscus forms above the edge of the container. After the container cap is tightened, the vial will be inverted and gently tapped in order to check for air bubbles. If bubbles appear, the cap will be removed and another meniscus formed before recapping the vial. This method will be repeated until no air is contained in the vial. The samples will be labeled, stored, and transported as described in Section 5.0 and Appendix A.

Monitoring well purge water will be placed in DOT approved 17H 55-gallon drums at the well head. The drums will be sealed and labeled and handled as described in Section 5.5. Ultimate disposal of drummed purge water will be determined pending analytical results from the associated groundwater sample.

5.0 SAMPLE HANDLING AND ANALYSIS PROGRAM

This section describes the sample handling and analysis program for all geotechnical and environmental samples and includes the analytical program, sample handling, documentation, and containment of wastes. The number of each type of chemical analysis to be conducted is presented in Table 5-1.

5.1 GEOTECHNICAL TESTING PROGRAM

The geotechnical testing program will be conducted in general accordance with standards of the ASTM. These procedures are recognized as the basis for uniformity and consistency in the geotechnical engineering profession. Physical parameters including moisture (ASTM D-2216), Atterberg limits (ASTM D-4318), and grain size (ASTM C-117, ASTM C-1136) will be determined in accordance with these procedures.

The moisture content of soils is an indicator of various physical properties, including strength and compressibility. Samples obtained for moisture analysis are weighed and then oven-dried at a temperature of 110 degrees Celsius. The samples are reweighed after drying, and the moisture content is calculated by dividing the weight of the evaporated water by the weight of the dried sample.

Representative samples will be subjected to Atterberg limits testing to determine the soil's plasticity characteristics. A layer of at least six inches in thickness of fine grain material must be encountered. The plasticity index (PI) is the range of moisture content over which the soil deforms as a plastic material. It is bracketed by the liquid limit (LL) and the plastic limit (PL). The liquid limit is the moisture content at which the soil becomes sufficiently "wet" to flow as a heavy viscous fluid. The PL is the lowest moisture content at which the soil is sufficiently plastic to be manually rolled into threads 1/8" diameter.

The grain size distribution of soil particles in a sample is an indicator of certain physical properties including permeability, compaction characteristics, liquification characteristics as well as numerous other engineering parameters. The distribution of grain size greater than 75 microns may be determined through successive sieving of the dried soil and washing over a #200 sieve screen.

5.2 ANALYTICAL TESTING PROGRAM

All analytical fractions, parameters, and methods are those of USEPA document SW-846. The analytical fraction includes VOCs. The organic compounds used in the degreaser units, TCE and 1,1,1-TCA, are VOCs.

5.2.1 Field Screening

Field screening for temperature, pH, and SC of aqueous samples will be conducted. Field screening for volatile vapor will be conducted on subsurface soils using a OVA or HNu. This screening instrument semi-quantitatively indicates total volatile organic vapor concentrations. Detailed information on the OVA and HNu procedures are provided in Appendix A, Section 4.3.

To field screen aqueous samples for temperature, the analog thermometer is cleaned and inspected for cracks and gaps in the liquid. The thermometer is then immersed in the sample and swirled in the liquid so that the thermometer bulb is completely covered by the sample. The thermometer remains in the sample until the temperature reading stabilizes, typically for no more than one minute. The temperature is read directly off the instrument in degrees Celsius or Fahrenheit to the nearest 0.5 degree. These data are recorded in the field log book and on the Field Data Information Log for Groundwater Sampling (Appendix B).

To field screen aqueous samples for pH, the pH meter is inspected and is allowed to equilibrate to ambient temperatures. The instrument is calibrated (as described in Section 3.2.2 of Appendix A), and the probe is rinsed with tap water. On non-temperature compensating instruments, the temperature setting must be tuned to the sample temperature. The probe is then simply inserted into the sample so that the sensing area is fully covered by the sample. The pH values are sensed instantaneously by the instrument and are read directly off the analog or digital scale (to $\pm$ 0.1 pH units), as the log (to the base 10) of the hydrogen ion concentration of the sample. These data are recorded in the field log book and on the Field Data Information Log for Groundwater Sampling (Appendix B).

To field screen aqueous samples for SC, the analog meter is inspected for cracks and is allowed to equilibrate to ambient temperatures. The instrument is then calibrated (as

described in Section 3.2.2 of Appendix A), and the probe is rinsed with deionized water. On instruments that are not temperature compensating, the temperature setting must be tuned to the approximate temperature of the sample. The probe is then simply inserted into the sample so that the sensing area is fully covered by the sample. The SC value is sensed instantaneously by the instrument and is read directly off the analog or digital scale, as micromhos per centimeter. For results less than 1000 micromhos/centimeter, the values are read to the nearest 10 units; for results greater than 1000 micromhos/centimeter, the values are read to the nearest 100 units. These data are recorded in the field log book and on the Field Data Information Log for Groundwater Sampling (Appendix B).

Soil volatile vapor headspace screening will be conducted in the following manner with a calibrated OVA or HNu:

(1) soil is placed in a clean 16 ounce jar, so that the jar is about half-filled;

(2) the jar is sealed with aluminum foil and a tight rubber band; no holes will be allowed in the foil cap, and the foil shall be tight against the mouth of the jar;

(3) the organic vapor in the soil is brought to equilibrium with the headspace in the jar for a period of about 15 minutes at a temperature of between 68 and 90°F ;

(4) following the 15 minute period, the headspace is sampled with an OVA or HNu in survey mode, by piercing the aluminum foil cap with a small hole, and inserting the OVA or HNu tip into the headspace. The volatile vapor concentration is read directly off the analog scale of the OVA or HNu. Operating procedures for the OVA or HNu are described in Section 4.3.5 of Appendix A.

These data are recorded in the field log book and on the Headspace Analysis Form (Appendix B). No background value corrections are made for these jarred headspace readings. Other readings made in ambient air will be corrected for the background concentrations.

5.2.2 Laboratory Analysis of Soil Samples

Soil samples to be analyzed for all suspected contaminants by Savannah Laboratories, Savannah, Georgia, using SW-846 methodologies. The analytical methods and holding times for all parameters are listed in Table 1-1 of Appendix A.

5.2.3 Laboratory Analysis of Groundwater Samples

Groundwater samples to be analyzed for all suspected contaminants by Savannah Laboratories, Savannah, Georgia, using SW-846 methodologies. The analytical methods and holding times for all parameters are listed in Table 1-1 of Appendix A.

5.2.4 Data Quality Objectives

Data Quality Objectives (DQOs) are defined as an integrated set of thought processes which define data quality requirements based on the intended use of the data. DQOs are necessary in obtaining sufficient data of known defensible quality for the intended use. This process will assist in determining the appropriate quantitation, detection, and reporting limits, analytical methods, and sample handling procedures. The DQOs are separated into two categories: Screening Data and Definitive Data. A brief description of these data categories is provided below.

5.2.5 Data Categories

DQOs are qualitative and quantitative statements that specify the quality of the data required to support decisions during remedial response activities (EPA, 1993). The required quality of the analytical data to be collected is dependent on the use of the data. EPA has defined two data categories as described below:

- Screening Data with definitive confirmation - Field screening using portable instruments, such as an organic vapor analyzer and sample collection methods such as HP II sampling and soil gas surveys, from which data are generated using rapid less precise methodologies with less rigorous sample separation. Ten percent of the screening data are confirmed using analytical methods and quality assurance (QA)/QC procedures associated with definitive data;

- Definitive Data - Analyses performed in a laboratory using rigorous analytical methods, such as EPA approved referenced methods. These analytical methodologies produce tangible raw data which may be generated on- or off-site, so long as the QA/QC requirements are satisfied. These methodologies may or may not utilize CLP protocols, which require stringent QA and QC procedures, documentation, and data validation. For the data to be definitive, either analytical or total measurement error must be determined.

5.2.6 Data Management and Evaluation

All data are generated and reduced following protocols specified in laboratory Standard Operating Procedures (SOPs). Where applicable or appropriate, the organic analyses will be evaluated with respect to the EPA CLP "National Functional Guidelines for Organic Data Review" (EPA, 1994a) and the inorganic analyses will be evaluated with respect to EPA CLP "National Functional Guidelines for Inorganic Data Review" (EPA, 1994b).

5.3 SAMPLE PACKAGING AND SHIPMENT

Samples are packed for shipping in a protected and controlled environment to insure sample integrity. Samples are packed in individual "ziplock" baggies followed by wrapping in bubble wrap or styrofoam packing to prevent breakage during shipment. The samples are cooled to 4 degrees Celsius by enclosing several bags of ice securely in double "ziplock" baggies. These measures are taken to prevent heating of samples during shipment which may accelerate decomposition and volatilization of contaminants. Sample security is monitored by securely taping the cooler, with two signed and dated custody seals placed across the seal of the lid. The sample coolers with associated documentation enclosed will be shipped via overnight express carrier to the laboratory. A copy of the shipping bill is retained by Rust and becomes part of the sample custody documentation. Concurrent with shipping, the sampler calls the laboratory to confirm the shipment and arrival.

5.4 SAMPLE DOCUMENTATION AND TRACKING

Sample collection and sample custody are designed so that field custody of samples are fully and continuously documented. These procedures provide complete identification and documentation of the sampling event from shipment of sample bottleware, through sample collection, to receipt of the samples by the contracted laboratory. When used in conjunction

with the laboratory's custody procedures and the sample bottleware documentation, these procedures establish full legal custody and allow complete traceability of sample history.

5.4.1 Field Records

Field records of equipment calibrations, daily activities, drilling activities, and all physical data will be collected on designated forms. The forms will be maintained for the life of the project and will be included in the SI report. The detailed description of records kept in the field are discussed in detail in Section 1.5 of Appendix A. An example of all forms utilized for this project can be found in Appendix B.

5.4.2 Chain-of-Custody Procedures

Information regarding sample analysis is recorded on the custody chain and analytical request form (see Appendix B), including sample identification, sampling time and date, location of sampling point, sampling personnel, and analytical parameters. This form is packed with the samples. A copy of this form is maintained in the project files.

5.5 CONTAINMENT AND DISPOSAL OF INVESTIGATION DERIVED WASTES

5.5.1 General

All contaminated environmental media and other investigation-derived wastes generated during on-site investigations will be managed in accordance with "EPA Region IV RCRA Guidance: Management of Contaminated Media", August 1992. The Region IV guidance sets forth procedures for the proper management of contaminated environmental media produced and/or managed during the investigation and remediation of hazardous waste sites.

EPA guidance suggests the following scenarios by which a contaminated environmental medium is subject to regulation under Subtitle C of RCRA. First, EPA's contained-in policy requires that contaminated environmental media which contain a listed hazardous waste be managed as if the media themselves were hazardous waste. Second, any residue or contaminated soil, water, or other debris resulting from the cleanup of a spill into or on the land or water of a P- or U-listed waste is itself a hazardous waste. However, once these media are decontaminated, they no longer meet the listing and are therefore not a listed hazardous wastes. Furthermore, these decontaminated media are not subject to RCRA Subtitle C regulation if the contamination resulted from a characteristic hazardous waste and the medium itself previously exhibited one or more of the characteristics of hazardous waste.

IDW at RSA will be handled in a manner that is protective of human health and to prevent any cross or re-contamination of the point of origin or area surrounding that point. Each type of IDW (soil cuttings associated with monitoring well installations, well development water, purge water, decon water) generated from a site will be containerized separately. In addition, IDW from each borehole or monitoring well will be containerized separately.

Soil cuttings from any soil boring that will not be converted to a monitoring well will be used to backfill the associated borehole as described in Section 4.1.3.

Following the containerization of the IDW in a DOT-approved 17H 55-gallon drum, it will be labeled with the location, date of generation, personnel responsible, the contents (source), and a unique inventory number using indelible ink. Filled drums will be

maintained at the point of origin pending analytical results. A record of the drums and their contents will be completed and will be included in the logbook.

The soil IDW will be characterized for disposal by the analytical samples collected from the same monitoring well boring which generated the cuttings. This procedure is expected to provide the most conservative characterization since the aliquot submitted for chemical analysis will be selected based on field screening results (i.e., elevated OVA or HNu measurements). Therefore, the aliquot selected for analysis and characterization should contain a contaminant concentration equal to, or greater than the remainder of the soil from that boring. The purge water will also be characterized by the analytical samples collected from the monitoring well which generated the purge water. Field screening results will not be utilized to select the most representative sample; however, the homogeneity of the media suggest that the results from the laboratory sample will adequately characterize the purge water. The decon water will be characterized by a sample to be collected following the containerization of the decon fluids. If more than one drum is required to containerize a sites' decon fluids, then a composite of all drums will be used for characterization. Analytical parameters will be chosen for each site based on results of previous investigations and knowledge of activities conducted at each site.

All hazardous waste management activities, including container management, will be performed in accordance with Alabama Hazardous Waste Regulations Division 14 Parts 335-14-2-01(2) and 335-14-3-03. Manifesting requirements, to include the completion of ADEM's Solid/Hazardous Waste Determination Form, requirements will be the responsibility of the MICOM Environmental Office. All waste, both hazardous and non-hazardous, will be granted the appropriate approvals prior to movement from the point of origin.

5.5.2 Soil IDW

Soil that has no contaminant levels above the detection limits will be handled as non-regulated and disposed at the discretion of RSA. Soils with contaminants detected, but which are determined to be non-hazardous, will be disposed of at either RSA's permitted dry trash landfill or a permitted Subtitle D facility such as the Valley View Sanitary Landfill in Stevenson, Alabama, depending on the presence or concentration of the contaminants. Should soils be determined to be a hazardous waste as defined in Title 40 of the Code of Federal Regulations (40 CFR) Part 261, the drums will be appropriately re-labeled and

relocated to a hazardous waste accumulation area on the installation pending disposal. When possible, the accumulation area will be the site where the IDW was generated. The drummed soils will be disposed of at the permitted Subtitle C facility located at Emelle, Alabama, (or a similar permitted facility) within 90 days of the date of waste generation, pending approval by the Alabama Department of Environmental Management (ADEM).

A flow chart showing the lifecycle of the soil cuttings derived from the investigation is presented as Figure 5-1.

5.5.3 Water IDW

The aqueous IDW (well development water, purge water and decon water) will be handled in the same manner due to their similar nature. The initial containment, labeling, and storage awaiting laboratory results will be the same as presented above for the soil IDW. Flow charts showing the lifecycle of the purge and decontamination water IDW are presented as Figures 5-2 and 5-3, respectively. Purge and/or decon water determined to be non-hazardous will be discharged to the on-site POTW (as allowed by permit conditions). Should the aqueous IDW be determined to be a hazardous waste as defined in 40 CFR Part 261, the drums will be appropriately re-labeled and relocated to a hazardous waste accumulation area on the installation pending disposal. The waste will be profiled for treatment at the permitted incinerator at Sauget, Illinois, (or a similar permitted facility) within 90 days of the date of waste generation.

5.5.4 Other

Other investigation by-products to include nylon line, polyethylene sheeting, paper products, and PPE such as tyveks and disposable gloves will be determined to be hazardous or non-hazardous by evaluating the analytical results from the media sampled at the site where the by-products were generated. Non-hazardous by-products will be handled as general debris and will be disposed of at either RSA's permitted dry trash landfill or the Valley View Sanitary Landfill in Stevenson, Alabama, depending on the presence or concentration of the contaminants. By-products generated at a site where a known hazardous media was sampled will be disposed of at a permitted Subtitle C facility.

6.0 PROJECT MANAGEMENT

This section will present the Project Team and the Project Schedule and will include the key project management and field sampling team members, and the anticipated schedule for the various activities and deliverables. In addition this section will outline the reporting requirements and provide information on how this project will support the existing Community Relations Plan (CRP).

6.1 PROJECT TEAM

Rust personnel and their subcontractors will make up the project field team (Figure 6-1). The Rust portion of the team is comprised of the project manager, field manager, task manager, quality assurance manager, and field staff which is generally a geologist or engineer and a technician. Resumes of key Rust project team members are provided in Appendix C.

The focal point of the Project Team will be the Project Manager, Mr. George R. Overby. Mr. Overby will be responsible for all day to day aspects of the project, both administrative and technical.

The Task Manager will be Mr. Charles Gorman, P.G.. Mr. Gorman will plan and coordinate all field operations and will oversee the preparation of all project documents.

The Quality Assurance Manager will be Mr. Mark Lancaster. Mr Lancaster will be responsible for assuring that the data collected during the SI are being collected in a manner which is consistent with the Data Quality Objectives, will oversee the data validation process and provide QA reviews for key project documents.

The Field Operations Manager will be Mr. David Dailey. The Field Sampling Manager will be responsible for the coordination of the various field activities associated with the SI. These responsibilities include supervising the collection of data, assuring data collection procedures are performed in accordance with the TSOW, acting as the Site Health and Safety Officer (HSO), and reporting to the Task Manager on a daily basis as to the status of the project. The Field Operations Manager will be the key team member to coordinate field efforts with RSA personnel.

The Regional Health and Safety Supervisor (RHSS) for the project is Mr. Sherman Woodson, C.I.H. Mr. Woodson is responsible for administering Rust's health and safety training and medical monitoring program, as described in the SSHP. The RHSS will be alerted in the event that site conditions change such that modifications to the field operating procedures are required. The RHSS will be available to perform site visit/inspections, if warranted.

6.2 REPORTING REQUIREMENTS

A variety of report mechanisms will be utilized throughout the SI to facilitate communication between RSA, USEPA, USACE, ADEM, and Rust. These include Daily Quality Control Reports (DQCRs), Monthly Progress Reports, Quarterly Meetings, Quality Control Summary Reports (QCSRs), and Draft, Draft-final, and Final SI Reports. Each of these reports is instrumental in assuring proactive communication between various entities involved.

6.2.1 Daily Quality Control Reports

DQCRs will be submitted at the end of each phase of field activity to the USACE. These reports will document field measurements, sample collection and management procedures, number of samples collected from each medium, and the number of QC samples obtained. Calibration and maintenance of field instruments will also be reported. Deviations from standard operating procedures and corrective actions taken will be documented in the DQCRs and the Project Manager will be notified immediately.

6.2.2 Monthly Progress Reports

Each month, Rust will submit a progress report to the USACE identifying accomplishments, noting deficiencies, and describing corrective actions associated with the project. Information from the DQCRs is summarized in the Monthly Progress Reports. Progress Reports will be submitted to the USACE Project Manager along with the request for payment. The percentage of the contract amount consumed by each task will be identified. In the event of schedule changes, an updated schedule in bar chart form will be included in the Monthly Progress Report.

6.2.3 Project Meetings

Project meetings between the Rust Project Manager, RSA, USACE, and any applicable sub-contractors will be held to discuss progress on the RSA SI and to conduct a technical review. Available analytical data and field observations will be reviewed at this time and the need for reassessment of forthcoming field activities may be discussed.

6.2.4 Quality Control Summary Report

After field activities are completed, DQCRs will be compiled and summarized in the QCSR. Analytical results will be reviewed in accordance with appropriate EPA Data Evaluation Guidelines (EPA, 1989), National Functional Guidelines for Organic Data Review (1994a) and National Functional Guidelines for Inorganic Data Review (1994b) and evaluated with respect to the corresponding QC samples and reported within 30 days of receiving the data. Laboratory QC samples include blanks, matrix spikes, and surrogates. Field QC samples include duplicates, trip blanks, and split samples. The QCSR will contain the analytical data pertaining to field samples and the corresponding QC samples.

The report will be issued as a draft to the USACE-Savannah and RSA. The review period is anticipated to be 30 days, at which time all comments will be responded to, resolved, and incorporated into the Final as necessary. The Final QCSR will be delivered within 30 days.

6.2.5 Draft, Draft-final, and Final SI Reports

Concurrent with data evaluation, the Draft SI Report will be prepared under the direction of the Project Manager, who assigns report tasks to Rust personnel as a function of their expertise. The report is then assembled and edited by the Project Manager and is reviewed by a senior level scientist. The Draft SI Report will then be submitted for review to USACE, RSA, and the Army Environmental Center (AEC).

Upon completion of the review, the comments will be responded to and resolved, and the SI Report will be revised as necessary. Within 35 days, a Draft-final will be submitted for final comments to all recipients of the Draft SI Report plus the appropriate State and Federal Regulators. Rust will respond to the final comments within 35 days, and the appropriate changes will be incorporated into the Final SI Report which will be re-submitted to all reviewers.

6.3 COMMUNITY RELATIONS

Each version of the SI Report will provide a section which details all Community Relations issues which are encountered during the life of the project. These Community Relations issues will involve coverage of environmental concerns at RSA by the media (i.e., newspaper, television, radio) as well as other investigation associated issues which arise during the project. This support to Community Relations will be coordinated with the advise and consent of the RSA Public Affairs Officer. In addition, if Technical Review Committee (TRC) meetings or Remedial Action Boards (RAB) are necessary, Rust will support USACE and RSA with matters associated with this investigation.

6.4 PROJECT SCHEDULE

The Project Schedule is provided in Figure 6-2. The schedule focuses on the major milestones associated with the project such as initiation and completion of field activities, deliverables, and agency review periods. A chronology of activities and a list of deliverables is provided below.

6.4.1 Chronology of Activities

This section provides a chronology of activities that will be performed in conjunction with the investigation and reporting efforts for this project. Specifically, the work plan will be submitted as a draft on October 20, 1995. Subsequent to receipt, consideration and incorporation of draft and draft final review comments, the Final SI Work Plan will be submitted. Upon approval of the work plan by all reviewers, the field activities schedule will be finalized and initiated. The non-intrusive field activities will be conducted in June 1996, so that a more focused intrusive field effort can be conducted. The results of the non-intrusive activities, including the soil gas survey, will be considered in finalization and performance of the intrusive field activities. Following the field activities the data will be incorporated into the Draft, Draft Final, and Final SI Reports.

6.4.2 List of Deliverables

As described in Section 6.2, numerous deliverables will be submitted throughout the completion of the SI. The deliverables are listed below for convenience.

- Daily Quality Control Reports
- Monthly Progress Reports
- Project Meeting Notes
- Quality Control Summary Reports
- Draft, Draft Final and Final SI Reports

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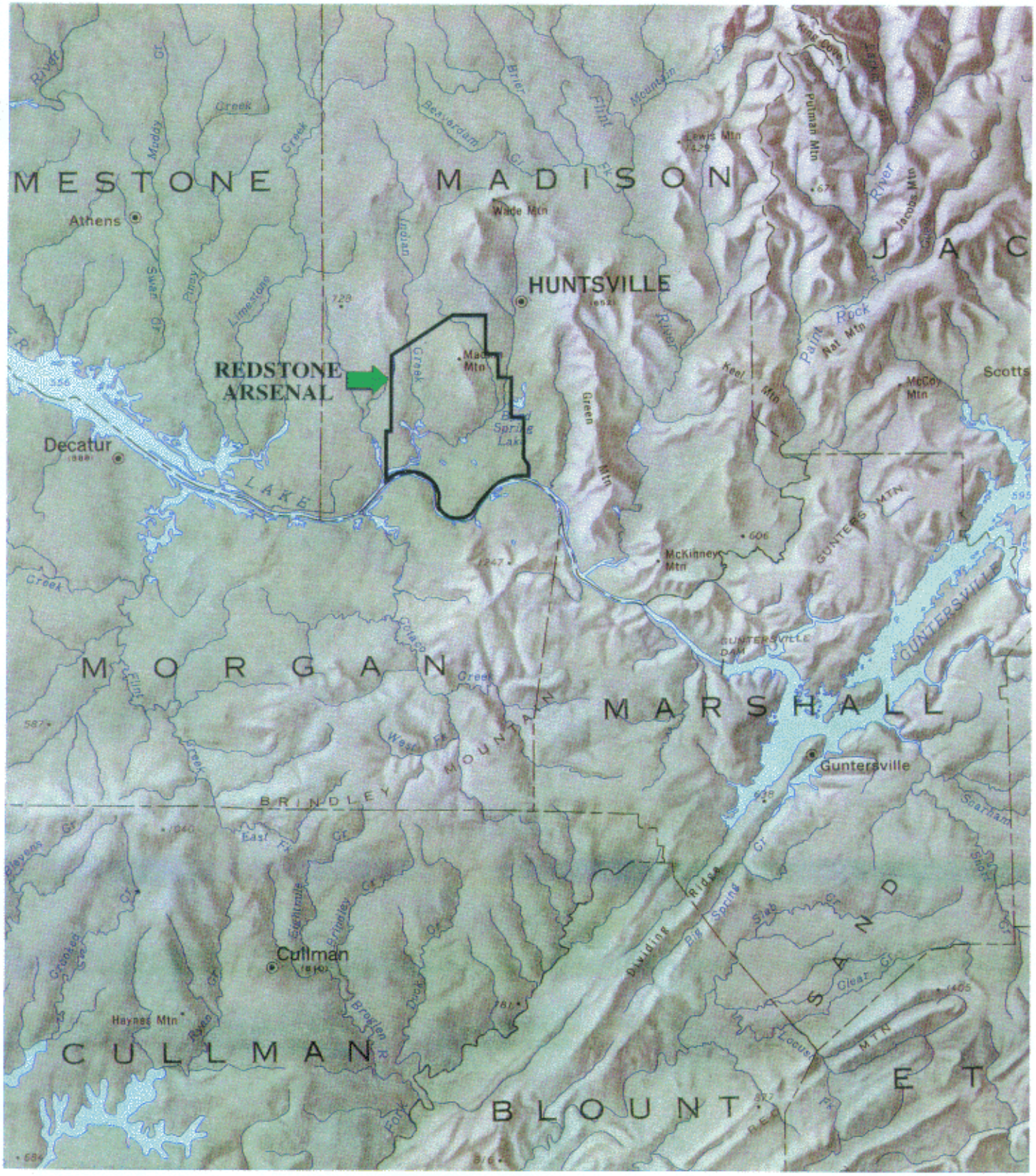
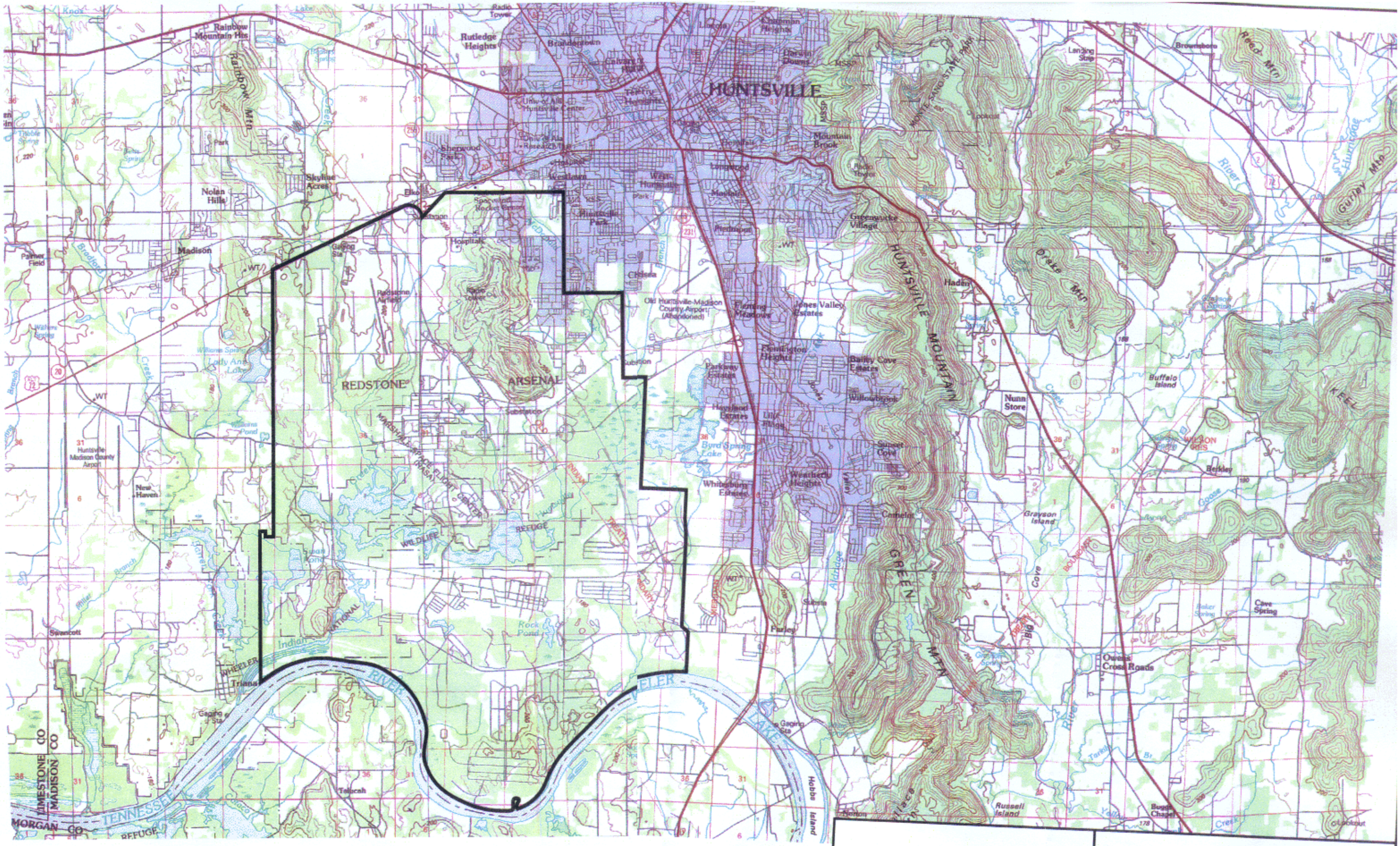
FIGURES



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 2-1
AREA LOCATION MAP
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

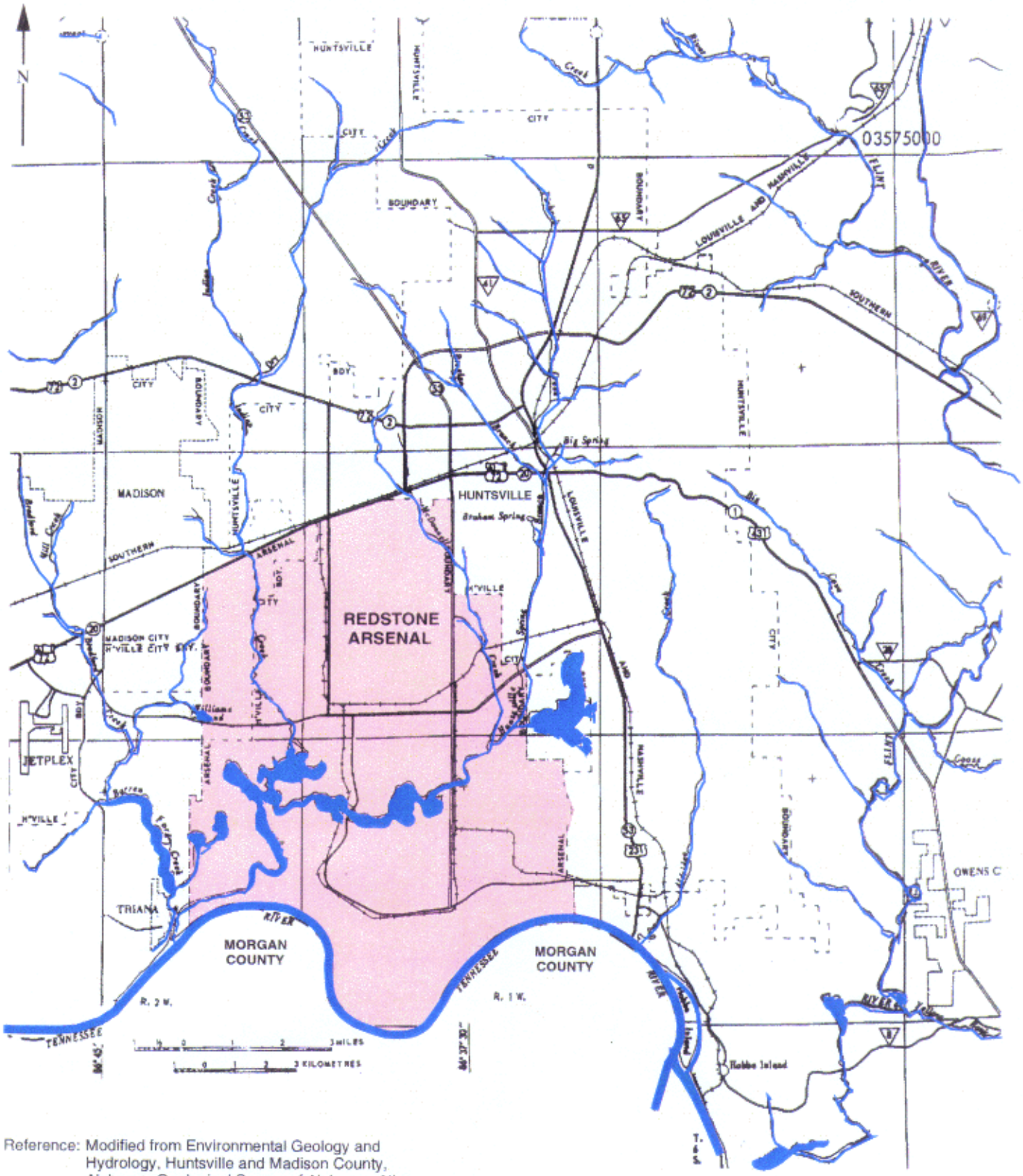


Reference: USGS 30 x 60 Minute Quadrangle; Huntsville, Alabama - Tennessee
Compiled from USGS maps dated 1964-1982, Photo Revised 1981.

Miles 1 0 2 3 4

RUST ENVIRONMENT & INFRASTRUCTURE

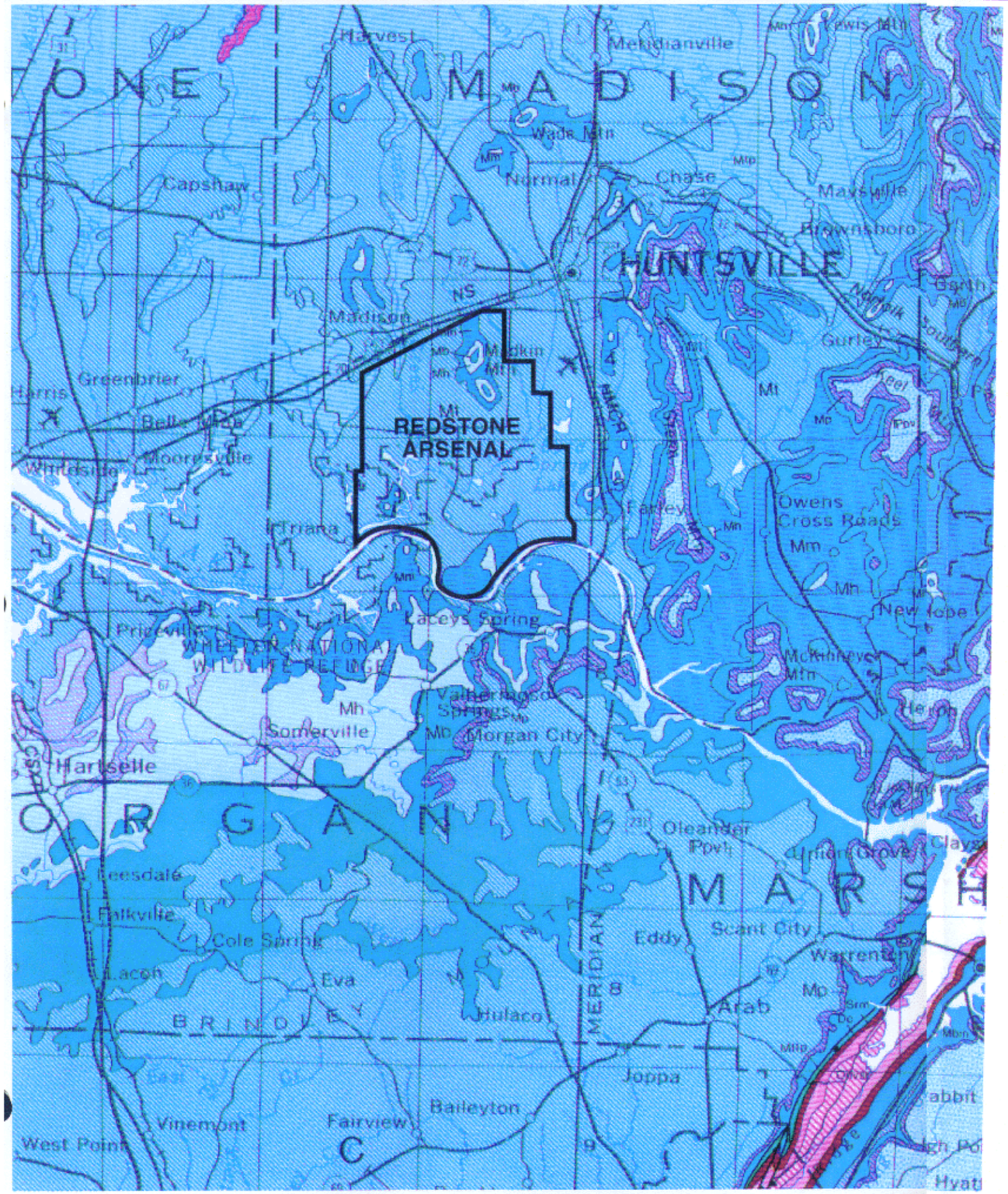
FIGURE 2-2
SITE LOCATION MAP
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



Reference: Modified from Environmental Geology and Hydrology, Huntsville and Madison County, Alabama; Geological Survey of Alabama; Atlas Series 8, 1975

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 2-3
DRAINAGE FEATURES
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



Legend

- Ppv — Pottsville Formation
- Pennington Formation
- Mb — Bangor Limestone
- Mh — Hartselle Sandstone
- Mm — Monteagle Limestone
- Mtp — Tuscumbia Limestone and Fort Payne Chert undivided
- Mt — Tuscumbia Limestone
- Mfp — Fort Payne Chert
- Srm — Red Mountain Formation
- Ou — Ordovician System undivided in part (Includes Sequatchie Formation, Elkmont Formatio, Leipers Limestone, Inman Formation, Nashville Group, and Stones river Group)
- Os — Sequatchie Formatio, Leipers Limestone, and Inman Formation undivided in part
- Onsr — Nashville and Stones River Groups undivided

N

Reference: Geological Survey of Alabama
Geologic Map of Alabama, 1989

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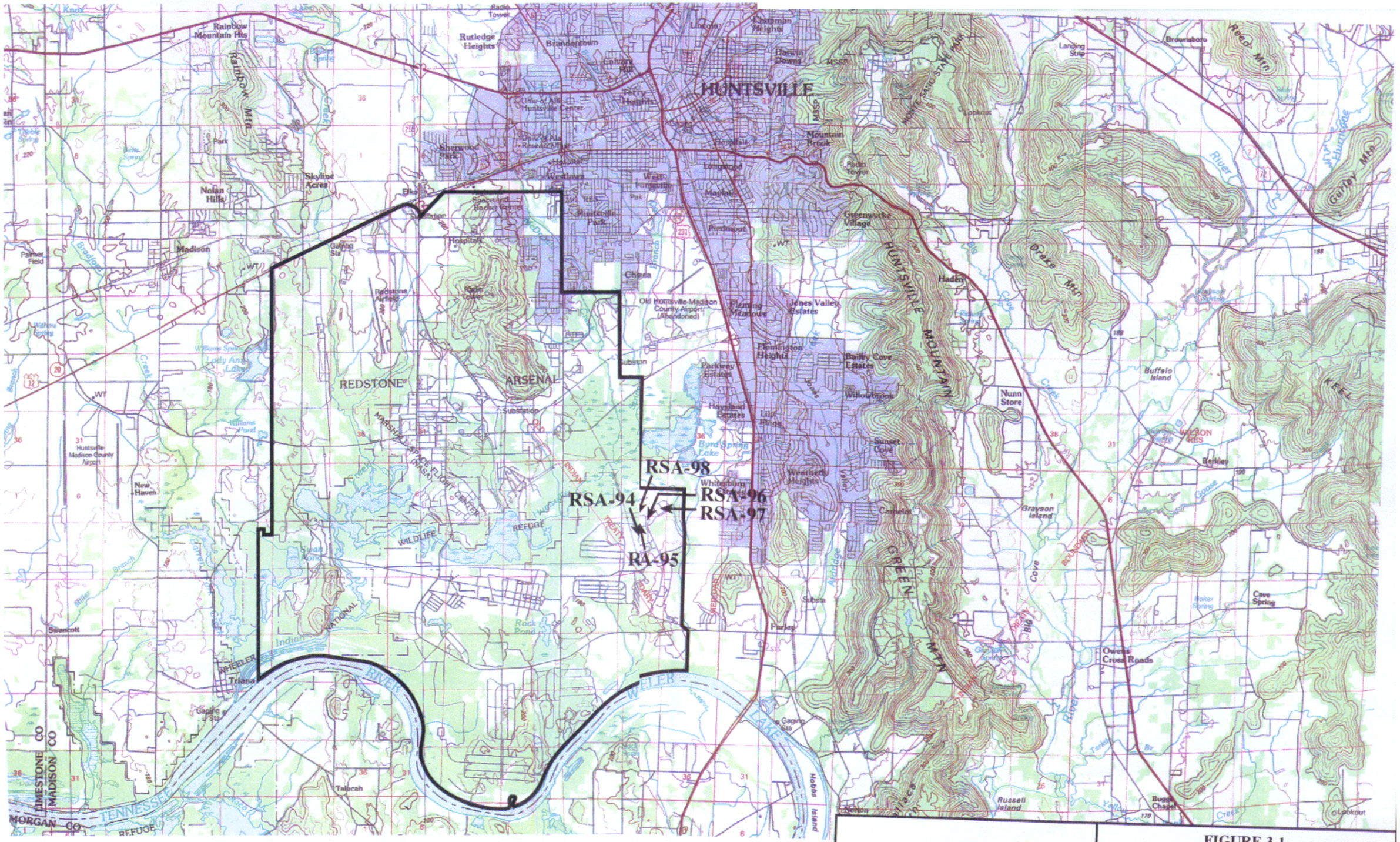
Miles

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 2-4
SURFACE GEOLOGY
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



Reference: USGS 30 x 60 Minute Quadrangle; Huntsville, Alabama - Tennessee
Compiled from USGS maps dated 1964-1982, Photo Revised 1981.

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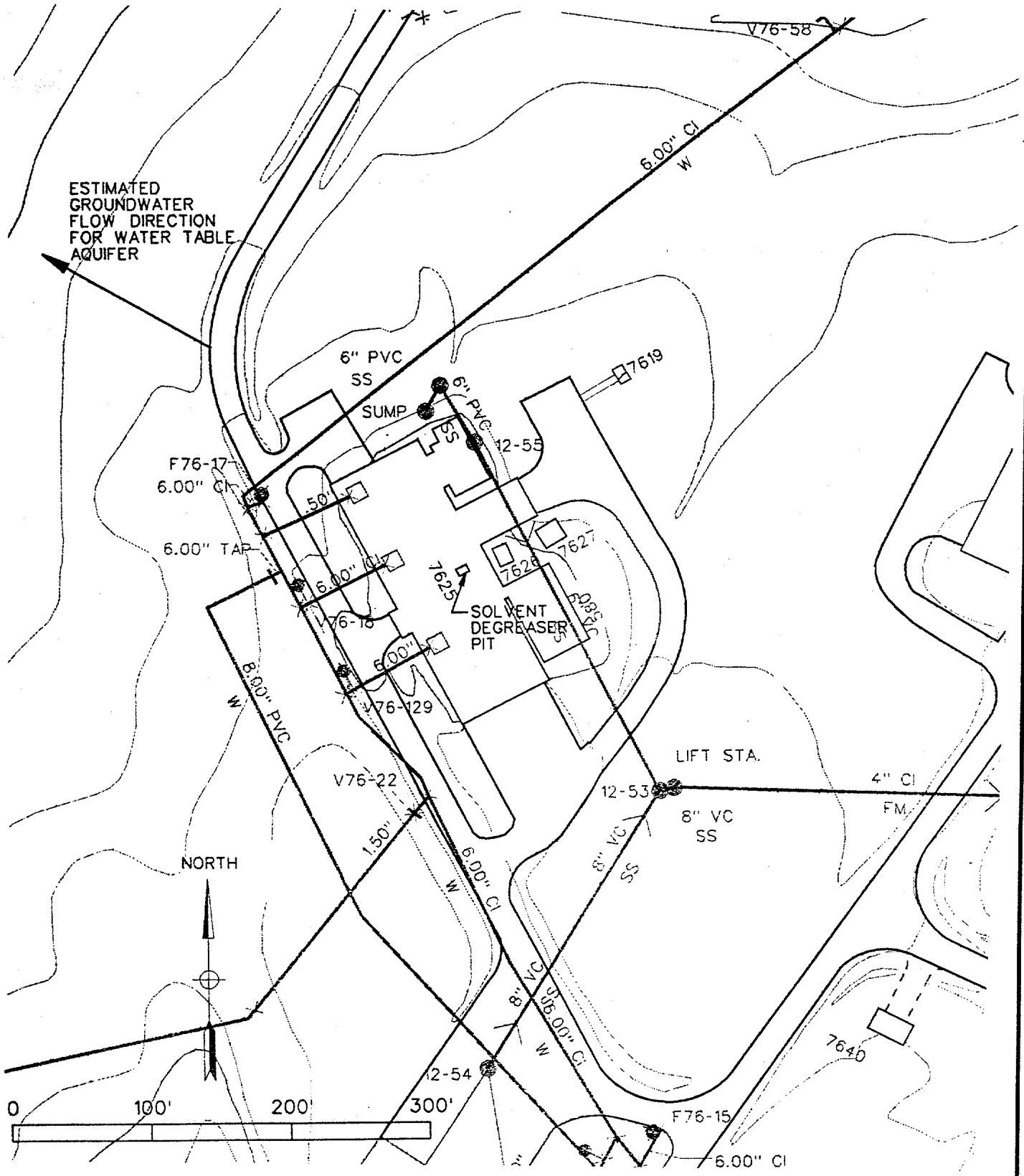
RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 3-1
SITE LOCATIONS & TOPOGRAPHY
(RSA 94, 95, 96, 97 & 98)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 3-2
SITE LOCATIONS
(RSA-94, 95, 96, 97 & 98)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

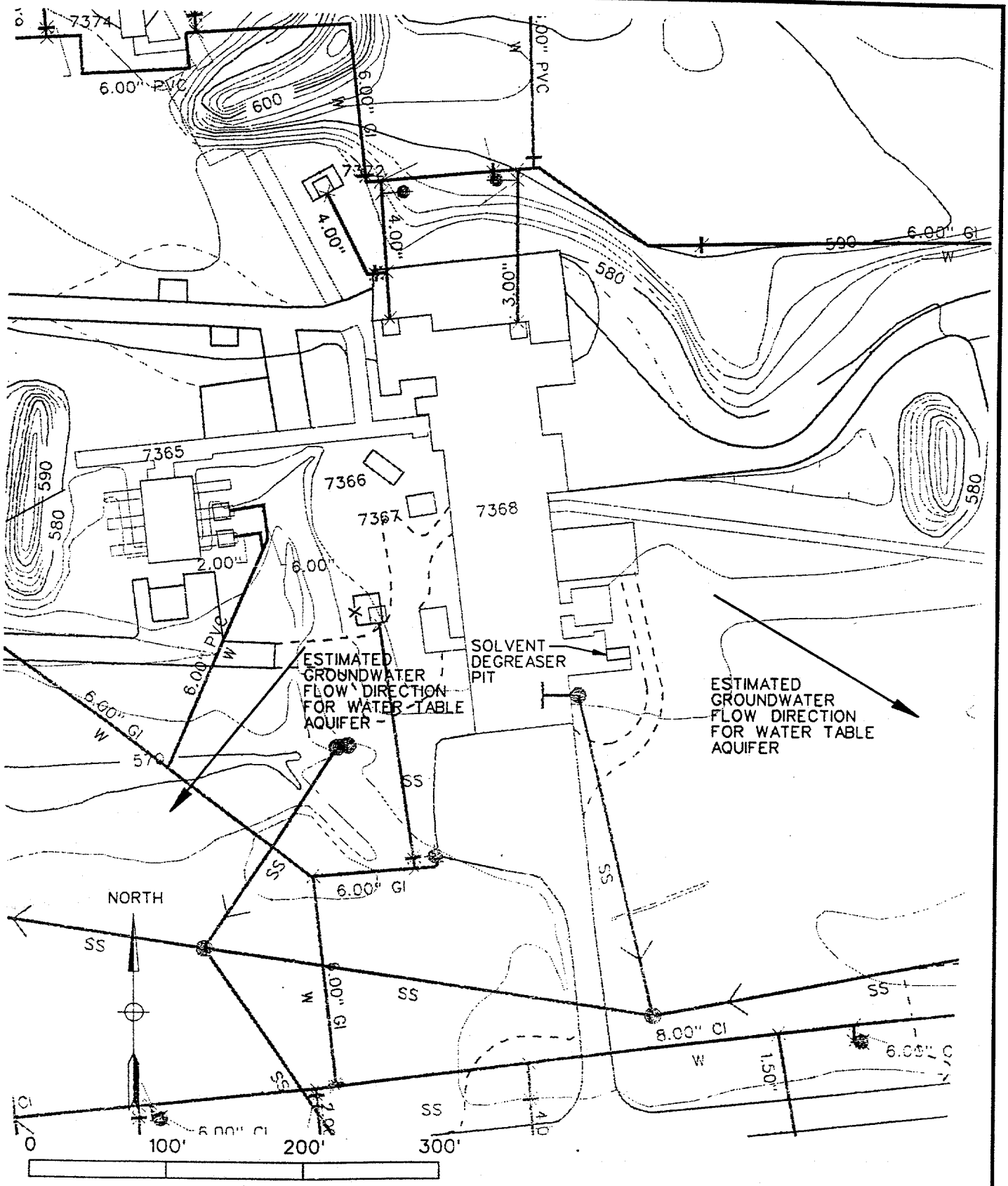
33833



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 3-3
SITE LOCATION (RSA-94)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

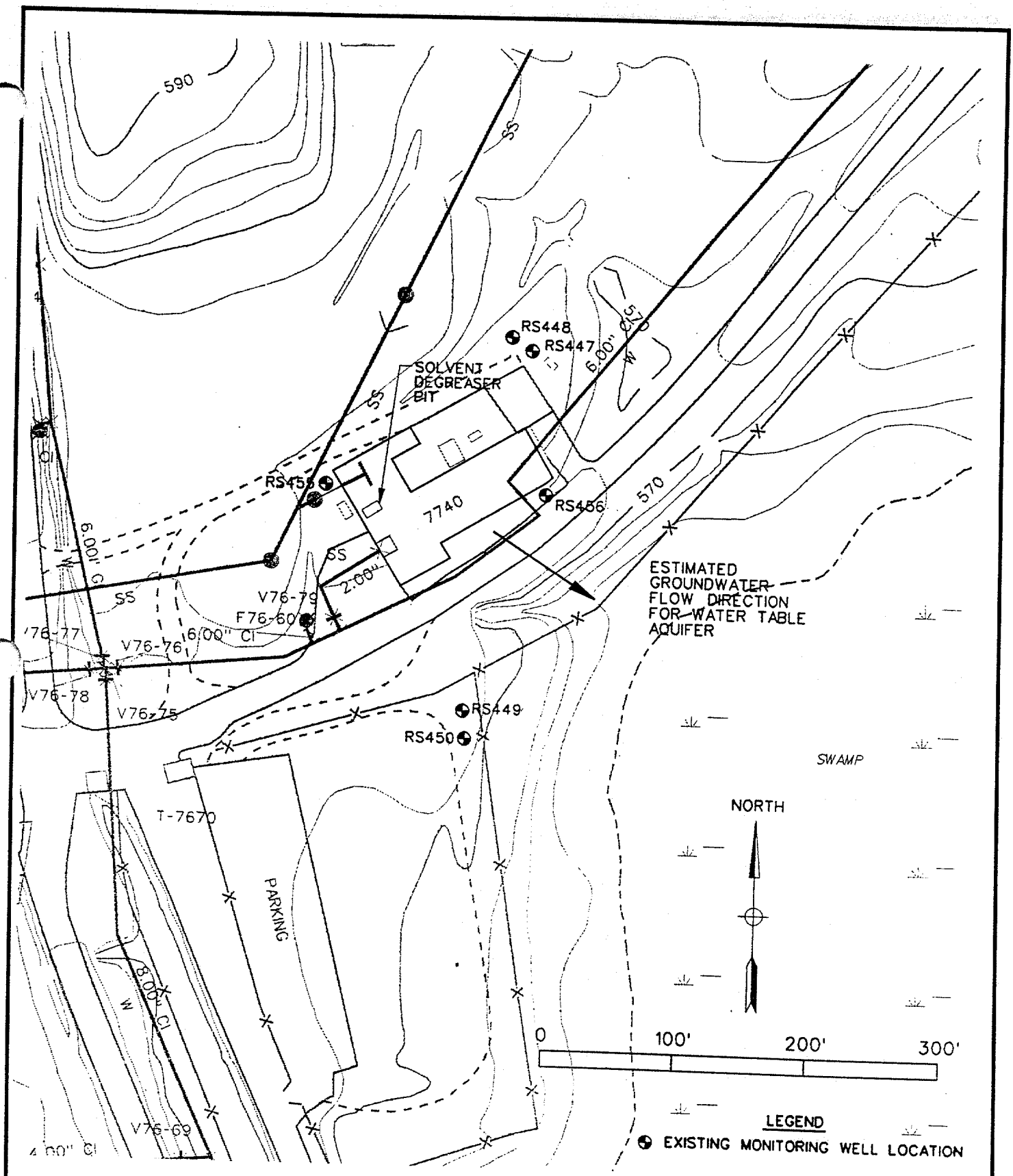
33833.



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 3-4
SITE LOCATION (RSA-95)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

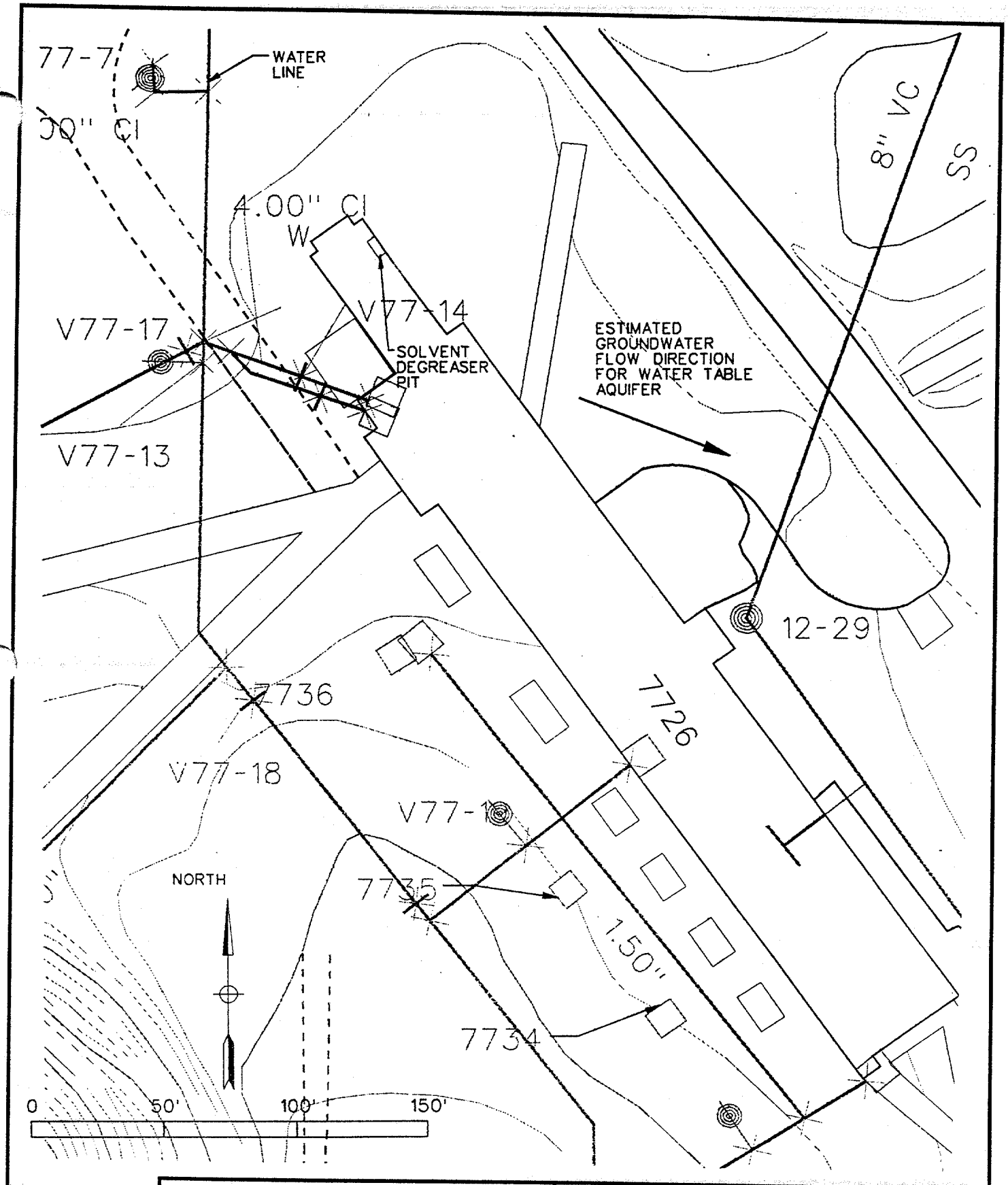
33833.



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 3-5
SITE LOCATION (RSA-96)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

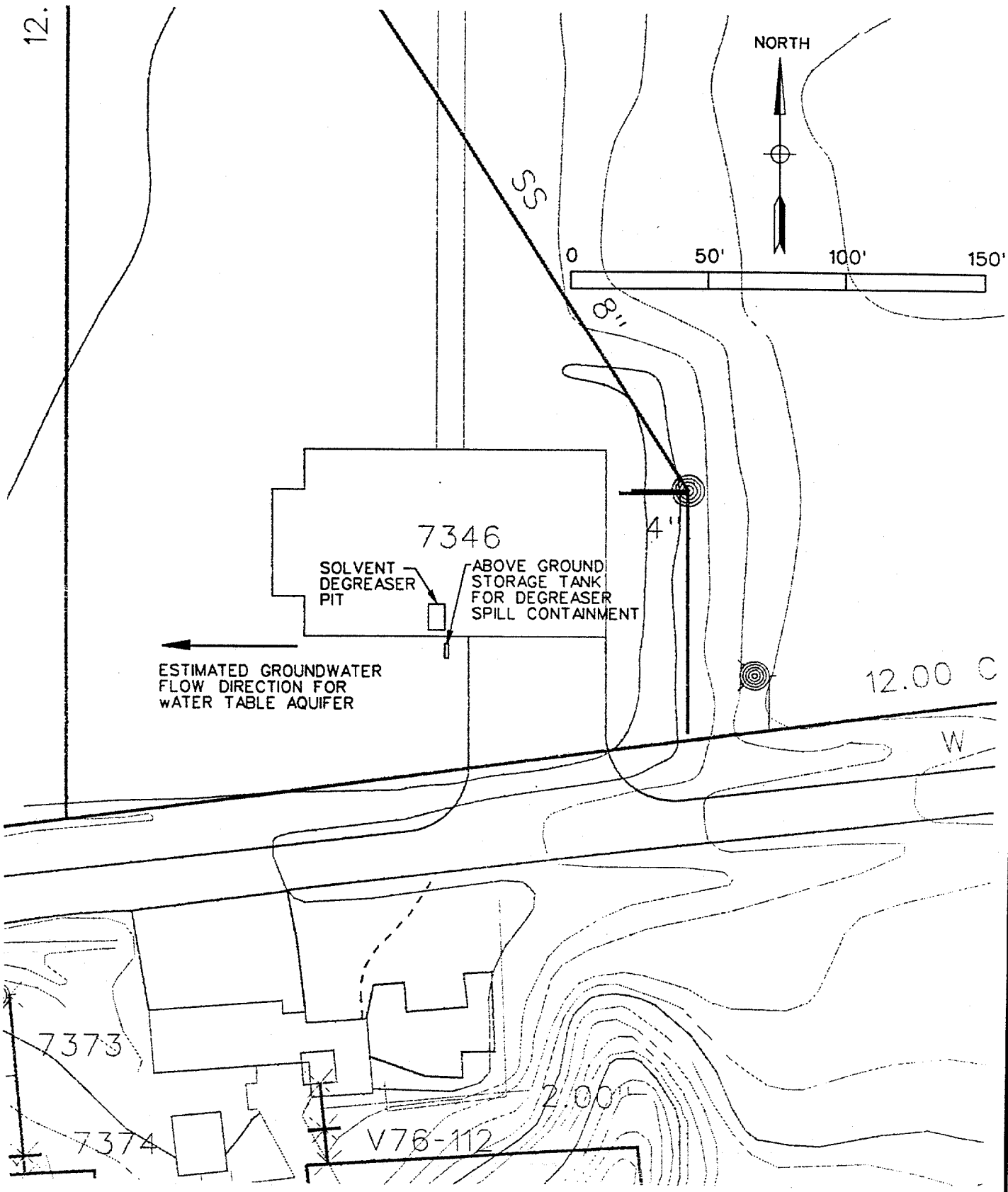
33833.



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 3-6
SITE LOCATION (RSA-97)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

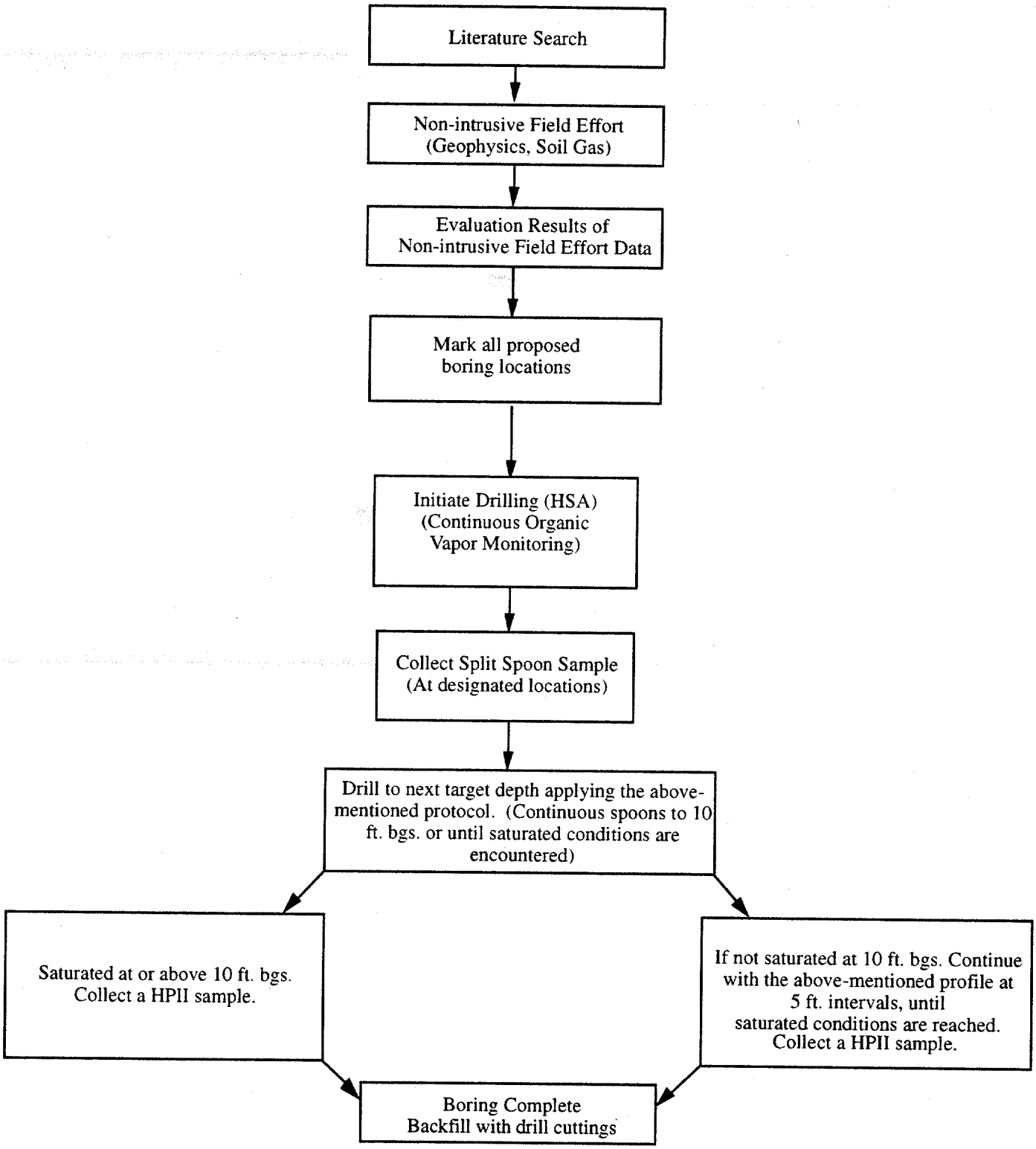
33833.



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 3-7
SITE LOCATION (RSA-98)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

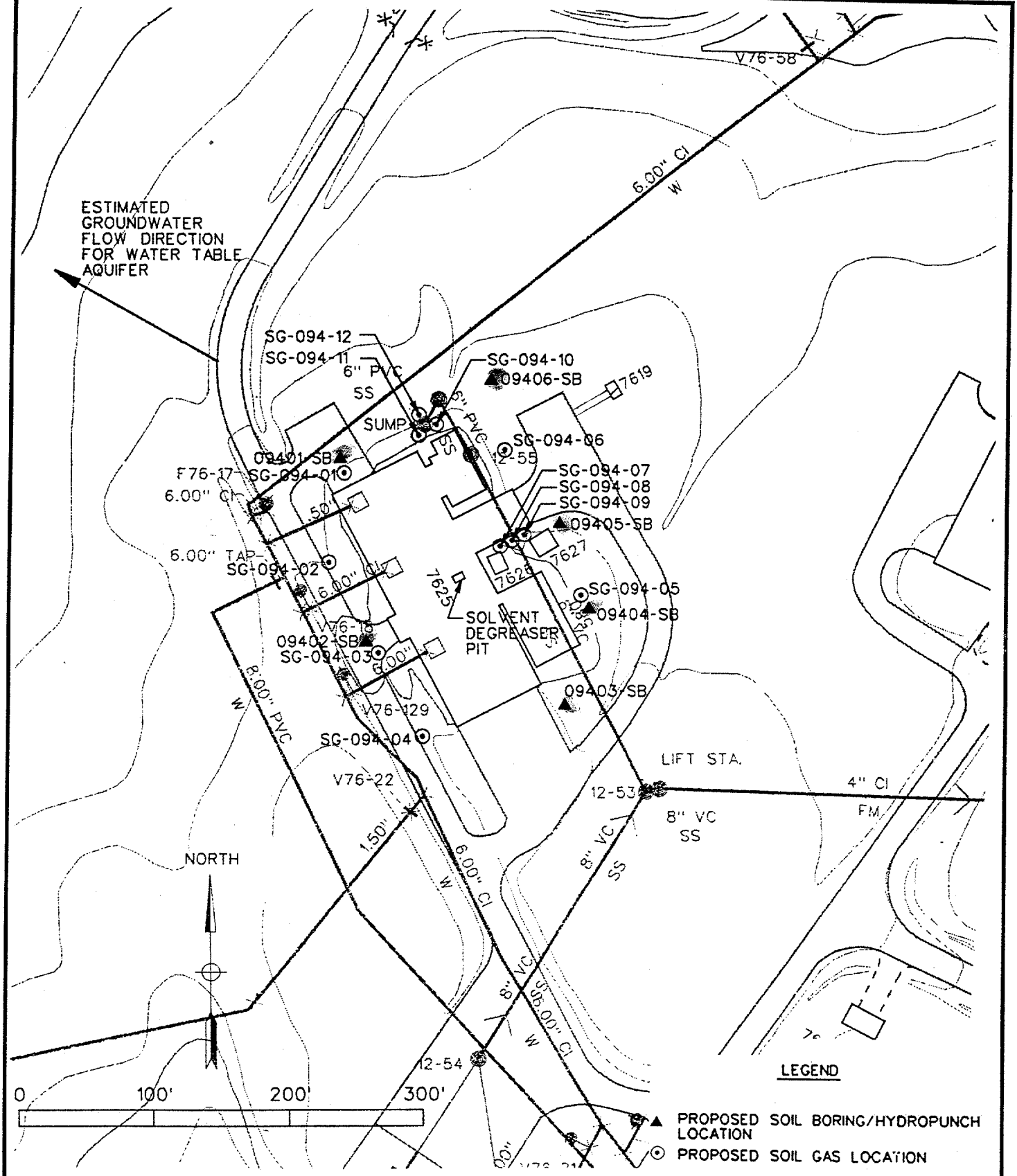
33833.



RUST ENVIRONMENT & INFRASTRUCTURE

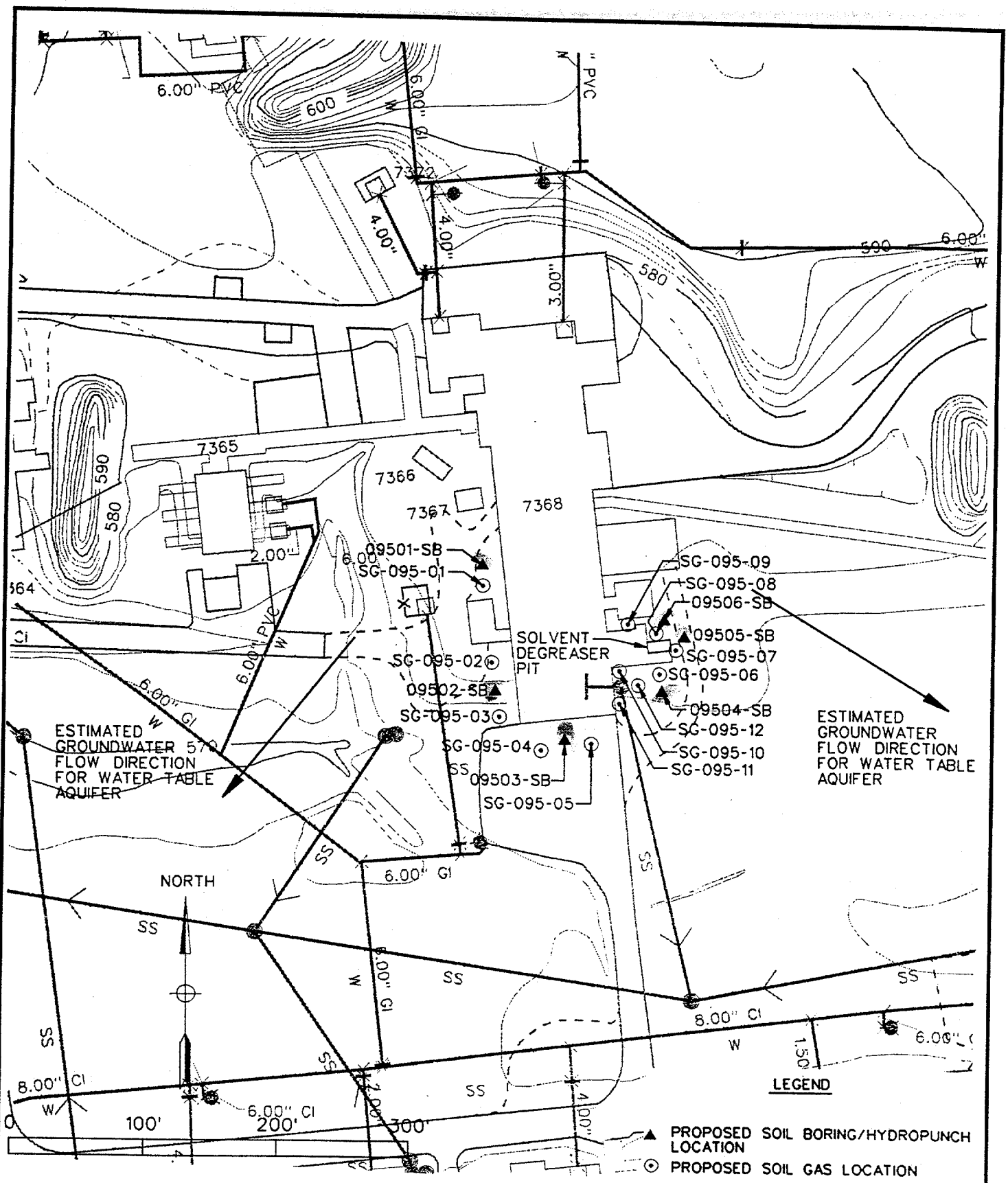
FIGURE 4-1
SOIL BORING PROTOCOL
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

33833.



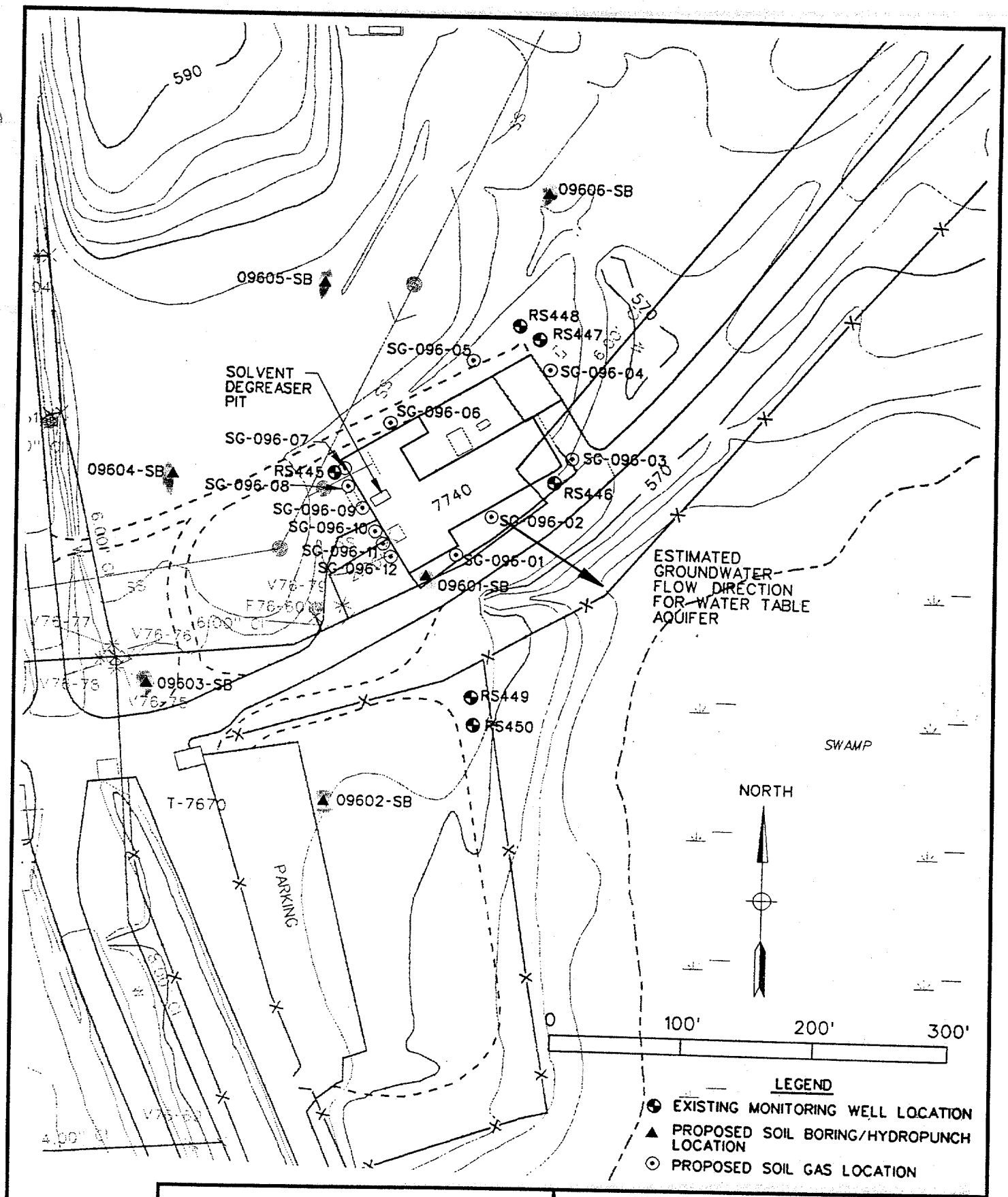
RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 4-2
PROPOSED SAMPLING LOCATIONS (RSA-94)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



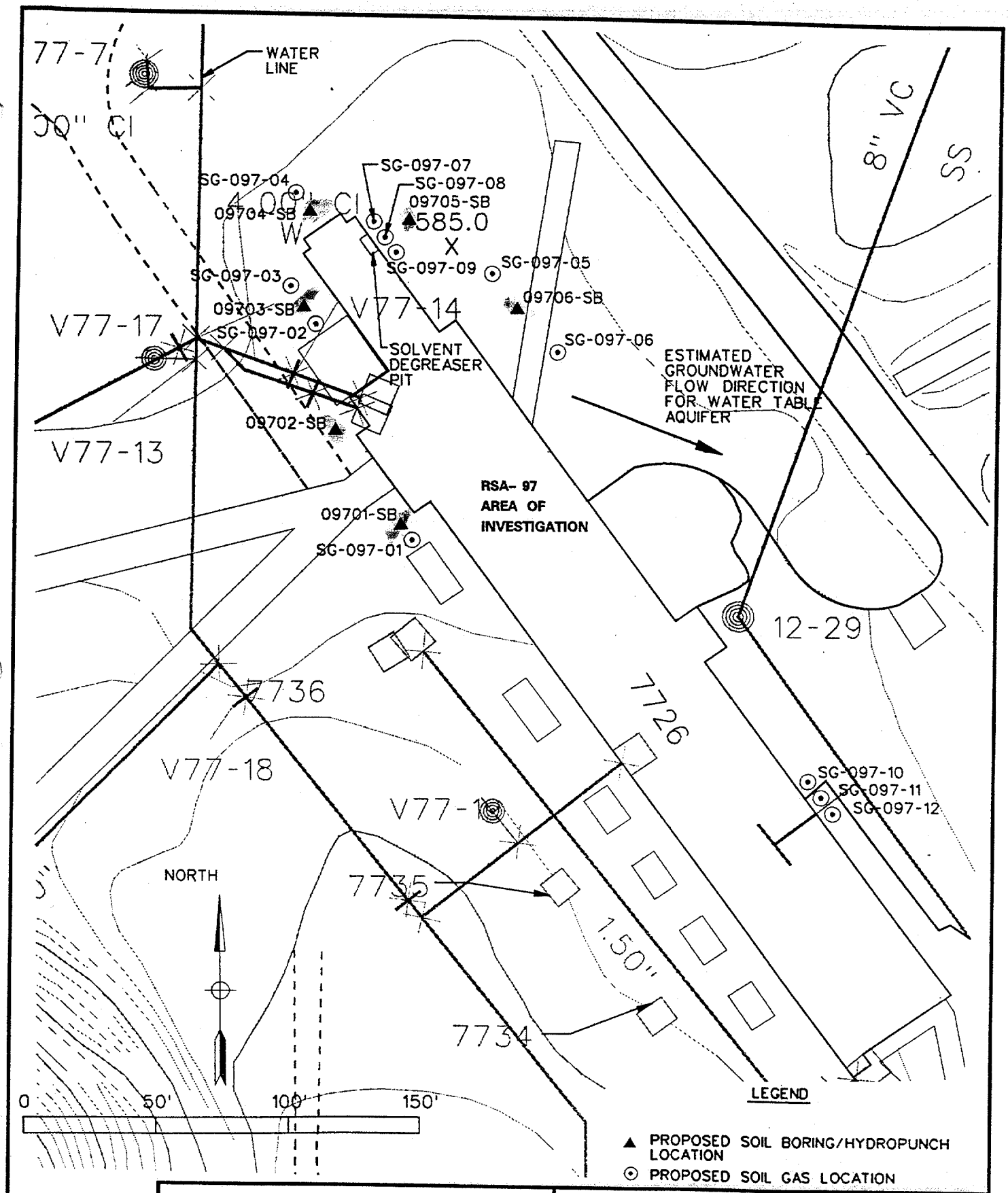
RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 4-3
PROPOSED SAMPLING LOCATIONS (RSA-95)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



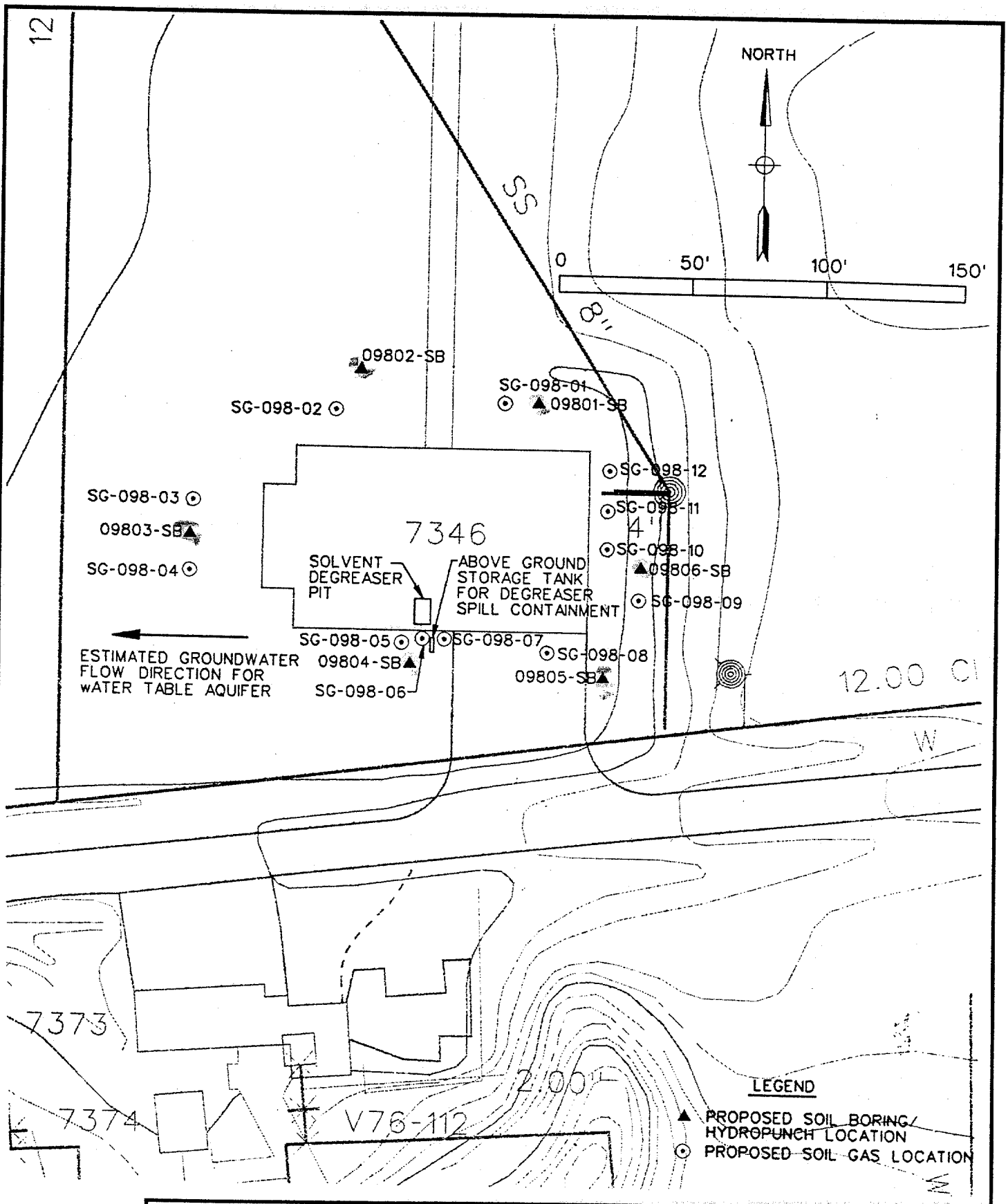
RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 4-4
PROPOSED SAMPLING LOCATIONS (RSA-96)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



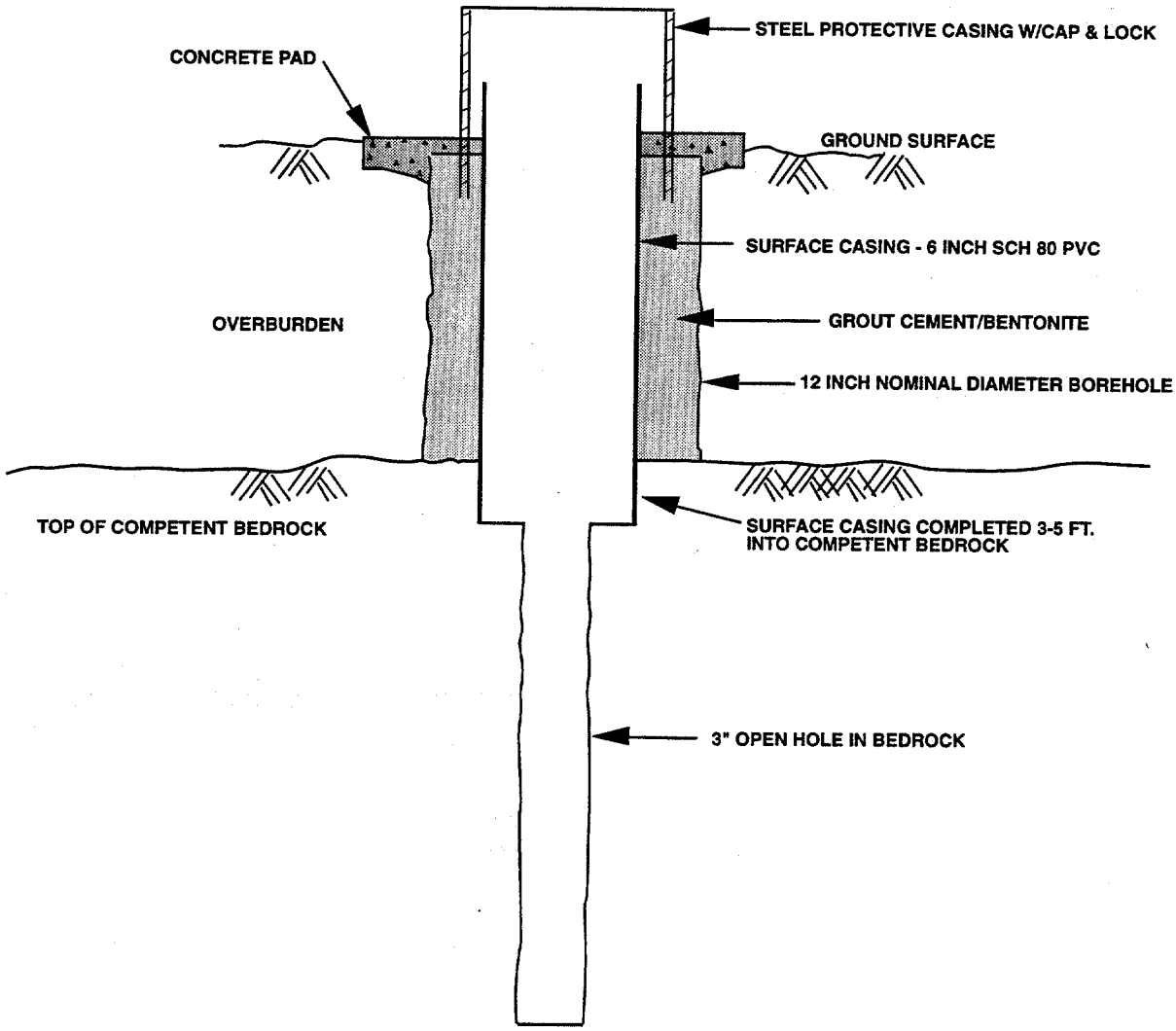
RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 4-5
PROPOSED SAMPLING LOCATIONS (RSA-97)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



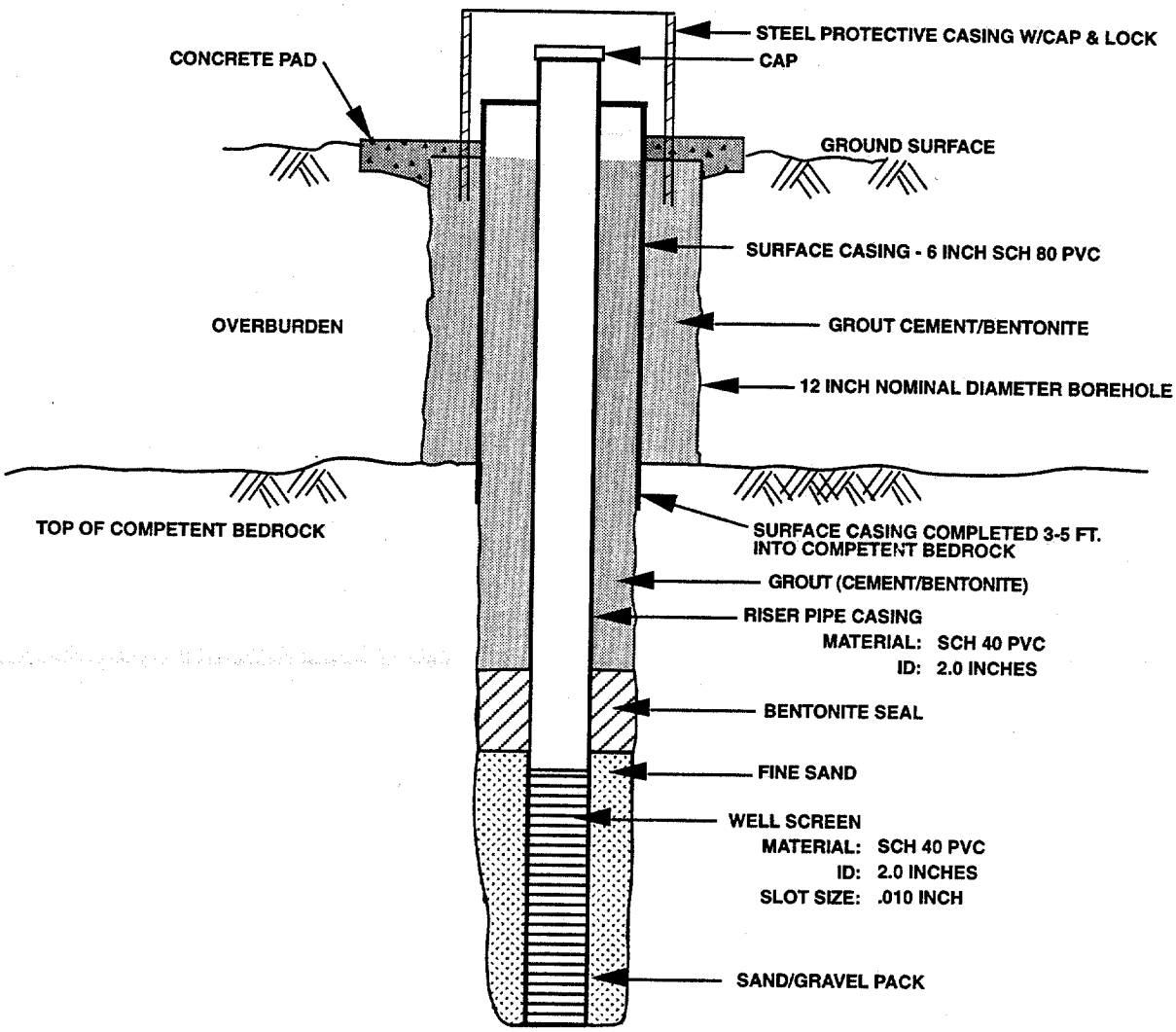
RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 4-6
PROPOSED SAMPLING LOCATIONS (RSA-98)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



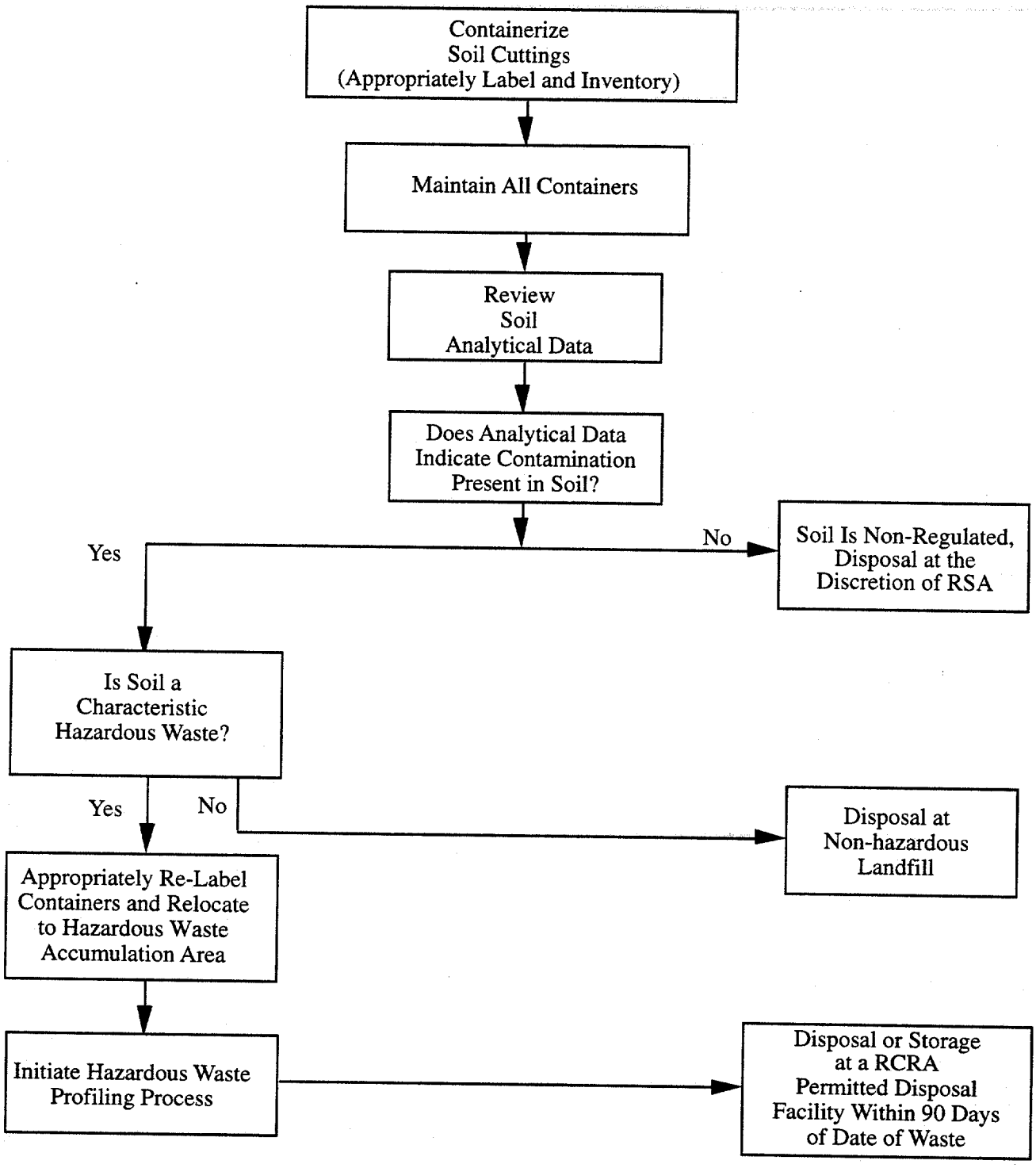
RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 4-7
MONITORING WELL DETAIL
OPEN-HOLE BEDROCK
WELL INSTALLATION
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



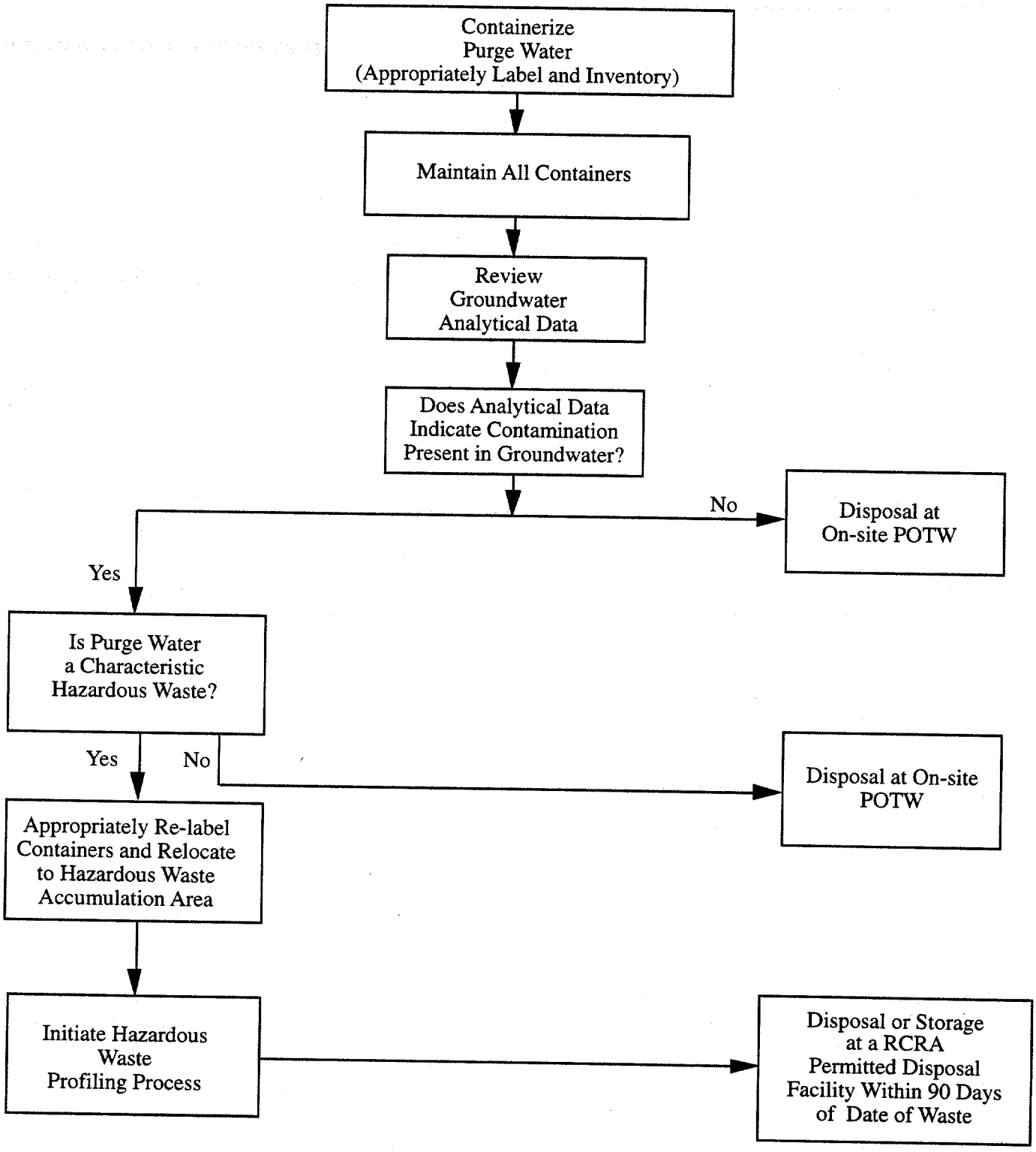
RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 4-8
MONITORING WELL DETAIL
BEDROCK WELL INSTALLATION
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



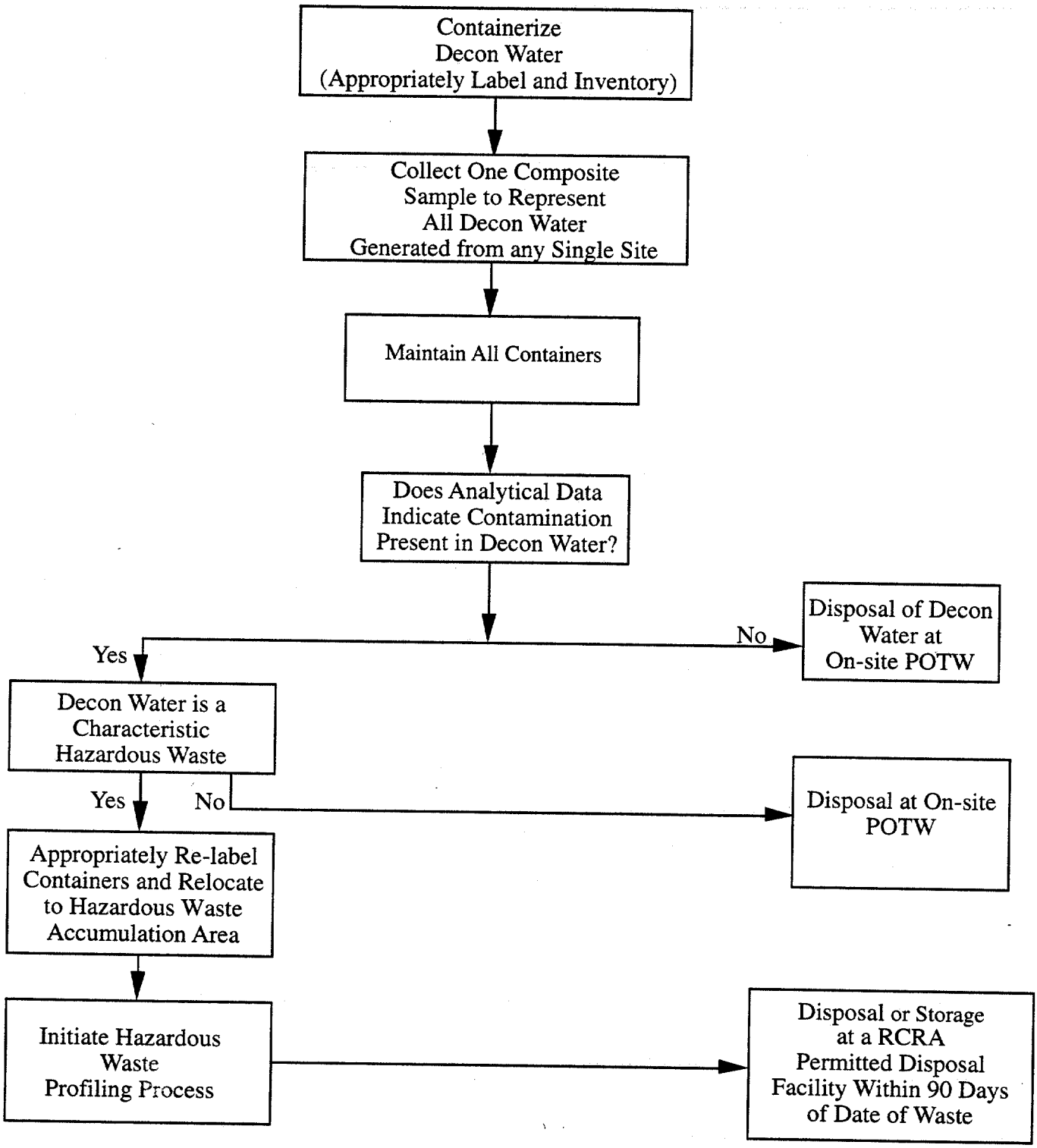
RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 5-1
IDW CHARACTERIZATION OF SOIL CUTTINGS
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



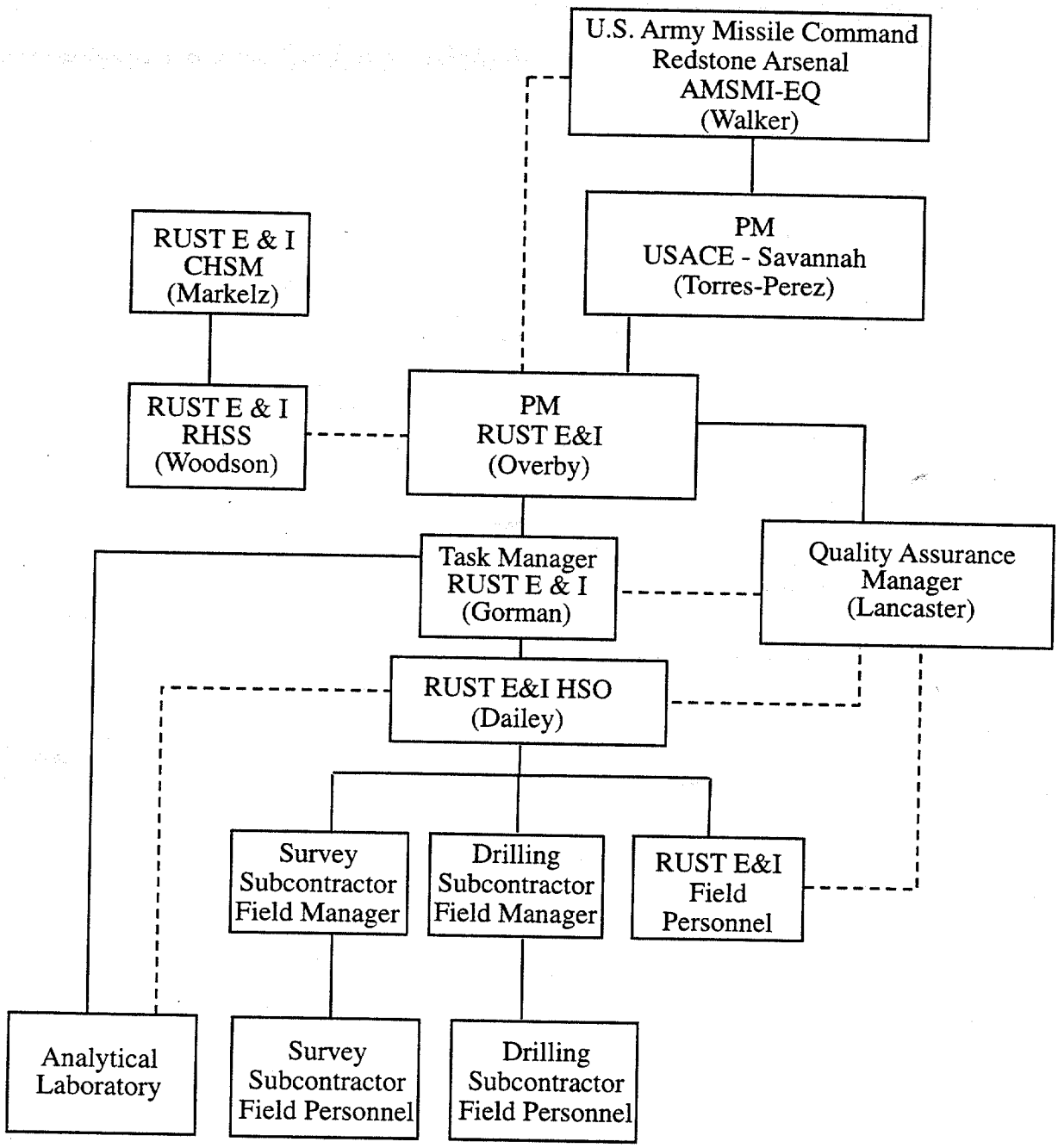
RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 5-2
IDW CHARACTERIZATION OF PURGE WATER
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 5-3
IDW CHARACTERIZATION OF DECON WATER
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



Legend:

Direct Line of Communication/Authority

Indirect Line of Communication/Authority (utilized by the project)

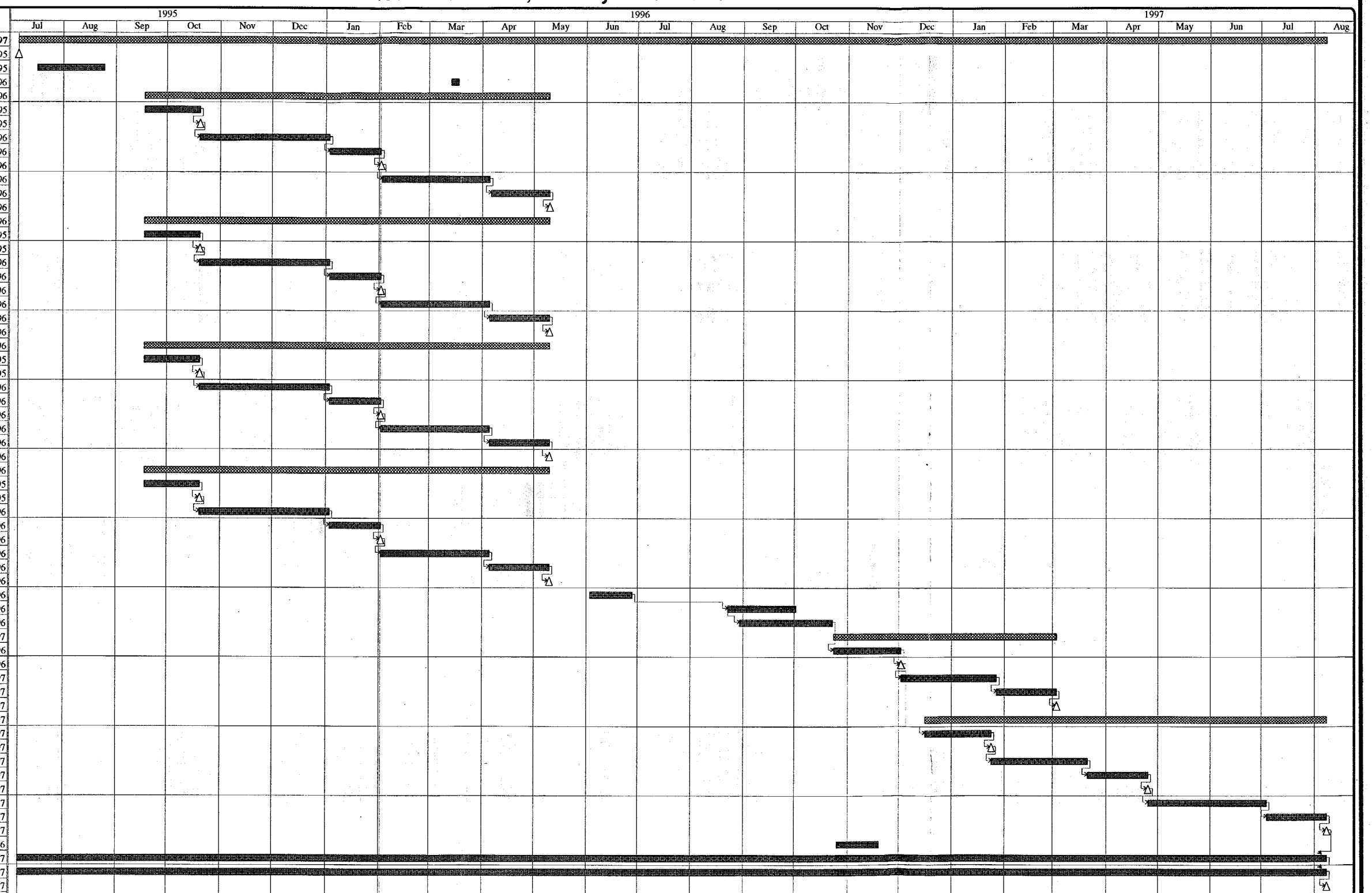
RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 6-1
STAFF ORGANIZATION CHART
SITE INSPECTIONS
RSA-94, 95, 96, 97 & 98
REDSTONE ARSENAL, ALABAMA

33833.

Phase I - Site Inspection, RSA 94, 95, 96, 97 and 98
Redstone Arsenal, Alabama
Contract No. DACA-21-93-D-0029, Delivery Order No.25

Row #	Task Name	Duration	Start	End
1	**DELIVERY ORDERS 25**	**109.27 w**	**Jul/06/95**	**Aug/08/97**
2	NOTICE TO PROCEED	0.00 d	Jul/06/95	Jul/06/95
3	PRE-WORK MEETING/RECORDS SEARCH	5.71 w	Jul/17/95	Aug/25/95
4	REVIEW CONFERENCE	5.00 d	Mar/14/96	Mar/18/96
5	WORK PLANS	33.71 w	Sep/18/95	May/10/96
6	Prepare Draft	4.71 w	Sep/18/95	Oct/20/95
7	Submit Draft	0.00 d	Oct/20/95	Oct/20/95
8	USACE Review	10.80 w	Oct/20/95	Jan/03/96
9	Prepare Draft Final	4.30 w	Jan/03/96	Feb/02/96
10	Submit Draft Final	0.00 d	Feb/02/96	Feb/02/96
11	USACE/Regulatory Review	9.00 w	Feb/03/96	Apr/05/96
12	Prepare Final	5.00 w	Apr/06/96	May/10/96
13	Submit Final	0.00 d	May/10/96	May/10/96
14	SOIL SAMPLING & FIELD SAMPLING PLAN	33.67 w	Sep/18/95	May/10/96
15	Prepare Draft	4.71 w	Sep/18/95	Oct/20/95
16	Submit Draft	0.00 d	Oct/20/95	Oct/20/95
17	USACE Review	10.80 w	Oct/20/95	Jan/03/96
18	Prepare Draft Final	4.30 w	Jan/03/96	Feb/02/96
19	Submit Draft Final	0.00 d	Feb/02/96	Feb/02/96
20	USACE/Regulatory Review	9.00 w	Feb/02/96	Apr/05/96
21	Prepare Final	5.00 w	Apr/05/96	May/10/96
22	Submit Final	0.00 d	May/10/96	May/10/96
23	SITE SAFETY & HEALTH PLAN	33.67 w	Sep/18/95	May/10/96
24	Prepare Draft	4.71 w	Sep/18/95	Oct/20/95
25	Submit Draft	0.00 d	Oct/20/95	Oct/20/95
26	USACE Review	10.80 w	Oct/20/95	Jan/03/96
27	Prepare Draft Final	4.30 w	Jan/03/96	Feb/02/96
28	Submit Draft Final	0.00 d	Feb/02/96	Feb/02/96
29	USACE/Regulatory Review	9.00 w	Feb/02/96	Apr/05/96
30	Prepare Final	5.00 w	Apr/05/96	May/10/96
31	Submit Final	0.00 d	May/10/96	May/10/96
32	CHEMICAL DATA ACQUISITION PLAN	33.67 w	Sep/18/95	May/10/96
33	Prepare Draft	4.71 w	Sep/18/95	Oct/20/95
34	Submit Draft	0.00 d	Oct/20/95	Oct/20/95
35	USACE Review	10.80 w	Oct/20/95	Jan/03/96
36	Prepare Draft Final	4.30 w	Jan/03/96	Feb/02/96
37	Submit Draft Final	0.00 d	Feb/02/96	Feb/02/96
38	USACE/Regulatory Review	9.00 w	Feb/02/96	Apr/05/96
39	Prepare Final	5.00 w	Apr/05/96	May/10/96
40	Submit Final	0.00 d	May/10/96	May/10/96
41	SITE CLEARING & SOIL GAS STUDY	3.60 w	Jun/03/96	Jun/28/96
42	DRILLING, SAMPLING & LEVEL SURVEY	5.70 w	Aug/23/96	Oct/02/96
43	CHEMICAL TESTING	7.86 w	Aug/30/96	Oct/23/96
44	QUALITY CONTROL SUMMARY REPORT	18.70 w	Oct/24/96	Mar/03/97
45	Prepare Draft	5.70 w	Oct/24/96	Dec/02/96
46	Submit Draft	0.00 d	Dec/02/96	Dec/02/96
47	USACE Review	8.00 w	Dec/02/96	Jan/27/97
48	Prepare Final	5.00 w	Jan/27/97	Mar/03/97
49	Submit Final	0.00 d	Mar/03/97	Mar/03/97
50	SITE INSPECTION REPORT	33.70 w	Dec/16/96	Aug/08/97
51	Prepare Draft	5.70 w	Dec/16/96	Jan/24/97
52	Submit Draft	0.00 d	Jan/24/97	Jan/24/97
53	USACE Review	8.00 w	Jan/24/97	Mar/21/97
54	Prepare Draft Final	5.00 w	Mar/21/97	Apr/25/97
55	Submit Draft Final	0.00 d	Apr/25/97	Apr/25/97
56	USACE/Regulatory Review	10.00 w	Apr/25/97	Jul/04/97
57	Prepare Final	5.00 w	Jul/04/97	Aug/08/97
58	Submit Final	0.00 d	Aug/08/97	Aug/08/97
59	DISPOSAL OF IDW	3.50 w	Oct/26/96	Nov/19/96
60	SUPPORT TO COMMUNITY RELATIONS	109.27 w	Jul/06/95	Aug/08/97
61	MONTHLY REPORTS	109.27 w	Jul/06/95	Aug/08/97
62	PROJECT COMPLETE	0.00 d	Aug/08/97	Aug/08/97



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Page 1
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Milestone △ Summary

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 6-2
PROJECT SCHEDULE
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

TABLES

TABLE 4-1
SUMMARY OF SI FIELD ACTIVITIES
REDSTONE ARSENAL, ALABAMA

	Shallow Soil Sampling	Subsurface Soil Sampling	HPII GW Sampling	Existing MW Sampling	Surface Water Sampling	Sediment Sampling	Other Sampling	Soil Gas Sampling
RSA-94	X	X	X					X
RSA-95	X	X	X					X
RSA-96	X	X	X					X
RSA-97	X	X	X					X
RSA-98	X	X	X					X

TABLE 4-2
DETAILED SOIL BORING SCHEME
REDSTONE ARSENAL, ALABAMA

Boring No.	Anticipated Depth (feet)	Sample Intervals	Samples Submitted for Analysis		
			Number of Soil Samples	Number of Geotech Samples	Number of Hydropunch Samples
RSA-94					
09401	16	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09402	16	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09403	16	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09404	16	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09405	16	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09406	16	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
RSA-95					
09501	18	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09502	18	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09503	18	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09504	18	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09505	18	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09506	18	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
RSA-96					
09601	12	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09602	12	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09603	12	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09604	12	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09605	12	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09606	12	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
RSA-97					
09701	20	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09702	20	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09703	20	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09704	20	Continuous 0-10 ft , every 5 ft thereafter	3	1	1

TABLE 4-2 (Continued)
DETAILED SOIL BORING SCHEME
REDSTONE ARSENAL, ALABAMA

Boring No.	Anticipated Depth (feet)	Sample Intervals	Samples Submitted for Analysis		
			Number of Soil Samples	Number of Geotech Samples	Number of Hydropunch Samples
09705	20	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09706	20	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
RSA-98					
09801	20	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09802	20	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09803	20	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09804	20	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09805	20	Continuous 0-10 ft , every 5 ft thereafter	3	1	1
09806	20	Continuous 0-10 ft , every 5 ft thereafter	3	1	1

TABLE 5-1
DETAILED ANALTICAL PROGRAM
REDSTONE ARSENAL, ALABAMA

RSA-94													
			QUALITY CONTROL SAMPLES				QUALITY ASSURANCE SAMPLES			CONTAINER, PRESERVATION, HOLDING TIME			
Matrix	Parameter	Analytical Method	No. of Field Samples	No. of Dups	No. of Trip Blanks	Total A-E Samples	No. of Splits	No. of QA Trip Blanks	Total QA Samples	Preservation[4]	Holding Time[4]	Volume/Container[4]	No. of Containers
Soil Gas	VOC[1]	TD-MS[2] TD-GC/MS[3]	12	3	0	15	0	0	0	None required	6 months	PETREX™ passive gas sampler with activated charcoal absorption element	15
Soil	VOC	EPA 8260/5030	18	2	0	20	2	0	2	Cool to 4°C No headspace	14 days	4 oz. CWM[5] with PTPE septa	44
Groundwater	VOC	EPA 8260/5030	6	1	1	8	1	1	2	HCL to pH < 2 Cool to 4°C No headspace	14 days	3x40mL GSV[6] with PTPE septa	30

[1]Volatile Organic Compound
[2]Thermal Desorption-Mass Spectrometry: Used for Field Samples
[3]Thermal Desorption-Gas Chromatograph/Mass Spectrometry: Used for Duplicate Samples
[4]Reference: USACE, September 1, 1994, Requirements for the Preparation of Sampling and Analysis Plans, EM200-1-3 (Table I-1, revised March 31, 1995)
[5]CWM – Clear Wide-Mouth Glass
[6]GSV - Glass Septa Vial with PTPE (Teflon) septa cap

TABLE 5-1 (Continued)
DETAILED ANALTICAL PROGRAM
REDSTONE ARSENAL, ALABAMA

RSA-95													
			QUALITY CONTROL SAMPLES				QUALITY ASSURANCE SAMPLES			CONTAINER, PRESERVATION, HOLDING TIME			
Matrix	Parameter	Analytical Method	No. of Field Samples	No. of Dups	No. of Trip Blanks	Total A-E Samples	No. of Splits	No. of QA Trip Blanks	Total QA Samples	Preservation[4]	Holding Time[4]	Volume/Container[4]	No. of Containers
Soil Gas	VOC[1]	TD-MS[2] TD-GC/MS[3]	12	3	0	15	0	0	0	None required	6 months	PETREX™ passive gas sampler with activated charcoal absorption element	15
Soil	VOC	EPA 8260/5030	18	2	0	20	2	0	2	Cool to 4°C No headspace	14 days	4 oz. CWM[5] with PTPE septa	44
Groundwater	VOC	EPA 8260/5030	6	0	1	7	0	0	0	HCL to pH < 2 Cool to 4°C No headspace	14 days	3x40mL GSV[6] with PTPE septa	21

[1]Volatile Organic Compound
[2]Thermal Desorption-Mass Spectrometry: Used for Field Samples
[3]Thermal Desorption-Gas Chromatograph/Mass Spectrometry: Used for Duplicate Samples
[4]Reference: USACE, September 1, 1994, Requirements for the Preparation of Sampling and Analysis Plans, EM200-1-3 (Table I-1, revised March 31, 1995)
[5]CWM – Clear Wide-Mouth Glass
[6]GSV - Glass Septa Vial with PTPE (Teflon) septa cap

TABLE 5-1 (Continued)
DETAILED ANALTICAL PROGRAM
REDSTONE ARSENAL, ALABAMA

RSA-96													
			QUALITY CONTROL SAMPLES				QUALITY ASSURANCE SAMPLES			CONTAINER, PRESERVATION, HOLDING TIME			
Matrix	Parameter	Analytical Method	No. of Field Samples	No. of Dups	No. of Trip Blanks	Total A-E Samples	No. of Splits	No. of QA Trip Blanks	Total QA Samples	Preservation[4]	Holding Time[4]	Volume/Container[4]	No. of Containers
Soil Gas	VOC[1]	TD-MS[2] TD-GC/MS[3]	12	2	0	14	0	0	0	None required	6 months	PETREX™ passive gas sampler with activated charcoal absorption element	14
Soil	VOC	EPA 8260/5030	18	2	0	20	1	0	1	Cool to 4°C No headspace	14 days	4 oz. CWM[5] with PTPE septa	42
Groundwater	VOC	EPA 8260/5030	6	1	1	8	1	1	2	HCL to pH < 2 Cool to 4°C No headspace	14 days	3x40mL GSV[6] with PTPE septa	30

[1]Volatile Organic Compound
[2]Thermal Desorption-Mass Spectrometry: Used for Field Samples
[3]Thermal Desorption-Gas Chromatograph/Mass Spectrometry: Used for Duplicate Samples
[4]Reference: USACE, September 1, 1994, Requirements for the Preparation of Sampling and Analysis Plans, EM200-1-3 (Table I-1, revised March 31, 1995)
[5]CWM – Clear Wide-Mouth Glass
[6]GSV - Glass Septa Vial with PTPE (Teflon) septa cap

TABLE 5-1 (Continued)
DETAILED ANALTICAL PROGRAM
REDSTONE ARSENAL, ALABAMA

RSA-97													
			QUALITY CONTROL SAMPLES				QUALITY ASSURANCE SAMPLES			CONTAINER, PRESERVATION, HOLDING TIME			
Matrix	Parameter	Analytical Method	No. of Field Samples	No. of Dups	No. of Trip Blanks	Total A-E Samples	No. of Splits	No. of QA Trip Blanks	Total QA Samples	Preservation[4]	Holding Time[4]	Volume/Container[4]	No. of Containers
Soil Gas	VOC[1]	TD-MS[2] TD-GC/MS[3]	12	2	0	14	0	0	0	None required	6 months	PETREX™ passive gas sampler with activated charcoal absorption element	14
Soil	VOC	EPA 8260/5030	18	2	0	20	2	0	2	Cool to 4°C No headspace	14 days	4 oz. CWM[5] with PTPE septa	44
Groundwater	VOC	EPA 8260/5030	6	0	1	7	0	0	0	HCL to pH < 2 Cool to 4°C No headspace	14 days	3x40mL GSV[6] with PTPE septa	21

[1]Volatile Organic Compound
[2]Thermal Desorption-Mass Spectrometry: Used for Field Samples
[3]Thermal Desorption-Gas Chromatograph/Mass Spectrometry: Used for Duplicate Samples
[4]Reference: USACE, September 1, 1994, Requirements for the Preparation of Sampling and Analysis Plans, EM200-1-3 (Table I-1, revised March 31, 1995)
[5]CWM – Clear Wide-Mouth Glass
[6]GSV - Glass Septa Vial with PTPE (Teflon) septa cap

TABLE 5-1 (Continued)
DETAILED ANALTICAL PROGRAM
REDSTONE ARSENAL, ALABAMA

RSA-98													
			QUALITY CONTROL SAMPLES				QUALITY ASSURANCE SAMPLES			CONTAINER, PRESERVATION, HOLDING TIME			
Matrix	Parameter	Analytical Method	No. of Field Samples	No. of Dups	No. of Trip Blanks	Total A-E Samples	No. of Splits	No. of QA Trip Blanks	Total QA Samples	Preservation[4]	Holding Time[4]	Volume/Container[4]	No. of Containers
Soil Gas	VOC[1]	TD-MS[2] TD-GC/MS[3]	12	2	0	14	0	0	0	None required	6 months	PETREX™ passive gas sampler with activated charcoal absorption element	14
Soil	VOC	EPA 8260/5030	18	1	0	19	2	0	2	Cool to 4°C No headspace	14 days	4 oz. CWM[5] with PTPE septa	42
Groundwater	VOC	EPA 8260/5030	6	1	1	8	1	1	2	HCL to pH < 2 Cool to 4°C No headspace	14 days	3x40mL GSV[6] with PTPE septa	30

[1]Volatile Organic Compound
[2]Thermal Desorption-Mass Spectrometry: Used for Field Samples
[3]Thermal Desorption-Gas Chromatograph/Mass Spectrometry: Used for Duplicate Samples
[4]Reference: USACE, September 1, 1994, Requirements for the Preparation of Sampling and Analysis Plans, EM200-1-3 (Table I-1, revised March 31, 1995)
[5]CWM – Clear Wide-Mouth Glass
[6]GSV - Glass Septa Vial with PTPE (Teflon) septa cap

APPENDIX A

SAMPLING, ANALYSIS, AND DATA EVALUATION GUIDANCE

DRAFT FINAL

SITE INSPECTION

SAMPLING, ANALYSIS, AND DATA EVALUATION GUIDANCE

RSA-94, 95, 96, 97, 98

REDSTONE ARSENAL, ALABAMA

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1.0 SAMPLING PROCEDURES

Field activities for this project include soil gas surveys, drilling and subsurface soil sampling, HydroPunch II™ (HPII) groundwater sampling, and air monitoring. Information resulting from these investigations will provide defensible data to support future site decisions.

Sampling procedures, including collection, containerization, preservation, documentation, and equipment decontamination, are discussed in this section.

1.1 GENERAL CONSIDERATIONS

Field activities affecting data quality and any deviation from Standard Operating Procedures (SOPs) will be documented. Activities affecting data quality include sample management, reagent/standard preparation, decontamination, sample collection, field measurements, equipment calibration and maintenance, and corrective action.

Samples will be collected from areas of least contamination to those of higher contamination based on previous data if available.

1.2 SAMPLE LOCATIONS

Information regarding sampling locations, frequency, and rationale can be found in Section 4.0 of the TSOW. All sample locations are designated on the site maps shown in Figures 4-2 through 4-6 of the TSOW.

1.3 DECONTAMINATION, CONTAINERIZATION, AND PRESERVATION

Prior to collection of any environmental sample, sampling equipment must be decontaminated according to the procedures outlined in Section 4.1.6 of the TSOW to avoid cross contamination of samples. Sample containers will be furnished by the laboratory or will be supplied by a commercial laboratory supply vendor. Sample containers will be pre-preserved at the laboratory when applicable. Preservation requirements for each analytical method for each matrix can be found in Table 1-1 of this appendix.

1.4 SAMPLING PROCEDURES

Table 4-2 of the TSOW details the sampling scheme for each unit and sampling point. The table specifies sampling intervals and the number of soil, geotechnical, and groundwater samples collected at each sampling point. Table 5-1 of the TSOW specifies the analytical parameters and quality control (QC) samples to be analyzed. This sampling plan has been designed to obtain representative data.

Table 1-1 of this appendix outlines the specific sample volume, sample containers, preservation requirements, and holding times required for each analytical methodology. The analytical methods to be applied are also listed on Table 1-1.

1.4.1 Sample Screening

Field screening for pH, specific conductance, and temperature of aqueous samples will be conducted prior to collection of samples for analysis. Field screening for volatile vapor will be conducted on subsurface soils using a flame ionization detector (FID) or a photoionization detector (PID) organic vapor analyzer, and the PETREX soil gas technology. The FID or PID will provide VOC concentrations from split spoon sampling at depths from each boring. PETREX sample tubes will collect VOCs in equilibrium with shallow (14 to 18 inches) surface soils. These instruments indicate quantitative total organic compound (VOC) concentrations. Detailed information regarding the calibration and use of a FID and PID can be found in Section 3.2 of this appendix. The PETREX technology is discussed in Section 4.1.1 of the TSOW.

1.4.2 Soil Sampling

Subsurface soil sampling will be conducted as described in Sections 4.1.3 of the TSOW, respectively. Table 4-2 of the TSOW specifies the depth at which each soil sample should be collected.

Samples to be analyzed for VOCs should be immediately transferred into the appropriate sample container. All QC samples will be collected in a similar manner.

Geotechnical testing will be conducted as outlined in Section 5.1 of the TSOW. Physical parameters, including moisture content, Atterberg limits, and grain size, will be determined in accordance with the American Society of Testing Materials (ASTM) procedures shown in Table 1-1.

1.4.3 Water Sampling

Groundwater sampling will be conducted via HPII as described in Section 4.1.4 of the TSOW. As discussed in Section 4.3, groundwater samples may be collected from monitoring wells as part of additional site inspection activities.

All aqueous samples to be analyzed for VOCs will be collected in 40 ml volatile organic analysis (VOA) vials with Teflon™ septa. The vials will be filled in such a way that no preservative (if applicable) overflows from the vial and that an inverted meniscus is obtained prior to closing the vial. This will assure that the sample is properly preserved to the correct pH and that no headspace exists in the sample vial.

1.4.4 Other Matrices

Air monitoring will be conducted for personal safety and to monitor volatile emissions in the work area. Air monitoring will be performed using a FID or PID. The Site Safety and Health Plan (SSHP) contains specifics of air monitoring, trigger levels, and personal protection equipment (PPE).

Soil gas sampling using PETREX passive gas collectors will be conducted as discussed in Section 4.1.1 of the TSOW.

1.5 FIELD DOCUMENTATION

Sampling personnel will record in a permanently bound field log book the preparation activities that may be pertinent to the sampling event at each sampling location. Sampling personnel will use a bound field log book with moisture resistant pages to record pertinent sampling information with waterproof ink. The log book will identify the project name, project number, project manager and telephone number, and principal street address or

geographic location of the site. Daily field activities and sampling information will be entered in the log book on dated, initialed, and serially-numbered pages. Corrections will be made to entries by initialed and dated line-out deletions. A diagonal line will be drawn across the remaining blank space of the last page of each day's entry. Each day's entry will be signed and dated by the author.

The date and time of sample preparation and collection, and personnel who conducted sampling will be recorded with the sample identification number in the field log book and on the chain-of-custody form. The names of visitors and any other persons on site will also be recorded in the field log book. Sampling personnel will also record in the field log book the ambient weather conditions and other conditions at the sampling location that may affect sample collection, the apparent representativeness of the sample, or sample analysis.

1.6 DATA MANAGEMENT

Data management involves maintaining and controlling field data, laboratory analytical data, and any other data relevant to the project. Bound field log books will be used for recording field data. This project will have dedicated field log books which will not be used for other projects. Once completed, the field log book will become part of the project file.

Office data management will involve establishing and maintaining a project file. The project file will consist of the following sections and subsections.

- Administrative
  - External and internal correspondence
  - Notes/minutes of meetings and phone conversations
  - Personnel, organization, and responsibilities
  - Planning and scheduling
  - QA auditing and inspection reports

- Engineering
  - Field sampling
  - Project operations
  - Calculations

- Analytical data
  - Laboratory
  - Field

- Procurement
  - Contract/purchase order
  - Change order
  - Bid evaluations

- Drawings

The project file will be maintained by document control personnel using a documentation log for each section. All project-related information will first be routed to the Rust Project Manager who will be responsible for routing the information to appropriate personnel.

2.0 SAMPLE CUSTODY

Sample collection and sample custody are designed so that field custody of samples will be fully and continuously maintained and documented. These procedures provide complete identification and documentation of the sampling event and the sample chain-of-custody from shipment of sample bottleware, through sample collection, to receipt of the samples by the subcontracted laboratory. When used in conjunction with the laboratory's custody procedures and the sample bottleware documentation, these data will establish full legal custody and allow complete traceability of a sample from preparation and receipt of sample bottleware to sample collection, preservation, and shipping, through laboratory receipt, sample analysis, and data validation.

2.1 SAMPLE IDENTIFICATION AND DOCUMENTATION

After sample collection, all sample containers will be labelled with an identification number that uniquely identifies the sample. The sample identification number will be logged in the field log book, as described in Section 1.5 of this appendix.

Sample identification is discussed in Section 4.1.7 of the TSOW. Samples shipped to the laboratory will have information transcribed to a sample custody chain and analytical request form as shown in Appendix B of the TSOW.

2.2 FIELD CUSTODY PROCEDURES

Field custody procedures are described below as two groups: (1) sample collection procedures that document the bottleware, sample identification, sampling personnel, sample collection procedures, sample preservation, and ambient conditions during sampling activities; and (2) sample shipment procedures that document handling, packing, and shipping of samples to the laboratory.

The persons responsible for sample custody, and a brief description of their duties, are:

- Laboratory Representative or Commercial Supplier - verifies that the bottleware is certified clean; arranges for bottleware shipment to field sampling personnel or the Rust equipment shop.

- Rust Equipment Manager - receives and stores bottleware that is shipped from a laboratory or a commercial supplier; relinquishes bottleware to field sampling personnel; initiates chain-of-custody from bottleware in storage.

- Rust Field Staff - receive sample bottleware from laboratory commercial supplier or the Rust equipment shop; inspects bottleware for physical integrity; retains bill of lading from shipping courier as documentation of transfer of bottleware; records manufacturer and lot number of bottleware for each sample; collects and preserves samples; retains bottleware and samples under custody until sample shipment; relinquishes samples to shipping courier or to laboratory representative.

- Rust Project Manager - Verifies reported laboratory analyses to the sample chain-of-custody form; assures that chain-of-custody documentation is incorporated into the project file.

2.2.1 Sample Collection

The following procedures will be conducted during sample collection activities, and will be recorded in a project field log book and on the sample chain-of-custody form (Appendix B of the TSOW).

2.2.1.1 Sample Containers

Rust will use sample containers furnished by the subcontracted laboratory or a commercial supplier. Rust will verify that the commercial supplier furnishes laboratory grade, certified clean containers. The source and lot numbers of sample containers used in the sampling event will be recorded in the project field log book for each sample collected. The lot

number may be used to trace the bottleware preparation and certification of cleanliness when the containers are shipped from the Rust equipment manager. When bottleware is shipped directly from the supplier to the field, a formal chain-of-custody will not normally be initiated. In this instance, the airway bill receipt or packing slip will serve as the initiation of chain-of-custody.

2.2.1.2 Sample Location, Sample Media, and Intended Parameters

The specific sampling location of each sample will be recorded with each sample identification number in the field log book and on the sample chain-of-custody form. Sampling locations will be referenced to a site location map in the TSOW. Other location references may be distance and bearing from a prominent landmark.

The type of sample media will be recorded with the sample identification number in the field log book and on the chain-of-custody form.

Laboratory analyses to be conducted on the sample will be recorded with the sample identification number in the field log book and on the chain-of-custody form.

2.2.1.3 Preliminary Sampling Activities

Sampling personnel will record in the field log book the preparation activities that may be pertinent to the sampling event at each sampling location. For groundwater sampling, this documentation may include the well construction materials and diameter of the riser pipe; the apparent integrity of the well at the surface; the volatile organic vapor concentrations in the well riser, breathing zone, and background; total depth of the well, the water level, and water column volume; presence of a light, non-aqueous phase liquid; the calculated well purge volume and actual volume purged; and the field monitoring parameters of purge water (pH, specific conductance, and temperature).

For soil sampling, this documentation may include information on presence of surface staining, water logging or ponding; proximity to roads or waste piles; apparent upgradient physiographic or hydrogeologic features of significance; background volatile organic vapor concentrations; the depth the samples were collected from; and the drilling method,

equipment, and materials (such as drilling mud) that were used to construct the boring, if this information is known by the sampling personnel.

For water sampling, this documentation may include construction of plumbing and tap; holding tank volume; the flow rate of purge water and the volume purged; the field monitoring results of purge water (pH, specific conductance, and temperature); the amount of time the well was allowed to purge; and the flow rate when the sample was collected.

2.2.1.4 Sample Collection

Sampling personnel will record in the field log book the type of equipment used to purge and conduct sampling, the order of sample collection (typically from most sensitive to least sensitive parameter), field screening results measured during sample collection (such as vapor headspace readings of soil samples), special collection procedures, and aberrations to sampling procedures. All sample containers will be pre-preserved. Duplicate QC samples, as described in Section 5.0 of this appendix, will have the same information recorded in the field log book.

Following collection of the sample, the sample identification number and other information on the sample label will be verified to the entry in the field log book. Sample identification number, time, and date of collection will be recorded on the chain-of-custody form.

Following sample labeling verification, the sample will be placed in a cooler with ice and be maintained in the sampler's presence or in a secure location for the remainder of the daily sampling activities, or until custody is transferred to another responsible party. A sample is considered to be in a person's custody whenever it is in a person's physical possession, when it is in view of the sampler or responsible party, or when it is in a secure location. Custody of a sample is also maintained when the sample is shipped in a container that is properly sealed against tampering with custody seals.

2.2.1.5 Quality Control Sample Collection

Information on QC samples will also be recorded in the field log book, on the sample bottleware label, and on the chain-of-custody form. Duplicate and split samples will have

the same information recorded as a regular sample. Trip blanks will have most of this same information recorded, with the exception that sample location, sample screening, and preliminary activities will not be applicable. A trip blank will be sent with each cooler of samples shipped for VOC analyses and will also be referenced to the actual samples that it will accompany in shipment and handling. A detailed discussion of QC samples is presented in Section 5.0 of this appendix.

2.3 SAMPLE MANAGEMENT

The following procedures will be conducted during sample handling and shipping, and will be recorded in the project field log book, custody chain and analytical request form, as indicated below.

2.3.1 Sample Packing

Samples will be immediately packed for shipping in waterproof ice chests and coolers. The sample containers may be individually sealed in "Zip-lock" or other plastic bags prior to packing them in the cooler with bubble wrap or styrofoam packing to prevent breakage during shipment. Wet ice sealed in "Zip-lock" or other plastic bags (to inhibit cross contamination of samples by meltwater) will be placed with the samples in the cooler to maintain the samples at a temperature of about 4° Celsius during shipping. Prior to shipment, any melted ice will be drained from the bags and fresh ice will be added.

The custody chain and analytical request form (Appendix B of the TSOW) that identifies the samples will be signed as "relinquished" by the principal sampler or responsible party. The form will be sealed in a waterproof plastic bag and will be placed inside the cooler, typically by taping the bag to the inside lid of the cooler.

Following packing, the cooler lid will be sealed with strapping tape. Two custody seals will be signed and dated, affixed about two corners of the cooler (across the seal of the lid), and additionally covered with clear tape.

2.3.2 Sample Shipping

The sample coolers will be typically shipped by overnight express carrier to the laboratory. A copy of the bill of lading will be retained by Rust and will become part of the sample custody documentation. Concurrent with shipping, the sampler will complete a sample shipping form (Appendix B of the TSOW) for reporting by telephone to the laboratory that will receive the samples.

2.4 LABORATORY CUSTODY PROCEDURES

Upon receipt by the lab, samples will proceed through an orderly processing sequence specifically designed to ensure continuous integrity of both the sample and its documentation.

All samples will be received by the lab and will be carefully checked for label identification and completed, accurate chain-of-custody records. The sample temperature will be measured upon arrival by measuring a temperature blank that will be shipped with the samples. Each sample will then be assigned a unique laboratory identification number through a computerized Laboratory Information Management System (LIMS) that stores all identifications and essential information. The LIMS system will track the sample from storage through the laboratory system until the analytical process is completed and the sample is disposed of. Access to the contract laboratory is restricted to prevent any unauthorized contact with samples, extracts, or documentation.

3.0 CALIBRATION PROCEDURES

3.1 LABORATORY INSTRUMENTS AND EQUIPMENT

Calibration procedures depend upon the reference material and the type of equipment used to make the analytical measurements. Calibration procedures have specific criteria for evaluating a successful calibration. Sample analysis should not proceed without successful calibration. If there are problems with calibration, the final report will clearly justify the acceptance of any sample data obtained from a measurement system which had not demonstrated acceptable calibration. Any data reported from such a system, which cannot be clearly justified, must be flagged as suspect in all data tables and fully discussed in the report.

All reference material used to calibrate analytical systems comes from sources that attest to the purity and identity of the material. For standard EPA analyses (e.g., metals, gas chromatography/mass spectrometry (GC/MS)), certified solutions are purchased for instrument calibration. These materials are accompanied with certificates attesting to the identity and purity of the material. Specific calibration procedures for the EPA methodologies delineated in Table 5-1 of the TSOW are available in the referenced method.

3.2 FIELD PROCEDURES

In addition to the sampling equipment described in Section 4.1 of the TSOW, field screening equipment will also be used to screen samples prior to shipment and analysis by the laboratory. These field screening instruments include pH meters, specific conductance meters and organic vapor analysers. The brands and model numbers of these instruments are described below in conjunction with the calibration procedures. Serial numbers corresponding to the instrument used in the field will be recorded in the field log book. All equipment will be decontaminated in accordance with Section 4.1.6 of the TSOW prior to its use in the field.

3.2.1 Field Equipment Standards

Field equipment calibration standards are received, stored, prepared, and used following procedures that allow tracing of the standard from suppliers, through storage and preparation, to instrument calibration and use of the instrument in the field.

Small amounts of standards for field instruments are received directly from the equipment manufacturer, analytical laboratory, or commercial laboratory supplier on an as-needed basis. Standards are received either pre-prepared or are prepared as needed, typically in association with instrument calibration. These standards are stored according to the supplier's specifications, with the lot number or supplier's identification number, the date that the standard was received, and the expiration date of the standard written on the standard storage container. This procedure references the standards to specific lots of the supplier. When the instrument is calibrated, the standard's lot number or product identifier, expiration date, and preparation date is recorded in the instrument log book. This procedure references instrument calibration to a specific standard and date of standard preparation.

3.2.2 Field Equipment Calibration Procedures

Calibration procedures for the each of the field instruments to be used during this field effort are described below.

pH Meters

Presto-Tek Model DSPH-3

The Presto-Tek model DSPH-3 pH meter is calibrated in the following manner:

(1) Rinse the pH probe in distilled water.

(2) Insert probe in #7 buffer solution.

(3) Adjust the CALibration potentiometer until the digital display reads 7.00.

(4) Rinse probe, and insert in #4 or #10 buffer solution, whichever is closer to the expected pH of the samples.

(5) Adjust the SLOPE potentiometer until the digital display reads 4.00 or 10.00, per the respective buffer.

Yokogawa Model PH51

The Yokogawa Model PH51 pH meter is calibrated in the following manner:

(1) Set the instrument to MEASure mode.

(2) Rinse the probe in water.

(3) Insert probe in #7 buffer solution.

(4) Measure the temperature of the buffer and adjust instrument temperature scale.

(5) Adjust STD dial until the scale shows 7.00.

(6) Rinse the probe in water.

(7) Insert probe in #4 or #10 buffer, whichever is closer to the expected pH of the samples.

(8) Measure the temperature of the buffer and adjust instrument temperature scale.

(9) Adjust SLOPE dial until the scale shows 4.00 or 10.00, per the respective buffer.

Specific Conductance Meters

Presto-Tek Model DSPH-3

The Presto-Tek Model DSPH-3 specific conductance meter is calibrated in the manner described below for specific conductance values less than 2000 μmhos/centimeter:

(1) Rinse probes, wipe off, and allow to air dry.

(2) Measure the conductance in air; it should read 0.00.

(3) If meter does not read 0.00, adjust the ZERO potentiometer to show 0.00.

(4) Immerse the probe in the 100 or 1413 buffer.

(5) Adjust the SPAN potentiometer so that the instrument shows 100 or 1413, respectively.

(6) For samples with a specific conductance greater than about 2000 μmhos/centimeter, a buffer approximating the sample specific conductance should be used in item 4, above.

Yokogawa Model SC51

The Yokogawa Model SC51 specific conductance meter is calibrated in the following manner:

(1) Set the measuring switch to CELL ADJ.

(2) Set the instrument in COND mode.

(3) Set the range selector switch to 2m.

(4) Verify that the display shows the value of the cell constant, that is shown on the electrode assembly.

(5) If the values do not agree, adjust the CELL ADJ dial until the display shows the cell constant value.

Organic Vapor Analyzers

Foxboro OVA Model 128

The Foxboro OVA Model 128 FID (OVA) is calibrated by the factory every six to nine months, or whenever the instrument is serviced by the manufacturer. Shop and field calibration using methane gas is conducted by Rust. The instrument is zeroed daily to background levels.

HNu Model PI 101

The HNu Model PI 101 PID (HNu) is calibrated in the following manner:

(1) With the instrument on, connect the cylinder of calibration gas to the probe;

(2) Check the response of the instrument to the gas;

(3) Adjust the SPAN potentiometer so that the instrument displays the concentration of the calibration gas;

(4) If the SPAN potentiometer setting is less than 1.0, 8.5, or 2.0 for the 9.5, 10.2, and 11.7 eV lamps, respectively, then the instrument is out of specification and must be returned to the manufacturer for repair.

3.2.3 Field Equipment Calibration Frequency

At a minimum, calibration and maintenance intervals for field instruments will be those recommended by the respective manufacturers, unless experience dictates a shorter interval.

When the manufacturer does not specify a calibration interval for the equipment, the interval will be established in writing by the user of such equipment and approved by the quality assurance (QA) Task Manager. Adherence to the calibration schedule is mandatory. The fact that these calibrations may be performed by an outside source does not exempt the user from the responsibility for identifying, monitoring, and controlling calibration intervals and ensuring that maintenance checks are made on time.

Documentation of field instrument calibrations will be the responsibility of the Field Task Manager. All calibration records shall be maintained in the field log book. In addition, the following information shall be recorded in the log book and on the DQCR.

- Equipment type (e.g., pH meter),
- Manufacturer and model number,
- Serial number,
- Recommended calibration frequency,
- Date of latest calibration,
- Dates of field measurement (use),
- Name of person who calibrated instrument,
- Calibration standards used, and
- Source of calibration standards.

Entries in the log book will be made at the beginning of each sampling or measuring effort and when each instrument is calibrated. All documentation in the log book will be made in ink. If an error occurs, corrections will be made by crossing a line through the error and entering the correct information. Changes will be dated and initialed. No entries will be obliterated or rendered unreadable. Records will be kept for all instruments requiring calibration.

3.2.4 Preventative Maintenance

pH Meters

Preventative maintenance of these instruments requires periodic cleaning, battery replacement, and storage of the probe in a neutral buffer solution.

Specific Conductance Meters

Preventative maintenance of these instruments requires periodic cleaning and battery replacement.

Organic Vapor Analyzers

Preventative maintenance of the OVA and HNu is conducted by the manufacturer at six to nine month intervals. Other preventative maintenance measures are battery charging and cleaning of the instrument.

4.0 ANALYTICAL PROCEDURES

Chemical analyses will be performed by Savannah Laboratories and Environmental Services, Inc. located at 5102 LaRoche Avenue, Savannah, Georgia 31404. Savannah Laboratories will perform all the primary analyses. The QA laboratory, South Atlantic Division Laboratory, is located at 611 South Cobb Drive, Marietta, GA 30060-3112. Ten percent of the samples submitted to Savannah Laboratories will be prepared as split samples and sent to the South Atlantic Division Laboratory.

4.1 CHEMICAL ANALYSES

The analytical methods to be performed by the contract laboratories are presented in Table 1-1 of this appendix. The VOC analytes requested will be those listed in the Target Compound List referenced in the October 1992 Contract Laboratory Procedure Statement of Work. VOCs will be analyzed in accordance with SW-846 Method 8260 using a gas chromatography capillary column and electron capture detector (GC/ECD). The detection and quantitation limits are those prescribed in the respective analytical methods. All procedures have been validated and approved through the Army Environmental Center (AEC).

4.2 METHOD SPECIFIC DATA QUALITY OBJECTIVES

Method specific Data Quality Objectives (DQOs) for each SW-846 method will be in compliance with DQOs specified in the laboratory.

4.3 FIELD SCREENING

Field screening of pH, specific conductance, and temperature of groundwater, volatile vapor headspace for soil, and soil gas samples will be conducted. Method number references are shown in Table 4-1 of this appendix. Equipment used for field screening is also shown in Table 4-1. Field screening procedures are described below.

4.3.1 Water pH

To field screen aqueous samples for pH, the pH meter is inspected, and is allowed to equilibrate to ambient temperatures. The instrument is calibrated (as described in Section 3.0), and the probe is rinsed with tap water. On non-temperature compensating instruments, the temperature setting must be tuned to the sample temperature. The probe is then simply inserted into the sample so that the sensing area is fully covered by the sample. The pH values are sensed instantaneously by the instrument and are read directly off the analog or digital scale (to ± 0.1 pH units) as the log (to the base 10) of the hydrogen ion concentration of the sample. These data are recorded in the field log book and on the Field Data Information Log for Groundwater Samples (Appendix B of the TSOW) or the Field data Information Log for Surface Water/Sediment Samples (Appendix B of the TSOW).

4.3.2 Water Specific Conductance

To field screen aqueous samples for specific conductance, the analog meter is inspected for cracks, and is allowed to equilibrate to ambient temperatures. The instrument is then calibrated (as described in Section 3.0 of this appendix), and the probe is rinsed with deionized water. On instruments that are not temperature compensating, the temperature setting must be tuned to the approximate temperature of the sample. The probe is then simply inserted into the sample so that the sensing area is fully covered by the sample. The specific conductance value is sensed instantaneously by the instrument and is read directly off the analog or digital scale, as micromhos per centimeter. For results less than 1000 micromhos/ centimeter, the values are read to the nearest 10 units; for results greater than 1000 micromhos/centimeter, the values are read to the nearest 100 units. These data are recorded in the field log book and on the Field Data Information Log for Groundwater Samples (Appendix B of the TSOW).

4.3.3 Water Temperature

To field screen aqueous samples for temperature, the analog thermometer is cleaned and inspected for cracks and gaps in the liquid. The thermometer is then immersed in the sample and swirled in the liquid so that the thermometer bulb is completely covered by the sample. The thermometer remains in the sample until the temperature reading stabilizes,

typically for no more than one minute. The temperature is read directly off the instrument in degrees Celsius or Fahrenheit to the nearest 0.5 degree. These data are recorded in the field log book and on the Field Data Information Log for Groundwater Samples (Appendix B of the TSOW).

4.3.4 Soil Volatile Vapor Headspace

Soil volatile vapor headspace screening will be conducted in the following manner with a calibrated flame ionizing detector (FID):

(1) Soil is placed in a clean 16 ounce jar, so that the jar is about half-filled.

(2) The jar is sealed with aluminum foil and a tight rubber band; no holes will be allowed in the foil cap and the foil shall be tight against the mouth of the jar.

(3) The soil in the jar is brought to equilibrium for a period of about 15 minutes at a temperature of between 68 an 90 degrees Fahrenheit.

(4) Following the 15 minute period, the headspace is sampled with a FID in survey mode, by piercing the aluminum foil cap with a small hole and inserting the FID tip into the headspace. The volatile vapor concentration is read directly off the analog scale of the FID.

These data are recorded in the field log book and on the Headspace Analysis Form (Appendix B). No background value corrections are made for these jarred headspace readings. Other readings made in ambient air will be corrected for the background concentrations.

4.3.5 Organic Vapor Analyzers

The OVA and HNu will be calibrated in a controlled environment prior to arrival at the site of investigation (see Section 3.2.2 of this appendix). Equipment calibration checks (using standards) will be performed on a daily basis. Equipment start-up will be performed as described in the manufacturers instructions that accompany the equipment. The OVA and

HNu will be "zeroed" to background at a location situated up wind from the area of investigation. Organic vapor measurements will be read directly off the OVA or HNu display.

5.0 INTERNAL QUALITY CONTROL

5.1 LABORATORY

Two types of quality checks will be utilized in the laboratory to ensure the analytical data are of known and documented quality. These checks include:

- Program quality assurance, and
- Analytical method quality assurance.

The contract laboratory will have a written QA/QC program which provides rules and guidelines ensuring the reliability and validity of all analytical work conducted in their laboratory. Compliance with the QA/QC program will be coordinated and monitored by designated laboratory QA personnel.

Objectives of the QA/QC program are to:

- Ensure all procedures are documented, including any changes in administrative and/or technical procedures,

- Ensure all analytical procedures are conducted according to sound scientific principles,

- Monitor laboratory performance using a systematic inspection program and provide for corrective action as necessary,

- Collaborate with other laboratories in establishing quality levels, as appropriate, and

- Ensure all data are properly recorded and archived.

In each data package provided, the laboratories will document all instrument and analytical QC functions (including holding times). Corrective action will be initiated on any sample associated with outlying QC criteria. QC samples analyzed (method blank samples,

laboratory duplicate analyses, control samples, etc.) will be run concurrently with the analytical batch to which they are assigned. An additional QC check will be performed in which surrogates are added to each sample (including QC samples) analyzed for organic compounds.

A brief summary of the required QC samples follows. The type and frequency of QC samples performed by the laboratory will be according to the specified analytical method.

5.1.1 Method Blank

Method blanks, also known as reagent, analytical, or preparation blanks, are analyzed to assess the level of background interference or contamination which exists in the analytical system and which might lead to the reporting of elevated concentration levels or false positive data.

5.1.2 Laboratory Control Spikes

A low level and duplicate high level spike will be prepared in standard matrix with each extraction batch. Accuracy and precision control charts will be maintained for a statistical basis.

5.1.3 Surrogate Recoveries and Standard Additions

Surrogate compounds are used to evaluate method accuracy and potential matrix effects. Surrogate compounds are added to each sample and QC sample which undergoes analysis for organic analytes, excluding soil gas/water headspace analyses. Surrogate compound data are expressed as percent recoveries.

5.1.4 Matrix Spikes and Matrix Spike Duplicates

A matrix spike (MS) is an environmental sample to which known concentrations of analytes have been added. The MS is taken through the entire analytical procedure and the recovery of the analytes is calculated. MS analyses will be performed for one out of every 20

investigative samples for each matrix. Results are expressed as percent recovery. The MS is used to evaluate the effect of the sample matrix on the accuracy of the analysis.

A matrix spike duplicate (MSD) is an environmental sample that is divided into two separate aliquots, each of which is spiked with known concentrations of analytes. MSD analyses will be performed for one out of every 20 investigative samples for each matrix. The two spiked aliquots are processed separately and the results compared to determine the effects of the matrix on the precision and accuracy of the analysis. Results are expressed as RPD and percent recovery.

5.2 FIELD ACTIVITIES

Proper measurement of accuracy and precision of field instruments will be verified by daily instrument calibration and QC checking procedures described in Section 3.2 of this appendix. This information will be recorded in the field log book and the Daily Quality Control Report (DQCR), provided in Appendix B of the TSOW. This information will be reviewed daily by the Field Task Manager who will audit the accuracy and precision of the field screening instruments. This information will also be audited weekly by the Project Manager.

Quality control checks in the field will include the collection of field QC samples and QC checks of field screening instruments. Field QC samples will include field duplicates, trip blanks, and splits. The following sections define each QC sample and provide the collection frequency and analytical requirements. A summary of the analytical and QC program is presented in Table 5-1 of the TSOW.

Information on QC samples will also be recorded in the field log book, on the sample bottleware label, and on the chain-of-custody form. Duplicate and split samples will have the same information recorded as a regular sample. Trip blanks will have most of this same information recorded, with the exception that sample location and sample screening and preliminary activities will not be applicable. The trip blank will also be referenced to the actual samples that it will accompany in shipment and handling. A detailed discussion of QC samples is presented below.

5.2.1 Field Duplicates

Duplicate samples collected in the field provide precision information for the entire measurement system including sample acquisition, homogeneity, handling, shipping, storage, preparation, and analysis. Samples for duplicate analyses will be selected at random by the Field Task Manager, and submitted blind to the laboratory for analyses. Duplicate analyses will be performed for one out of every ten investigative samples for each matrix. More frequent collection of duplicates will occur if deemed necessary by the Field Task Manager. Duplicate samples will be analyzed by the laboratory for the same parameters as the primary sample (i.e., the sample which is being duplicated).

5.2.2 Trip Blanks

Trip blanks are prepared in the laboratory using organic-free water and are preserved along with other volatile samples, shipped with the sample containers to the site, and are kept with the investigative samples throughout the sampling event. They are then packaged for shipment with the other samples and submitted for analysis. A trip blank will be included with each shipment of water samples requiring VOC analysis. Trip blanks will be analyzed for the VOCs.

5.2.3 Split Samples

Split samples are replicate samples divided into two portions, submitted to different laboratories, and subjected to the same environmental conditions and steps in the measurement process. They serve as an oversight function in assessing the analytical portion of the measurement system. Split samples will be collected at a rate of one out of every ten investigative samples for each matrix as appropriate. The split samples will be submitted to South Atlantic Division Laboratory, 611 South Cobb Drive, Marietta, Georgia 30060-3112. South Atlantic Division Laboratory will be notified of sample shipment 48 hours prior to shipping.

5.2.4 Materials Quality Control Samples

A Material Safety Data Sheet (MSDS) will be obtained for each material to be introduced into the subsurface media; however, these materials will not be sampled. No materials which, upon review of their MSDS, are considered to potentially jeopardize the integrity of the groundwater samples will be used.

6.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT OF DATA

To generate data that will meet the project objectives, it is necessary to define the types of decisions that will be made, identify the intended use of the data, and design a data collection program. Data quality objectives (DQOs) are defined as an integrated set of thought processes which define data quality requirements based on the intended use of the data. DQOs are necessary in obtaining sufficient data of known defensible quality for the intended use. The DQO process will assist in determining the appropriate quantitation, detection, reporting limits, analytical methods, and sample handling procedures.

Evaluation of all data collected during this program will be performed to assure that the quality procedures have been followed and the quantity of data will adequately support the intended use of the data as described in the EPA's DQOs Process for Superfund (September 1993). The QA/QC evaluation will determine whether the data meet the requirements of the project, and will include an evaluation of the laboratory data, when appropriate or applicable, as described in EPA's "National Functional Guidelines for Inorganic Data Review" (1994a) and "National Functional Guidelines for Organic Data Review" (1994b). When not appropriate or applicable, the data evaluation will be performed per the specific analytical method.

6.1 DATA QUALITY LEVELS

Different levels of data quality are required depending on the type of data collected and how it is to be used. EPA (September 1993) has established levels for data quality objectives to include "screening" data with definitive confirmation and "definitive" data. For example, Health and Safety monitoring and field screening will require screening data quality. Results of screening data are often not compound-specific or quantitative, but provide an immediate, qualitative indication of the presence or absence of VOCs. By using more sophisticated portable instruments, compound-specific screening data are available almost immediately. The quality of data generated will depend on the use of suitable calibration standards, sample preparation equipment, and the training of the operator. Ten percent of screening data should be confirmed using analytical methods and QA/QC procedures associated with definitive data, when applicable. Soil gas samples provide relative concentrations; however, and will not be confirmed with definitive analyses.

Definitive data quality is required for all off-site laboratory analyses. Definitive data are generated using rigorous analytical methodologies, such as approved EPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. For the data to be definitive, either analytical or total measurement error must be determined. Laboratory QC parameters such as variance, mean, and coefficient of variation are calculated and compared to method-specific performance requirements or established measurement error goals. QA samples, including method blanks, matrix spikes, and surrogates, are performed for each laboratory batch.

6.2 CHARACTERISTICS OF DATA QUALITY

This QA program addresses both field and laboratory activities. The measurement of QC includes the PARCC parameters (i.e., precision, accuracy, representativeness, comparability, and completeness). The procedures described herein are designated to obtain PARCC data for each field procedure and analytical method. To ensure that quality data continues to be produced, systematic checks must show that test results and field procedures remain reproducible and that the analytical methodology is actually measuring the quantity in each sample. The PARCC parameters are indicators of data quality and are described in Sections 6.2.1 to 6.2.5.

All laboratory chemical data will be generated by Savannah Laboratories. Savannah Laboratories has a systematic program for data reduction, validation, and documentation as part of their QA program. The reliability and credibility of analytical laboratory results can be corroborated by the inclusion of a program of scheduled replicate analyses, analyses of standard or spiked samples, and analyses of split samples with QA laboratories. Regularly scheduled analyses of known duplicates, standards, and spiked samples are a routine aspect of data reduction, validation, and documentation procedures.

Specific QA measurements will be addressed to satisfy the QA objectives. These measurements include precision, accuracy, representativeness, completeness, and comparability.

6.2.1 Precision

Whereas accuracy measures the average properties of an analytical method, precision examines the spread of the reported values about their mean. The spread of reported values refers to how different the individual reported values are from the average reported value. Precision is a measure of the magnitude of errors which can be measured in a variety of ways. A simple measure of precision is the standard deviation.

Precision is commonly determined from duplicate samples; thus, precision is usually expressed as relative percent difference (RPD). The equation to calculate RPD is as follows:

$$RPD = \frac{|D_1 - D_2|}{(D_1 + D_2)/2} \; x \; 100$$

where D_1 and D_2 are the reported concentrations for each duplicate sample.

If triplicate analyses are performed, precision is calculated using relative standard deviation (RSD). The equation to calculate RSD is as follows:

$$\% \; RSD = (SD \; x \; 100)/\overline{D}$$

$$SD = \sqrt{\frac{\Sigma(D_i - \overline{D})^2}{N - 1}}$$

where

SD	=	standard deviation
D_i	=	a measurement value
$\overline{D}$	=	mean measurement value
N	=	number of measurements

6.2.2 Accuracy

Accuracy measures the bias in a measurement system and is difficult to measure for the entire data collection activity. Potential sources of error include the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis techniques. Sampling accuracy may be assessed by evaluating the results of rinsate and trip blanks, and analytical accuracy may be assessed through the use of known and unknown QC samples and spike samples.

Accuracy values can be presented in a variety of ways. The average error is one way; however, accuracy is more commonly presented as percent bias or percent recovery. Percent bias is a standardized average error; that is, the average error divided by the actual or spiked concentration and converted to a percentage. Percent recovery provides the same information as percent bias. Since accuracy is often determined from spiked samples, laboratories commonly report accuracy as:

$$\text{Percent Recovery} = \frac{S - R}{A} \times 100$$

where

S = spiked concentration
R = reported concentration
A = spike added

6.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter which is most concerned with the proper design of the sampling program. The representativeness criterion is best satisfied by making certain that sampling locations are selected properly and a sufficient number of samples are collected.

Representativeness is addressed by describing sampling techniques and the rationale used to select sampling locations. Sampling locations can be biased (based on existing data, instrument surveys, observations, etc.) or unbiased (completely random or stratified-random approaches). Either way, the rationale used to determine sampling locations must be explicitly explained.

Representativeness can be assessed by the use of duplicate samples. By definition, duplicate samples are collected so that they are equally representative of a given point in space and time. In this way, they provide both precision and representativeness information.

6.2.4 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is essentially the same for all data uses in that a sufficient amount of valid data must be generated. It is important that critical samples are identified and valid data obtained. Percent completeness for a sample set is calculated as follows:

$$\text{Percent Completeness} = \frac{\text{Non-Rejected Data}}{\text{Total Data}} \times 100$$

Contract Laboratory Program data has been found to be 80 to 85 percent complete on a nationwide basis. Completeness goals for this project have been set at 90 percent.

6.2.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved by using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units. Comparability is limited to the other PARCC parameters because only when precision and accuracy are known can data sets be compared with confidence.

6.3 DATA EVALUATION

In addition to the internal data evaluation and validation conducted by the laboratory, evaluation of information and data on field activities will be conducted as a QC procedure by Rust. Rust will evaluate information and data on field activities conducted as QC procedures and will perform a complete validation of analytical data. The results of the field activities evaluation and data validation will be presented in the QCSR.

The data validation by Rust will involve five major areas: 1) preparedness review, 2) field sampling check, 3) data verification, 4) analytical data validation, and 5) data assessment. The validation normally will be conducted as described in "National Functional Guideline for Inorganic Data" (EPA, 1994a) and "National Functional Guideline for Organic Data Review" (EPA, 1994b). For methods not covered in the Functional Guidelines, the data validation will be performed per the analytical method. The final component in the data validation process involves the integration of all information collected about a result. Based on the validation process, results will be flagged, as appropriate, to aid in the interpretation of the data. The data flagging system incorporates data qualifiers which are similar to flags specified in the CLP protocols, as well as additional flags used to help explain batch-specific events.

The Project Manager will review the field results and validated laboratory data before using the data to assess contaminant distributions and magnitudes. The field instrument QC measurements will be reviewed to assure the accuracy and precision of the field screening measurements. This information will be used to qualify the field screening results. Field log books and chain-of-custody forms will be cross checked to each other and to the laboratory results to assure conformity of sample identification numbers. This information will be compared to results of duplicate and blank samples, and to information on field conditions at the time of sample collection in order to qualify the sample analytical results.

REFERENCES

U.S. Environmental Protection Agency (EPA), 1971. Methods for Chemical Analysis of Water and Waste, 3rd Edition.

U.S. Environmental Protection Agency (EPA) Region IV, February 1991, Standard Operating Procedures and Quality Assurance Manual.

U.S. Environmental Protection Agency (EPA), September 1993. Data Quality Objectives Process for Superfund. Interim Final Guidance.

U.S. Environmental Protection Agency (EPA), 1994a. National Functional Guidelines for Inorganic Data Review. Hazardous Site Evaluation Division. Contract Laboratory Program, July 1988.

U.S. Environmental Protection Agency (EPA), 1994b. National Functional Guidelines for Organic Data Review. Hazardous Site Evaluation Division. Contract Laboratory Program, July 1991.

TABLES

Table 1-1
Analytical Methods and the Associated
Volume, Container, and Preservation Requirements
Redstone Arsenal, Alabama

Analytical Parameter	Analytical Method	Reference	Weight or Volume Per Analysis			Sample Container		Sample Preservation		Holding Times	
			Soil/ Sediment (g)	Water (ml)	Charcoal (g)	Soil/ Sediment	Water	Soil/ Sediment	Water	Soil/ Sediment	Water
Volatile Organics	SW-846 Method 8260	SW-846	10	3 x 40	NR	4-oz. CWM	3 x 40 ml GSV	4 degrees C No headspace	HCl pH <2 No headspace	14 days	14 days
Moisture	ASTM D-2216	ASTM	25	N/A	N/A	8-oz.	N/A	None	N/A	N/A	N/A
Atterberg Limits	ASTM D-4318	ASTM	500	N/A	N/A	Bag	N/A	None	N/A	N/A	N/A
Grain Size	ASTM C-117 and C-1136	ASTM	500	N/A	N/A	Bag	N/A	None	N/A	N/A	N/A

NOTES:

NR = Not Requested
N/A = Not Applicable
CWM = Clear Wide-Mouth Glass with PTPE (Teflon) Septa
GSV = Glass Septa Vial with PTPE (Teflon) septa cap
C = Celsius
HCl = Hydrochloric Acid
Reference: USACE, September 1, 1994, Requirements for the Preparation of Sampling and Analysis Plans, EM200-1-3 (Table I-1, revised March 31, 1995)

Table 4-1
Quality Assurance Objectives for Field Screening Methods
Redstone Arsenal, Alabama

Analyte	Matrix	Method	Precision	Accuracy
Temperature	Water	Any high quality mercury-filled thermometer or thermistor with analog or digital read-out device (1); U.S. EPA Method 170.1 (3).	Not determined (1)	Not determined (1)
pH	Water	Electromagnetically using either a glass electrode in combination with a reference potential or a combination electrode, and a pH meter (1); U.S. EPA Method 150.1 (3).	0.1 pH unit (1) in laboratory test 0.5 pH unit in field conditions	0.1 pH unit (1) in laboratory test 0.5 pH unit in field conditions
Specific Conductance	Water	Measured by use of a self-contained conductivity meter, wheatstone bridge-type or equivalent (1); U.S. EPA Method 120.1 (3).	1 percent of true value (1) in laboratory test 5 percent of true value in field conditions	1 percent of true value (1) in laboratory test 5 percent of true value in field conditions
Organic Vapor OVA 128	Air	Measures concentration of trace volatile gases present in the atmosphere by flame ionization (2).	Not available	20 percent of Individual Full Scale (2)
HNu Model PI 101	Air	Measures concentrations of trace volatile gases present in the atmosphere by photoionization (4)	1 percent of full scale detection (4)	Not Available

<u>References:</u>

(1) U.S. EPA SOP and Quality Assurance Manual, Region IV, February 1, 1991
(2) Instruction Manual Model OVA 128 Century Organic Vapor Analyzer
(3) U.S. EPA Methods for Chemical Analysis of Water and Wastes, 3rd Edition, 1979
(4) Instruction Manual for HNu Model PI 101

APPENDIX B

FIELD LOGS

HTW DRILLING LOG

1. COMPANY NAME **RUST E&I**	2. DRILLING CONTRACTOR	HOLE NO. SHEET 1 OF 3 SHEETS
3. PROJECT	4. LOCATION	
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL	
7. SIZES & TYPES OF DRILLING & SAMPLING EQUIPMENT	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED	11. DATE COMPLETED
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED	
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

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

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE REC %

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

ELEV. FT MSL	DEPTH b	DESCRIPTION OF MATERIALS c	Field Screening Results d	Geotech Sample or Core Box No. e	Analytical Sample No. f	Blow Counts g	REMARKS h
	0						
	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						
	10						

PROJECT	HOLE NO.

HTW DRILLING LOG

PROJECT	INSPECTOR	HOLE NO.
		SHEET 2 OF 3 SHEETS

ELEV. FT MSL	DEPTH b	DESCRIPTION OF MATERIALS c	Field Screening Results d	Geotech Sample or Core Box No. e	Analytical Sample No. f	Blow Counts g	REMARKS h
	11						
	12						
	13						
	14						
	15						
	16						
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						

PROJECT	HOLE NO.

RUST ENVIRONMENT & INFRASTRUCTURE

HEADSPACE ANALYSES

JOB NUMBER _____

PROJECT: _____

CLIENT: _____

LOCATION: _____

INSTRUMENT USED: _____

DATE SAMPLED _____

DATE ANALYZED _____

ANALYST _____

EXPLORATION NUMBER	SAMPLE NUMBER	DEPTH (FT)	SAMPLE TYPE	SAMPLE READING (PPM)*	BACKGROUND READING (PPM)*	AMBIENT AIR TEMP. (F)	REMARKS **

* PPM represents concentration of detectable volatile and gaseous compounds in parts per million of air.

** Indicate time elapsed from sampling or removing samples from cooler.

RUST ENVIRONMENT & INFRASTRUCTURE

GROUNDWATER MONITORING
INSTALLATION DETAIL (Flush Mount)

PROJECT: _____

LOCATION: _____

CLIENT: _____

CONTRACTOR: _____

DRILLER: _____ CERTIFICATION NO: _____

RUST FIELD REPRESENTATIVE: _____

JOB NO. _____

INSTALLATION NO. _____

TYPE OF INSTALLATION _____

BORING NO. _____

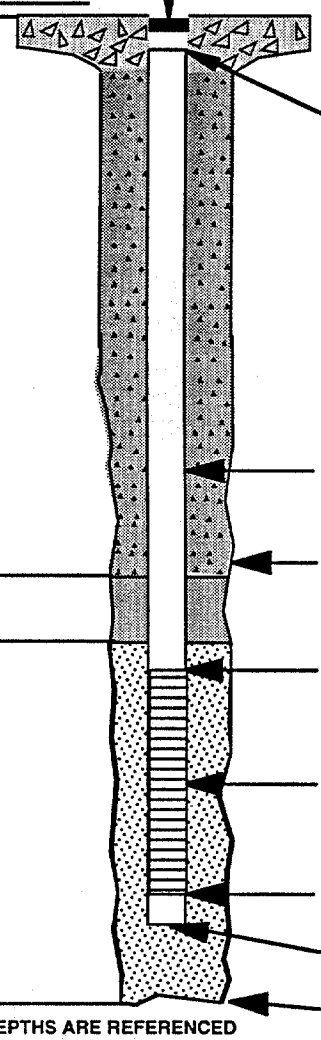
LOCATION _____

INSTALLATION DATE _____

SURVEY DATUM: _____

GROUND SURFACE ELEVATION: _____

SUMMARIZE SOIL CONDITIONS, BACKFILL AND SEALS (NOT TO SCALE)



TOP OF PROTECTIVE VAULT

INSIDE DIAMETER _____

TYPE OF SURFACE SEAL _____

THICKNESS OF SURFACE SEAL _____

TOP OF WELL CASING OR RISER PIPE

EL. _____ STICKUP _____

TYPE OF WELL CASING OR RISER PIPE _____

INSIDE DIAMETER _____

APPROXIMATE DIAMETER OF BOREHOLE _____

TOP OF WELL POINT

EL. _____ DEPTH _____

TYPE OF SCREEN _____

SCREEN GAUGE OR SIZE OF OPENINGS _____

INSIDE DIAMETER _____

TYPE OF BACKFILL AROUND SCREEN _____

BOTTOM OF SCREENED INTERVAL

EL. _____ DEPTH _____

BOTTOM OF WELL

EL. _____ DEPTH _____

BOTTOM OF BOREHOLE

EL. _____ DEPTH _____

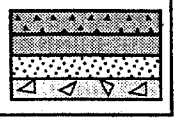
• FIGURES ABOVE REFER TO DEPTH IN FEET

• ALL DEPTHS ARE REFERENCED TO GROUND SURFACE

*NOT TO SCALE

_____ LENGTH OF RISER PIPE + _____ LENGTH OF SCREEN + _____ LENGTH OF CAP/PLUG = _____ TOTAL

GROUT
FINE SAND
FILTER PACK
CONCRETE



100-000-000

RUST ENVIRONMENT & INFRASTRUCTURE

Field Data Information Log for Ground Water Sampling

Page ____ of ____

Date (yr/mo/day) _____

Field Personnel _____

Site Name _____

RUST Environment & Infrastructure Job # _____

Well ID # _____

____ Upgradient ____ Downgradient

Weather Conditions _____

Air Temperature _____ °C

Total Well Depth (TWD) = _____ 1/100 ft

Depth to Ground Water (DGW) = _____ 1/100 ft

Length of Water Column (LWC) = TWD - DGW = _____ 1/100 ft

1 Casing Volume (OCV) = LWC x _____ = _____ gal

3 Casing Volumes = _____ gal = Standard Evacuation Volume

Method of Well Evacuation _____

Method of Sample Collection _____

Total Volume of Water Removed _____ gal

Casing Diameter _____ Inches

Casing Material _____

Measuring Point Elevation _____ 1/100 ft

Height of Riser (above land surface) _____ 1/100 ft

Land Surface Elevation _____ 1/100 ft

Screened Interval _____ 1/100 ft

Dedicated Pump or Bailer YES ____ NO ____ Type ____

Steel Guard Pipe Around Casing YES ____ NO ____

Locking Cap YES ____ NO ____

Protective Post/Abutment YES ____ NO ____

Well Integrity Satisfactory YES ____ NO ____

Well Yield LOW ____ MODERATE ____ HIGH ____

Remarks _____

FIELD ANALYSES

VOLUME PURGED (gallons)							
TIME (military)							
pH (S.U.)							
Eh (mV)							
Sp. Cond. (µmhos/cm)							
Water Temp. (°C)							
TURBIDITY (subjective) *							

* (1) Clear (2) Slight (3) Moderate (4) High

COMMENTS/OBSERVATIONS: _____

RUST ENVIRONMENT & INFRASTRUCTURE

Chain Of Custody Record
U.S. Army Corps Of Engineers Format

Page _____ of _____

Project No. _____

Custody No. _____

Project/Location:

Client Name:

Collected By:

Sample ID	Date	Time	Comp	Grab	Well	Sample Location/ Sample Depth	# Of Containers	SAMPLE ANALYSIS (x)										COMMENTS Method Detection Limits must be provided with each deliverable.	FIELD LOT CONTROL NUMBER: Ambient Condition Blank	Equipment Blank	Trip Blank	Cooler Letter

Custody Transfers Prior to Receipt By Lab

	Relinquished by/(Signed) (Organization)	Received by/(Signed) (Organization)	Date	Time
1.				
2.				
3.				

Sample Delivery Details/Laboratory Receipt

Delivered Directly to Lab ☐ Shipped ☐

Method of Shipment: _____ Airbill #: _____

Analytical Lab: _____ Location: _____

Lab Recipient: _____ Date: _____ Time: _____
(Signature)

Additional Remarks:
(Condition Upon Lab Receipt, Etc.)

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RUST E&I

DATE: _____ TIME: _____

COLLECTED BY: _____

JOB NUMBER: _____

JOB NAME: _____

SAMPLE ID: _____

MATRIX: _____

ANALYSIS: _____

PRESERVATIVES: _____

SHIPMENT INFORMATION

(Field to Lab by Telephone)

Date of Shipment: _____

Laboratory Destination: _____

Laboratory Project Contact: _____
(Name) (Telephone Number)

Number Containers Shipped: _____

Mode of Shipment: _____

Shipment Number(s): _____

Time of Shipment: _____

Date/Time of Shipping Info Release to Lab: _____

Signature of Releaser: _____

NOTE: PROVIDE THIS INFORMATION TO RECEIVING LABORATORY AS SOON AS POSSIBLE AFTER SAMPLES ARE SHIPPED.

RUST ENVIRONMENT & INFRASTRUCTURE

DAILY QUALITY CONTROL REPORT

JOB NUMBER _____ DATE _____ REPORT NUMBER _____

PROJECT & LOCATION _____

WEATHER _____ TEMPERATURE RANGE _____ WIND _____

SEC PERSONNEL ON SITE _____ TIME ON SITE _____

SUMMARY OF SITE ACTIVITIES _____

LEVEL OF HEALTH & SAFETY PROTECTION _____

INSTRUMENTATION USED _____

CALIBRATION(S) PERFORMED _____

INSTRUMENT PROBLEMS / REMEDIES _____

SAMPLES COLLECTED* _____

SAMPLE COLLECTION METHOD(S) _____

QUALITY CONTROL SAMPLES* _____

ADDITIONAL REMARKS _____

SIGNATURE: _____

* INDICATE SAMPLE MEDIA: GROUND WATER, SURFACE WATER, SOIL OR SEDIMENT; SAMPLE TYPE: COMPOSITE, GRAB, SPLIT, DUPLICATE, RINSATE; AND SAMPLE I. D. NUMBERS

APPENDIX C

RESUMES

George R. Overby, CHMM
Project Manager

Education

B.S., 1982, Marine Science, University of South Carolina, Columbia, South Carolina

Pre-M.S. Studies, 1989, Environmental Systems Engineering, Clemson University, Clemson, South Carolina

Registrations

Certified Hazardous Materials Manager, CHMM, No. 5965, 1995
UXO Specialist - Indian Head, MD - 1986

Areas of Expertise

DOD IRP Investigations
Remedial Investigations/Feasibility Studies
Preliminary Assessments/Site Investigations

Experience

Mr. Overby is a project manager in the Earth Sciences Department with experience in the design of site characterizations on RCRA and CERCLA sites. His responsibilities include preparing and managing all facets of site investigation/characterization jobs under federal and state regulatory requirements as well as for the DOD. Specifically, Mr. Overby is responsible for managing projects on military installations requiring characterization and remediation due to explosive ordnance and other unique military contaminants. He also manages and coordinates field personnel, subcontractor support, and field work scheduling.

DOD IRP Investigations

Redstone Arsenal, Huntsville, Alabama. Project manager for Remedial Investigations, Baseline Risk Assessments and Site Inspections covering 55 sites ranging in complexity from standard soil and groundwater sampling on sites suspected of petroleum and solvent contamination to sites potentially contaminated with chemical warfare agents and explosives which are covered with water. Responsible for all aspects of the job beginning with the proposals and negotiations and including the overall field effort, work plan and report generation, and interaction with the regulators and the United States Army Corps of Engineers.

Tyndall Air Force Base, Panama City, Florida. Project manager for an extensive site investigation involving; sediment sampling, flora and fauna sampling, and an ecological risk assessment. Instrumental in establishing clean-up levels for the remedial design. Project Manager during multi-site investigation of petroleum hydrocarbon contaminated areas and areas with potential explosive and radio-isotope contamination. Coordinated all field activities including all subcontract task report preparation, and client relations.

Norton Air Force Base, San Bernardino, California. Task Manager for a ground water investigation of possible radio-isotope contamination with Air Force personnel, EPA, and surrounding municipal water authorities. Acted as Site Health and Safety Officer and participated in the report preparation.

Corps of Engineers, Hamilton Air Force Base, Novato, California. Task Manager responsible for scheduling of ground and surface water sampling efforts, data collection, and preparation of final report to Client.

Remedial Investigations/Feasibility Studies

General Electric, Greenville, South Carolina. Task manager for quarterly stream assessment involving surface water sampling and flow analysis. Responsible for preparation of quarterly reports and client and regulatory relations. Field operations manager for site wide quarterly groundwater sampling events including coordination of subcontractors and field personnel, laboratory arrangements, data evaluation, and report preparation.

Tri-City NPL Site, Brooks, Kentucky. Task Manager responsible for multi-phase field investigation following U.S. EPA emergency removal action. Responsible for preparation of initial and subsequent quarterly reports to client and regulatory agencies.

Medley Farm NPL Site, Gaffney, South Carolina. Task Manager during the initial and subsequent phases of the remedial investigation. Acted as health and safety monitor during the Remedial Investigation (RI) drilling efforts, coordinated the soil sampling procedures and participated in preparation of the final report.

Brewer Gold Company, Jefferson, South Carolina. Task Manager for the sampling program following emergency response by U.S. EPA. Designed a soil and sediment sampling program and documented the site conditions and performed on-site geologic characterization of sampling site.

Jet Research Corporation (Chemtronics Superfund Site), Swannanoa, North Carolina. Task Manager and Health and Safety Coordinator for project involving various subcontractors tasked with identifying areas to be used as infiltration galleries during the site remediation.

Preliminary Assessments/Site Investigations

Waste Management of North America, Various Locations. Project Manager responsible for environmental assessments at various WMNA sites (Asheville, North Carolina, Winston Salem, North Carolina, and Nashville, Tennessee). Coordinated all subcontractors, provided field oversight, evaluated data, and generated all reports and regulatory communication.

Various Underground Storage Tanks, South Carolina. Provided technical oversight of underground storage tank closures, including health and safety monitoring and soil sampling, documentation of site history and hydrogeologic characteristics, and preparation of closure reports suitable for submittal to various regulatory agencies.

Previous Experience

United States Navy Explosive Ordnance Disposal Diver

Six years of significant and varied Navy management experience including management and disposal of explosive ordnance and hazardous waste.

Facilitated technical transport of explosive and hazardous agents, conducted and supervised extensive surface and underwater explosive and hazardous agent operations. Maintained and operated nuclear, chemical, biological sampling and analysis equipment.

Specific assignments included the supervision of equipment and material readiness activities, preparation and administration of training programs, management of diving operations, and support to the United States Secret Services.

Special Studies/Training

Unexploded Ordnance Detection and Range-Remediation, 1994, Golden, Colorado
Remediating Sites Contaminated with Explosive Waste, 1993, EPA Washington, D.C.
Fate and Transport of Petroleum Hydrocarbons, 1992, University of Massachusetts
Applying Ecological Risk Assessments, 1992, University of Massachusetts
Explosive Ordnance Disposal School, 1986, Indian Head, Maryland
Numerous U.S. Navy Schools, including extensive hazardous agent and hazardous waste programs
40-Hour Hazardous Waste Health and Safety Training
8-Hour Refresher Training

Employment History

1990 - Present	Rust Environment & Infrastructure
1983 - 1989	United States Navy

1/96

Charles M. Gorman III, P.G.
Project Manager/Hydrogeologist

Education

M.S., 1985, Geology, University of Utah
B.S., 1981, Geology, University of South Carolina, Columbia, South Carolina

Professional Registration

Professional Geologist, South Carolina, No. 886, 1990

Experience

Mr. Gorman is a project manager for CERCLA investigations being conducted at several federal facilities. He also provides senior technical support for hydrogeology and regulatory issues concerning CERCLA investigations as well as other environmental investigations. Mr. Gorman is responsible for providing technical support for remedial investigations and actions conducted for federal and state CERCLA sites. He is responsible for preparing technical reports and documentation packages in addition to conducting technical reviews of documents and activities for National Priority List sites and State Priority List Sites.

Division of Hydrogeology, Bureau of Solid and Hazardous Waste Management, South Carolina Department of Health and Environmental Control. Project Manager. Supervised a nine-person section consisting of staff through project-level hydrogeologists. Responsibilities included hiring and evaluating personnel as well as providing senior technical reviews of work performed by the section. The federal program activities included: the preparation of technical reports and documentation packages for the Preliminary Assessment/Site Inspection/Hazard Ranking System program; and technical review of documents and activities for National Priority List sites and sites at the Savannah River Site being evaluated under a Federal Facility Agreement. State program activities included: identifying State Priority List sites; active participation in the management, design and implementation or remedial investigations and actions for fund-lead SPL sites; and technical oversight for PRP-lead SPL sites. Participated in an agency-wide work group concerned with groundwater and soil clean-up issues.

Superfund and Solid Waste Section, Division of Hydrogeology, Bureau of Solid and Hazardous Waste Management, South Carolina Department of Health and Environmental Control. Project Manager. In addition to the superfund-related duties listed above, this position included the administrative and technical management of the hydrogeologists involved with siting, permitting, compliance monitoring and contaminant assessments for solid waste disposal facilities. Other activities included the development of the hydrogeologic siting and groundwater monitoring criteria in the current state regulations governing municipal solid waste facilities.

Professional Services Department, Westinghouse Environmental and Geotechnical Services, Inc., Columbia, South Carolina. Senior Geologist/Project Manager. Managed a nineteen -person department comprised of staff through project-level geologists, engineers and biologists. Responsibilities included: hiring, evaluating, training and scheduling department personnel. Department personnel were involved with: contaminant assessments and remedial actions for commercial, industrial and governmental facilities; wetland delineation studies; asbestos surveys and removals; radon surveys; wastewater treatment system design and permitting; and geotechnical investigations. Provided senior technical review for contaminants assessments, real estate transaction environmental evaluations and wetland delineation studies.

Environmental Evaluation Department, Westinghouse Environmental and Geotechnical Services, Inc., Columbia, South Carolina. Project Manager. Managed a three-person department comprised of staff through project-level environmental scientists. Responsibilities included: hiring, evaluating, training and scheduling department personnel; business development; client relations; and senior technical review of work performed by the department. Department conducted real estate transaction environmental evaluations of industrial and commercial facilities and wetland delineation studies. Environmental sampling of various media, such as soil, groundwater, surface water, air, waste, building materials for asbestos, and electrical equipment for PCBs. Some environmental evaluation projects evolved into contaminant assessment/remedial action projects that also were managed by the department. Department personnel worked in numerous states including Alaska, California, Texas, and Washington. Acted as the primary company contact for several national clients.

Westinghouse Environmental and Geotechnical Services, Inc., Columbia, South Carolina. Project Manager/Geologist. Project manager for a wide variety of environmental projects. Conducted contaminant assessments of industrial, municipal landfill, underground and aboveground storage tank sites. Designed and implemented soil and groundwater remedial actions for contaminated underground storage tank and industrial sites. Conducted real estate transaction environmental evaluations (in twenty states), asbestos, radon, PCB and formaldehyde surveys, and surface and subsurface geophysical surveys. Project manager responsibilities included: client relations; proposal and report preparation; coordination of field activities; budget control; and invoicing.

Soil and Material Engineers, Inc., Columbia, South Carolina. Staff Geologist. Participated in contaminant assessments of underground storage tank, municipal landfill and industrial sites. Conducted field activities such as monitoring well installations and environmental sampling of various media. Assisted project manager with report preparation activities.

Utah Geological and Mineral Survey. Geotechnician. Compiled information about Utah coal reserves for the USGS National Coal Resources Data System. Interpreted geophysical well-log data and interfaced various types of computer software.

Petroleum Investment Company. Contract Geologist. Responsibilities included evaluating the oil and gas potential of lands in the western United States that were put up for lease by the Bureau of Land Management.

Union Oil Company, Geothermal Division. Assistant Geologist. Responsibilities included geochemical analysis of hot springs in the field, and field and office research to evaluate geothermal prospects in Utah and New Mexico.

Professional Memberships

National Ground Water Association

Publications

Gorman, C.M., Godfrey, S.C., Gerald, W.C., and Powell, W.E., Selecting Remediation Strategies for Petroleum-Hydrocarbon Contaminated Sites in South Carolina: Geol. Soc. Am. Abstr. Prog., V.20, No. 4. 1988.

Gorman, C.M., The Geology, Geochemistry, and Geochronology of the Rattlesnake Creek Terrane, West-Central Klamath Mountains, California: M.S. thesis, pp. 112, University of Utah, 1985.

Keith, A.C., and Gorman, C.M., Coal Reserves and Coal Quality of Selected Land in the Pine Canyon (7.5') Quadrangle, Book Cliffs Coal Field, Utah: Utah Geol. and Min. Surv. Rep. of Invest., No. 207. 1987.

Norman, E.A., Gorman, C.M., Harper, G.D., and Wagner, D.L., Northern Extension of the Rattlesnake Creek Terrane: Geol. Soc. Am. Abstr. Prog., v. 15, pgs. 314-315, 1983.

Employment History

1994 to present	Rust Environment & Infrastructure, Greenville, South Carolina
1991 to 1994	South Carolina Department of Health and Environmental Control, Columbia, South Carolina
1986 to 1991	Westinghouse Environmental Services, Inc. (formerly S&ME, Inc.) Columbia, South Carolina
1986	Utah Geological and Mineral Survey, Salt Lake City, Utah
1985-1986	Petroleum Investment Company, Salt Lake City, Utah
Summer 1984	Union Oil Company, Geothermal Division, Santa Rosa, California

Mark A. Lancaster
Engineer/Scientist

Education

M.S., 1990, Environmental Systems Engineering, Clemson University, Clemson, South Carolina
B.S., 1982, Biology, Lander College, Greenwood, South Carolina

Areas of Expertise

RCRA
Underground Storage Tank Regulations
SARA Title III Regulations
Environmental Assessments
Environmental Compliance Audits
Remedial Investigations/Site Characterizations

Experience

Mr. Lancaster has extensive experience in performing the technical as well as project management aspects of projects relating to regulatory compliance. His project experience ranges from conducting environmental assessments for real estate transactions to preparing RCRA permit applications. These projects have provided experience in regulation interpretation, information collection and organization, report writing, and other related duties.

RCRA

Confidential Client, Greenville, South Carolina. Prepared an Interim Status Closure/Post-Closure Plan for three surface impoundments, managed an interim waste removal project.

GSX, Reidsville, North Carolina. Participated in the preparation of the facility RCRA permit application.

Aqua-Tech/Groce Laboratories, Greer, South Carolina. Participated in the preparation of the facility RCRA permit application.

IBM, Endicott, New York. Prepared a closure plan for closure of a RCRA tank farm. Also assisted in oversight of the closure activities.

Macalloy Corporation, Charleston, South Carolina. Project Manager for and preparer of a RCRA closure plan for inground ash treatment tank.

Westinghouse Electric Corporation, Hampton, South Carolina. Prepared a revised closure plan in response to regulatory agency comments.

Davis Mechanical Contractors, Inc., Greenville, South Carolina. Prepared a hazardous waste training manual and facility contingency plan.

Savannah River Site, Aiken, South Carolina. Assisted in the preparation of demonstrations of compliance with hazardous waste facility location standards.

Champion Spark Plug Company, Liberty, South Carolina. Prepared a hazardous waste training manual and facility contingency plan.

Westinghouse Electric Corporation, Hampton, South Carolina. Compiled information for submission to regulatory agencies as a part of the facility RFA.

U.S. Department of the Navy, Charleston, South Carolina. Prepared and presented to Navy personnel a training session concerning the RCRA regulatory requirements for closing hazardous waste units.

Siemens Energy and Automation, Spartanburg, South Carolina. Prepared an annual interim status ground water monitoring report.

Confidential Client, Syracuse, New York. Project Manager and lead regulatory specialist for a RCRA mixture rule exemption study and demonstration for a pharmaceutical company facility located in Puerto Rico.

U.S. Army Corps of Engineers, Omaha District,Omaha, Nebraska. Task manager and led regulatory specialist for the preparation of a portion of a RCRA Permit Application for an Open Burning/Open Detonation treatment facility located at Poinsett Weapons Range in South Carolina.

U.S. Navy, Southern Division Facilities Engineering Command, Charleston, South Carolina. Task manager and lead regulatory specialist for a RCRA mixture rule exemption study and demonstration for NAS Cecil Field. The project involved collecting material usage information from 300 work centers and identifying those which contain solvents subject to the exemption.

Underground Storage Tanks

Savannah River Site, Aiken, South Carolina. Task manager for the preparation of a comprehensive underground storage tank compliance manual.

CRS Sirrine, Greenville, South Carolina. Prepared specifications for an underground storage tank removal project.

Nabisco Biscuit Company. Prepared a synopsis of state regulatory underground storage tank requirements and developed a priority ranking for underground storage tank replacement based on the regulatory requirements as part of a national, comprehensive underground storage management plan.

Greenville Water System, Greenville, South Carolina. Provided general assistance with maintaining compliance with the South Carolina underground Storage Tank regulations.

SARA Title III

Savannah River Site, Aiken South Carolina. Assisted in inventory estimates for SARA 311/312 reporting.

Confidential Client, Perry, Florida. Assisted in compiling a chemical database to be used for reporting and proper use information for compliance with SARA and other regulatory requirements.

Confidential Client, Perry, Florida. Assisted in calculations for a pulp and paper mill's SARA 313 reporting for three reporting years.

Confidential Client, Oglethorpe, Georgia. Assisted in calculations for a pulp and paper mill's SARA 313 reporting for three reporting years.

Bommer Industries, Landrum, South Carolina. Prepared SARA 313 reports for three reporting years for a metal plating and manufacturing facility.

Robert Bosch Corporation, Charleston, South Carolina. Performed calculations for SARA 313 reporting for a manufacturing facility.

Environmental Site Assessments

A representative client list for which Phase I property transfer audits have been performed:

- Waste Management
- Myrtle Beach Farms
- Hallmark Properties
- Clemson University
- Trumper Communications
- Phillips Fibers
- Columbia Farms
- Spartan Grain and Mill
- Wallace Thompson Hospital
- NationsBank
- Motels of America
- United American Video
- EEA, Inc.
- Ciba-Geigy Corporation
- Oscar-Merald and Associates
- Hawk Corporation
- Southern National Bank
- Jack Gray Transport

- Saloman Brothers
- Fieldcrest Cannon
- BB & T Bank
- C. Dan Joyner
- Riva Financial

Environmental Compliance Audits

International Paper Corporation, Selma, Alabama. Participated in the performance of a comprehensive environmental audit of a brownstock paper mill. Concentrated on SARA and TSCA compliance issues.

Hovis Precision Products, Greenville, South Carolina. Participated in the performance of a compliance audit at the facility.

Thermo-Kinetics Corporation, Greenville, South Carolina. Assisted in a compliance audit of the facility.

Woodbury Box company, Woodbury, Georgia. Performed a regulatory status determination of a wastewater lagoon.

Bowater Incorporated, Millinochet, Maine. Performed SARA compliance determinations for two brownstock paper mills.

Remedial Investigations/Site Characterizations

U.S. Army Corps of Engineers, Omaha district, Omaha, Nebraska. Task manager for the performance of a Supplemental Remedial Investigation at two former landfills at Shaw Air Force Base in South Carolina. Project activities included preparation of a Supplemental Remedial Investigation Work Plan, coordinating field investigation activities, and coordinating the preparation of a Supplemental Remedial Investigation Work Plan, coordinating field investigation activities, and coordinating the preparation of the Remedial Investigation Report, Feasibility Report, and Proposed Plan.

U. S. Army Corps of Engineers, Omaha District, Omaha, Nebraska. Participated in Field Investigations for two Air Force Stations in Florida. The work included preparation of a Sampling and Analysis Plan, collection of information and samples at each site, and preparation of a Field Investigation Report.

U. S. Army Corps of Engineers, Fort Rucker, Alabama. Performed a regulatory review of the base operations as part of an Environmental Impact Statement preparation.

Macon Dockery Superfund Site, Richmond County, North Carolina. Assisted in the preparation of a Remedial Investigation Report.

Miscellaneous Projects

Spartan Mills, Spartanburg, South Carolina. Provided oversight and technical assistance during the removal of PCB contaminated materials.

Savannah River Site, Aiken, South Carolina. Participated in preparation of an Environmental Compliance Manual for the facility.

Previous Experience

Clemson University, Clemson, South Carolina. Member of a research team involved in evaluating the effectiveness of on-site environmental protection systems, and the off-site impacts of the construction of a hydroelectric project. Also worked as co-investigator for a portion of the siting studies for a proposed hydroelectric project. This included scheduling and coordinating monthly stream sampling trips; performing stream sampling and analysis; developing computer routines for data analysis and supervising their use; preparing monthly and several annual reports, and presenting reports to technical and management personnel with the project sponsor, regulatory agencies, and professional organizations.

South Carolina Department of Health and Environment Control, Columbia, South Carolina. Responsible for reviewing statewide wastewater treatment plant inspections and effluent sampling inspections; notifying permittees of industrial, public, and private treatment plants of sampling and inspection results; performing diagnostic evaluations and performance audit inspections at various types of wastewater treatment plants statewide; preparing related inspection reports, and evaluating quality control and quality assurance practices of twelve SCDHEC district Facility Evaluators.

South Carolina Department of Health and Environmental Control, Spartanburg, South Carolina. Responsible for performing state and federal operation, maintenance, and compliance inspections at various wastewater treatment plants; preparing associated inspection reports; investigating complaints concerning stream water quality; performing agricultural waste treatment system siting, and operation inspections.

U.S. Department of Energy, Pittsburgh, Pennsylvania. Responsibilities included developing a study of the small mammal and bird ecology of the Pittsburgh Energy Technology Center property; implementing the study by trapping small mammals and siting birds at the facility; and preparing a written report of the study findings.

Special Training

OSHA 40 hours Hazardous Waste Site Health and Safety Training

Presentations, Publications, Awards

Publications

Lancaster, Mark A., "Assessing the Environmental Quality of Appalachian Mountain Streams", Masters Thesis, Clemson University, December, 1990.

Dysart, B. C. III and M. A. Lancaster. "Characterizing Southern Blue Ridge Escarpment Streams: Methods and Findings." Briefing prepared for Monte Seehorn, U.S. Forest Service, Gainesville, GA, September 1988.

Dysart, B. C. III, R. M. El-Farhan, and M. A. Lancaster. "Improving the Cost Effectiveness and Performance of Erosion Control Systems." Presented by B. C. Dysart III at the National Conference of Erosion and Sediment Control Program Administrators, Charleston, SC, June 1988.

Dysart, B. C. III, A. R. Abernathy, and M. A. Lancaster. "Howard Creek Construction-Phase Water Quality Monitoring: 1987." Report prepared for Duke Power Company, Charlotte NC, May 1988, Report No. DPC/GC-TCR-22-0588.

Lancaster, M. A., B. C. Dysart III, S. G. Braswell, and R. D. Hatcher Jr. "Characterization of Southern Blue Ridge Escarpment Streams." Abstract in Eos, Transactions, American Geophysical Union, Vol. 69 No. 16, April 19, 1988. Presented by M. A. Lancaster at the American Geophysical Union Spring Meeting, Baltimore, MD, May 1988.

Professional Memberships

Chi Epsilon - National Civil Engineering Honor Society

Employment History

January 1989 to present	RUST Environment and Infrastructure
June 1987 - December 1988	Clemson University
May 1983 - August 1986	SC Department of Health and Environmental Control
January - August 1981	U.S. Department of Energy

David C. Dailey, E.I.T.
Environmental Engineer

Education

M.S., Environmental Engineering, University of Alabama, 1993, Tuscaloosa, Alabama
B.S., Biology, Birmingham-Southern College, 1988, Birmingham, Alabama

Professional Registration

Registered Environmental Professional, 1994
Engineering-in-Training, 1993

Areas of Expertise

CERCLA Site Investigation
Landfill Inspection
Soil and Groundwater Assessment

Experience

CERCLA Site Investigation

Redstone Arsenal, Huntsville, Alabama. Field Operations Manager responsible for conducting geophysical studies to determine the location and extent of hazardous waste deposits in remote areas of the installation.

Landfill Inspection

Salem Landfill, Opelika, Alabama and Valley View Landfill, Ider, Alabama. Installed monitor wells and conducted hydraulic conductivity studies to monitor landfill leachate concentrations and flow characteristics.

Soil and Groundwater Assessment

Chevron and Exxon - Various Sites. Performed numerous groundwater and soil assessments for Chevron and Exxon at sites in Alabama, Georgia, Tennessee, and South Carolina to determine petroleum hydrocarbon contamination in the surrounding media.

Special Training

HAZWOPER 40-hour training course, University of Alabama at Birmingham, 1994.
Adult CPR training certification course, Birmingham, 1994.
Construction Safety Awareness training course, Birmingham, 1994.

Employment History

1994 to present	Rust Environment & Infrastructure
1991-1993	DCH Regional Medical Center
1988-1991	UAB Immunogenetics Program

Sherman Woodson
Certified Industrial Hygienist

Education

Master of Public Health (M.P.H.), 1986, Industrial Hygiene, University of South Carolina, Columbia, South Carolina

B.S., 1983, Biology, Furman University, Greenville, South Carolina

Professional Registrations/Certifications

American Board of Industrial Hygiene - Comprehensive Practice — Certification No. 6081
South Carolina Department of Health and Environmental Control Asbestos Abatement License No. 20021 - Consultant (AHERA)/Management Planner
DOE "L" Clearance - OR154307

Areas of Expertise

Health and Safety Program Development
Emergency Response and Hazardous Waste 1910.120 Training
Air Monitoring

Experience

Mr. Woodson is responsible for industrial hygiene and safety investigations, regulatory compliance assessments, and health and safety training for workers. He develops site-specific health and safety plans for hazardous waste site activities.

Health and Safety Program Development

Confidential Client, Greensboro, North Carolina. Health and safety compliance audits of eight manufacturing facilities. Audits focused on general OSHA compliance including machine guarding, hazard communication, lockout, tagout and confined space entry.

Diversified Scientific Services, Inc. (DSSI), Kingston, Tennessee. Developed health and safety programs including Confined Space Entry, Respiratory Protection, Air Monitoring Plan, Hazard Communication, Fire Prevention, and Hearing Conservation. Provided safety oversight for construction activities at the facility such as issuing confined space entry permits and hot work permits.

Confidential Client, Greenville, South Carolina. Provided continuous on-site health and safety support for three years. Revised and directed the following Health and Safety Programs: Forklift Inspection and Operation, Hearing Conservation, Lockout/Tagout, Respiratory Protection,

Confined Space Entry, Spray Painting, Crane Inspection, Air Monitoring, Radiography, Lasers, Asbestos, Hazard Communication, Accident Reporting and Investigation, and Ergonomics.

Also provided training in the following areas: Forklift, Hazard Communication, Hearing Conservation, Lockout/Tagout, Respiratory Protection, Confined Space Entry, Lasers, and Emergency Responder (1910.120).

Radian Inc., Oak Ridge, Tennessee. Evaluation of Confined Space Entry and Airline Respirator Programs for the five installations operated by Martin Marietta Energy Systems. Evaluated these programs for compliance with applicable OSHA, ANSI, and DOE standards.

Radian Inc., Oak Ridge, Tennessee. Follow-up to Technical Safety Audit of ORNL. Ensured that corrective actions were adequate to respond to findings from a Department of Energy safety audit.

Radian Inc., Oak Ridge, Tennessee. Development of carcinogen control safety plans for the Department of Energy's Oak Ridge Y-12 Plant. Safety plans included required personal protective equipment, engineering controls, hazard assessment, and monitoring procedures developed for suspected and known carcinogens in use at the Y-12 Plant.

Emergency Response and Hazardous Waste 1910.120 Training

Westvaco, Charleston, South Carolina. Revision of Emergency Response Plan and 24-hour training to ensure compliance with 29 CFR 1910.120.

Radian Inc., Oak Ridge, Tennessee. Instructor for health and safety training for hazardous waste site operations. Provided training in practical aspects of personal protective equipment, air monitoring, and sampling.

Air Monitoring

Confidential Client, Greenville, South Carolina. Conducted air monitoring for an acid etch operation and metal spray operation.

Confidential Client. Greenville, South Carolina. Conducted air monitoring for the following operations: welding, paint spraying, flame spraying, and grinding.

Radian Inc., Oak Ridge, Tennessee. Solid Waste Storage Area 6 Interim Corrective Measures (ICM) at Oak Ridge National Laboratory. Provided industrial hygiene monitoring and general site safety monitoring during the covering of hazardous waste trenches with a liner.

Radian Inc., Oak Ridge, Tennessee. Y-12 Closure and Post closure (CAPCA) Activities. Provided industrial hygiene and radiation monitoring during the remediation of several hazardous waste sites at the Oak Ridge Y-12 Plant.

Roy F. Weston, Inc., Atlanta, Georgia. Performed site safety audits and air monitoring during EPA remediation projects.

Carolina Eastman Company, Columbia, South Carolina. Performed various industrial hygiene duties as a summer intern. Duties included air sampling, noise monitoring, and laboratory analysis of asbestos samples.

Other Projects

University of South Carolina, Health and Safety Office, Columbia, South Carolina. Graduate Assistant. Duties included walk-through safety inspections at various campus work sites and ensuring that hazardous waste generated on campus was disposed of properly.

South Carolina Department of Health and Environmental Control, Greenville, South Carolina. Enforced state environmental regulations by investigating citizen complaints of potential health hazards. Performed sampling of soil and water.

Trident Building, Greenville, South Carolina. Provided asbestos inspection and sampling services.

Naval Facilities Engineering Command, (NAVFAC), Polaris Military Base, Charleston, South Carolina. Inspection and sampling for asbestos.

Special Training

Health and Safety Training for Hazardous Waste Workers, presented by Roy F. Weston, Inc., Lionville, Pennsylvania, March 1987, 40 initial classroom hours with 8 hours annual refresher training

Air Surveillance for Hazardous Materials, presented by the U.S. Environmental Protection Agency, Atlanta, Georgia, December 1987, 40 classroom hours.

Hazardous Waste Site Sampling, presented by the U.S. Environmental Protection Agency, Athens, Georgia, June 1988, 16 classroom hours.

Inspecting Buildings for Asbestos-Containing Materials, presented by Georgia Tech, Atlanta, Georgia, October 1989 24 classroom hours.

Managing Asbestos in Buildings, presented by Georgia Tech, Atlanta, Georgia, October 1989, 16 classroom hours.

Professional Memberships

American Industrial Hygiene Association
American Society of Safety Engineers

Employment History

1990 to present	Rust Environment & Infrastructure
1988—1989	Radian Inc.
1987—1988	Roy F. Weston Inc.
1985—1986	University of South Carolina
1984—1985	South Carolina Department of Health and Environmental Control

10/95

DRAFT FINAL

SITE SAFETY AND HEALTH PLAN
RSA- 94, 95, 96, 97, 98

EPA ID NO. AL7 210 020 742

REDSTONE ARSENAL
MADISON COUNTY, ALABAMA

FEBRUARY 1996

DRAFT FINAL SITE SAFETY AND HEALTH PLAN
FOR
SITE INSPECTIONS

RSA-94, 95, 96, 97, 98

EPA ID NO. AL7 210 020 742

REDSTONE ARSENAL
MADISON COUNTY, ALABAMA

CONTRACT NO. DACA 2193-D-0029
DELIVERY ORDER NO. 025

Prepared for:

U.S. Army Corps of Engineers
Savannah District

Prepared by:

Rust Environment & Infrastructure Inc.
Greenville, South Carolina

FEBRUARY 1996

SITE SAFETY AND HEALTH PLAN REVIEW SHEET
33833
Please sign and date.

Sherman Woodson (date) January 31, 1996

Prepared By: Rust Health and Safety
Mr. Sherman Woodson

Sherman Woodson (date) January 31, 1996

Reviewed By: Rust CIH
Mr. Sherman Woodson

George R. Overby (date) Feb. 1, 1996

Approved By: Rust Project Manager
Mr. George Overby

(date)

Approved By: USACE Savannah,
CESAS-SO-SAFETY

NOTE: EMERGENCY TELEPHONE NUMBERS AND HOSPITAL DIRECTIONS ARE LOCATED IN APPENDIX A.

PRE-SITE BRIEFING SIGNATURE SHEET
33833
Please sign and date.

	Name	Representing	Date
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NOTE: ALL SITE PERSONNEL AND VISITORS REQUESTING WORK AREA ENTRY MUST RECEIVE A SITE-SPECIFIC BRIEFING PRIOR TO SITE ACCESS.

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1.0 INTRODUCTION

1.1 OBJECTIVES OF THE PLAN

This document defines the Health and Safety considerations for the Site Inspection (SI) field activities to be conducted at sites RSA-94, 95, 96, 97, 98 at Redstone Arsenal (RSA) in Madison County, Alabama. Rust Environment & Infrastructure (Rust) personnel will provide technical oversight for the field activities on behalf of the U.S. Army Corps of Engineers (USACE). This document is required by the USACE Contract, Rust policies and procedures, and Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120. All Rust personnel and their subcontractors will be familiar with the information contained in this Site Safety and Health Plan (SSHP).

1.2 PLAN DEVELOPMENT

The Architect/Engineer (AE) Project Manager (PM) must not allow work to begin until this SSHP has been approved by the USACE and provided to all field personnel. Before work area entry, all site personnel and visitors must attend a site-specific briefing session, to be conducted by the Rust Site Health and Safety Officer (HSO), on the potential site hazards and specific requirements of this SSHP.

Drilling subcontractors will be responsible for developing and implementing a plan for establishing health and safety procedures for all drilling operations and associated tasks as defined in 29 CFR 1926 (Construction Industry Standards). Drilling safety procedures are discussed in Section 10.3.

In addition, all site personnel and visitors requesting entry into the contamination reduction and exclusion zones must provide the Contracting Officer with a written statement documenting full compliance with 29 CFR 1920.120.

All site investigation activities and health and safety documents required by this scope of work (described in Section 3.0) shall comply with and reflect, as a minimum, the following regulations and appropriate guidance publications:

1. Federal Acquisition Regulation (FAR) Clause 52.236-13: Accident Prevention.

2. USACE, Safety and Health Requirements Manual, EM 385-1-1 (latest revision).

3. OSHA Construction Industry Standards, 29 CFR 1926, and General Industry Standards, 29 CFR 1910; especially 29 CFR 1910.120-"Hazardous Waste Site Operations and Emergency Response".

4. NIOSH/OSHA/USCG/EPA, "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities", October 1985.

5. Department of Army Regulations ER 385-1-92, 18 March 1994. "Safety and Occupational Health Document Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) and Ordnance and Explosive Waste (OEW) Activities."

6. Department of the Army Pamphlet, Chemical Accident or Incident Response and Assistance (CAIRA) Operations.

7. Department of Army Regulation, AR 200-1. "Environmental Protection and Enhancement."

8. Other applicable Federal, State, and local safety and health requirements.

NOTE: REFER TO APPENDIX A OF THIS DOCUMENT FOR EMERGENCY CONTACT NUMBERS

1.3 FACILITY BACKGROUND, LOCATION, AND SITE DESCRIPTIONS

1.3.1 Facility Background

RSA is evaluating past hazardous waste management practices at its facility. These studies are being performed in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Approximately 200 known or potential

solid waste management units (SWMUs) have been identified. The USACE, Savannah District, on behalf of RSA, is contracting for the required work. This document outlines the site health and safety procedures associated with the SIs at the five locations. The SIs are being conducted to determine if additional investigations will be necessary, or if recommendations for no further action can be made.

1.3.2 Location

RSA is a U.S. Army facility located in Madison County, Alabama (Figure 1-1). RSA occupies approximately 38,000 acres. It is bounded on the north and east by the City of Huntsville, on the southwest by Wheeler National Wildlife Refuge (WNWR), on the south by the Tennessee River Valley Authority (TVA) property and the Tennessee River, and on the west by agricultural, residential and light industrial areas (Figure 1-2).

1.3.3 Site Descriptions

This section presents information on the physical setting and previous use of each of the sites, which along with the data from any previous investigations can help determine the types of contamination that may be present at each site. The general locations of the sites are shown in Figures 1-3 and 1-4.

1.4 RSA-94 (SOLVENT DEGREASER/STILL)

RSA-94 is a solvent degreaser/still unit located inside Thiokol's North Plant Building 7625 (Figure 1-5). The solvent degreaser/still system consists of the solvent degreaser/still and concrete pit. The solvents reportedly used in this system were trichloroethene (TCE) from 1984 to 1989 and 1,1,1-trichloroethane (TCA), from 1989 to present. There have been no documented releases of solvents from this site.

1.5 RSA-95 (SOLVENT DEGREASER/STILL)

RSA-95 is a closed solvent degreaser/still unit located inside Thiokol's North Plant Building 7368 (Figure 1-6) The solvent degreaser/still unit has been removed; however, the concrete pit

remains. The solvents reportedly used in this system were TCE from 1984 to 1989 and 1,1,1-TCA, from 1989 until the unit was closed. There have been no documented releases of solvents from this site.

1.6 RSA-96 (SOLVENT DEGREASER/STILL)

RSA-96 is a solvent degreaser/still area located inside Thiokol's North Plant Building 7740 (Figure 1-7). The solvent degreaser/still unit and concrete pit remain but are no longer in use. The solvents reportedly used in this system were TCE from 1984 to 1989 and 1,1,1-TCA, from 1989 until the unit was closed. There have been no documented releases of solvents from this site; however, previous investigations of nearby RSA-142 have revealed levels of TCE and acetone, exceeding 10,000 μg/L, in groundwater in the immediate vicinity of Building 7740.

1.7 RSA-97 (SOLVENT DEGREASER/STILL)

RSA-97 is a solvent degreaser/still unit located inside Thiokol's North Plant Building 7726 (Figure 1-8). The solvent degreaser/still system has been removed and the concrete pit has been backfilled with gravel and concrete. The solvents reportedly used in this system were TCE from 1984 to 1989 and 1,1,1-TCA, from 1989 until the unit was closed. There have been no documented releases of solvents from this site.

1.8 RSA-98 (SOLVENT DEGREASER/STILL)

RSA-98 is an active solvent degreaser/still unit located inside Thiokol's North Plant Building 7346 (Figure 1-9). A solvent degreaser/still system and concrete pit are present at the site. In addition, an aboveground storage tank is located outside of the building and is designed to be used as a temporary storage vessel for solvent in the event that a release occurs from the degreaser/distillation unit. The solvents reportedly used in this system were TCE from 1984 to 1989 and 1,1,1-TCA, from 1989 to present. There have been no documented releases of solvents from this site.

2.0 ORGANIZATION AND RESPONSIBILITIES

2.1 PROJECT TEAM ORGANIZATION

Rust personnel and their subcontractors will make up the health and safety team. The Rust portion of the team is comprised of the Corporate Health and Safety Manager (CHSM), the Region Health and Safety Specialist (RHSS), the Site Health and Safety Officer (HSO), and the PM. Additional assistance will be available as needed through the Chief of U.S. Army Missile Command (MICOM) Safety and the MICOM Environmental PM, both located at RSA, and the USACE at Savannah, Georgia.

An organization chart showing the relationships to contractor personnel and the Contracting Officer is shown in Figure 2-1.

2.2 PROJECT TEAM RESPONSIBILITY

The CHSM is responsible for the development of company safety protocols and procedures necessary for field operations and is also responsible for the resolution of any outstanding safety issues which arise during site work. The RHSS has overall responsibility for the development and implementation of the SSHP. The RHSS shall approve any changes to the SSHP due to modification of procedures, newly proposed site activities, and/or unexpected site conditions. The HSO, PM, and other Rust personnel on site will have the following responsibilities:

- Project Manager - The PM is the senior contractor representative on site who reports to upper level management and the Contracting Officer. Assigned responsibilities include the authority to direct daily site work activities, respond to emergency situations and assume total control over all Rust site activities. The PM is responsible for the preparation, organization and review of the project including the SSHP and the Work Plan, and is responsible for the selection, assignment, and conduct of the site organization. The PM obtains the necessary site access authorizations, ensures that the appropriate plans are in place to support site work activities, briefs field team members, coordinates with appropriate regulatory officials, serves as liaison with the Contracting Officer, coordinates all activities of site personnel and coordinates preparation of any final reports and

supporting documentation. The PM has overall responsibility for the health and safety of Rust project personnel.

- Site Health and Safety Officer (Site Supervisor) - This individual reports to the RHSS/PM and is responsible for all aspects of site health and safety. He/she has the authority and responsibility for stopping site work should activities jeopardize the health and safety of workers or the public **(If practical, the PM should be consulted before any operation is interrupted)**. Additional responsibilities include conducting daily safety briefings and inspections, selecting protective equipment and clothing, control of entry and egress from the work area, coordination of the project safety and health program with advisory personnel, confirmation of workers' suitability for performance of activities, monitoring of workers for adverse effects of hazardous contaminants, overview of site work hazards, enforcement of the requirements of the SSHP, daily inspection of the work site to assure compliance with the safety and health requirements, and coordination of medical care. If project work activities are being performed simultaneously at numerous sites, each distinct site must have a HSO. In this case, the site supervisor would have overall responsibility for multi-site health and safety.

- Other Project Personnel - All other personnel assigned as site workers, laborers, technicians, equipment operators or other classifications shall be selected based upon the specific project requirements as defined by the Work Plan. Project personnel are responsible for the conduct of all assigned tasks in a safe manner which complies with the SSHP and are responsible for notification of the PM, the HSO or other responsible personnel in the event of unsafe conditions.

If work is stopped due to any health and safety concern, immediate attention should be given by health and safety personnel, working with the PM and Contracting Officer to identify and correct the cause of concern as quickly as possible. Any such incident should be fully documented by the HSO in a report to the RHSS and PM. In the event of a work stoppage, USACE must be notified as soon as possible, and kept apprised of progress in resolving the incident until normal operations are resumed.

Subcontractors shall comply with the requirements outlined in the SSHP and in accordance with OSHA 29 CFR 1910 and 29 CFR 1926; but, in all cases, subcontractors shall be responsible for site safety related to or affected by their own field operations.

3.0 PROJECT DESCRIPTION

Rust has prepared a detailed work plan for the site activities. In summary, the first stage of this effort will include the following:

- installation of the soil gas collectors
- recover soil gas collectors

Once the information from the initial investigation is collected the results of the soil gas survey will determine the locations for the soil borings. Upon approval, the locations will be staked for utility clearance at the beginning of the second field event. The second event will include the following:

- installation of soil borings by drill rig
- environmental sampling of soil and groundwater
- management and disposal of IDW

Once the above tasks are completed, the results will be collected, evaluated, and incorporated into the SI Report. If following the evaluation of the results additional site inspection activities are required, future investigative activities may include:

- installation of soil borings by drill rig
- environmental sampling of soil and groundwater
- management and disposal of IDW
- monitoring well installation/sampling

4.0 HAZARD ASSESSMENT

Site history indicates the presence of acetone, 1,1,1-TCA, and TCE. In addition to resident contaminants of concern, nitric acid, hydrochloric acid, sulfuric acid, isopropyl alcohol, and compressed hydrogen will be onsite in support of field activities. These chemicals may present skin contact and explosion hazards. Care should be taken to avoid all unprotected contact with acids. Compressed hydrogen cylinders must be protected from physical damage and stored in a cool, dry, well-ventilated area. Valve protection caps must remain in place unless in use.

Site personnel may also be exposed to native poisonous plants, animals, and insects. The work area will be visually assessed by the HSO for the presence of these dangers. Personnel with admitted sensitivities will not be permitted to work in an area identified as containing the above-mentioned biological hazards. In the event of an extremely hazardous episode (snake or spider bite), the victim will be immobilized and emergency transport will be summoned.

Site chemicals of concern can affect the body if they are inhaled, come in contact with the eyes and/or skin, or are ingested.

Table 4-1 presents a variety of exposure limits applicable to workplace exposure for compounds which, according to site history, may be present at several sites. The American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) for the work environment are given for airborne exposures. Three TLV standards are presented, if available, for each chemical. The Time Weighted Average (TWA) is the time-weighted average concentration for a normal 8-hour day and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect. The Short-term Exposure Limit (STEL) is a 15-minute time-weighted average exposure that should not be exceeded at any time during a work day even if the 8-hour TWA is within the TLV. Exposures above the TLV-TWA up to the STEL should not be longer than 15 minutes and should not occur more than four times per day. There should be at least 60 minutes between successive exposures in this range. The ceiling values (CEIL) refer to the maximum exposure concentration at any duration.

Also presented are the OSHA Permissible Exposure Limits (PELs). The PEL values are presented either as an 8-hour TWA, 15-minute STEL, or ceiling CEIL limit. The immediately dangerous

to life and health (IDLH) value represents a maximum concentration from which one could escape within 30 minutes without any escape-impairing symptoms or any irreversible health effects. Other relevant health-based information that applies to this health and safety plan or to the employee's right to know is discussed in the toxicity summaries and MSDS for the chemicals of concern in Appendix B and C, respectively. General first-aid procedures are presented in Section 11.4 of this document. Chemical-specific first-aid is discussed in attached MSDS.

5.0 POTENTIAL HAZARDS

Site history indicates the potential for project personnel to be exposed to acetone, 1,1,1-TCA, and TCE. Chemical warfare materials (CWM) are not anticipated to be present at these work areas. Exposure to the above-mentioned chemicals of concern may produce contact dermatitis and irritation of the eyes, nose, and throat. If splashed into the eyes, severe damage may occur. Acute exposures may depress the central nervous system resulting in such symptoms as headache, dizziness, tremors, nausea, and irregular heartbeat. In severe cases, unconsciousness and death have been reported.

The potential for fire and explosion may be present during field operations that use mechanized equipment or gasoline or diesel fuel products. Fuel required for portable power equipment will not be stored in the access or egress routes of a work site. Fuel is to be stored in an approved safety can and never in direct sunlight. Fire extinguishers are to be staged for ready availability near the fuel storage location. Smoking or open flames within 50 feet of where flammables are being stored or transferred, or when equipment is being fueled is prohibited. The use of powered equipment in dry timber or grass areas is a concern due to the potential for spot fires from sparking equipment or muffler exhaust. Fire fighting equipment will be staged for ready availability. Static electricity can be a source of spurious signals causing the initiation of explosives, flammables or vapors.

6.0 ENVIRONMENTAL MONITORING

6.1 ORGANIC VAPORS

The Rust HSO will conduct organic vapor screening with a direct reading instrument (Foxboro Organic Vapor Analyzer (OVA) or equivalent Flame Ionization Detector (FID)) during all intrusive activities. Since TCE has the lowest published exposure limit of any potential site contaminants, the PEL multiplied by the detection sensitivity (50 ppm x 0.54 = 27 ppm) will be used as the respirator trigger. If levels are at or above 27 ppm for 15 minutes or more in the breathing zone, site personnel must wear half-mask respirators equipped with organic vapor/HEPA combination cartridges. For breathing zone concentrations exceeding 270 ppm for 15 minutes or more or upon splash conditions, full-face respirators equipped with organic vapor/HEPA combination cartridges are mandatory. For concentrations exceeding 540 ppm, site personnel must evacuate work area immediately. Upon completion of the evacuation, the Rust HSO must notify the Contracting Officer, PM, and the Rust RHSS.

Exposure Limits	Response Actions
At or above 27 ppm for 15 minutes or more in the breathing zone	Exclusion zone personnel will don half-mask respirators equipped with organic vapor/HEPA combination cartridges
270 ppm to 540 ppm for 15 minutes or more in the breathing zone and/or upon splash conditions	Exclusion zone personnel will don full-face respirators equipped with organic vapor/HEPA combination cartridges.
Above 540 ppm	Site Evacuation and Notifications.

6.2 FLAMMABLE VAPORS/OXYGEN

The Rust HSO will screen the site during intrusive activities with a combustible gas indicator (CGI) and oxygen meter. For any flammable concentrations greater than 10% LEL or oxygen concentrations less than 19.5%, site personnel must evacuate the work area immediately. Upon

completion of the evacuation, the Rust HSO must notify the contracting officer, PM, and the Rust RHSS.

Exposure Limits	Response Actions
Flammable Vapor > 10% LEL Oxygen Concentration < 19.5%	Site Evacuation and Notifications

6.3 DUST

During visibly dusty and/or windy conditions, the Rust HSO will survey airborne particulates with a Mini-ram Dust Monitor. If airborne dust concentrations exceed 0.15 mg/m^3 for 15 minutes or more in the breathing zone, site personnel must don full-face respirators equipped with organic vapor/HEPA combination cartridges. If vision is impaired, site personnel must evacuate work area until dusty/windy conditions cease. Upon completion of the evacuation, the Rust HSO must notify Contracting Officer, PM, and the Rust RHSS.

Exposure Limits	Response Actions
At or above 15 mg/m^3 for 15 minutes or more	Exclusion zone personnel will don full-face respirators equipped with organic vapor/HEPA combination cartridges
Impaired vision	Site Evacuation and Notifications

6.4 NOISE

During the use of all heavy equipment or work near a potential noise hazard(s), the Rust HSO will collect sound level measurements. Site personnel must use appropriate hearing protection whenever noise levels exceed 85 dBA. If levels exceed 115 dBA, site personnel must cease site activity and evacuate work area. Upon completion of the evacuation, the Rust HSO must notify Contracting Officer, PM, and the Rust RHSS.

Exposure Limits	Response Actions
At or above 85 dBA	Mandatory use of hearing protection
At or above 115 dBA	Site Evacuation and Notifications

7.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

7.1 RESPIRATORY PROTECTION

See Section 6.1 and 6.2 for respiratory personal protective equipment (PPE) requirements for the presence of organic vapors and airborne dust in the breathing zone.

7.2 NON-RESPIRATORY PROTECTION

At a minimum, nonrespiratory PPE will consist of Tyvek coveralls, neoprene steel-toe boots, and chemical-resistant gloves. Work around drill rigs will require the use of eye protection, a hard hat, and hearing protection. If wet or free-product conditions are encountered and contact/splash hazards exist, Saranex and chemical splash goggles or face shields (8" minimum) coveralls will be worn.

The following equipment shall be maintained throughout the duration of site work for use in the exclusion zone. All items shall be available to site personnel (see following page for level-specific PPE). One fire extinguisher (A-B-C Rated) will be required on each drill rig and decon station.

- Mini-ram Dust Monitor
- Organic Vapor Analyzer (OVA)
- Combustible Gas Indicator/O_2 Meter
- Sound Level Meter
- Tyvek (Dusty Conditions)
- Saranex (Wet/Splash Conditions)
- Neoprene Boots (Steel Toe/Shank)
- Safety Hard Hats
- Safety Glasses/Chemical Splash Goggles
- Latex Inner Gloves
- Nitrile Outer Gloves
- Work Gloves
- Ear Plugs
- Chain Saws
- Safety Line/Belts

- Nylon Rope
- Fire Extinguisher (A-B-C Rated)
- Decon Sprayers (2 per decon station)
- Drink Cooler with electrolyte replenishing liquid (Support Zone)
- Eyewash Kits (Decon Station)
- First-Aid Kits (Support Zone)
- Bloodborne Pathogen Kits (Support Zone)

During non-intrusive operations, employees must wear clothing suitable for the weather and work conditions.

The following PPE levels have been set for site activities:

Level D - For work outside of exclusion zone and any activity inside of exclusion zone below required respirator limits.

Required PPE:
Tyvek (optional)
Hard Hat (for overhead hazard)
Safety Boots (steel toe/shank)
Latex Inner Gloves
Nitrile Outer Gloves
Ear Plugs/Muffs (Optional)

Level C - For work inside exclusion zone within previously indicated respirator limits.

Required PPE:
Tyvek (if coverall not worn)
Saranex (wet/splash conditions)
Hard Hat (for overhead hazards)
Safety Glasses (with half-mask respirator)
Neoprene Boots (steel toe/shank)
Latex Inner Gloves
Nitrile Outer Gloves
Half-face Respirator

Full-face Respirator
Organic Vapor/HEPA Combination Cartridges
Ear Plugs/Muffs

8.0 HEAT STRESS/COLD STRESS PROTECTIVE MEASURES

8.1 HEAT STRESS

When the body temperature rises, the body seeks to dissipate the excess heat. The major disorders due to heat stress are heat cramps, heat exhaustion, and heat stroke. Heat cramps are painful spasms which occur in the muscles of workers who sweat profusely in the heat and drink large quantities of water, but fail to replace the body's lost salts and electrolytes.

Heat exhaustion is characterized by extreme weakness or fatigue, dizziness, nausea, and headache. In serious cases, a worker may vomit or lose consciousness. The skin is clammy and moist, complexion pale or flushed, and the body temperature can be normal or slightly higher than normal. Treatment consists of rest in a cool place and replacement of body water lost by perspiration. Mild cases may recover spontaneously with this treatment. Severe cases may require care for several days. There are no permanent effects.

Heat stroke is caused by the breakdown of the body's heat regulating mechanism. The skin is very dry and hot with a red or bluish appearance. Unconsciousness, mental confusion, or convulsions may occur. Without quick and adequate treatment, the result can be death or permanent brain damage. Medical assistance should be given quickly. The person should be moved to a cool place. Body heat should be reduced artificially by soaking the person's clothes with water. The following steps can be taken to reduce heat stress:

- Acclimate the body.
- Drink more liquids to replace body water lost during sweating.
- Increase salt consumption (salt tablets are not recommended).
- Wear personal cooling devices.
- Wear supplied air suits or respirators equipped with a vortex tube that cools the air being supplied.
- Count pulse rate during a 30-second period as early as possible in the rest break. If the heart rate exceeds 110 beats per minute at the beginning of the rest break, shorten the next work cycle by one-third and keep the rest break the same. If the heart rate still exceeds 110 beats per minute at the next rest break, shorten the following work cycle by one-third.

Heat procured by the body and the environmental heat together determine the total heat load. Therefore, if work is to be performed under hot environmental conditions, the workload category of each job should be established and the heat exposure limit pertinent to the workload evaluated against the applicable standard in order to protect the worker exposure beyond the permissible limit.

The work load category may be established by ranking each job into light, medium, or heavy categories on the basis of type of operation:

1. light work (up to 200 kcal/hr or 800 Btu/hr): e.g. sitting or standing to control machines, performing light hand or arm work,

2. moderate work (200-350 kcal/hr or 800-1400 Btu/hr): e.g., walking about with moderate lifting and pushing, or

3. heavy work (350-500 kcal/hr or 1400-2000 Btu/hr): e.g., pick and shovel work.

Where the work load is ranked into one of three said categories, the permissible heat exposure TLV for each workload can be estimated from Table 8-1. The heat stress TLVs refer to heat stress conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse health effects. These TLVs are based on the assumption that nearly all acclimatized, fully clothed (e.g., lightweight pants and shirt) workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 38°C (100.4°F).

Where there is a requirement for protection against other harmful substances in the work environment and additional personnel protective clothing and equipment must be worn, a correction to the Wet Bulb Globe Temperature (WBGT) TLV values, as presented in Table 8-2, must be applied.

At the present time, WBGT Index is the simplest and most suitable technique to measure environmental heat factors. WBGT values are calculated by the following equations:

- Outdoors with solar load

$$WBGT = 0.7\,NWB + 0.2\,GT + 0.1\,DB$$

- Indoors/Outdoors with no solar load

$$WBGT = 0.7\,NWB + 0.3\,GT$$

Where

WBGT	=	Wet Bulb Globe Temperature
NWB	=	Natural Wet Bulb Temperature
DB	=	Dry Bulb Temperature
GT	=	Globe Temperature

8.2 COLD EXPOSURE

Fatal exposures to cold among workers have almost always resulted from accidental exposures involving failure to escape from low environmental air temperatures or from immersion in low temperature water. The single most important aspect of life-threatening hypothermia is the fall in the deep core temperature of the body. The clinical presentations of victims of hypothermia are shown in Table 8-3. Workers should be protected from exposure to cold so that the deep core temperature does not fall below 36°C (96.8°F); lower body temperatures will very likely result in reduced mental alertness, reduction in rational decision making, or loss of consciousness with the threat of fatal consequences.

Pain in the extremities may be the first early warning of danger to cold stress. During exposure to cold, maximum severe shivering develops when the body temperature has fallen to 35°C (95°F). This must be taken as a sign of danger to the workers, and exposure to cold should be immediately terminated for any workers when severe shivering becomes evident. Useful physical or mental work is limited when severe shivering occurs.

Since prolonged exposure to cold air, or to immersion in cold water, at temperatures well above freezing can lead to dangerous hypothermia, whole body protection must be provided.

1. Adequate insulating dry clothing to maintain core temperatures above 36°C (96.8°F) must be provided to workers if work is performed in air temperatures below 4°C (40°F). Wind chill cooling rate and the cooling power of air are critical factors. [Wind chill cooling rate is defined as heat loss from a body expressed in watts per meter squared which is a function of the air temperature and wind velocity upon the exposed body.] The higher the wind speed and the lower the temperature in the work area, the greater the insulation value for the protective clothing required. An equivalent chill temperature chart relating the actual dry bulb air temperature and the wind velocity is presented in Table 8-4. The equivalent chill temperature should be used when estimating the combined cooling effect of wind and low air temperatures on exposed skin or when determining clothing insulation requirements to maintain the deep body core temperature.

2. Unless there are unusual or extenuating circumstances, cold injury to other than hands, feet, and head is not likely to occur without the development of the initial signs of hypothermia. Older workers or workers with circulatory problems require special precautionary protection against cold injury. The use of extra insulating clothing and/or a reduction in the duration of the exposure period are among the special precautions which should be considered. The precautionary actions to be taken will depend upon the physical condition of the worker and should be determined with the advice of a physician with knowledge of the cold stress factors and the medical condition of the worker.

For exposed skin, continuous exposure should not be permitted when the air speed and temperature results in an equivalent chill temperature of -32°C (-25.6°F). Superficial or deep local tissue freezing will occur only at temperatures below -1°C (30.2°F) regardless of wind speed. At air temperatures of 2°C (35.6°F) or less, it is imperative that workers who become immersed in water or whose clothing becomes wet be immediately provided a change of clothing and treated for hypothermia. TLVs recommended for properly clothed workers for periods of work at temperatures below freezing are shown in Table 8-5.

Special protection of the hands is required to maintain manual dexterity for the prevention of accidents:

1. If fine work is to be performed with bare hands for more than 10-20 minutes in an environment below 16°C (60.8°F), special provisions should be established for keeping the workers' hands warm. For this purpose, warm air jets, radiant heaters (fuel burner or electric radiator), or contact warm plates may be utilized. Metal handles of tools and control bars should be covered by thermal insulating material at temperatures below -1°C (30.2°F).

2. If the air temperature falls below 16°C (60.8°F) for sedentary, 4°C (39.2°F) for light, -7°C (19.4°F) for moderate work, and fine manual dexterity is not required, then gloves should be used by the workers.

To prevent contact frostbite, the workers should wear anticontact gloves.

1. When cold surfaces below -7°C (19.4°F) are within reach, a warning should be given to each worker to prevent inadvertent contact with bare skin.

2. If the air temperature is -17.5°C (0°F) or less, the hands should be protected by mittens. Machine controls and tools for use in cold conditions should be designed so that they can be handled without removing the mittens.

Provisions for additional total body protection are required if work is performed in an environment at or below 4°C (39.2°F). The workers should wear cold protective clothing appropriate for the level of cold and physical activity:

1. If the air velocity at the job site is increased by work, draft, or artificial ventilating equipment, the cooling effect of the wind should be reduced by shielding the work area or by wearing an easily removable windbreak garment.

2. If only light work is involved and if the clothing on the worker may become wet on the job site, the outer layer of the clothing in use may be of the type impermeable to water. With more severe work under such conditions, the outer layer should be water repellent, and the outerwear

should be changed as it becomes wetted. The outer garments should include provisions for easy ventilation in order to prevent wetting of inner layers by sweat. If work is done to normal temperatures or in a hot environment before entering the cold area, the employee should make sure that clothing is not wet as a consequence of sweating. If clothing is wet, the employee should change into dry clothes before entering the cold area. The workers should change socks and any removable felt insoles at regular daily intervals or use vapor barrier boots. The optimal frequency of change should be determined empirically and will vary individually and according to the type of shoe worn and how much the individual's feet sweat.

3. If exposed areas of the body cannot be protected sufficiently to prevent sensation of excessive cold or frostbite, protective items should be supplied in auxiliary heated versions.

4. If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work should be modified or suspended until adequate clothing is made available or until weather conditions improve.

5. Workers handling evaporative liquid (gasoline, alcohol or cleaning fluids) at air temperatures below 4°C (39.2°F) should take special precautions to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling. Special note should be taken of the particularly acute effects of splashes of "cryogenic fluids" of those liquids with a boiling point that is just above ambient temperature.

Work-Warming Regimen

If work is performed continuously in the cold at an equivalent chill temperature (ECT) or below -7°C (19.4°F), heated warming shelters (tents, cabins, rest rooms, etc.) should be made available nearby. The workers should be encouraged to use these shelters at regular intervals, the frequency depending on the severity of the environmental exposure. The onset of heavy shivering, frostnip, the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for immediate return to the shelter. When entering the heated shelter, the outer layer of clothing should be removed and the remainder of the clothing loosened to permit sweat evaporation or a change of dry work clothing provided. A change of dry work clothing should be provided as necessary to prevent workers from returning to work with wet clothing. Dehydration, or the loss of body fluids, occurs insidiously in

the cold environment and may increase the susceptibility of the worker to cold injury due to a significant change in blood flow to the extremities. Warm sweet drinks and soups should be provided at the work site to provide caloric intake and fluid volume. The intake of coffee should be limited because of the diuretic and circulatory effects.

9.0 ACCIDENT PREVENTION

Rust shall provide the subcontractor(s) with this SSHP. Adherence to the standard safety operating procedures and practices described in Section 10 shall be required to minimize the risk of accidents resulting in injury or excessive chemical exposure. It is the responsibility of each contractor to ensure that employees perform their job duties safely.

10.0 STANDARD OPERATING SAFETY PROCEDURES AND CONTROLS

The following general operating procedures shall be followed by all site personnel. These precautionary measures are designed to reduce the risks of inadvertent or accidental chemical exposure or injury during on-site operations.

10.1 PERSONAL PRECAUTIONS

- Be familiar with standard operating procedures and adhere to all instructions and requirements in the site safety plan.

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any contaminated or potentially contaminated area. However, a supply of cold water and disposable cups will be located in the decontamination area such that employees will have access to water with only removal of gloves, hat, and respirator and washing of face and hands.

- Contact lenses shall not be worn in any contaminated area.

- Hands and face must be thoroughly washed upon leaving the work area. Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.

- No facial hair which interferes with a satisfactory respirator fit of the mask-to-face seal is allowed on personnel required to wear respirators.

- Avoid contact with contaminated or suspected contaminated surfaces. Whenever possible, avoid walking through puddles, pools, mud, etc. Avoid kneeling or sitting on the ground, equipment, or drums.

- Personal articles shall be prohibited in any contaminated or potentially contaminated area.

- Medicine and alcohol can exacerbate the effects from exposure to toxic chemicals. Alcoholic beverage intake should be minimized or avoided on off-work hours during field operations. Prescribed drugs should not be taken by personnel on site operations where the potential for absorption, inhalation or ingestion of toxic substances exists unless specifically approved by a qualified physician. Do not work when ill.

- Clothing will be changed at the beginning and ending of each work shift. Upon beginning the day, personal clothing will be removed and replaced with issued wear. Rust, and other Rust subcontractors will supply their own wear. Rust will provide two sets of PPE (not including respirators) per day for government personnel visiting the site. Personal items are the responsibility of the individual. Personal property should remain in the care of the individual.

- Persons with "open wounds" are not permitted to enter any exclusion zone for 24 hours. If the wound may be immersed or splashed with liquid chemical, the restriction from the exclusion zone must be enforced for 7 to 10 days.

- Each site worker will shower at the end of each shift. Thirty minutes will be granted for all team members to redress and shower. Additional time required for the employee will be at his choice and is non-compensatory.

- Supplies of decontaminating solution and emergency showers for personal decontamination will be available at the operational areas when operations are in progress.

10.2 OPERATIONAL REQUIREMENTS

- Contaminated soil, water and PPE produced during this site investigation shall be handled and disposed of in accordance with all state and federal regulations including the Alabama Department of Environment Management (ADEM) Hazardous Waste Regulations, Division 14, Parts 335-14-2-01(2) and 335-14-3-.03.

- All contaminated soil and water must be stored in a watertight drum. Care must be taken to ensure that all gaskets are properly sealed at the time of drum closure.

- All manifests for transport off the installation must be coordinated through the RSA Environmental Office and signed by the installation representative. Temporary storage of waste material will also be coordinated with the RSA Environmental Office.

- Documentation (i.e., landfill receipts, manifest, etc.) of proper disposal must be provided to the USACE.

- Daily safety and health inspections shall be conducted to determine if operations are being performed in accordance with this Health and Safety Plan, USACE and OSHA regulations, and contract requirements.

- In the event of an accident/incident, the AE shall immediately notify the USACE. Within two (2) working days of any reportable accident, the AE shall complete and submit to the USACE an Accident Report on ENG Form 3394 and USACE supplements.

- All personnel going on site shall be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures, and communications.

- Respiratory protective devices and/or protective clothing appropriate to the designated levels of protection shall be worn by all personnel going into areas designated for wearing protective equipment.

- Personnel on site shall use the buddy system, particularly when wearing respiratory protective equipment.

- Visual and/or voice contact shall be maintained between pairs on-site. Entry team members shall remain close together to assist each other during emergencies.

- During drilling and/or sampling operations at or near water hazards, procedures and protective equipment must be utilized to reduce the risks associated with engulfment and skin contact.

- Site access paths are to be marked with twine and survey tape so a visible line from the entry point to within the boundaries of the actual working area can be identified. Working area boundaries are to be squared off with twine and survey tape in order to identify safe areas (entry control point, parking areas, break areas).

- During continual operations, on-site workers shall act as safety backup to each other. Off-site personnel shall provide emergency assistance.

- Personnel should practice unfamiliar operations prior to doing the actual procedure.

- Entrance and exit locations shall be designated and emergency escape routes delineated. The following warning signals shall be used when necessary:

  Hand gripping throat --------- Can't breathe

  Grip partner's wrist or
  both hands at waist ---------- Leave area immediately

  Hands on top of head --------- Need assistance

  Thumbs up ---------- OK, I'm alright, I understand

  Thumbs down ---------- No, Negative

- Communications shall be maintained between field team members within all zones at all times. The HSO shall maintain a warning device such as a vehicle horn or portable signal horn to alert field team members to emergency situations.

- Wind indicators (such as surveyor flagging attached to the drill rig) visible from the work location should be identified before commencing operations.

- Personnel and equipment in the contaminated area shall be minimized, consistent with effective site operations.

- Decontamination procedures for leaving a contaminated area shall be followed. Hands and face shall be washed prior to work breaks and eating and drinking. Work areas and decontamination procedures have been established based on expected site conditions.

- Report all injuries or work related illnesses to the HSO or supervisor as soon as possible.

10.3 DRILLING SAFETY

10.3.1 Introduction

Drilling safety is the responsibility of each member of the drilling crew. Standard operating safety procedures shall comply with guidelines and recommendations specified in the Drilling Safety Guide (International Drilling Federation, 1991). (Drilling guidelines will be filed on site and available for review by contacting the HSO.)

Rust personnel shall not assist subcontracted drillers with their assigned tasks. This is required in order to limit the exposure of Rust employees to hazards associated with drilling operations.

10.3.2 Drill Rig Housekeeping

The first requirement for safe field operations is that the safety supervisor understand and fulfill the responsibility for maintenance and "housekeeping" on and around the drill rig. The safety supervisor must:

- Provide suitable storage locations for all tools, materials, and supplies so that these items can be conveniently and safely handled without hitting or falling on a member of the drill crew or a visitor.

- Avoid storing or transporting tools, materials, or supplies within or on the mast (derrick) of the drill rig, unless designed for this purpose.

- Stack pipe, drill rods, casing, augers, and similar drilling tools in orderly fashion on racks or sills to prevent spreading, rolling, or sliding.

- Place penetration or other driving hammers at a safe location on the ground or secure them to prevent movement when not in use.

- Keep work areas, platforms, walkways, scaffolding, and other access ways free of materials, debris, obstructions, and substances such as ice, grease or oil that could cause a surface to become slick or otherwise hazardous.

- Keep all controls, control linkages, warning and operation lights and lenses free of oil, grease, and/or ice.

- Store gasoline only in a non-sparking, red container with a flame arrester in the fill spout and having the word "gasoline" easily visible.

10.3.3 Maintenance

Good maintenance will make drilling operations safer. Also, maintenance must be performed safely. The following points are essential to safety:

- Wear safety glasses when performing maintenance on a drill rig or on drilling tools.

- Shut down the drill rig engine to make repairs or adjustments to a drill rig or to lubricate fittings (except repairs or adjustments that can only be made with the engine running). Take precautions to prevent accidental starting of an engine during maintenance by removing or tagging the ignition key.

- Block the wheels or lower the leveling jacks, or both, and set hand brakes before working under a drill rig.

- Release all pressure on the hydraulic systems, the drilling fluid system and the air pressure systems of the drill rig -- when possible and appropriate -- prior to performing maintenance.

In other words, reduce the drill rig and operating systems to a "zero energy state" before performing maintenance. Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.

- Do not touch an engine or the exhaust system of an engine following its operation until the engine and exhaust system have had adequate time to cool.

- Never climb the mast (derrick) to do maintenance or make repairs. Lower mast, stop engine and deenergize rig before starting maintenance or repair on mast.

- Never weld or cut on or near a fuel tank.

- Do not use gasoline or other volatile or flammable liquids as a cleaning agent on or around a drill rig.

- Follow the manufacturer's recommendations for applying the proper quantity and quality of lubricants, hydraulic oils and/or coolants.

- Replace all caps, filler plugs, protective guards or panels, and high pressure hose clamps and chains or cables that have been removed for maintenance before returning the drill rig to service.

10.3.4 Hand Tools

Since there are almost an infinite number of hand tools that can be used on or around a drill rig and in repair shops, there are an equal number of instructions for proper use. "Use the tool for its intended purpose" is the most important rule. The following suggestions apply to safe use of several hand tools that frequently are used on and around drill rigs:

- When a tool becomes damaged, either repair it before using it again or discard.

- When using a hammer, any kind of hammer for any purpose, wear safety glasses and require all others around you to wear safety glasses.

- When using any kind of chisel or punch, for any purpose, wear safety glasses and require all others around you to wear safety glasses.

- Keep all tools cleaned and stored appropriately when not in use.

- Use wrenches -- not pliers -- on nuts.

- Use screwdrivers with blades that fit the screw.

- When using a wrench on a tight nut, first use some penetrating oil and then use the largest wrench available that fits the nut. When possible, pull on the wrench handle rather than push on it; apply force to the wrench with both hands when possible and with both feet firmly planted. Always assume that you may lose your footing; check the place that you may fall for sharp objects.

- Keep all pipe wrenches clean and in good repair. Use a wire brush frequently to clean the jaws of pipe wrenches. An accumulation of dirt and grass can cause wrenches to slip.

- Never use pipe wrenches in place of a rod-holding device.

- Replace hook and heel jaws when they become visibly worn.

- When breaking tool joints on the ground or on a drilling platform, position your hands so that your fingers will not be smashed between the wrench handle and the ground or the platform if the wrench should slip or the tool joint suddenly let go.

10.3.5 Clearing the Work Area

Prior to drilling, adequately clear and level the site to accommodate the drill rig and supplies and provide a safe working area. Do not begin drilling if tree limbs, unstable ground, or site obstructions cause unsafe tool handling conditions.

10.3.6 Start-Up

Instruct all drill rig personnel and visitors to "stand clear" of the drill rig immediately prior to starting the engine.

- Make sure all brakes are set, all gear boxes are in neutral, all hoist levers disengaged, all hydraulic levers or air controls are in the correct positions, and the cathead rope is not on the cathead before starting a drill rig engine.

- Start all engines according to the manufacturer's manual.

10.3.7 Drilling Operations

Safety requires the attention and cooperation of every worker and site visitor.

- Do not drive the drill rig from hole to hole with the mast (derrick) in the raised position.

- Before raising the mast (derrick), look up to check for overhead obstructions. (Refer to Section 10.3.8 on Overhead and Buried Utilities.)

- Before the mast (derrick) of a drill rig is raised and drilling is begun, the drill rig must first be leveled and stabilized with leveling jacks and/or solid cribbing. Re-level the drill rig if it settles after initial set up. Lower the mast (derrick) only when the leveling jacks are down, and do not raise the leveling jack pads until the mast (derrick) is lowered completely.

- Before starting drilling operations, secure and/or lock the mast (derrick), if required, according to the drill manufacturer's recommendations.

- Do not stand on the elevated deck of a truck-mounted or all-terrain-mounted drill rig while the drill rig is in operation unless necessary for special tasks and the operator has been notified.

- Only operate a drill rig from the position of the controls. Before leaving the area of the controls, shift the transmission controlling the rotary drive into neutral and place the feed lever in neutral. Before leaving the vicinity of the drill, shut down the drill engine.

- Throwing or dropping tools must not be permitted. Carefully pass tools by hand between personnel or use a hoist line.

- Do not consume alcoholic beverages, other depressants, or chemical stimulants prior to starting work on a drill rig or while on the job.

- If it is necessary to drill within an enclosed area, make certain that exhaust fumes are conducted out of the area. Exhaust fumes are toxic, and some cannot be detected by smell.

- Clean mud and grease from boots before stepping on a drill platform and use hand holds and railings. Watch for slippery ground when stepping down from the platform.

- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.

- Drain all air and water lines and pumps when not in use if freezing weather is expected.

- Adequately cover or protect all unattended boreholes to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole. Cover, protect or backfill all open boreholes according to local or state regulations on completion of the drilling project.

- Never allow "horsing around" within the vicinity of the drill rig and tool and supply storage areas - even when the drill rig is shut down.

- When using a ladder on a drill rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool "bucket" or a safety hook to raise or lower hand tools.

- Terminate drilling operations during an electrical storm and move the complete crew away from the drill rig.

An elevated derrick platform should be used with the following precautions:

- When working on a derrick platform, use a safety belt and a lifeline. The safety belt must be at least 4 in. (100 mm) wide and should fit snugly but comfortably. The lifeline, when attached to the derrick, must be less than 6 ft. (2 m) long. The safety belt and lifeline must be strong enough to withstand the dynamic force of a 250 lb. (115 kg) weight (contained within the belt) falling 6 ft. (2 m).

- Use a safety device when climbing to a derrick platform that is higher than 20 ft. (6 m).

- When on a derrick platform, fasten the lifeline to the derrick just above the derrick platform and to a structural member that is not attached to the platform or to other lines or cables supporting the platform.

- When first arriving at a derrick platform, immediately inspect for broken members, loose connections, loose tools, or other loose materials.

- Securely attach tools to the platform with safety lines. Do not attach a tool to a line attached to one's wrist or any other part of the body.

- When working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.

- Do not leave loose tools and similar items on the derrick platform or on structural members of the derrick.

- A derrick platform over 4 ft. (1.2 m) above ground surface must have toe boards and safety railing that are in good condition.

- Avoid being under rig workers on elevated platforms whenever possible.

If heavy objects must be manually lifted, exercise care to avoid injury.

- Before lifting an object without using a hoist, make sure that the load is within your personal lifting capacity. If it is too heavy, ask for assistance.

- Before lifting a relatively heavy object, approach the object by bending at the knees, keeping the back vertical and unarched while obtaining firm footing. Grasp the object firmly with both hands and stand slowly and squarely while keeping the back vertical and unarched. In other words, perform the lifting with the muscles in the legs, not with the muscles in the lower back.

- If a heavy object must be moved some distance without the aid of machinery, keep the back straight and unarched. Change directions by moving the feet, not by twisting the body.

- Move heavy objects with the aid of hand carts whenever possible.

10.3.8 Overhead and Buried Utilities

Both supervisors and members of the exploration crew must take special precautions when a drill rig will be used on a site or project within the vicinity of electrical power lines and other utilities. Electricity can shock, it can burn, and it can cause death.

- Locate, note, and emphasize overhead and buried utilities on all boring location plans and boring assignment sheets.

- When overhead electrical power lines exist at or near a drilling site or project, consider all wires to be alive and dangerous.

- Watch for sagging power lines before entering a site. Do not lift power lines to gain entrance. Call the utility and ask them to lift or raise the lines or deenergize (turn off) the power.

- Before raising the drill rig mast (derrick) on a site in the vicinity of power lines, walk completely around the drill rig. Determine the minimum horizontal distance from any point

on the drill rig to the nearest power line when the mast is raised and/or being raised. If this horizontal distance is less than 100 ft. (30 m), first consult the local utility company and refer to OSHA REG 29 CFR 1910.180 before commencing operations.

- Keep in mind that both hoist lines and overhead power lines can be moved toward each other by the wind.

- In order to avoid contact with power lines, only move the drill rig with the mast (derrick) down.

- If there are any questions concerning the safety of drilling on sites in the vicinity of overhead power lines, call the power company. The power company will provide expert advice at the drilling site as a public service and at no cost.

Electricity is as dangerous underground as overhead. Be aware of and always suspect the existence of underground utilities such as electrical power, gas, petroleum, telephone, sewer and water:

- If a sign warning of underground utilities is located on a site boundary, do not assume that underground utilities are located on or near the boundary or property line under the sign. Call the utility and check it out. The underground utilities may be a considerable distance away from the warning sign.

- Always contact the owners of utility lines or the nearest underground utility location service before drilling. Determine jointly with utility personnel the precise location of underground utility lines, mark and flag the locations, and determine jointly with utility personnel what specific precautions must be taken to ensure safety.

10.3.9 Wire Line Hoists, Wire Rope, and Hoisting Hardware

Use wire line hoists, wire rope, and hoisting hardware only as stipulated by the American Iron and Steel Institute, Wire Rope Users Manual.

- Visually inspect all wire ropes and fittings during use and thoroughly inspect them at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire

diameter, fatigue, corrosion, damage from heat, improper reeving, jamming, crushing, bird caging, kinking, core protrusion, and/or damage to lifting hardware. Replace wire ropes when inspection indicates excessive damage.

- Thoroughly inspect all wire ropes that have not been used for a period of a month or more.

- Install all connections and end fittings, which consist of spliced eyes and various manufactured devices, according to the manufacturer's specifications. Do not exceed ratings specified by manufacturer.

- If a ball-bearing type hoisting swivel is used to hoist drill rods, inspect and lubricate swivel bearing daily to assure that the swivel freely rotates under load.

- If a rod slipping device is used to hoist drill rods, do not drill through or rotate drill rods through the slipping device; do not hoist more than 1 ft. (0.3 m) of the drill rod column above the top of the mast (derrick); do not hoist a rod column with loose tool joints; and do not make, tighten, or loosen tool joints while the rod column is being supported by a rod slipping device. If drill rods should slip back into the borehole, do not attempt to break the fall of the rods by hand or by tensioning the slipping device.

- Most sheaves on exploration drill rigs are stationary with a single part line. Never increase the number of parts of line without first consulting with the manufacturer of the drill rig.

- Wire ropes must be properly matched with each sheave. If the rope is too large, the sheave will pinch the wire rope. If the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger-sized wire ropes.

The following procedures and precautions must be understood and implemented for use of wire ropes and rigging hardware:

- Use tool handling hoists only for vertical lifting of tools (except when angle hole drilling). Do not use tool handling hoists to pull on objects away from the drill rig; however, drills may be

moved using the main hoist of the drill if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.

- When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or to the feed mechanism of the drill.

- When attempting to pull out a mired down vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle and stay as far as possible away from the wire rope. Do not attempt to use tool hoists to pull out a mired down vehicle or drill rig carrier.

- Apply loads smoothly and steadily to minimize shock loading of a wire rope.

- Avoid sudden loading in cold weather.

- Never use frozen ropes.

- Protect wire rope from sharp corners or edges.

- Replace faulty guides and rollers.

- Replace worn sheaves or worn sheave bearings.

- Replace damaged latches on hooks before using.

- Know the working load of the equipment and tackle being used. Never exceed this limit.

- Always wear gloves when handling wire ropes.

- Do not use hands to guide wire rope on drum hoists.

- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.

- Never conduct any hoisting operations when the weather conditions are such that hazards to personnel, the public, or property are created.

- Never leave a load suspended in the air when the hoist is unattended.

- Keep hands away from hoists, wire rope, hoisting hooks, sheaves, and pinch points while slack is being taken up or when the load is being hoisted.

- Never hoist the load over the head, body, or feet of any personnel.

- Never use a hoist line to "ride" up the mast (derrick) of a drill rig.

- Use replacement wire ropes that conform to the drill rig manufacturer's specifications.

10.3.10 Cathead and Rope Hoists

Follow these procedures when using a cathead hoist:

- Keep the cathead clean and free of rust, oil and grease. Rust should be removed from the cathead with a wire brush having a handle.

- Check the cathead periodically, when the engine is not running, for rope wear grooves. If a rope groove forms to a depth greater than 1/8 in. (3 mm), replace the cathead.

- Always use a clean, dry, sound rope. A wet or oily rope may "grab" the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.

- Should the rope "grab" the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel, including the operator, to rapidly back away and stay clear. If the rope "grabs" the cathead, and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and

appropriate action is taken to release the tools. Keep careful watch on the suspended tools and quickly back away after turning off the engine.

- Always protect the rope from contact with chemicals. Chemicals can cause deterioration of the rope that may not be detected visibly.

- Never wrap the rope from the cathead (or any other rope, wire rope, or cable on the drill rig) around a hand, wrist, arm, foot, ankle, legs, or any other part of the body.

- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing or other tools with the cathead and rope method. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.

- Never operate a cathead (or perform any other task around a drill rig) with loose, unbuttoned, or otherwise unfastened clothing or when wearing gloves with large cuffs or loose straps or lacings.

- Do not use a rope that is any longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.

- Do not use more rope wraps than are required to hoist a load.

- Do not leave a cathead unattended with the rope wrapped on the drum.

- Position all other hoist lines to prevent contact with the operating cathead rope.

- When using the cathead and rope for driving or back-driving, make sure that all threaded connections are tight and stay as far away as possible from the hammer impact point.

- Only operate the cathead standing on a level surface with good, firm footing conditions without distraction or disturbance.

10.3.11 Augers

Follow these general procedures when starting a boring with continuous flight or hollow-stem augers:

- Start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.

- Apply an adequate amount of down pressure prior to rotation to seat the auger head below the ground surface.

- Look at the auger head while slowly engaging the clutch or rotation control and starting rotation. Stay clear of the auger.

- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or on the rotation control at all times until the auger has penetrated about one foot or more below ground surface.

- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control and repeat the hole starting process.

- An auger guide can facilitate the starting of a straight hole through hard ground or a pavement.

Establish a system of responsibility for the operator and tool handler to follow during the series of various activities required for auger drilling, such as connecting and disconnecting auger sections, and inserting and removing the auger fork. The operator must ensure that the tool handler is well away from the auger column, and that the auger fork is removed before starting rotation. In addition:

- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason whatsoever.

- Only use the manufacturer's recommended method of securing the auger to the power coupling. Do not use an over-length pin or bolt. Do not touch the coupling or the auger with hands, a wrench, or any other tools during rotation.

- Whenever possible, use tool hoists to handle auger sections.

- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.

- Never allow feet to get under the auger section that is being hoisted.

- Use a long-handed shovel to move auger cuttings away from the auger. Never use hands or feet to move cuttings away from the auger.

- Do not attempt to remove earth from rotating augers. Clean augers only when the drill is in neutral and the augers are stopped from rotating.

10.3.12 Rotary and Core Drilling

Check rotary drilling tools prior to drilling:

- Lubricate and check for frozen bearings before using water/air swivels and hoisting plugs. Water/air swivel bearings must be free before using, and stay clear of water/air swivel hose when rotating.

- Check drill rod chuck jaws periodically and replace when necessary.

- Check the capacities of hoists and sheaves against the anticipated weight of the drill rod string plus other expected hoisting loads.

During rotary or core drilling, follow these special precautions that involve chucking, joint break, hoisting, and lowering of drill rods:

- Only the operator of the drill rig should be allowed to brake or set a manual chuck so that rotation of the chuck will not occur prior to removing the wrench from the chuck.

- Drill rods should not be braked while lowering into the hole with drill rod chuck jaws.

- Do not lower drill rods into the hole with pipe wrenches.

- If a string of drill rods is accidentally or inadvertently released into the hole, do not attempt to grab the falling rods by hand or with a wrench.

- In the event of a plugged bit or other circulation blockage, relieve the high pressure in the piping and hose between the pump and the obstruction before breaking the first tool joint.

- When drill rods are hoisted from the hold, clean them only with a wiper made of rubber or other suitable material. Do not use hands to clean drilling fluid from drill rods.

- If work must progress above a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. Equip the mud pit with rough surfaced, fitted cover panels of adequate strength to hold drill rig personnel.

- Do not lift or lean unsecured drill rods against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage, or lay the rods down.

10.3.13 Transporting a Drill Rig

When transporting a drill rig on and off a drilling site:

- Allow only licensed individuals to operate the vehicle. Comply with all federal, state, and local regulations.

- Know the traveling height (overhead clearance), width, length, and weight of the drill rig with carrier, and know the highway and bridge load, width, and overhead limits. Allow adequate margins, and make sure that they are not exceeded.

- Never move a drill rig unless the vehicle brakes are in sound working order.

- Allow for mast overhang with cornering or approaching other vehicles or structures.

- Be aware that the canopies of service stations and motels are often too low for a drill rig mast to clear with the mast in the travel position.

- Watch for low hanging electrical lines, particularly at the entrances to drilling sites, restaurants, motels, or other commercial sites.

- Never travel on a street, road, or highway with the mast (derrick) of the drill rig in the raised or partially raised position.

- Remove all ignition keys when a drill rig is left unattended.

10.3.14 Loading and Unloading

When loading or unloading a drill rig on a trailer or a truck:

- Use ramps of adequate design that are solid and substantial enough to bear the weight of the drill rig with carrier -- including tooling.

- Load and unload on level ground.

- Use the assistance of someone on the ground as a guide.

- Check the brakes on the drill rig carrier before approaching loading ramps.

- Distribute the weight on the drill rig, carrier, and tools on the trailer so that the center of weight is approximately on the center-line of the trailer, and so that some of the trailer load is transferred to the hitch of the pulling vehicle. Refer to the trailer manufacturer's weight distribution recommendations.

- Secure the drill rig and tools to the hauling vehicle with ties, chains, and/or load binders of adequate capacity.

10.3.15 Off-Road Movement

Follow these procedures during off-road movement:

- Before moving a drill rig, first walk the route of travel, inspecting for depressions, stumps, gullies, ruts, and similar obstacles.

- Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven, or hilly ground.

- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mountings.

- Discharge all passengers before moving a drill rig on rough or hilly terrain.

- Engage the front axle (for 4x4, 6x6, etc. vehicles or carriers) when traveling off highway on hilly terrain.

- Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs because the arbitrary addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill. Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).

- Attempt to cross obstacles such as small logs and small erosion channels or ditches squarely rather than at an angle.

- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.

- Set all brakes and/or locks after the drill has been moved to a new drilling site. When grades are present, block the wheels.

- Never travel off-road with the mast (derrick) of the drill rig in the raised or partially raised position.

10.3.16 Drill Rig Utilization

Do not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc. Only use the drill rig and tools for the purposes for which they are intended and designed.

10.3.17 Drill Rig Alterations

Alterations to a drill rig or drilling tools must only be made by qualified personnel and only after consultation with the manufacturer.

10.4 ADHERENCE TO BUDDY SYSTEM

No field operation is without some degree of risk. For this reason, a minimum of two people must be assigned to all task locations and must stay within voice contact at all times.

10.5 SPILL CONTROL PLANS

10.5.1 Spill Prevention Control and Countermeasure (SPCC) Plan

This plan applies to all organizations on RSA, including all contractors who receive, store, or use petroleum products and/or non-CWM hazardous materials. For a complete review of SPCC plan, see U.S. Army Missile Command, Redstone Arsenal, Spill Prevention Control and Countermeasure Plan (Appendix G).

10.5.1.1 Spill Prevention Control

Spill Prevention Control Policies

All petroleum products will be handled, used, and stored to avoid or minimize the possibility of an accidental spill or discharge and pollution of land and water at this installation. Spills of hazardous

substances in quantities exceeding the reportable quantity (RQ) require reporting, immediate action to eliminate the source and contain the spill, and initiation of efforts to mitigate damage. Remedial actions to correct or neutralize spills that could result in additional damage and thus increase the extent of legal liability caused by the spill will be taken only after consultation with the EPA, National Response Center, spill cleanup contractors, or the U.S. Army Environmental Center.

Contracts for disposal of petroleum products or hazardous substances will contain provisions that require the disposal method to be in accordance with Federal, State and/or Local regulations.

Spill Prevention Control Responsibilities

All organizations, building custodians, and contractors on RSA that receive, store, or dispense petroleum products or hazardous materials will be responsible for:

- Visually inspecting storage containers and areas at least once every week, for leaks or spills.
- Having a responsible person in attendance when filling containers in case of a spill or leak.

10.5.1.2 Spill Prevention Countermeasures

Spill Prevention Countermeasure Notification Procedures

a. IN THE EVENT OF ANY SPILL DURING OR AFTER WORKING HOURS, NOTIFY:

FIRE DEPARTMENT EMERGENCY NUMBER 117 (or 876-2117)

SPILL COUNTERMEASURES: In the event of an oil spill, the following actions will be taken by the Installation On-Scene Coordinator (IOSC).

a. An earth dike will be immediately built enclosing the area covered by the spill to contain the oil.

b. All of the oil that can be removed by pumps on the tank trucks will be removed.

c. Earth, hay, or other absorbent material will then be used to absorb the rest of the oil that cannot be removed by pumping.

d. All contaminated earth, hay, and other absorbent material will then be removed from the area and disposed of in a manner approved by existing EPA regulations.

LEAK COUNTERMEASURES: In the event that a leak is discovered in one of the storage tanks, the following actions will be taken by the IOSC:

a. Underground:

(1) The oil in the tank will be removed by the tank trucks and stored in any other tanks available until used or disposed of through proper channels.

(2) The tank will then be removed, repaired, and tested or replaced as necessary.

(3 All contaminated earth will be removed and disposed of in a manner approved by existing EPA regulations.

b. Aboveground:

(1) All of the oil remaining in the tank will be removed and stored in any other available tanks until used or disposed of through proper channels.

(2) All of the oil within the diked area that can be removed by pumps will be removed by tank trucks to other available tanks and disposed of through proper channels. There is an empty tank available at Building 4234 with a capacity of 700,000 gallons not being used due to safety regulations which could be waived in an emergency.

HAZARDOUS SUBSTANCES COUNTERMEASURES:

a. Spills of hazardous substances in quantities exceeding the reportable quantity (RQ) require reporting (see para 8-3, AR 200-1, "Environmental Protection and Enhancement"), immediate

action to eliminate the source and contain the spill, and initiation of efforts to mitigate damage. The Chief, Environmental Management Office, or his representative is responsible for reporting RQ spills to the proper agencies. Remedial actions to correct or neutralize spills that could result in additional damage and thus increase the extent of legal liability caused by the spill will be taken only after consultation with the EPA, National Response Center, spill cleanup contractors, or the U.S. Army Environmental Center.

b. Hazardous substances located on RSA that are handled in large quantities with a potential to cause a spill event are listed below along with the reportable quantity level for each material.

Hazardous Substance	Reportable Quantity (lbs.)
Chlorine	10
Sodium Hypochlorite (laundry bleach)	100
Trichloroethylene	1000
Sodium Hydroxide (liquid caustic)	1000
Aluminum Sulfate (liquid alum)	5000
Sodium Silicofluoride	1000
Polychlorinated Biphenyls	10
Methylene Chloride	100
1,1,1-Trichloroethane	1000

10.5.2 Installation Spill Contingency Plan (ISCP)

Concept of ISCP

The concept of this plan is a five-phase operation beginning with the initial notification of a spill. The spill is then evaluated for severity, and a determination is made as to the action required to contain it. When containment has been accomplished, cleanup and restoration operations are conducted. The final phase is primarily administrative and consists of determining financial responsibility, enforcement, and submission of reports. These phases may become intermingled, or some may occur simultaneously; however, they are established and described separately for the purpose of clarity. For a complete review of the ISCP, see U.S. Army Missile Command, Redstone Arsenal, Installation Spill Contingency Plan for Oil and Hazardous Substances (Appendix G).

Notification Procedures:

IN THE EVENT OF ANY SPILL DURING OR AFTER WORKING HOURS CALL

FIRE DEPARTMENT EMERGENCY NUMBER: 117 (or 876-2117)

10.5.2.1 Initial Response Actions

The primary concern in any spill situation is to protect personnel from harm. Whenever a spill is discovered by an employee, the employee shall notify his/her supervisor immediately. The person finding the spill shall report the spill to the Fire Department Emergency Number, telephone 117 (or 876-2117). In most cases, the initial observer will know what material has been spilled and should be aware of the safety precautions required. If there is any doubt, the observer should get safely away and await the arrival of response personnel. Individuals working around hazardous materials should be instructed and well informed of the safety measures and spill procedures applicable to the materials. Protect yourself and others from harm. If you find a spill, your safety and the safety of others is the primary concern. Promptly call the Fire Department Emergency Number 117 (or 876-2117), evacuate the area, extinguish smoking materials, and remove potential sources of ignition.

The senior occupant or supervisor in charge of the area where the spill has occurred will report to the Incident Command Post set up by the Fire Department at the scene to act as the subject matter expert for the Incident Commander and will render technical advice about the spilled substance.

10.5.3 Notification

To report a conventional spill (petroleum product and/or non-CWM hazardous substance), contact the RSA Fire Department at 117 (or 876-2117).

10.5.4 Rescue

If site personnel are unable to evacuate the spill area, their rescue will be first priority of responders. Responders will wear appropriate PPE, as directed by the Fire Department representative.

10.5.5 Assessment/Characterization

Initial reentry to the area to identify the spilled material will be directed by the Fire Department. Spilled material may be identified through container markings, physical properties of spilled material, and other available evidence. When doubt exists as to the identity of the spilled material, it will be presumed to be hazardous until proven otherwise. At the discretion of the Fire Department, samples of the spilled material will be collected for field and/or laboratory analysis.

10.5.6 Demarcation of Hazardous Spill Area

The area of the spill will be determined and documented, noting area of visible contamination. The quantity of material spilled will be estimated, and the basis for the estimate will be noted. The area will be marked with stakes and engineer tape.

10.5.7 Air Monitoring

If identification reveals that the material may be detected with a direct reading instrument, the Fire Department will conduct breathing zone air monitoring for the responders, as well as upwind and down wind of the spill area.

10.5.8 Prevent Spill Migration

Containers can be placed in an upright position or rotated to stop or reduce flow. Surrounding soil, loose sorbent and/or sorbent pads may be used to dike or berm spilled material subject to flow. Choose response materials with the least potential of incompatibility. Clean soils or sorbent pads with impervious backing may be applied to spill area to suppress vapors. Apply loose sorbents to solidify spilled liquids. Clay and/or inorganic sorbent should be used on materials not fully identified.

10.5.9 Disaster Control Plan

10.5.9.1 Introduction

Disasters can occur at any time as a result of natural forces, civil disturbance, major accident or incident, or enemy action. Disasters, either natural or man-made, are situations which disrupt essential operations by endangering lives, destroying facilities, and creating varying degrees of chaos. The means taken to counter the actual or anticipated effects of a disaster are generally termed disaster control. Disaster control includes all measures undertaken to reduce the possibility of loss of human life or damage, to minimize the effects of damage, and to recover from damage caused by overt or covert enemy action, natural forces, accidental events, or anarchic conditions. Within the Continental United States (CONUS), such emergencies may create conditions requiring control and recovery actions by RSA and may require the provisioning of assistance to the civilian community to save human life and property, alleviate human suffering, mitigate damage to public property, or restore law and order subject to such limitations imposed by law or regulation. RSA must be prepared to effect immediate disaster control recovery operations in order to assure the performance of essential functions and responsibilities in times of enemy attack, natural disaster, major accident or incident, and civil disturbances. Therefore, it is necessary to develop plans and establish organizations geared to recovery from the most devastating possibility (nuclear attack), but flexible enough to permit their adaptation to recover from any disaster of lesser magnitude. For complete information on the Disaster Control Plan for RSA, please review the U.S. Army Missile Command, Redstone Arsenal, May 1990. Disaster Control Plan 544-1.

10.5.9.2 Responsibilities

- Commander, MICOM and tenant organizations, operating geographically at RSA will plan for and support civil authorities in local emergencies, such as flood, earthquake, tornado, etc.

- The American National Red Cross (ANRC). Undertakes activities for the relief of persons suffering from disaster as stated in Section 3 of the Act of January 5, 1905, Chapter 23, as amended (36 U.S.C. 3) entitled "An Act to Incorporate the American National Red Cross."

- The Federal Emergency Management Agency (FEMA). Directs and coordinates Federal emergency or major disaster relief on behalf of the President. When the President declares an emergency or major disaster, the FEMA Director or Regional Director may direct any Federal agency to assist state and local governments.

- The Chief of Engineers (COE). Responsible for the provision of disaster assistance by applicable Division and District Engineers when required by disaster of imminent seriousness and as authorized by statutory authorities or as directed by the Stafford Act, or when in support of the Natural Oil and Hazardous Substances Pollution Contingency Plan.

- Federal Coordinating Officer (FCO). The person appointed by the FEMA to operate under the Housing and Urban Development (HUD) Regional Director for Federal Disaster Assistance Administration (FDAA) to coordinate Federal assistance in a major disaster.

- The Environmental Protection Agency (EPA) or the U.S. Coast Guard (USCG). Depending on the location of the spill, provides for coordination of Federal response to control a spill of oil or other hazardous substance in navigable U.S. waters.

- The Boise Interagency Fire Center (BIFC). A Federal interagency center under the control of the Department of Agriculture and the Interior provides coordination and logistical support for federal fire control.

- USCG. Assists civil authorities in protecting life and property during maritime disasters.

- The Agency for International Development, Department of State. Manages international disaster relief for the United States.

- Other DOD, Federal agencies, state and local governments, and industrial facilities may provide cooperative disaster relief assistance to RSA as coordinated or requested.

10.5.9.3 Command

- Normal command relationships prevail. Authority is granted for direct CONUS Army contact for mutual aid.

- Upon implementation of this plan, operational control of all forces is assumed by the Disaster Control Coordinator (DCC).

- The RSA Emergency Operations Center is located in Building 5300. Telephone numbers are 876-4105/4106/4107, area code 205, DSN 746 (Secure Telephone Unit (STU) III capability) during duty hours. During nonduty hours: Staff Duty Officer DSN 746-3331, Commercial (205) 876-3331.

- The HQ AMC Operations Center is located in Room G2-C60, AMC Building, Alexandria, VA and during duty hours the telephone number is DSN 284-8406. During nonduty hours the Staff Duty Officer can be reached at DSN 284-9223, Commercial (202) 274-9223.

10.5.9.4 Definition of Signals

- Automatic Digital Network (AUTODIN). This network is primarily used for data (card, paper, and magnetic tape) communications. AUTODIN is an automatic, electronic, high speed communications switching system serving DOD (Army-Navy-Air Force) and provides a high capacity means for exchanging record communications. Terminals are generally installed on a secure basis. Nonsecure operation is possible but not desirable.

- Secure Telephone Unit-III (STU-III). The STU-III is a fully integrated microcomputer based equipment that includes voice processing, crypotologic control and telephone line modem functions in a single chassis. The STU-III provides the commander's staff personnel and DA civilian contractors secure voice for rapid exchange of information during crisis or mobilization.

- Defense Switched Network (DSN) formerly AUTOVON. This network is primarily used for worldwide voice communications. The DSN circuits are also used, as required, or data and facsimile means of communications.

- Defense Communications System (DCS). The DCS is a worldwide complex of DOD telecommunications facilities and resources, organized into a single compatible communications system. AUTODIN and DSN comprise the DCS.

10.5.9.5 General Information on Signals

- In the event of a disaster, communications will be derived from local installation resources or commercial carriers augmented by messenger/couriers and postal services as appropriate. Long distance communications will be provided by surviving DSN and AUTODIN augmented by commercial facilities and available emergency radio systems.

- Communications personnel required to operate C-E facilities will be provided within existing local resources. Requirements for additional personnel will be submitted to Headquarters USAISC-AMC, ATTN: ASNC-R-AO, by the most expeditious means available.

10.5.9.6 Warning Signals

All emergency warning instructions posted on RSA conform to the FEMA definitions and meanings. The warning signals at RSA are:

ATTACK WARNING - A three to five-minute wavering tone on sirens, or series of short blasts on horns or other devices, repeated as deemed necessary. The ATTACK WARNING signal shall mean that an actual attack against the country has been detected and that protective actions should be taken immediately. THIS SIGNAL WILL BE USED FOR NO OTHER PURPOSE AND WILL HAVE NO OTHER MEANING.

ATTENTION or ALERT. A three to five-minute steady tone on sirens, horns, or other devices. This signal may be used for any peacetime emergency, e.g., tornadoes, hurricanes, etc., in which the local commander desires to get the attention of the installation/activity population to prepare to receive

essential information through local media, such as public address systems, supervisory channels, or radio.

10.5.9.7 Severe Weather

Severe weather will create unsafe working conditions and will, therefore, require a complete work stoppage until conditions improve.

Definitions

- Watch - Weather conditions are favorable for the development of the alert (i.e., thunderstorms, tornadoes, floods) in or close to the watch area during a specified period of time.

- Warning - The alert condition is occurring in the warned area. In the case of a tornado warning, a tornado has been visually sighted, detected on radar, or has touched down.

- Severe Weather Bulletins - Heavy snowfall, extremes in temperature, etc.

General

- Due to the erratic behavior and severity of tornadoes, little can be done to prevent damage to fixed facilities and structures. Recovery capabilities and the prevention of loss of life and injury to personnel are the major concerns in the event of a tornado striking the installation. However, if time permits, loss or damage due to severe winds can be minimized by preventive measures such as tie-down of equipment and removal of aircraft and vehicles. Potential flying objects such as planks, metal sheeting, garbage cans, and lawn furniture should be secured if there is sufficient warning of severe winds or tornadoes.

Concept

- The installation receives warnings of severe weather particularly tornado watches and warnings from the Huntsville Madison County Emergency Management Agency. This

agency has direct radio and telephone contact with the Weather Service at the Huntsville Jetport. Local radio nets will be operational to monitor severe weather conditions. During normal duty hours, these calls are received by the Plans and Operations Office (AMSMI-PT-MO-OC) who will immediately notify the DCC. During other than normal duty hours the Staff Duty Officer, MICOM will be notified and will call an Emergency Operations Center (EOC) staff member who will initiate alert notification procedures.

- The DCC will notify the installation of severe weather and/or tornado watch/warning, as he deems necessary, in the event a tornado or other severe weather threatens RSA and the Huntsville environs. This will be done through the use of the Emergency Telephone Warning Net (ETWN), sirens, or other means. The offices that have Emergency Telephone Warning Net Master instruments, Personnel and Training Directorate; RSA Support Activity; Missile Logistics Center; Research, Development, and Engineering Center; Information Systems Command-MICOM; and U.S. Army Ordnance Missile and Munitions and Command School (USAOMMCS) will further disseminate the information when directed. This instrument is normally located in the area of the Emergency Action Officer (EAO) for that Directorate/Office/ Center. Conventional sirens, MP vehicles with sirens, and Television Override announcements will be used in the quarters area, as appropriate.

- Upon notification by the DCC that a tornado warning is in effect, RSA organizational elements will follow internal procedures to minimize loss of life and injury to personnel.

- When severe winds or tornadoes are forecasted to affect RSA, the following personal safety precautions should be observed: **Seek shelter in the best available portion of the building (Basements or interior hallways at ground floor level are considered best)**. In light structures without basements, seek shelter under heavy furniture against inside walls or a ravine or ditch nearby. Avoid auditoriums, gymnasiums and other structures with wide span roofs.

- Emergency temporary office space will be provided to the extent available for personnel whose work areas have been damaged. If the requirements for office space exceeds that which is available, a plan for co-locating personnel can be employed.

10.5.9.8 Bomb Threat

General

- The majority of bomb threats are false alarms, apparently intended to create confusion and to disrupt operations. The threat of such action within facilities on RSA, however, cannot be overlooked.

- It is impossible to determine whether a bomb threat is real, and management's first consideration must be for the safety of personnel and for the protection of property. The most serious decision is whether or not to evacuate the building without a search or whether a search without evacuation is the more reasonable course. The decision should be based on the current local conditions (racial, dissidence, labor problems, previous bomb threats), warning time, location, and extent of the specific threatened area.

- Bomb threats should receive the least possible publicity consistent with the degree of action to be taken by personnel affected, to minimize panic.

Policy

- Upon receipt of a bomb threat, the senior military or civilian supervisor (of division level or higher) will render a decision on whether or not to evacuate the building or area and when to re-enter the threatened building.

- The fire drill signal will normally be used to evacuate the building to alleviate panic.

- Since the troop area is more susceptible to bomb threats, a more elaborate search will be conducted in this area. Compensatory time for troops will not be granted for time involved in a bomb search.

- Locked doors, lockers, briefcases, etc., will be assumed to be locked for other purposes than to hide a bomb and will not be forcibly entered unless information indicates the likelihood of the suspected device being contained therein.

Concept

- A bomb threat may be received by telephone or by written message by anyone at any location: A person receiving a telephone bomb threat should attempt to obtain as much information as possible.

- All personnel should be alert to observe and report suspicious objects, items, or parcels that do not appear to belong in the area in which observed.

- Supervisory personnel will be relied upon to conduct a search in their area of responsibility. Their familiarity with the work area and its normal contents will enable them to recognize anything unusual. As a general rule, search areas must be limited to a size which can reasonably be searched in not more than 20 minutes.

- Office personnel will secure all classified material and make an inspection of their desks, file cabinets, vaults, and other areas of responsibility. Drawers of desks and unclassified cabinets will be left slightly ajar to indicate that they have been searched.

- If a suspected object is found, it must not be disturbed. Its location and description will be reported to the head of the "Public Area" search team, who will notify the Explosives Ordnance Disposal (EOD) team.

- Search teams for "Public Areas" will be headed by the Building Custodian/Fire Warden plus volunteer searchers, who will be pre-designated where possible. These teams will search restrooms, utility rooms, stair-wells, elevators, etc.

- In the event of evacuation, supervisors will see that all employees are notified and safely out of the building to a designated assembly point.

- The RSA Disaster Control Coordinator (DCC) will furnish bomb threat support to RSA tenant organizations, except in areas considered more feasible to be handled by the tenant, such as

conducting the search and making the decision to evacuate their facilities. Fire fighting, traffic control, or other types of normal support will be provided.

10.5.9.9 Environmental Disaster

General

- Spills of oil/hazardous materials may occur either on the facility or off the facility as designated in Annex B. Contracts or agreements with contractors, haulers or similar personnel for movement of such commodities as fuel, waste oil, etc., onto or off the facility will stipulate that the contractor, hauler or similar person will be responsible for clean up of on-facility spills caused by his negligence, and that once he leaves the physical confines of the facility, the installation commander's responsibility for his actions terminates.

- Responsive alert procedures in the event of a spill include (1) rapid containment and cleanup; (2) satisfaction of legal reporting requirements and (3) provision, upon request, of assistance to other Federal, State, interstate and local government agencies in the event of a spill or oil or hazardous materials.

- In areas where air pollution (smog conditions) can occur, Army installations will cooperate with local authorities in reducing air emissions from air pollution sources; this may include curtailment of all but essential traffic, if necessary. This emission reduction will be described in an Air Pollution Emergency Plan.

Objectives

- To provide planning guidance to elements for the prevention and control of discharges of oil and hazardous substances, but not to include toxic chemical warfare agents, nuclear materials and radiological health and hazardous materials.

- To control vehicular traffic in order to achieve national ambient air standards and to prevent/reduce air pollution episodes.

Policy

- All petroleum products and other hazardous chemicals use and/or stored on MICOM will be handled in such a manner to avoid or minimize accidental spills and/or discharge which could result in a pollution incident.

- Disposal of petroleum products and other hazardous waste will be accomplished in accordance with current Federal, state and/or local regulations as appropriate.

11.0 DECONTAMINATION CONTROL MEASURES

Decontamination depends on the establishment of effective site control zones. These site work zones shall be established to reduce the accidental spread of hazardous substances by workers or equipment. The flow of personnel and equipment among these zones shall be controlled through designated access and egress points by the HSO.

Personnel decontamination procedures for this work shall involve washing boots with a soap and water solution and rinsing with water. Gloves shall also be washed with soap and water and rinsed. Respirators must be thoroughly washed with a soap and water solution and rinsed with clean water. Prior to storing respirator in sealable plastic bag, each respirator should be disinfected. Soiled protective clothing shall have gross contamination removed and be carefully placed into disposal bags that must be disposed of properly, under the supervision of the HSO. Containment and disposal of all contaminated materials and decon water will follow pre-determined methods. All materials and equipment brought to the exclusion zone must be decontaminated before being removed or reused.

11.1 SITE ORGANIZATION AND CONTROL

Site organization and control will be established and maintained according to the recommendations set forth in EPA's "Standard Operating Safety Guide," November 1984 and the NIOSH/OSHA/USCG/EPA publication "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," October 1985. Three general areas of operation shall be established to reduce the risk of personnel exposure to hazardous substances. The three areas are:

- Exclusion Zone (Zone A)
- Contamination Reduction Zone (Zone B)
- Support Zone (Zone C).

The dimensions of each area and the safe working distances between each area shall be established by the HSO and balanced against practical work considerations and existing field conditions.

11.1.1 Exclusion Zone

The Exclusion Zone is generally defined as the area of approximately 75 feet from the well hole, or the area that is contaminated or will be unavoidably contaminated by site operations. Since this area shall be considered contaminated, all personnel within the area must use the prescribed levels of personal protection. A checkpoint will be established at the periphery of the Exclusion Zone to regulate the flow of personnel and equipment in and out of the area. The Exclusion Zone boundary (hotline) is based on observations and/or measurements. Any change in the protection level specified by the SSHP shall be approved by the HSO and the USACE contracting officer before being initiated. The hotline shall be well-defined by geographical or physical boundaries.

As defined in the SSHP, there may be some areas where the use of respiratory protection is not required during normal work activities. Respirators should be immediately available for use, however, should a potential hazard become evident. These areas are identified by the following characteristics:

- No known airborne hazards are present, and there is little or no potential for release of hazardous airborne contaminants,

- Work operations preclude splashing of hazardous materials.

Because of the nature of field operations, Tyvek suits, disposable gloves, safety glasses, and shoe coverings should be available for use in the Exclusion Zone and Contamination Reduction Zone as a general rule. Hard hats are only required in areas with overhead hazards (i.e., drill rig work zone). Any item taken into the Exclusion Zone shall be considered to be contaminated until carefully inspected by the HSO and/or decontaminated. All vehicles, equipment, instruments, and materials taken into the Exclusion Zone shall remain in the zone until no longer needed or until they need repair.

11.1.2 Contamination Reduction Zone

The Contamination Reduction Zone (Zone B) shall serve as a buffer between the Exclusion Zone and the Support Zone, and is intended to prevent the spread of contaminants from work areas. All decontamination procedures shall be conducted within this area. Personnel entering this area shall

be wearing the prescribed PPE. Exit from the Contamination Reduction Zone requires the removal of any suspected or known contaminants through compliance with established decontamination procedures. All personnel will remove their own PPE and perform any required decontamination. The Rust HSO personnel will supervise the decontamination procedures to ensure workers are properly decontaminating themselves.

11.1.3 Support Zone

The Support Zone (Zone C) shall consist of a staging area in a non-contaminated or clean area. It shall contain the Citizen's Band (CB) radio for field operations, a first-aid station, and other elements necessary to support site activities. Normal work clothes and safety shoes are worn in this area.

11.1.4 Modifications to Site Control

Less stringent site control and decontamination procedures may be utilized based upon field activities and results of monitoring data.

11.2 DECONTAMINATION PROCEDURES

Safe personal hygiene practices are discussed in Section 10, Standard Operating Safety Procedures and Controls. Personnel and portable field equipment decontamination shall be carried out in the contamination reduction corridor. When working in the Exclusion Zone, care should be taken to avoid contamination of equipment (particularly instruments) whenever possible. All gross contamination on equipment will be removed at the drill site utilizing a portable decon sprayer. After gross contamination is removed, drill rigs, other heavy equipment and ancillary tools will be cleaned at a heavy equipment decontamination area. Critical zones and areas shall be variously identified and delineated with surveyor flagging.

NOTE: **All personnel subject to decontamination should shower daily as soon as practicable after their work shift.**

Monitoring instruments and protective equipment shall be decontaminated if the equipment has been in contact with the ground or splashed with contaminated water, mud, or other material.

Decontamination solution shall consist of detergent and water. Rinse solution shall be potable water. Decontamination and rinse solutions shall be containerized on site in a watertight drum. Decontamination of drill rigs, vehicles, equipment and ancillary tools and sampling devices shall consist of removal of contaminated soil and mud, and steam cleaning. All vehicles and equipment shall be cleaned before relocation to and use at any other sampling site or work area. A minimum decontamination layout for Level C protection and equipment can be found in Table 11-1.

11.3 MEDICAL EMERGENCIES

For physical injuries, first-aid treatment shall be given at the site, depending upon the seriousness of the injury. The victim should undergo decontamination, if necessary, unless such procedures interfere with necessary and safe treatment. In life-threatening situations, care shall be instituted immediately. Protective clothing shall be removed or cut away if this will not cause delays, interfere with treatment, or aggravate the problem. If contaminated protective clothing cannot be removed, wrap the victim in clean materials to help prevent contamination of medical personnel and ambulances. For chemical exposure emergencies, decontamination procedures shall be followed unless severe medical problems requiring life sustaining measures are evident.

11.4 FIRST-AID

In the event of injury, the emergency shall be handled according to the procedures described in the Emergency Procedures Section. First-aid and bloodborne pathogen kits shall be maintained at the control access point between the decontamination and support zones and in support vehicles. If the victim cannot be safely moved from the contamination area, first aid necessary to stabilize the victim for safe transport shall be administered at the accident location. Appropriate decontamination of all clothing and equipment shall be followed upon leaving the contaminated area.

12.0 EMERGENCY PROCEDURES

Some risk of personal injury or chemical exposure is inherent in hazardous waste site activities. These risks and the effects of unpredictable events such as injury, chemical exposure, fire or explosion shall be minimized by:

- Adhering to good work practices,
- Using personal protective equipment appropriate for existing field conditions,
- Performing adequate monitoring of individuals and ambient field conditions,
- Staying alert both to personal performance and to that of co-workers.

An emergency situation is considered to exist if:

- Any member of the field crew is injured in an accident, or experiences or exhibits any adverse effects or symptoms of chemical exposure,
- Safety monitoring indicates site conditions more hazardous than anticipated or that an immediate danger to life or health exists.

12.1 GENERAL EMERGENCY PROCEDURES

- In the event that any member of the field crew experiences any adverse effects or symptoms of exposure while on the scene, the entire field crew shall immediately halt work and act according to the instructions provided by the HSO. This includes heat or cold exposure as well as chemical exposure.
- The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated shall result in the evacuation of the field team and reevaluation of the hazard and the level of protection required.

- In the event that an accident occurs, the HSO will complete an Accident Report. Follow-up action shall be taken to correct the situation that caused the accident.

- The USACE will be notified according to the requirements in Appendix E.

12.2 PERSONAL INJURY

Rust site personnel are trained in American Red Cross first-aid procedures and shall administer appropriate first-aid treatment, including cardio-pulmonary resuscitation (CPR), in emergency situations. At least two employees trained in first aid/CPR will be on site during site operations. The following general emergency procedures shall be carried out in the event of injury:

1. Notify the HSO of the incident.
2. If the victim can be moved safely, remove him from the contaminated zone to the decontamination zone using established control points.
3. Administer first-aid.
4. Transport victim to nearest hospital or emergency medical center or call for ambulance transport, as appropriate (Figure 12-1).
5. Notify the Rust RHSS of the incident and describe the emergency response actions taken.

12.3 CHEMICAL EXPOSURE

Before entering the contaminated zone, all site personnel shall be thoroughly acquainted with the types of toxic/hazardous chemicals present on site and their potential concentrations. The following general procedures shall be followed for chemical exposure emergencies:

1. Move the victim from the immediate area of exposure or contamination, taking precautions to prevent additional exposure of other individuals.
2. If the victim can be moved safely, proceed to the decontamination zone through established control points.
3. Notify the HSO of the exposure incident.
4. Decontaminate clothing or remove if safe to do so.

- For skin or eye contact: Thoroughly wash affected areas with water (eyes should be flushed for at least 15 minutes).

- For inhalation exposure: ensure that the victim has adequate fresh air.

5. Administer additional first-aid treatment as appropriate.
6. Transport victim to nearest hospital or emergency medical center or call for ambulance transport as appropriate.

Directions to Fox Army Hospital from Thiokil Area:

South to Redstone Rd. right (west) to Patton Rd. turn right (north) to Martin Rd. turn left (west) travel to Toftoy Rd. turn right (north) follow to Rideout Rd. merge right and travel to Goss Rd. and turn right (east) the hospital will be on the right across from the gold course.

Directions to Huntsville Hospital from Thiokol Area:

Head south to Redstone Rd. and turn left (east) and exit through gate 3 and turn left (north) on Memorial Parkway (231/53) and travel (x) miles to Governors Drive 431 East and turn right (east) and travel to corner of Governors and Madison where the hospital is located.

7. Notify the Rust RHSS of the incident and describe the emergency response actions taken.

12.4 FIRE OR EXPLOSION

In the event of a fire or explosion:

1. Immediately evacuate injured personnel and leave the area,
2. Administer first-aid as appropriate,
3. Notify RSA Fire Department, and
4. Notify the HSO.

12.5 EMERGENCY CONTACTS

The appropriate contact(s) from the Emergency Contact list found in Appendix A shall be made for all emergency situations.

NOTE: **All emergency services can be reached by dialing 876-2117 (RSA Fire Department). For ambulance, fire or police contacts, give the name of the road and the nearest intersection. In the event no telephone can be reached, channel 9 can be accessed with a Citizen's Band (CB) Radio for emergency assistance.**

Notify the USACE contact and the Rust RHSS after emergency contacts have been made.

The PPE Manager should be contacted if unforeseen circumstances require the immediate procurement of additional personal protective or emergency equipment. Attending emergency physicians should be given the telephone number of the Rust Medical Director to obtain immediate access to an employee's medical records and for consultation purposes.

13.0 TRAINING OF PERSONNEL

In order to be in compliance with OSHA regulations, all personnel whose duties include participation in job-related activities on this site must be able to document "a minimum of 40 hours of initial instruction off the site, and a minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor." Each employee will receive annual 8-hour refresher training and the PM and HSO will have an 8-hour supervisor's course.

Site-specific training shall be carried out by the HSO before entering the contamination reduction and exclusion zones. This shall consist of a review of the specific hazards of concern, risks, symptoms of exposure and an overview of the Safety and Health Plan to include delineation of work zones, access, decontamination protocols, safety procedures, and emergency contacts. All visitors and site personnel entering the contamination reduction and exclusion zones must receive site-specific training and provide current documentation of OSHA Training (40-Hour, Supervisor, and Annual Refresher), Respirator Fit-Test, and Medical Fit-for-Duty prior to project involvement.

14.0 MEDICAL SURVEILLANCE

Rust is providing medical surveillance support for numerous ongoing operations. The Medical Surveillance Program is the element of the Rust Health and Safety Program that provides for employee assurance as well as liability protection. The intent of this program is to detect deleterious consequences of occupational exposure to hazardous substances and physical stresses, particularly those associated with the work environment at hazardous waste sites. The Surveillance Program is designed to monitor specific physiological conditions and mechanisms that may be affected by non-episodic exposure as well as to provide acute or episodic medical care as needed (see following summary for exam components).

All personnel working on these sites will have had a pre-employment and current annual physical examination in accordance with 29 CFR 1910.120, American National Standards Institute (ANSI) Z-88.2, and Department of the Army Pamphlets 40-173 and 40-8 conducted by an occupational health physician and, on the basis of this examination, will have been certified as being fit for duty on potentially hazardous sites.

Unscheduled medical examinations will be conducted, however, in the unlikely event of unusual exposures or accidents. All AE medical records are maintained with the Rust Medical Director and are accessible, within the limits of the Privacy Act, through written requests to the Rust RHSS.

Exam Component Summary	
Occupation History	Dipstick Urine Analysis
Medical History	Audiometry
Physical Exam	Spirometry
Bio-Chem Specimen	EKG
Vital Signs	X-ray
Vision Screening	RBC-Che

15.0 RECORDKEEPING

Rust and all subcontractors shall maintain logs and reports sufficient to document the implementation and execution of the personnel protection program. This documentation shall consist of medical surveillance files, training files, daily logs and accident reports.

15.1 TRAINING

Documentation of AE employee training is maintained in Rust Health and Safety files under the direction of the Rust RHSS. These files document employee attendance, level of training and follow-up or refresher instruction. Any subcontractor will make available documentation of their employees' training upon request. Prior to project involvement within the contamination reduction and exclusion zones, all visitors and site personnel must provide current documentation of OSHA Training (40-Hour, Supervisor, and Annual Refresher) Respirator Fit-Test, and Medial Fit-for-Duty.

15.2 WORK LOGS

AE daily work logs shall be maintained by the HSO. Copies of daily logs shall be forwarded to the Contracting Officer on request. The daily log shall contain:

- Date,
- Area(s) or site(s) worked,
- List of employees by area and hours exposed,
- PPE utilized by employees,
- Results of monitoring tests,
- Waste materials removed from work area(s),
- List of equipment decontaminated,
- Description of special or unusual events or incidents, including all first aid treatments not otherwise reportable.

Any incident resulting in a work stoppage shall be fully documented in a report prepared by the HSO and submitted to the Rust RHSS.

15.3 ACCIDENT REPORTING

In addition to descriptions in the daily log and work stoppage reports, an accident and/or chemical exposure incident shall be investigated, analyzed and documented in an accident investigation report submitted to the Rust RHSS. This process shall be applicable to both Rust and all subcontractors. These reports, prepared by the HSO in consultation with the Rust RHSS, shall contain a full description and analysis of the incident, including exposure work-hours and a log of occupational injuries and illnesses (OSHA form 200 or equivalent as prescribed by 29 CFR 1904).

Formal accident reports shall be prepared for any diagnosed illness or injuries that result in a lost work day or fatality. The accident report shall identify all contributing causes and recommend future hazard control measures to reduce the risk of recurrence.

Persons on site are responsible for reporting all injuries as soon as possible to the HSO. These injuries will be reported to the USACE according to the requirements stated in the Accident Reported Procedure contained in Appendix D.

16.0 JOB EXPOSURE REPORT

The HSO shall complete the attached Job Exposure Report Form (Appendix E) and deliver it to the Rust RHSS at the termination of field activities on the site, in the event of assignment of a new HSO at an intermediate point during site activities, or at the ends of discrete phases of prolonged field activities. The intent of Job Exposure Reports is to provide documentation of actual and suspected job-related exposures for use by the Rust Medical Director in making decisions on appropriate periodic examination procedures.

17.0 LIST OF REFERENCES

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American Iron and Steel Institute, "Wire Rope User's Manual."

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Clayton, George D. and T.E. Clayton, 1981. Patty's Industrial Hygiene and Toxicology. 3rd Edition, Volume IIA. Wiley-Inter-Science Publication.

Department of Army Regulation ER 385-1-92, 18 March 1994. "Safety and Occupational Health Document Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) and Ordnance and Explosive Waste (OEW) Activities."

Department of Army Regulation AR 200-1

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Hazardous Waste Site Operations and Emergency Response Standard (OSHA 29 CFR 1910.120), March 1989.

International Drilling Federation, 1991. "Drilling Safety Guide."

National Library of Medicine, 1992. MEDLARS on-line network, Hazardous Substances Data Bank (HSDB). NLM, U.S. Department of Health and Human Services, Bethesda, Maryland.

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NIOSH Pocket Guide to Chemical Hazards, June 1994. U.S. Department of Health and Human Services.

OSHA, Construction Industry Standard (29 CFR 1926), and General Industry Standard (19 CFR 1910); especially 29 CFR 1910.120, Hazardous Waste Site Operations and Emergency Response.

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U.S. Army Missile Command, Redstone Arsenal, May 1990. "Disaster Control Plan 500-1.

U.S. Army Missile Command, Redstone Arsenal, August 1991. "Spill Prevention Control and Countermeasure Plan."

U.S. Army Missile Command, Redstone Arsenal, August 1991. "Installation Spill Contingency Plan for Oil and Hazardous Substances."

U.S. Dept. of Health, Education, and Welfare, June 1977. NIOSH Occupational Diseases. A Guide to Their Recognition.

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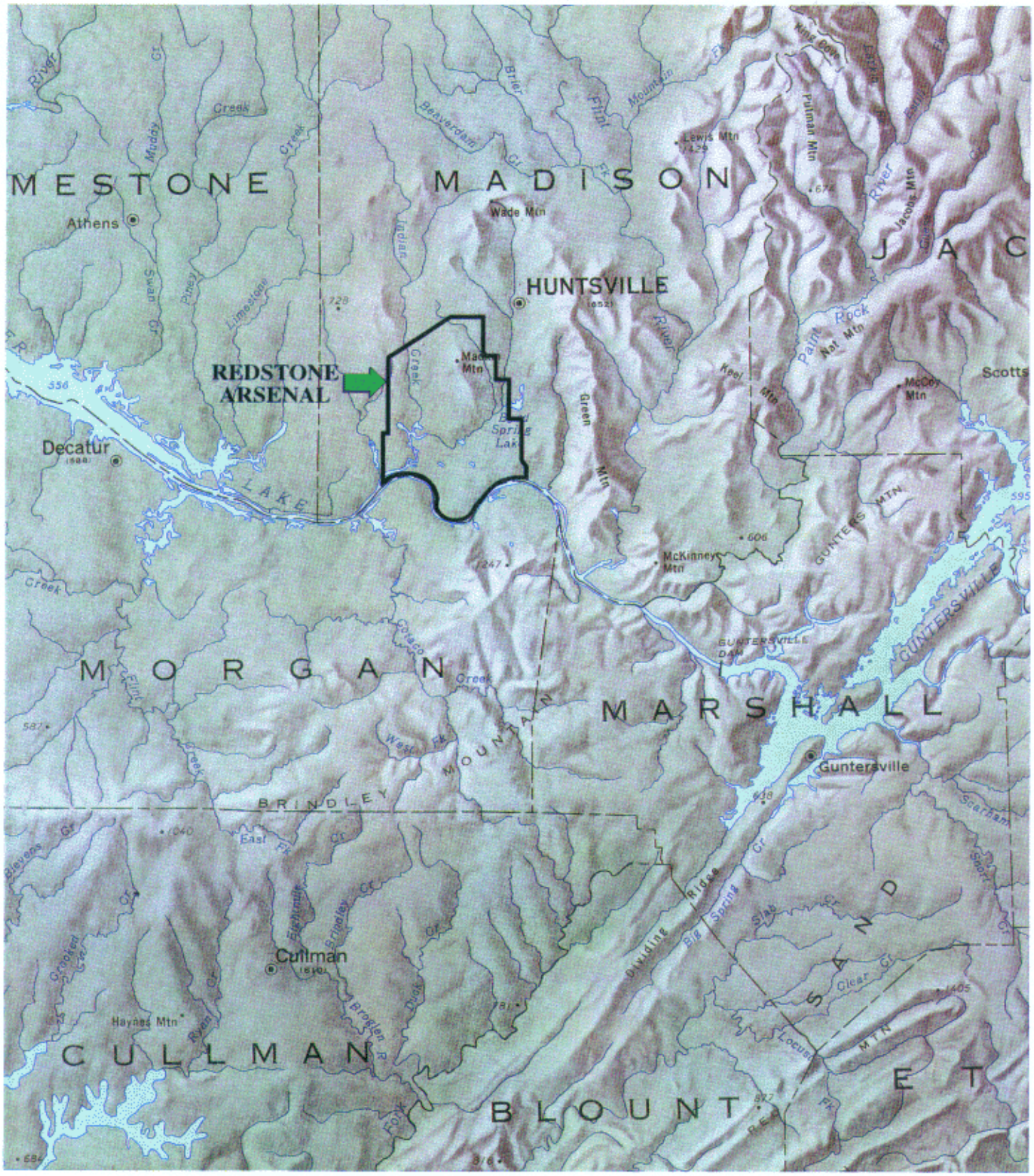
FIGURES

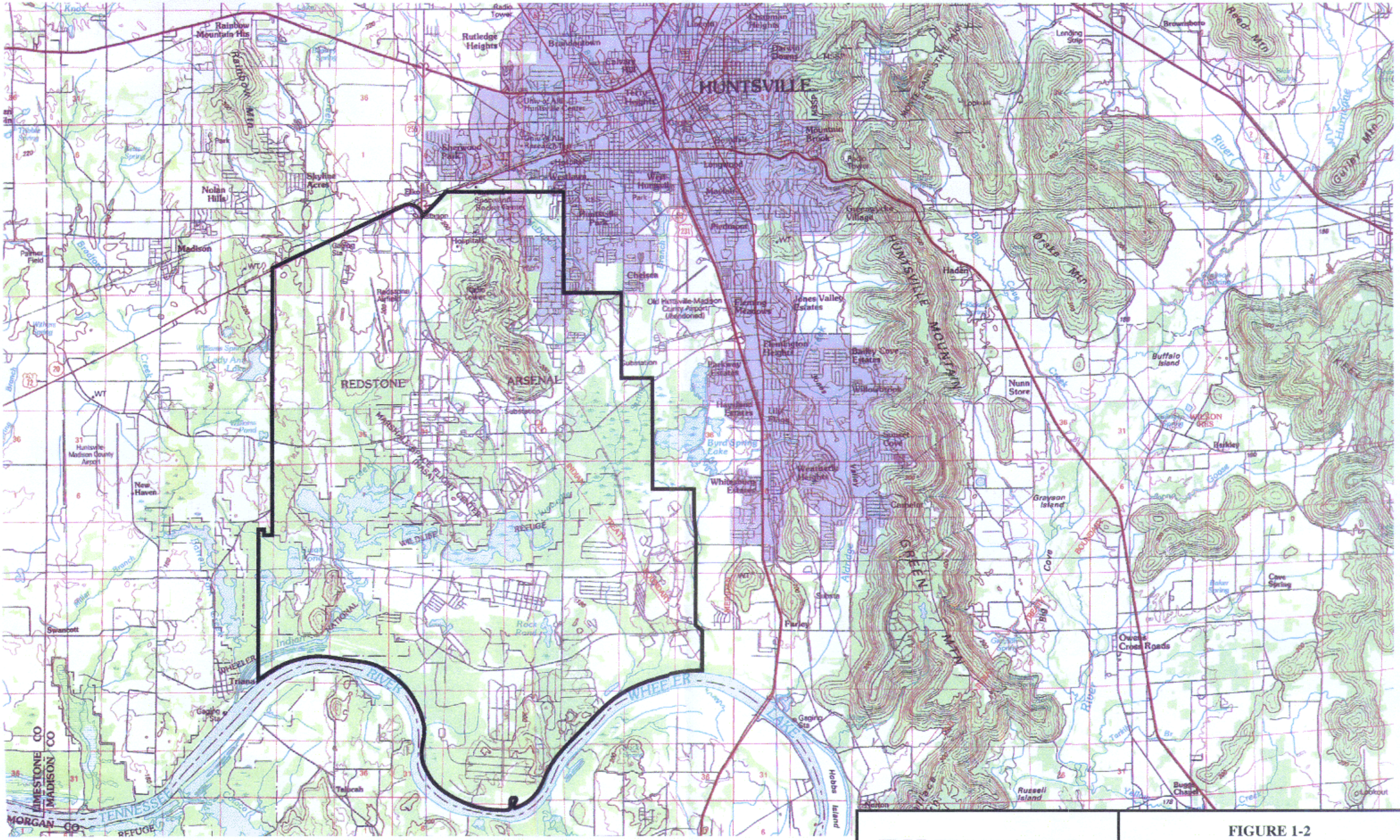


Reference: USGS State of Alabama
Shaded Relief Map; compiled 1964

10 0 10 20 Miles

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 1-1
AREA LOCATION MAP
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



Reference: USGS 30 x 60 Minute Quadrangle; Huntsville, Alabama - Tennessee
Compiled from USGS maps dated 1964-1982, Photo Revised 1981.

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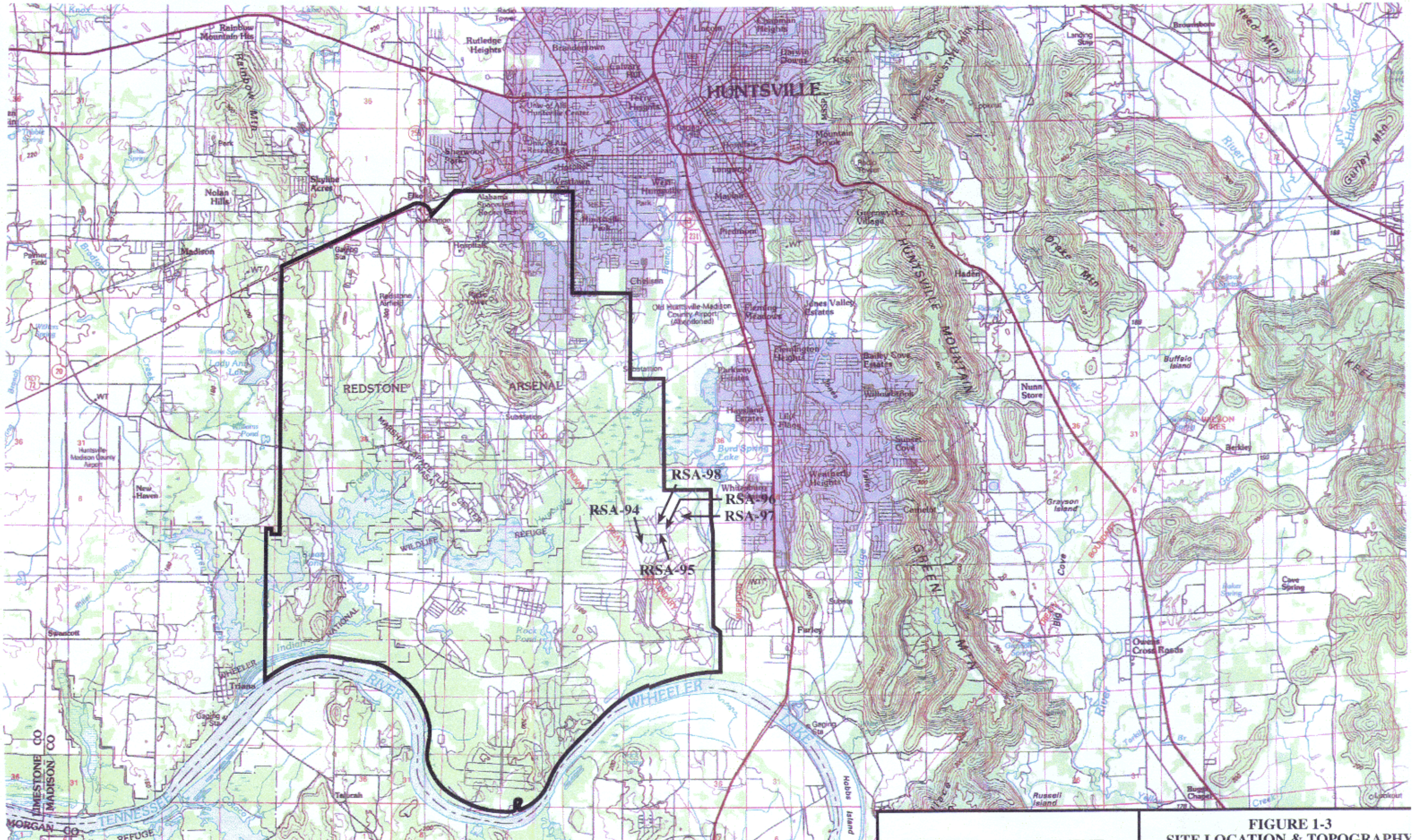
RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 1-2
SITE LOCATION MAP
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



Reference: USGS 30 x 60 Minute Quadrangle; Huntsville, Alabama - Tennessee
Compiled from USGS maps dated 1964-1982. Photo Revised 1981.

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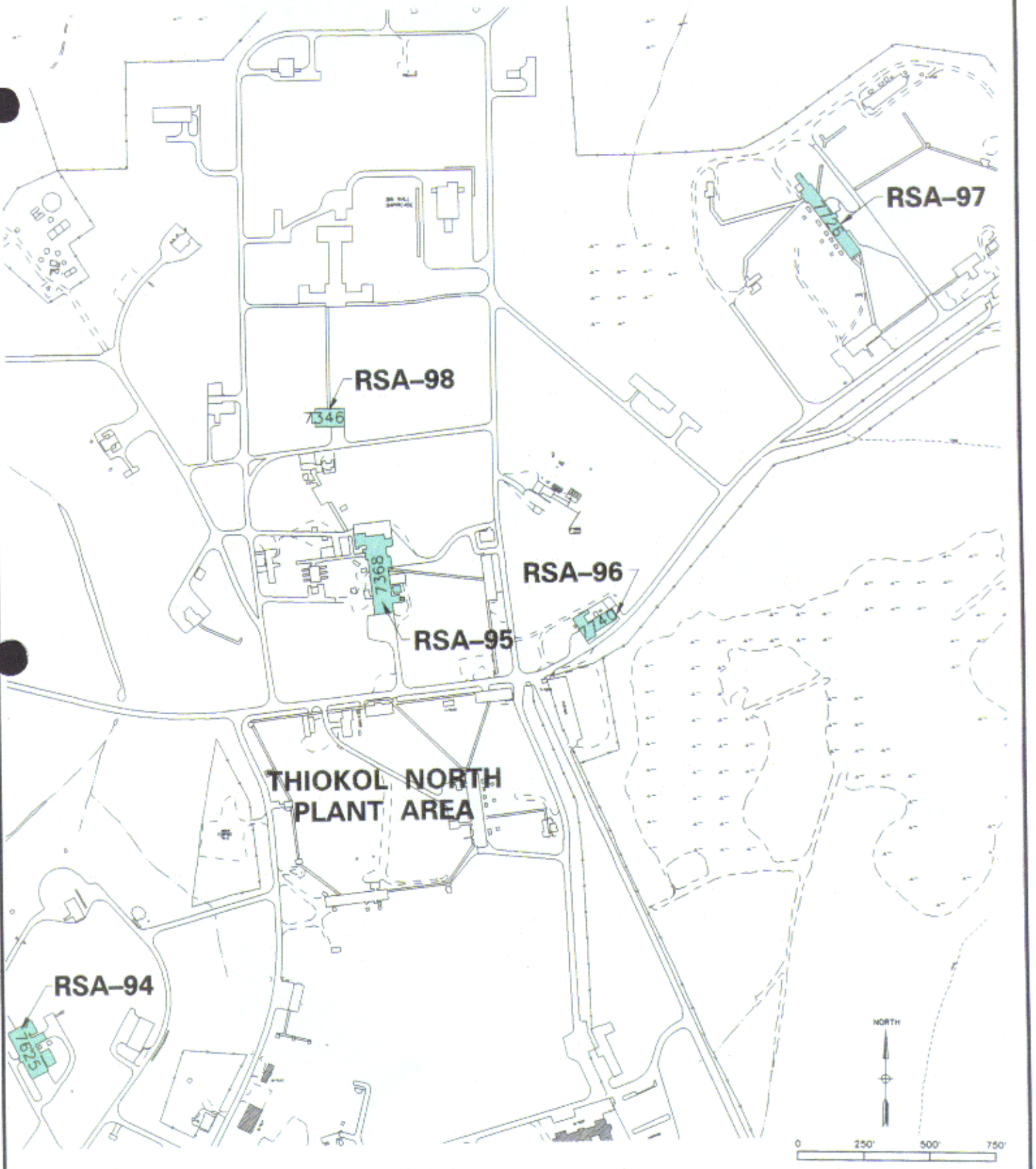
RUST ENVIRONMENT & INFRASTRUCTURE

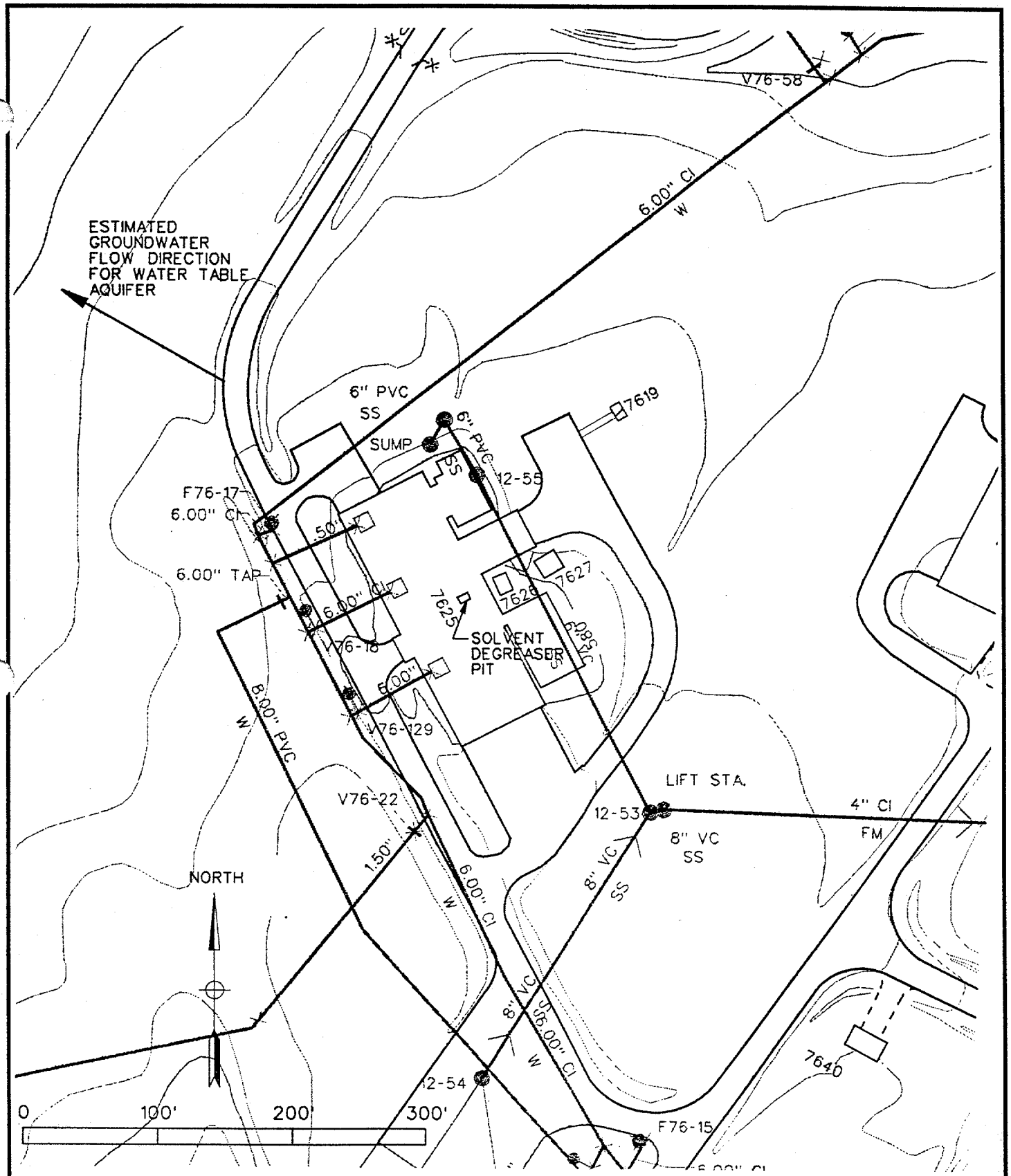
FIGURE 1-3
SITE LOCATION & TOPOGRAPHY
(RSA 94, 95, 96, 97, & 98)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 1-4
SITE LOCATIONS
(RSA-94, 95, 96, 97 & 98)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

33833.



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 1-5
SITE LOCATION (RSA-94)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

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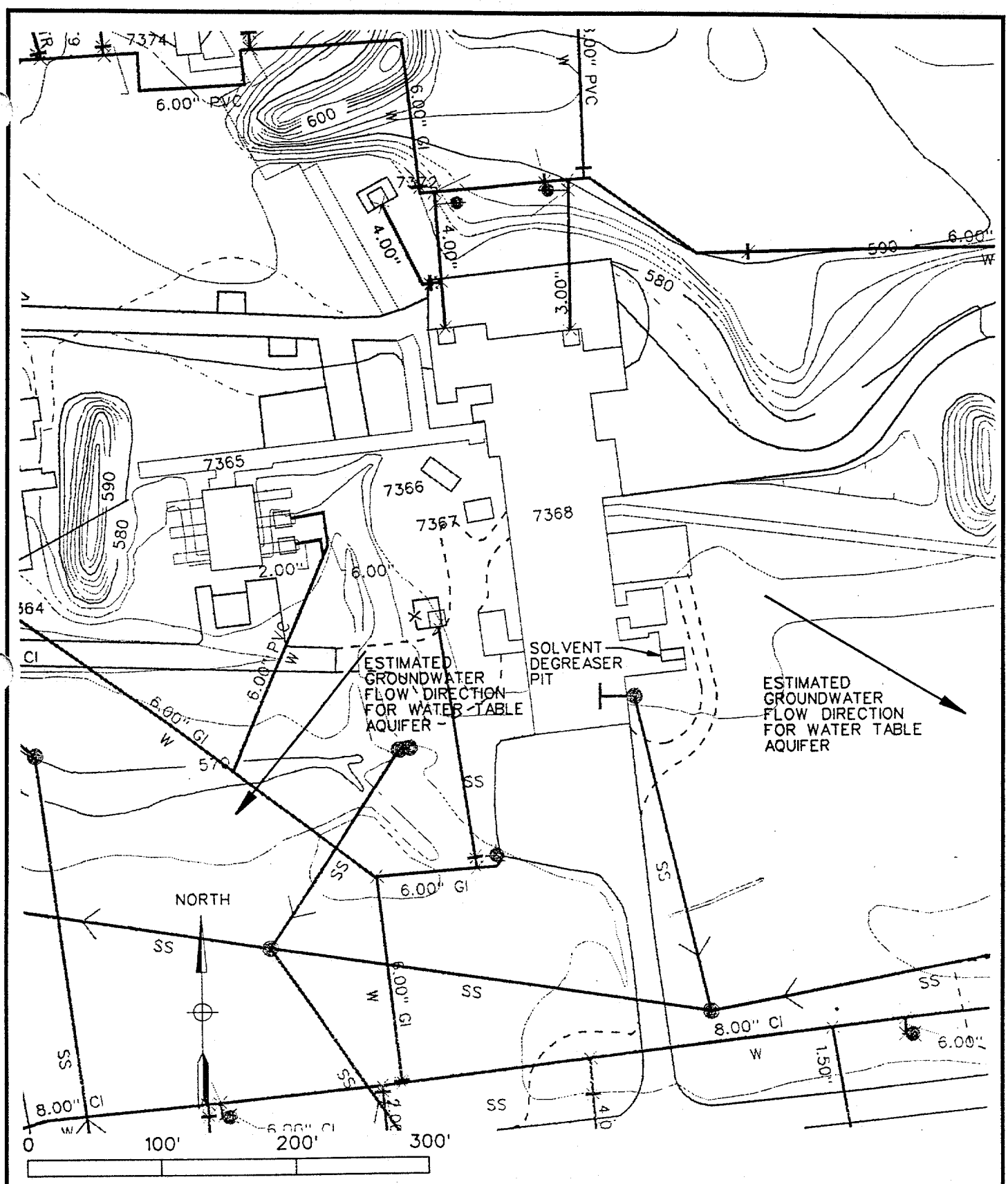

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 1-6
SITE LOCATION (RSA-95)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

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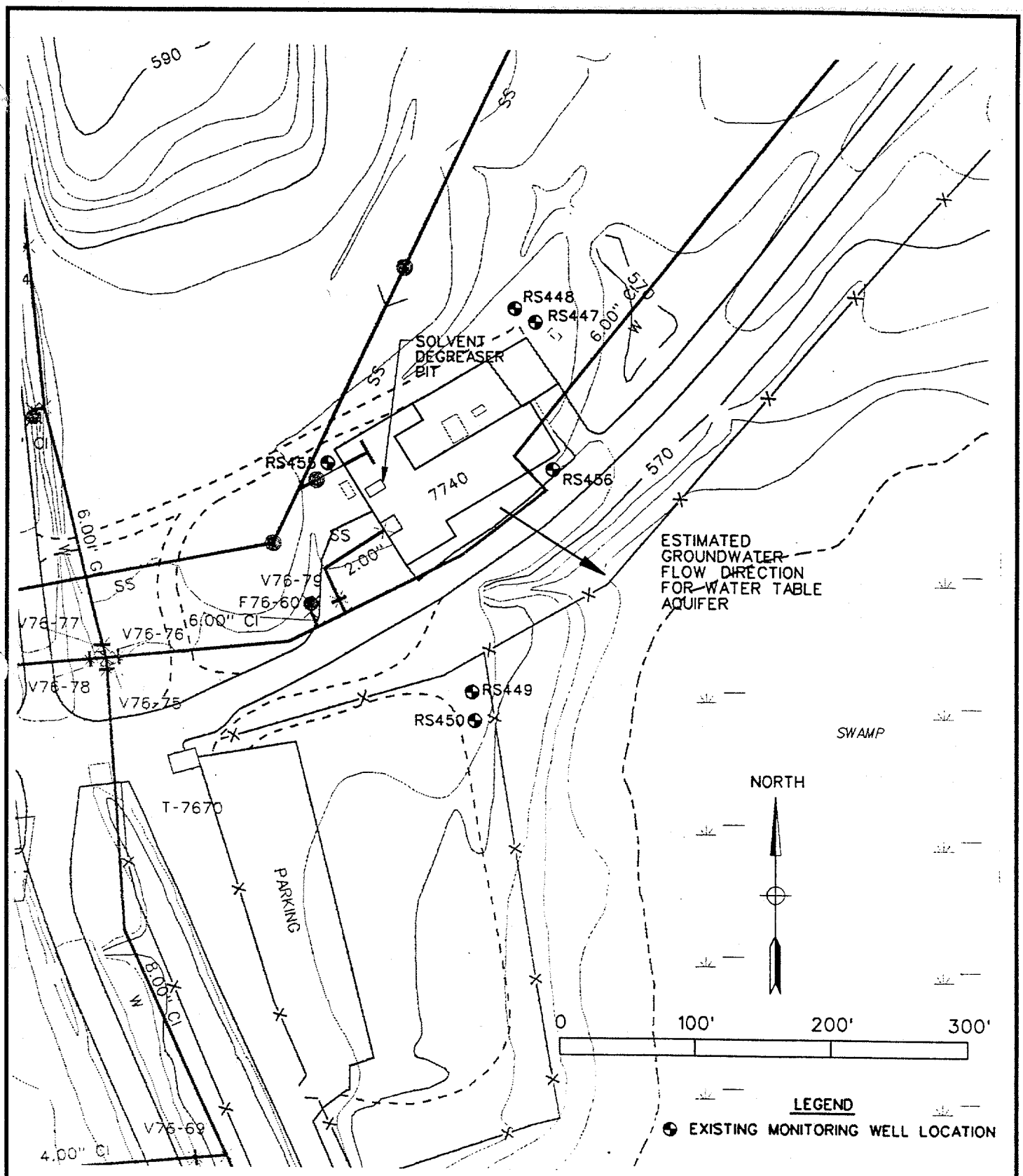

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 1-7
SITE LOCATION (RSA-96)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

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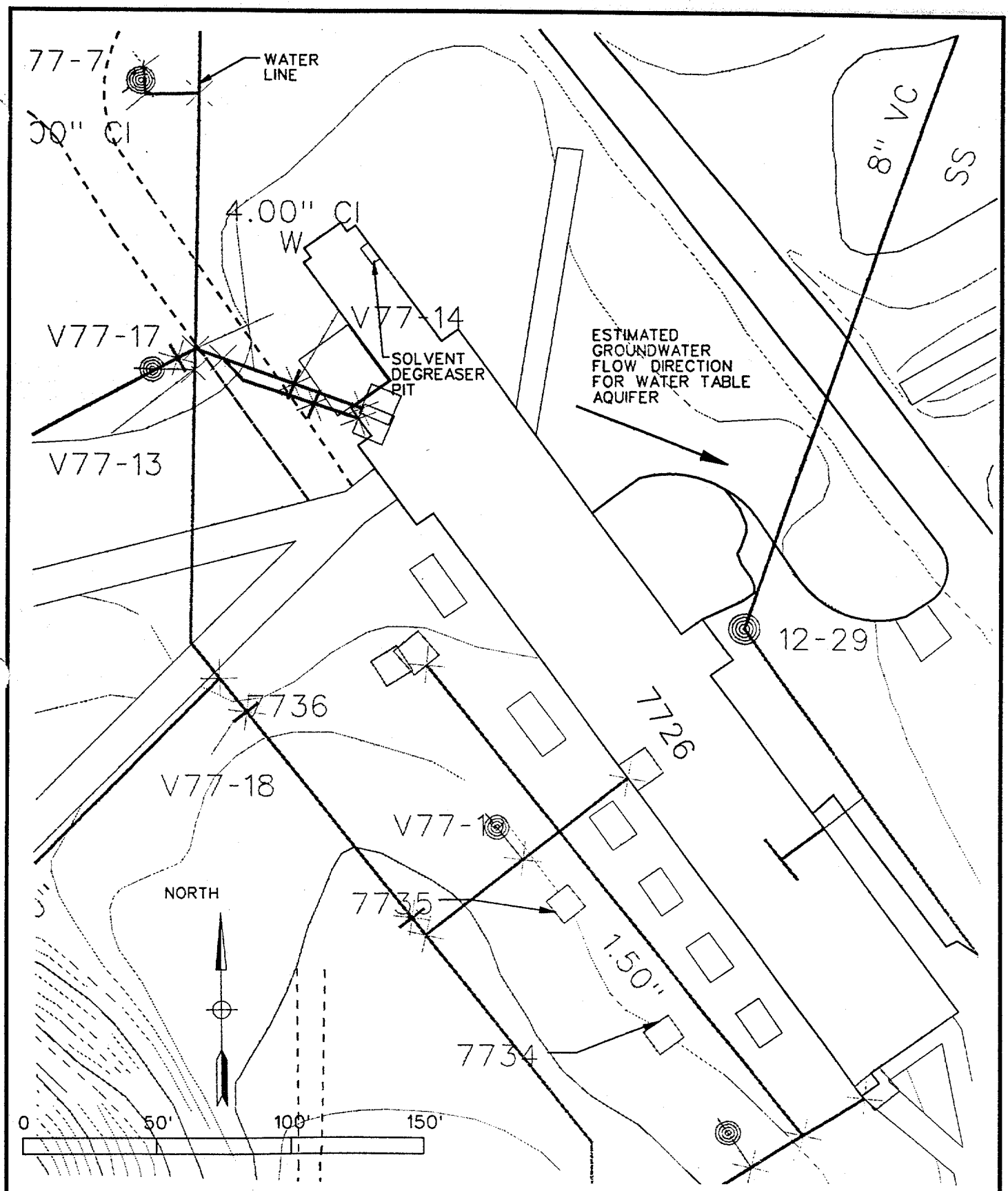

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 1-8
SITE LOCATION (RSA-97)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

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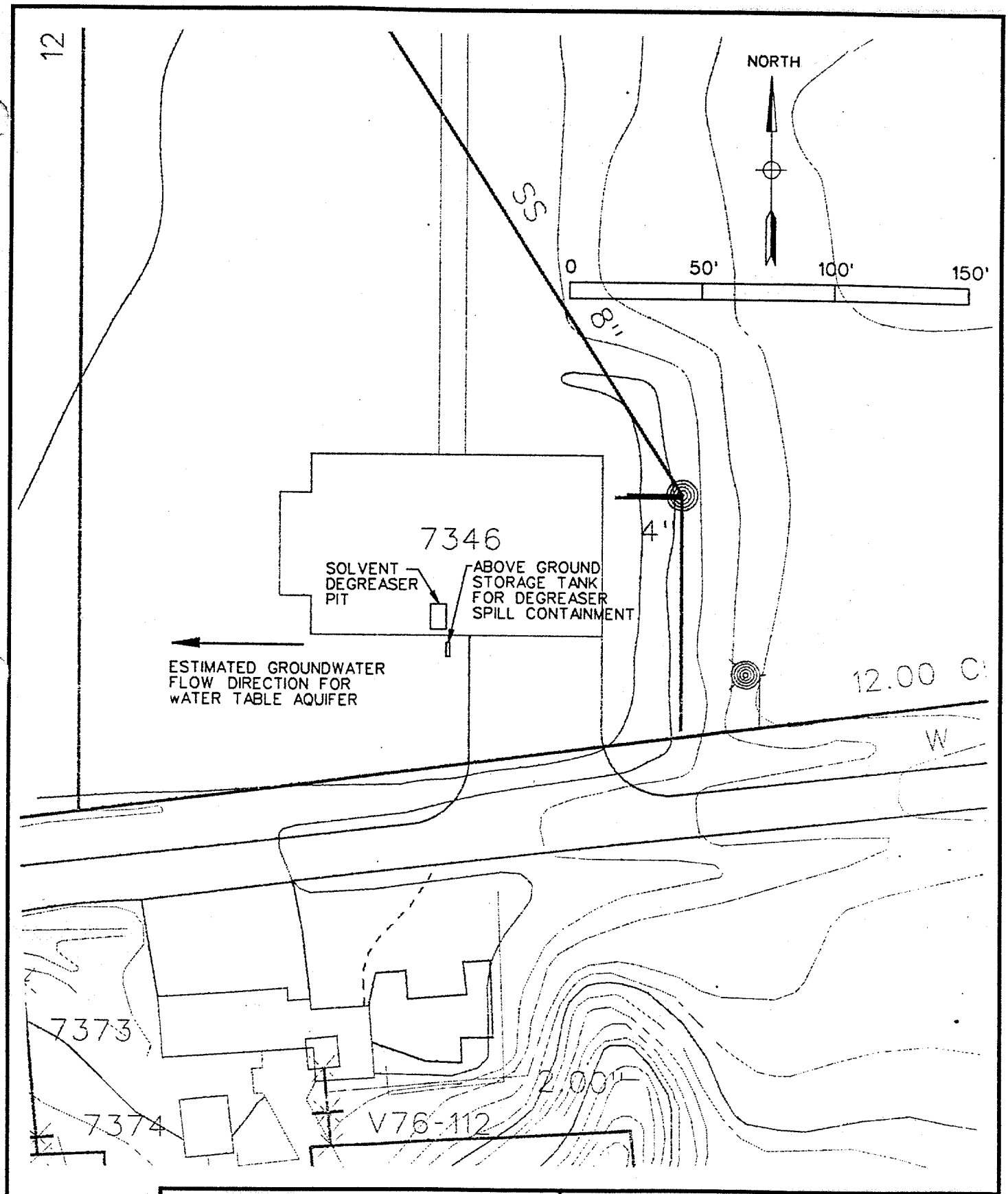

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 1-9
SITE LOCATION (RSA-98)
SITE INSPECTIONS
REDSTONE ARSENAL, ALABAMA

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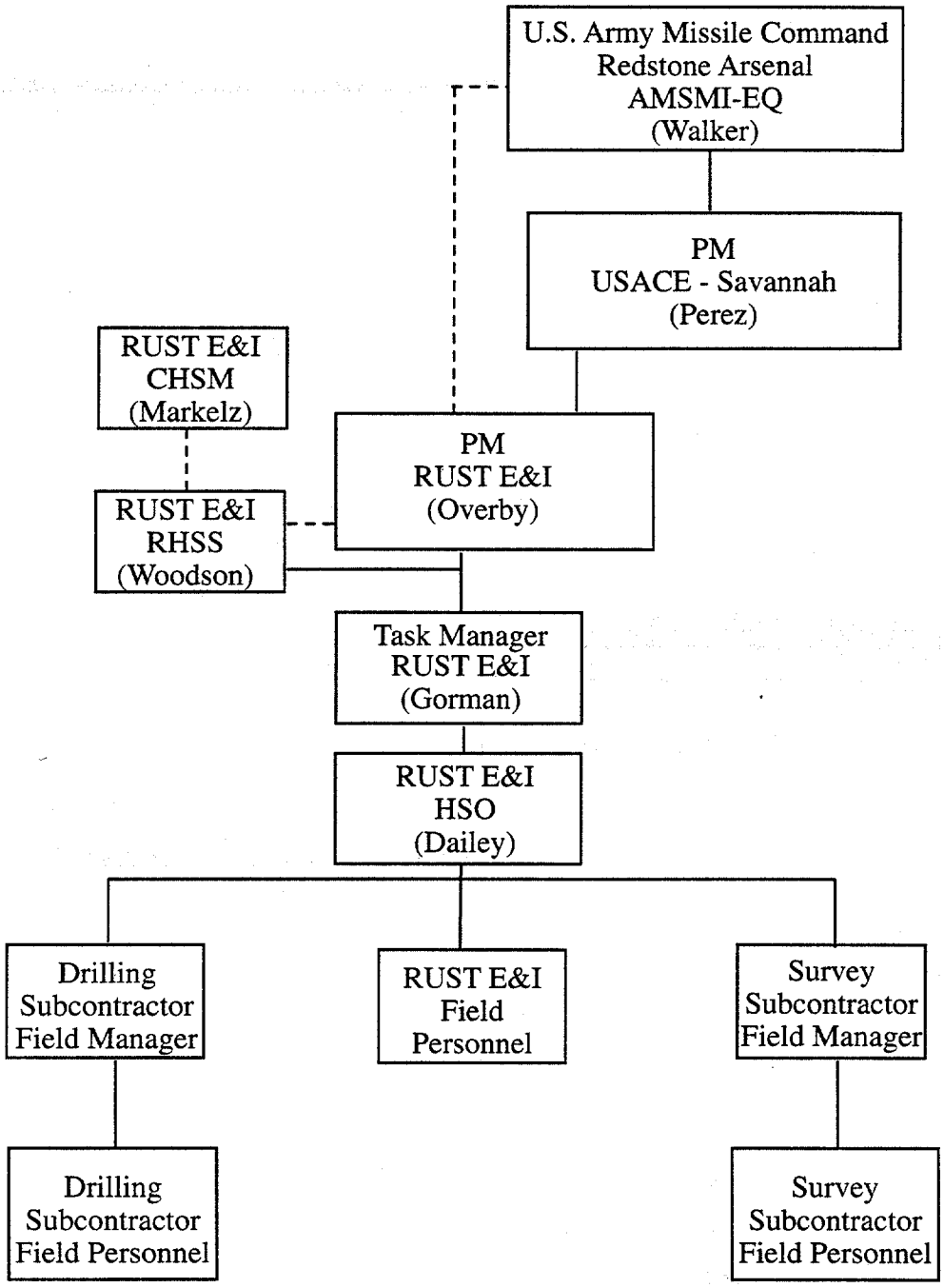

Legend:

——— Direct Line of Communication/Authority

- - - - - - Indirect Line of Communication/Authority (utilized by the project)

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 2-1
STAFF ORGANIZATION CHART
SUPPLEMENTAL REMEDIAL INVESTIGATION
REDSTONE ARSENAL, ALABAMA

33833.

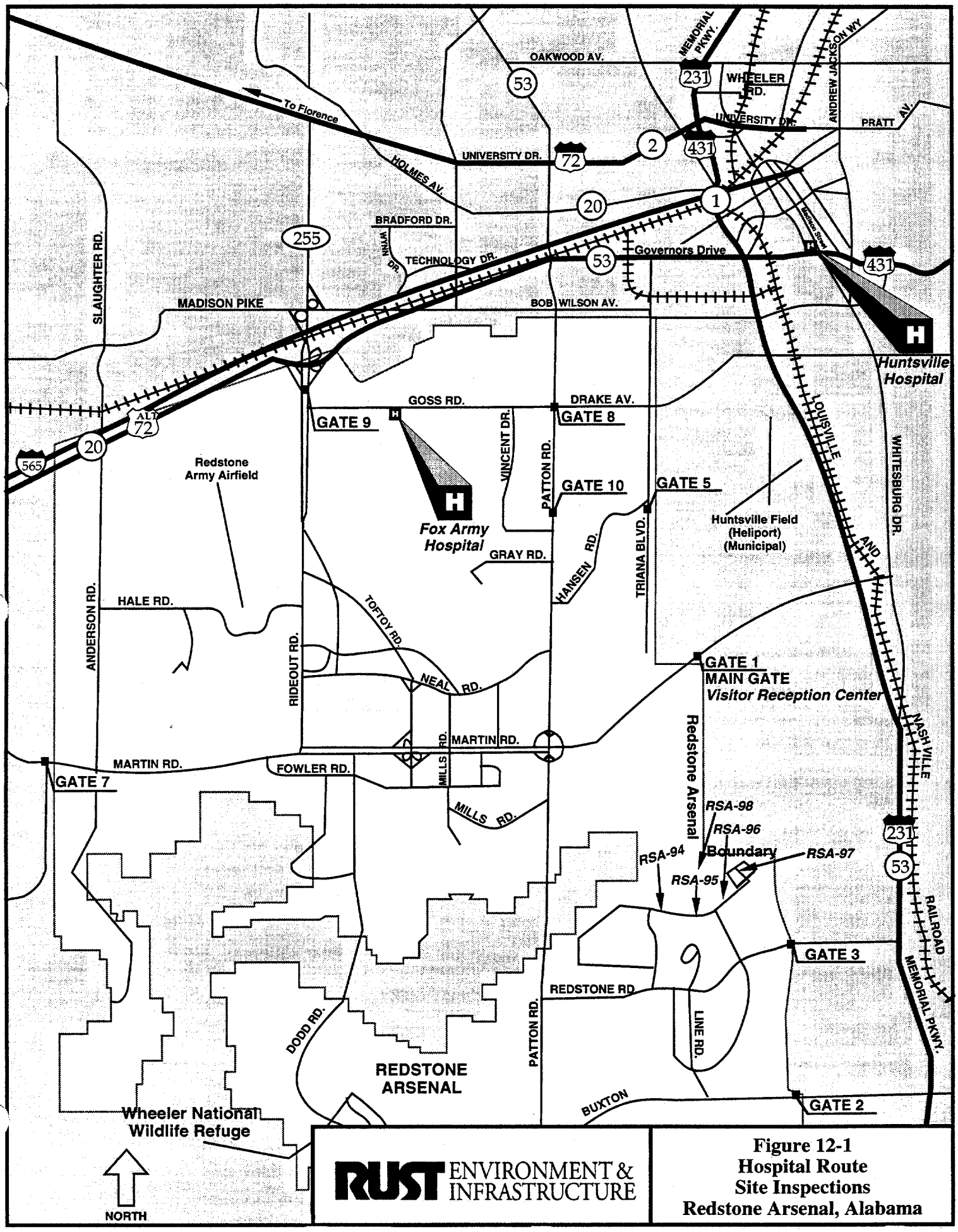

Figure 12-1
Hospital Route
Site Inspections
Redstone Arsenal, Alabama

TABLES

Table 4-1
Exposure Limits Based on Human Health Criteria
Contaminants of Concern
Redstone Arsenal, Alabama

Contaminant	TLV-TWA	TLV-STEL	PEL-TWA	PEL-STEL	IDLH
Acetone	750 ppm	1000 ppm	750 ppm	1000 ppm	2500 ppm LEL
Hydrochloric Acid, Skin	5 ppm Ceil	---	5 ppm Ceil	---	50 ppm
Hydrogen, FG/SA	---	---	---	---	---
Isopropanol	400 ppm	500 ppm	400 ppm	500 ppm	2000 ppm
Nitric Acid, Skin	2 ppm	4 ppm	2 ppm	4 ppm	25 ppm
Sulfuric Acid, Skin	1 mg/m^3	3 mg/m^3	1 mg/m^3	---	15 mg/m^3
1,1,1-Trichloroethane	350 ppm	450 ppm	350 ppm	450 ppm	700 ppm
Trichloroethylene	50 ppm, A5	100 ppm, A5	50 ppm	200 ppm	1000 ppm, Ca

A5 - No suspected as Human Carcinogen
Ca - Carcinogen
FG - Flammable Gas
SA - Simple Asphyxiant

Table 8-1

Examples of Permissible Heat Exposure
Threshold Limit Values
[Values given in °C and (°F) WBGT]

Work-Rest Regimen	Work Load		
	Light	Moderate	Heavy
Continuous work	30.0 (86)	26.7 (80)	25.0 (77)
75% Work - 25% Rest, each hour	30.6 (87)	28.0 (82)	25.9 (78)
50% Work - 50% Rest, each hour	31.4 (89)	29.4 (85)	27.0 (82)
25% Work - 75% Rest, each hour	32.2 (90)	31.1 (88)	30.0 (86)

Table 8-2
TLV WBGT Correction Factors in °C for Clothing
Redstone Arsenal, Alabama

Clothing Type	Clothing Value	WBGT Correction
Summer work uniform	0.6	0
Cotton coveralls	1	-2
Winter work uniform	1.4	-4
Water barrier, permeable	1.2	-6

WBGT - Wet Bulb Globe Temperature

NOTE:

If special clothing is required for a particular job and this clothing is heavier or it impedes sweat evaporation or has a higher insulation value, the worker's heat tolerance is reduced, and the permissible heat exposure TLVs are not applicable. In this case, the permissible heat exposure TLVs should be established by an expert.

Table 8-3
Progressive Clinical Presentations of Hypothermia
Redstone Arsenal, Alabama

Core Temperature °C	°F	Clinical Signs
37.6	99.6	"Normal" rectal temperature
37	98.6	"Normal" oral temperature
36	96.8	Metabolic rate increases in an attempt to compensate for heat loss
35	95.0	Maximum shivering
34	93.2	Victim conscious and responsive, with normal blood pressure
33	91.4	Severe hypothermia below this temperature
32	89.6	Consciousness clouded; blood pressure becomes difficult to obtain
31	87.8	pupils dilated but react to light; shivering ceases
30	86.0	Progressive loss of consciousness; muscular rigidity increases;
29	84.2	pulse and blood pressure difficult to obtain; respiratory rate decreases
28	82.4	Ventricular fibrillation possible with myocardial irritability
27	80.6	Voluntary motion ceases; pupils nonreactive to light; deep tendon and superficial reflexes absent
26	78.8	Victim seldom conscious
25	77.0	Ventricular fibrillation may occur spontaneously
24	75.2	Pulmonary edema
22	71.6	Maximum risk of ventricular fibrillation
21	69.8	
20	68.0	Cardiac standstill
18	64.4	Lowest accidental hypothermia victim to recover
17	62.6	Isoelectric electroencephalogram
9	48.2	Lowest artificially cooled hypothermia patient to recover

Table 8-4
Cooling Power of Wind on Exposed Flesh Expressed as Equivalent Temperature
Redstone Arsenal, Alabama

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	*LITTLE DANGER* In < hr with dry skin. Maximum danger of false sense of security.				*INCREASING DANGER* Danger from freezing of exposed flesh within one minute.				*GREAT DANGER* Flesh may freeze within 30 seconds.			
	Trenchfoot and immersion foot may occur at any point on this chart.											

Table 8-5
Threshold Limit Values Work/Warm-up Schedule for Four-Hour Shift*
Redstone Arsenal, Alabama

Air Temperature--Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	(Norm. Breaks)	1	(Norm. Breaks)	1	75 min	2	55 min	3	40 min	4
-29° to -31°	-20° to -24°	(Norm. Breaks)	1	75 min	2	55 min	3	40 min	4	30 min	5
-32° to -34°	-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min	4	30 min	5	Non-emergency work should cease					
-40° to -42°	-40° to -44°	30 min	5	Non-emergency work should cease							
-43° & below	-45° & below	Non-emergency work should cease									

Notes for Table 8.5

*1. Schedule applies to any 4-hour work period with moderate to heavy work activity, with warm-up periods of ten (10) minutes in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For Light-to-Moderate Work (limited physical movement): apply the schedule one step lower. For example, at -35°C(-30°F) with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (Step 5).

2. The following is suggested as a guide for estimating wind velocity if accurate information is not available:
5 mph: light flag moves; 10 mph: light flag fully extended; 15 mph: raises newspaper sheet; 20 mph: blowing and drifting snow.

3. If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be: 1) special warm-up breaks should be initiated at a wind chill cooling rate of about 1750 W/m^2; 2) all non-emergency work should have ceased at or before a wind chill of 2250 W/m^2. In general, the warmup schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges because windy conditions rarely prevail at extremely low temperatures.

4. TLVs apply only for workers in dry clothing.

*Adapted from Occupational Health & Safety Division, Saskatchewan Department of Labor.

Table 11-1
Minimum Decontamination Layout
For Level C Protection and Equipment
Redstone Arsenal, Alabama

	Station 1	Station 2	Station 3	Station 4	Station 5
Decon Procedures	Equipment Drop	PPE and Other Equipment Wash	PPE and Other Equipment Rinse	PPE Disposal	Hand and Face Wash

<u>Equipment needed to perform decontamination</u>

Station 1:	Plastic Sheet	Station 4:	20-30 Gallon Trash Can, Disposal Bag
Station 2:	Wash tub, Decon Solution, Long-handled soft-bristled scrub brush	Station 5:	Field table, 5 gal water cooler or carboy, soap, towels
Station 3:	Wash tub, rinse water, long-handled soft-bristled scrub brush		

APPENDIX A

EMERGENCY CONTACTS

EMERGENCY CONTACTS

ALL EMERGENCY SERVICES CAN BE REACHED BY DAILING 876-2117 (RSA FIRE DEPARTMENT)

RSA Military Police	(205) 976-2222
Huntsville Police	911
Huntsville Fire	911
RSA Ambulance	(205) 876-6110
Poison Control Center	(800) 462-0800
USEPA (Region IV 24 Hour Hotline)	(404) 347-4062
Fox Army Hospital	(205) 876-8287

Directions to Fox Army Hospital: **Enter Gate 8 and travel west on Goss Road for approximately 1.75 miles. Fox Army Hospital is located on the southside of Goss Road across from the Base golf course. The hospital is approximately 1,000 yards east of the intersection of Goss and Rideout Roads (Figure 12-1).**

Direction to Huntsville Hospital: **Exit Gate 8 and travel east on Goss Road, which becomes Drake Avenue, for approximately 3.6 miles. Exit Drake Avenue and travel north on Whitesburg Drive for approximately 1.2 miles to the intersection of Governors Drive and Drake Avenue. The Huntsville Hospital is located on the west side of Drake Avenue, which becomes Madison Street, immediately after cross Governors Drive (Figure 12-1).**

After primary contacts have been made, the following secondary contacts may be made as appropriate:

USACE Huntsville	(205) 955-1229
Francis E. Hart Chief of MICOM Safety	(205) 876-2944
Whitt Walker USAMICOM Env. PM	(205) 955-6967
Pat Shirley Rust E&I Program Manager	(803) 234-3068
George Overby Rust E&I Project Manager	(803) 234-2293
Chuck Gorman Rust E&I Task Manager	(803) 234-8972
David Dailey Rust E&I HSO	(205) 995-7373
Sherman Woodson Rust E&I RHSS Greenville Operations	(803) 234-2297
Eric Olson PPE Manager and Emergency Equipment Procurement	(803) 297-3102
Dr. Elayne F. Theriault Rust E&I Medical Director	(800) 229-3674 (404) 455-0818

APPENDIX B

TOXICITY SUMMARIES

ACETONE

(CH_3COCH_3) 2-Propanone, Dimethyl Ketone, Ketone Propane

Acetone is a member of a very large family of ketones that are used as solvents and chemical intermediates in industry. Acetone may produce a dry, scaly and fissured dermatitis after repeated exposure. High vapor concentrations may irritate the conjunctiva and mucous membranes of the nose and throat, producing eye and throat symptoms. In high concentrations, narcosis is produced, with symptoms of headache, nausea, light headedness, vomiting, dizziness, incoordination, and unconsciousness.

TLV:	750 ppm TWA, 1000 ppm STEL
PEL:	750 ppm TWA, 1000 ppm STEL
IDLH:	2500 ppm
DESCRIPTION:	Colorless liquid with a fragrant, mint-like odor
SOLUBILITY:	Miscible
FLASH POINT:	0°F
IONIZATION POTENTIAL:	9.69 eV
VAPOR PRESSURE:	180 mm Hg @ 68°F
LEL:	2.6%
UEL:	12.8%
RESPIRATOR CARTRIDGE BREAKTHROUGH TIME:	37 min @ 1000 ppm
HNu SENSITIVITY:	63%
OVA SENSITIVITY:	60%

HYDROCHLORIC ACID

(HCl, Muriatic Acid, Chlorohydric Acid, Aqueous Hydrogen Chloride)

Hydrochloric acid is a breakdown product of mustard gas and lewisite. It is highly corrosive to the eyes, skin, and mucous membranes. Skin contact may produce burns, ulceration, and severe scarring, Eye contact may results in reduced vision or blindness. Ingestion may produce fatal effects from esophageal and/or gastric disorders. Vapor inhalation can lead to laryngitis, bronchitis, pulmonary edema and death.

TLV:	5 ppm CEIL
PEL:	5 ppm CEIL
IDLH:	50 ppm
DESCRIPTION:	Colorless to slightly yellow gas with a pungent odor.
SOLUBILITY:	67% @ 86°F
FLASH POINT:	N/A
IONIZATION POTENTIAL:	12.74 eV
VAPOR PRESSURE:	> 1 atm
LEL:	N/A
UEL:	N/A
RESPIRATOR CARTRIDGE BREAKTHROUGH TIME:	N/A
HNu SENSITIVITY:	N/A
OVA SENSITIVITY:	N/A

HYDROGEN
(H_2)

Hydrogen is not toxic, but it may act as a simple asphyxiant by displacing oxygen in a closed space. Highly dangerous fire hazard when exposed to heat, flame, and/or oxidizers. When hydrogen is compressed or mixed with air, oxygen, or chlorine, a potential flammable and explosive atmosphere may develop.

TLV:	Simple Asphyxiant
PEL:	N/A
IDLH:	N/A
DESCRIPTION:	Colorless, odorless, flammable gas
SOLUBILITY:	N/A
FLASH POINT:	N/A
IONIZATION POTENTIAL:	N/A
VAPOR PRESSURE:	
LEL:	4.1%
UEL:	74.2%
RESPIRATOR CARTRIDGE BREAKTHROUGH TIME:	N/A
HNu SENSITIVITY:	N/A
OVA SENSITIVITY:	N/A

NITRIC ACID
(HNO_3, Aqua Fortis, Hydrogen Nitrate)

Nitric acid may produce irritation of the eyes and mucous membranes. It is extremely corrosive to the skin and may cause severe burns, ulcers, and tissue damage. Poisonous by ingestion and acts as a irritant to the upper respiratory system. Nitric acid is incompatible with reducing agents resulting in a flammability hazard. A water and steam reaction may produce toxic and corrosive fumes.

TLV:	2 ppm TWA, 4 ppm STEL
PEL:	2 ppm TWA, 4 ppm STEL
IDLH:	25 ppm
DESCRIPTION:	Colorless, yellow or red fuming liquid
SOLUBILITY:	Miscible
FLASH POINT:	N/A
IONIZATION POTENTIAL:	11.95 eV
VAPOR PRESSURE:	48 mm Hg @ 68°F
LEL:	N/A
UEL:	N/A
RESPIRATOR CARTRIDGE BREAKTHROUGH TIME:	N/A
HNu SENSITIVITY:	N/A
OVA SENSITIVITY:	N/A

1,1,1-TRICHLOROETHANE
(Methyl Chloroform, CH_3CCl_3)

Methyl chloroform is a common solvent, used as a degreaser and cleaner for metals. Liquid and vapor are irritating to eyes on contact. This effect is usually noted first in acute exposure cases. Mild inflammation of the eyelid lining develops but recovery is usually rapid. Repeated skin contact may produce a dry, scaly, and fissured dermatitis, due to the solvent's defatting properties. Methyl chloroform is a narcotic and depresses the central nervous system. Acute overexposure symptoms include dizziness, incoordination,drowsiness, increased reaction time, unconsciousness, and death.

TLV:	350 ppm TWA, 450 ppm STEL
PEL:	350 ppm TWA, 450 ppm STEL
IDLH:	700 ppm
DESCRIPTION:	Colorless liquid with a mild,chloroform-like odor
SOLUBILITY:	0.04%
FLASH POINT:	N/A
IONIZATION POTENTIAL:	11.00 eV
VAPOR PRESSURE:	100 mm Hg @ 68°F
LEL:	7.5%
UEL:	12.5%
RESPIRATOR CARTRIDGE BREAKTHROUGH TIME:	40 minutes @ 1000 ppm
HNu SENSITIVITY:	90% with an 11.7 eV lamp
OVA SENSITIVITY:	105%

TRICHLOROETHYLENE
(CHC1CC1$_2$, Ethylene Trichloride, Ethinyl Trichloride, Trichloroethene, TCE)

Trichloroethylene is a colorless, nonflammable, noncorrosive liquid with the "sweet" odor characteristic of some chlorinated hydrocarbons. Decomposition of trichloroethylene, due to contact with hot metal or ultraviolet radiation, forms products including chlorine gas, hydrogen chloride, and phosgene. dichloroacetylene may be formed from the reaction of alkali with trichloroethylene. TCE is primarily used as a solvent in vapor degreasing. It is also used for extracting caffeine form coffee, as a drycleaning agent, and as a chemical intermediate in the production of pesticides,waxes, gums, resins, tars, paints, varnishes, and specific chemicals such as chloroacetic acid.

Exposure to trichloroethylene vapor may cause irritation of the eyes, nose, and throat. The liquid, if splashed in the eyes, may cause burning irritation and damage. Repeated or prolonged skin contact with the liquid may cause dermatitis. Acute exposure to trichloroethylene depresses the central nervous system exhibiting such symptoms as headache, dizziness, vertigo, tremors, nausea and vomiting, irregular heart beat, sleepiness, fatigue, blurred vision, and intoxication similar to that of alcohol. Unconsciousness and death have been reported. Alcohol may make the symptoms of trichloroethylene overexposure worse. If alcohol has been consumed,the overexposed worker may become flushed. TCE addiction and peripheral neuropathy have been reported. Recent reports indicate that exposure to trichloroethylene may induce liver tumors in mice.

TLV:	50 ppm TWA, 100 ppm STEL, A5
PEL:	50 ppm TWA, 200 ppm STEL
IDLH:	1000 ppm, Carcinogen
DESCRIPTION:	Colorless liquid with a chloroform-like odor
SOLUBILITY:	0.1% @ 77°F
FLASH POINT:	99°F
IONIZATION POTENTIAL:	9.47 eV
VAPOR PRESSURE:	58 mm Hg @ 68°F
LEL:	8% @ 77°F
UEL:	10.5% @ 77°F
RESPIRATOR CARTRIDGE BREAKTHROUGH TIME:	55 minutes at 1000 ppm
HNu SENSITIVITY:	89% with a 10.2 eV lamp
OVA SENSITIVITY:	54%

A5 - Not Suspected As Human Carcinogen

APPENDIX C

MATERIAL SAFETY DATA SHEETS

type 3/2/14

3 Entry: 14

BAKER Accession Number 10827

(MID) Material Identification:

H3880 -04 HYDROCHLORIC ACID
EFFECTIVE: 03/30/92 ISSUED: 04/03/93

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SECTION I - PRODUCT IDENTIFICATION

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PRODUCT NAME: HYDROCHLORIC ACID
COMMON SYNONYMS: MURIATIC ACID; CHLOROHYDRIC ACID; HYDROGEN CHLORIDE, AQUEOUS
CHEMICAL FAMILY: INORGANIC ACIDS
FORMULA: HCL
FORMULA WT.: 36.46
CAS NO.: 7647-01-0
NIOSH/RTECS NO.: MW4025000
PRODUCT USE: LABORATORY REAGENT
PRODUCT CODES: 4800,9542,9534,9549,9547,9546,6900,9536,9540,9548,9544,5800 5214,9543,9530,9537,5537,5814,5575,5593,9538,5367,9529,9535 5839,9539

(PHAZ) Primary Hazards:

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PRECAUTIONARY LABELING

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BAKER SAF-T-DATA* SYSTEM

HEALTH - 3 SEVERE (POISON)
FLAMMABILITY - 0 NONE
REACTIVITY - 2 MODERATE
CONTACT - 3 SEVERE (CORROSIVE)

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

U.S. PRECAUTIONARY LABELING

POISON DANGER

CAUSES SEVERE BURNS. MAY BE FATAL IF SWALLOWED OR INHALED.
DO NOT GET IN EYES, ON SKIN, ON CLOTHING. DO NOT BREATHE VAPOR. CAUSES DAMAGE TO RESPIRATORY SYSTEM (LUNGS), EYES AND SKIN. KEEP IN TIGHTLY CLOSED CONTAINER. LOOSEN CLOSURE CAUTIOUSLY. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF SPILL NEUTRALIZE WITH SODA ASH OR LIME AND PLACE IN DRY CONTAINER.

INTERNATIONAL LABELING

IRRITATING TO EYES AND SKIN.
I P OUT OF REACH OF CHILDREN. IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.

SAF-T-DATA* STORAGE COLOR CODE: WHITE (CORROSIVE)

(COMP) Components:

SECTION II - COMPONENTS

COMPONENT	CAS NO.	WEIGHT %	OSHA/PEL	ACGIH/TLV
HYDROCHLORIC ACID	7647-01-0	33-40	5 PPM	5 PPM
WATER	7732-18-5	60-67	N/E	N/E

(PHYS) Physical Properties:

SECTION III - PHYSICAL DATA

I LING POINT: 149 C (300 F) (AT 760 MM HG)

VAPOR PRESSURE (MMHG): N/A

MELTING POINT: -25 C (-13 F) (AT 760 MM HG)

VAPOR DENSITY (AIR=1): 1.3

SPECIFIC GRAVITY: 1.18 (H2O=1)

EVAPORATION RATE: N/A

SOLUBILITY(H20): COMPLETE (100%) (21 C)

% VOLATILES BY VOLUME: 100

PH: 1.0 (0.1M SOLUTION)

ODOR THRESHOLD (P.P.M.): N/A

PHYSICAL STATE: LIQUID

COEFFICIENT WATER/OIL DISTRIBUTION: N/A

APPEARANCE & ODOR: CLEAR, COLORLESS FUMING LIQUID. PUNGENT ODOR.

(FHAZ) Fire Hazards:

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP): N/A

NFPA 704M RATING: 3-0-0

AUTOIGNITION TEMPERATURE: N/A

FLAMMABLE LIMITS: UPPER - N/A LOWER - N/A

EXTINQUISHING MEDIA

USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE.

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL. DO NOT GET WATER INSIDE CONTAINERS.

UNUSUAL FIRE & EXPLOSION HAZARDS

MAY EMIT HYDROGEN GAS UPON CONTACT WITH METAL.

TOXIC GASES PRODUCED

HYDROGEN CHLORIDE, HYDROGEN

EXPLOSION DATA-SENSITIVITY TO MECHANICAL IMPACT

NONE IDENTIFIED.

EXPLOSION DATA-SENSITIVITY TO STATIC DISCHARGE

NONE IDENTIFIED.

(HAZH) Health Hazards:

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV/TWA): 7 MG/M3 (5 PPM)

TLV (CEILING) IS FOR HYDROGEN CHLORIDE.

SHORT-TERM EXPOSURE LIMIT (STEL): NOT ESTABLISHED

PERMISSIBLE EXPOSURE LIMIT (PEL): 7 MG/M3 (5 PPM)

PEL (CEILING) IS FOR HYDROGEN CHLORIDE.

TOXICITY OF COMPONENTS

INTRAPERITONEAL MOUSE LD50 FOR HYDROCHLORIC ACID 40 MG/KG
L RABBIT LD50 FOR HYDROCHLORIC ACID 900 MG/KG
LATION-1HR RAT LC50 FOR HYDROCHLORIC ACID 3124 PPM
INTRAPERITONEAL MOUSE LD50 FOR WATER 190 G/KG
INTRAVENOUS MOUSE LD50 FOR WATER 25 G/KG
CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

CARCINOGENICITY

NONE IDENTIFIED.

F RODUCTIVE EFFECTS

NONE IDENTIFIED.

EFFECTS OF OVEREXPOSURE

INHALATION: PULMONARY EDEMA, CIRCULATORY FAILURE, RESPIRATORY SYSTEM DAMAGE, COLLAPSE, COUGHING, DIFFICULT BREATHING

SKIN CONTACT: SEVERE BURNS

EYE CONTACT: SEVERE BURNS

SKIN ABSORPTION: NONE IDENTIFIED

INGESTION: IS HARMFUL AND MAY BE FATAL, SEVERE BURNS TO MOUTH, THROAT, AND STOMACH, NAUSEA, VOMITING

CHRONIC EFFECTS: MAY CAUSE TEETH DAMAGE

TARGET ORGANS

RESPIRATORY SYSTEM, EYES, SKIN

M DICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

NONE IDENTIFIED

PRIMARY ROUTES OF ENTRY

INGESTION, INHALATION, SKIN CONTACT, EYE CONTACT

(AID) First Aid:

EMERGENCY AND FIRST AID PROCEDURES

INGESTION: CALL A PHYSICIAN. IF SWALLOWED, DO NOT INDUCE VOMITING. IF CONSCIOUS, GIVE WATER, MILK, OR MILK OF MAGNESIA.

INHALATION: IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

SKIN CONTACT: IN CASE OF CONTACT, IMMEDIATELY FLUSH SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. WASH CLOTHING BEFORE RE-USE.

EYE CONTACT: IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.

(REGS) Regulations:

SARA/TITLE III HAZARD CATEGORIES AND LISTS

ACUTE: YES CHRONIC: YES FLAMMABILITY: NO PRESSURE: NO REACTIVITY: NO

EXTREMELY HAZARDOUS SUBSTANCE: YES CONTAINS HYDROGEN CHLORIDE (RQ = 1 LB, T = 500 LBS)
CERCLA HAZARDOUS SUBSTANCE: YES CONTAINS HYDROCHLORIC ACID (RQ = 5000 LBS)
SARA 313 TOXIC CHEMICALS: YES CONTAINS HYDROCHLORIC ACID
GENERIC CLASS: GENERIC CLASS REMOVED FROM CFR: 7/1/91
TSCA INVENTORY: YES

(HAZR) Hazardous Reactions:

SECTION VI - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: HEAT, MOISTURE

INCOMPATIBLES: MOST COMMON METALS, WATER, AMINES, METAL OXIDES, ACETIC ANHYDRIDE, PROPIOLACTONE, VINYL ACETATE, MERCURIC SULFATE, CALCIUM PHOSPHIDE, FORMALDEHYDE, ALKALIES, CARBONATES, STRONG BASES, SULFURIC ACID, CHLOROSULFONIC ACID

DECOMPOSITION PRODUCTS: HYDROGEN CHLORIDE, HYDROGEN, CHLORINE

(SPIL) Spillage Disposal:

SECTION VII - SPILL & DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE

WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. STOP LEAK IF YOU CAN DO SO WITHOUT RISK. VENTILATE AREA. NEUTRALIZE SPILL WITH SODA ASH OR LIME. WITH CLEAN SHOVEL, CAREFULLY PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER; REMOVE FROM AREA. FLUSH SPILL AREA WITH WATER.

J. T. BAKER NEUTRASORB(R) OR TEAM(R) 'LOW NA+' ACID NEUTRALIZERS ARE FOR SPILLS OF THIS PRODUCT.

DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: D002 (CORROSIVE WASTE)

(EQP) Protective Equipment:

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SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT
==========

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 100 PPM, A CHEMICAL CARTRIDGE RESPIRATOR WITH ACID CARTRIDGE IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM,PROTECTIVE SUIT, NEOPRENE GLOVES ARE RECOMMENDED.

(STOR) Storage Procedures:

==========
SECTION IX - STORAGE AND HANDLING PRECAUTIONS
==========

S -T-DATA* STORAGE COLOR CODE: WHITE (CORROSIVE)

STORAGE REQUIREMENTS

KEEP CONTAINER TIGHTLY CLOSED. STORE IN CORROSION-PROOF AREA. ISOLATE FROM INCOMPATIBLE MATERIALS. DO NOT STORE NEAR OXIDIZING MATERIALS.

(TRAN) Transportation Information:

==========
SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION
==========

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME: HYDROCHLORIC ACID, SOLUTION
HAZARD CLASS: 8 (CORROSIVE MATERIAL)
UN/NA: UN1789 REPORTABLE QUANTITY: 5000 LBS. PACKAGING GROUP: II
LABELS: CORROSIVE
REGULATORY REFERENCES: 49CFR 172.101

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME: HYDROCHLORIC ACID, SOLUTION
HAZARD CLASS: 8 I.M.O. PAGE: 8183
UN: UN1789 MARINE POLLUTANTS: NO PACKAGING GROUP: II

LABELS: CORROSIVE
REGULATORY REFERENCES: 49CFR 172.102; PART 176; IMO

IP (I.C.A.O.)

PROPER SHIPPING NAME: HYDROCHLORIC ACID, SOLUTION
HAZARD CLASS: 8
UN: UN1789 PACKAGING GROUP: II
LABELS: CORROSIVE
REGULATORY REFERENCES: 49CFR 172.101; 173.6; PART 175; ICAO/IATA= = = WE BELIEVE THE TRANSPORTATION DATA AND REFERENCES CONTAINED HEREIN TO BE FACTUAL AND THE OPINION OF QUALIFIED EXPERTS. THE DATA IS MEANT AS A GUIDE TO THE OVERALL CLASSIFICATION OF THE PRODUCT AND IS NOT PACKAGE SIZE SPECIFIC, NOR SHOULD IT BE TAKEN AS A WARRANTY OR REPRESENTATION FOR WHICH THE COMPANY ASSUMES LEGAL RESPONSIBILITY.= = = THE INFORMATION IS OFFERED SOLELY FOR YOUR CONSIDERATION, INVESTIGATION, AND VERIFICATION. ANY USE OF THE INFORMATION MUST BE DETERMINED BY THE USER TO BE IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS. SEE SHIPPER REQUIREMENTS 49CFR 172.3 AND EMPLOYEE TRAINING 49CFR 173.1.

U.S. CUSTOMS HARMONIZATION NUMBER: 28061000000

N/A = NOT APPLICABLE OR NOT AVAILABLE
N/E = NOT ESTABLISHED

(DISC) Disclaimer:

THE INFORMATION IN THIS MATERIAL SAFETY DATA SHEET MEETS THE REQUIREMENTS OF THE UNITED STATES OCCUPATIONAL SAFETY AND HEALTH ACT AND REGULATIONS PROMULGATED THEREUNDER (29 CFR 1910.1200 ET. SEQ.) AND THE CANADIAN WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM. THIS DOCUMENT IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PERSON TRAINED IN, OR SUPERVISED BY A PERSON TRAINED IN, CHEMICAL HANDLING. THE USER IS RESPONSIBLE FOR DETERMINING THE PRECAUTIONS AND DANGERS OF THIS CHEMICAL FOR HIS OR HER PARTICULAR APPLICATION. DEPENDING ON USAGE, PROTECTIVE CLOTHING INCLUDING EYE AND FACE GUARDS AND RESPIRATORS MUST BE USED TO AVOID CONTACT WITH MATERIAL OR BREATHING CHEMICAL VAPORS/FUMES.
EXPOSURE TO THIS PRODUCT MAY HAVE SERIOUS ADVERSE HEALTH EFFECTS. THIS CHEMICAL MAY INTERACT WITH OTHER SUBSTANCES. SINCE THE POTENTIAL USES ARE SO VARIED, BAKER CANNOT WARN OF ALL OF THE POTENTIAL DANGERS OF USE OR INTERACTION WITH OTHER CHEMICALS OR MATERIALS. BAKER WARRANTS THAT THE CHEMICAL MEETS THE SPECIFICATIONS SET FORTH ON THE LABEL.
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THE USER SHOULD RECOGNIZE THAT THIS PRODUCT CAN CAUSE SEVERE INJURY AND EVEN DEATH, ESPECIALLY IF IMPROPERLY HANDLED OR THE KNOWN DANGERS OF USE NOT HEEDED. READ ALL PRECAUTIONARY INFORMATION. AS NEW DOCUMENTED GENERAL SAFETY INFORMATION BECOMES AVAILABLE, BAKER WILL PERIODICALLY REVISE THIS MATERIAL SAFETY DATA SHEET.
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A SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT INVOLVING CHEMICALS. ALL NON-EMERGENCY QUESTIONS SHOULD BE DIRECTED TO CUSTOMER SERVICE (1-800-JTBAKER) FOR ASSISTANCE.

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APPROVED BY QUALITY ASSURANCE DEPARTMENT.

Option?

type 1/2

1 Entry: 1

BAKER Accession Number 11170

(MID) Material Identification:

N3660 M06 NITRIC ACID
EFFECTIVE: 05/04/92 ISSUED: 04/03/93

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SECTION I - PRODUCT IDENTIFICATION

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PRODUCT NAME: NITRIC ACID
COMMON SYNONYMS: HYDROGEN NITRATE; AZOTIC ACID
CHEMICAL FAMILY: INORGANIC ACIDS
FORMULA: HNO3
FORMULA WT.: 63.01
CAS NO.: 7697-37-2
NIOSH/RTECS NO.: QU5775000
PRODUCT USE: LABORATORY REAGENT
PRODUCT CODES: 5555,9597,6901,5801,9605,5113,4801,9601,9600,9598,9602,9604
5371,9616,9606

AZ) Primary Hazards:

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PRECAUTIONARY LABELING

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BAKER SAF-T-DATA* SYSTEM

HEALTH - 3 SEVERE (POISON)
FLAMMABILITY - 0 NONE
REACTIVITY - 3 SEVERE (OXIDIZER)
CONTACT - 4 EXTREME (CORROSIVE)

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

U.S. PRECAUTIONARY LABELING

POISON DANGER

SPILLAGE MAY CAUSE FIRE OR LIBERATE DANGEROUS GAS. HARMFUL IF INHALED AND MA
CAUSE DELAYED LUNG INJURY. STRONG OXIDIZER. CONTACT WITH COMBUSTIBLE
MATERIALS, FLAMMABLE MATERIALS, OR POWDERED METALS CAN CAUSE FIRE OR
EXPLOSION. LIQUID AND VAPOR CAUSE SEVERE BURNS. MAY BE FATAL IF SWALLOWED OR
INHALED.
KEEP FROM CONTACT WITH CLOTHING AND OTHER COMBUSTIBLE MATERIALS. DO NOT ST
NEAR COMBUSTIBLE MATERIALS. DO NOT GET IN EYES, ON SKIN, ON CLOTHING. DO NOT
BREATHE VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH ADEQUATE
VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE, USE WATER

SPRAY. IN CASE OF SPILL, NEUTRALIZE WITH SODA ASH OR LIME.

INTERNATIONAL LABELING

CAUSES SEVERE BURNS.
KEEP OUT OF REACH OF CHILDREN. DO NOT BREATHE VAPOUR. IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE. TAKE OF IMMEDIATELY ALL CONTAMINATED CLOTHING.

SAF-T-DATA* STORAGE COLOR CODE: YELLOW (REACTIVE)

(COMP) Components:

SECTION II - COMPONENTS

COMPONENT	CAS NO.	WEIGHT %	OSHA/PEL	ACGIH/TLV
NITRIC ACID	7697-37-2	65-71	2 PPM	2 PPM
WATER	7732-18-5	29-35	N/E	N/E

(PHYS) Physical Properties:

SECTION III - PHYSICAL DATA

BOILING POINT: 121 C (249 F) (AT 760 MM HG)

VAPOR PRESSURE (MMHG): 9 (20 C)

MELTING POINT: -42 C (-43 F) (AT 760 MM HG)

VAPOR DENSITY (AIR=1): N/A

SPECIFIC GRAVITY: 1.41 (H_2O=1)

EVAPORATION RATE: N/A

SOLUBILITY(H20): COMPLETE (100%) (21 C)

% VOLATILES BY VOLUME: 100

PH: 1.0 (0.1M SOLUTION)

ODOR THRESHOLD (P.P.M.): N/A

PHYSICAL STATE: LIQUID

COEFFICIENT WATER/OIL DISTRIBUTION: N/A

APPEARANCE & ODOR: CLEAR, COLORLESS LIQUID. SUFFOCATING ODOR.

(FIRE) Fire Hazards:

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP): N/A NFPA 704M RATING: 3-0-0 OXY

AUTOIGNITION TEMPERATURE: N/A

FLAMMABLE LIMITS: UPPER - N/A LOWER - N/A

FIRE EXTINQUISHING MEDIA

USE WATER SPRAY.

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE EXPOSED CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL; DO NOT GET WATER INSIDE CONTAINERS.

UNUSUAL FIRE & EXPLOSION HAZARDS

STRONG OXIDIZER. CONTACT WITH COMBUSTIBLE MATERIALS, FLAMMABLE MATERIALS, OR POWDERED METALS CAN CAUSE FIRE OR EXPLOSION. REACTS WITH MOST METALS TO PRODUCE HYDROGEN GAS, WHICH CAN FORM AN EXPLOSIVE MIXTURE WITH AIR. A VIOLENT EXOTHERMIC REACTION OCCURS WITH WATER. SUFFICIENT HEAT MAY BE PRODUCED TO IGNITE COMBUSTIBLE MATERIALS.

TOXIC GASES PRODUCED

OXIDES OF NITROGEN, HYDROGEN

EXPLOSION DATA-SENSITIVITY TO MECHANICAL IMPACT

NONE IDENTIFIED.

EXPLOSION DATA-SENSITIVITY TO STATIC DISCHARGE

NONE IDENTIFIED.

(HAZH) Health Hazards:

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SECTION V - HEALTH HAZARD DATA

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THRESHOLD LIMIT VALUE (TLV/TWA): 5 MG/M3 (2 PPM)

SHORT-TERM EXPOSURE LIMIT (STEL): 10 MG/M3 (4 PPM)

PERMISSIBLE EXPOSURE LIMIT (PEL): 5 MG/M3 (2 PPM)

TOXICITY OF COMPONENTS

INHALATION-1HR RAT LC50 FOR NITRIC ACID 2500 PPM
INTRAPERITONEAL MOUSE LD50 FOR WATER 190 G/KG
INTRAVENOUS MOUSE LD50 FOR WATER 25 G/KG
CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

CARCINOGENICITY

NONE IDENTIFIED.

REPRODUCTIVE EFFECTS

NONE IDENTIFIED.

EFFECTS OF OVEREXPOSURE

INHALATION: SEVERE IRRITATION OR BURNS OF RESPIRATORY SYSTEM, COUGHING, DIFFICULT BREATHING, CHEST PAINS, PULMONARY EDEMA, LUNG INFLAMMATION, UNCONSCIOUSNESS, AND MAY BE FATAL

SKIN CONTACT: SEVERE IRRITATION OR BURNS

EYE CONTACT: SEVERE IRRITATION OR BURNS

SKIN ABSORPTION: NONE IDENTIFIED

INGESTION: NAUSEA, VOMITING, SEVERE BURNS, ULCERATION - MOUTH, THROAT, STOMACH, AND MAY BE FATAL

CHRONIC EFFECTS: DAMAGE TO LUNGS, TEETH

TARGET ORGANS

YES, SKIN, MUCOUS MEMBRANES, RESPIRATORY SYSTEM, LUNGS, TEETH, GI TRACT

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

DAMAGED SKIN, EYE DISORDERS, CARDIOPULMONARY DISEASE, LUNG DISEASE

PRIMARY ROUTES OF ENTRY

INHALATION, INGESTION, EYE CONTACT, SKIN CONTACT

(AID) First Aid:

EMERGENCY AND FIRST AID PROCEDURES

INGESTION: CALL A PHYSICIAN. IF SWALLOWED, DO NOT INDUCE VOMITING. IF CONSCIOUS, GIVE WATER, MILK, OR MILK OF MAGNESIA.

INHALATION: IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

SKIN CONTACT: IN CASE OF CONTACT, IMMEDIATELY FLUSH SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. WASH CLOTHING BEFORE RE-USE.

EYE CONTACT: IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.

(REGS) Regulations:

SARA/TITLE III HAZARD CATEGORIES AND LISTS

ACUTE: YES CHRONIC: YES FLAMMABILITY: YES PRESSURE: NO REACTIVITY: NO

EXTREMELY HAZARDOUS SUBSTANCE: YES CONTAINS NITRIC ACID (RQ = 1,000 LBS, TPQ = 1,000 LBS)
CERCLA HAZARDOUS SUBSTANCE: YES CONTAINS NITRIC ACID (RQ = 1000 LBS)
SARA 313 TOXIC CHEMICALS: YES CONTAINS NITRIC ACID
GENERIC CLASS: GENERIC CLASS REMOVED FROM CFR: 7/1/91
TSCA INVENTORY: YES

(HAZR) Hazardous Reactions:

SECTION VI - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: HEAT, LIGHT, MOISTURE

INCOMPATIBLES: STRONG BASES, CARBONATES, SULFIDES, CYANIDES, COMBUSTIBLE MATERIALS, ORGANIC MATERIALS, STRONG REDUCING AGENTS, MOST COMMON METALS, POWDERED METALS, CARBIDES, AMMONIUM HYDROXIDE, WATER, ALCOHOLS

DECOMPOSITION PRODUCTS: OXIDES OF NITROGEN, HYDROGEN

(SPIL) Spillage Disposal:

SECTION VII - SPILL & DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE

WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. STOP LEAK IF YOU CAN DO SO WITHOUT RISK. VENTILATE AREA. NEUTRALIZE SPILL WITH SODA ASH OR LIME. WITH CLEAN SHOVEL, CAREFULLY PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER; REMOVE FROM AREA. FLUSH SPILL AREA WITH WATER.
KEEP COMBUSTIBLES (WOOD, PAPER, OIL, ETC.) AWAY FROM SPILLED MATERIAL.

BAKER NEUTRASORB(R) OR TEAM(R) 'LOW NA+' ACID NEUTRALIZERS ARE FOR SPILLS OF THIS PRODUCT.

DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: D001, D002 (IGNITABLE, CORROSIVE WASTE)

(EQP) Protective Equipment:

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 100 PPM, A CHEMICAL CARTRIDGE RESPIRATOR WITH ACID CARTRIDGE IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM,PROTECTIVE SUIT, NEOPRENE GLOVES ARE RECOMMENDED.

(STOR) Storage Procedures:

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA* STORAGE COLOR CODE: YELLOW (REACTIVE)

STORAGE REQUIREMENTS

KEEP CONTAINER TIGHTLY CLOSED. STORE SEPARATELY AND AWAY FROM FLAMMABLE AND COMBUSTIBLE MATERIALS. ISOLATE FROM INCOMPATIBLE MATERIALS. KEEP PRODUCT OUT OF LIGHT.

(TRAN) Transportation Information:

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME: NITRIC ACID (OTHER THAN RED FUMING WITH MORE THAN 70 PERCENT NITRIC ACID)
HAZARD CLASS: 8 (CORROSIVE MATERIAL)
NA: UN2031 REPORTABLE QUANTITY: 1000 LBS. PACKAGING GROUP: I
LABELS: CORROSIVE
REGULATORY REFERENCES: 49CFR 172.101

NTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME: NITRIC ACID (OTHER THAN RED FUMING, ALL CONCENTRATIONS)
HAZARD CLASS: 8 I.M.O. PAGE: 8195
UN: UN2031 MARINE POLLUTANTS: NO PACKAGING GROUP: I
LABELS: CORROSIVE
REGULATORY REFERENCES: 49CFR 172.102; PART 176; IMO

AIR (I.C.A.O.)

PROPER SHIPPING NAME: NITRIC ACID, OTHER THAN RED FUMING WITH MORE THAN 70 PERCENT NITRIC ACID
HAZARD CLASS: 8
UN: UN2031 PACKAGING GROUP: I
LABELS: CORROSIVE, (PASSENGER AIRCRAFT - FORBIDDEN)
REGULATORY REFERENCES: 49CFR 172.101; 173.6; PART 175; ICAO/IATA=== WE BELIEVE THE TRANSPORTATION DATA AND REFERENCES CONTAINED HEREIN TO BE FACTUAL AND THE OPINION OF QUALIFIED EXPERTS. THE DATA IS MEANT AS A GUIDE TO THE OVERALL CLASSIFICATION OF THE PRODUCT AND IS NOT PACKAGE SIZE SPECIFIC, NOR SHOULD IT BE TAKEN AS A WARRANTY OR REPRESENTATION FOR WHICH THE COMPANY ASSUMES LEGAL RESPONSIBILITY.=== THE INFORMATION IS OFFERED SOLELY FOR YOUR CONSIDERATION, INVESTIGATION, AND VERIFICATION. ANY USE OF THE INFORMATION MUST BE DETERMINED BY THE USER TO BE IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS. SEE SHIPPER REQUIREMENTS 49CFR 172.3 AND EMPLOYEE TRAINING 49CFR 173.1.

U.S. CUSTOMS HARMONIZATION NUMBER: 28080000000

N/A = NOT APPLICABLE OR NOT AVAILABLE
N/E = NOT ESTABLISHED

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APPROVED BY QUALITY ASSURANCE DEPARTMENT.

Option?

2-PROPANOL
2-PROPANOL
2-PROPANOL

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
1 REAGENT LANE
FAIR LAWN NJ 07410
(201) 796-7100

EMERGENCY NUMBER: (201) 796-7100
CHEMTREC ASSISTANCE: (800) 424-9300

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SUBSTANCE IDENTIFICATION

SUBSTANCE: **2-PROPANOL** CAS-NUMBER 67-63-0

TRADE NAMES/SYNONYMS:
ISOPROPANOL; LUTOSOL; PETROHOL; DIMETHYLCARBINOL; IPA; AVANTIN; PROPAN-2-OL; ALCOSOLVE 2; AVANTINE; ISOPROPYL ALCOHOL; ALCOJEL; ISOHOL; N-PROPAN-2-OL, SEC-PROPYL ALCOHOL; PRO; STCC 4909205; UN 1219;
A415; A416; A417; A426; A419; A432; A451; A519; A520; A451SK; A416SK;
A426P; A464; A516; C3H8O; ACC12090

CHEMICAL FAMILY:
Hydroxyl, aliphatic

MOLECULAR FORMULA: C3-H8-O

MOLECULAR WEIGHT: 60.11

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=0 PERSISTENCE=0
NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=3 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: 2-PROPANOL PERCENT: 100
CAS# 67-63-0

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
ISOPROPYL ALCOHOL (ISOPROPANOL; 2-PROPANOL):
400 ppm (983 mg/m3) OSHA TWA; 500 ppm (1230 mg/m3) OSHA STEL
400 ppm (983 mg/m3) ACGIH TWA; 500 ppm (1230 mg/m3) ACGIH STEL
400 ppm (983 mg/m3) NIOSH recommended TWA;
500 ppm (1230 mg/m3) NIOSH recommended STEL
400 ppm (983 mg/m3) DFG MAK TWA;
800 ppm (1966 mg/m3) DFG MAK 30 minute peak, average value, 4 times/shift

Measurement method: Charcoal tube; 2-butanol/carbon disulfide; gas chromatography with flame ionization detection; (NIOSH Vol. III # 1400, Alcohols I).

Subject to SARA Section 313 Annual Toxic Chemical Release Reporting (only persons who manufacture by the strong acid process are subject, supplier notification not required.)

OSHA revoked the final rule limits of January 19, 1989 in response to the 11th Circuit Court of Appeals decision (AFL-CIO v. OSHA) effective June 30, 1993. See 29 CFR 1910.1000 (58 FR 35338)

PHYSICAL DATA

DESCRIPTION: Transparent, colorless, mobile liquid with a characteristic mild alcoholic odor and a slightly bitter taste. BOILING POINT: 180 F (82 C)

MELTING POINT: -129 F (-89 C) SPECIFIC GRAVITY: 0.785 VOLATILITY: 100%

VAPOR PRESSURE: 40 mmHg @ 23.8 C EVAPORATION RATE: (butyl acetate=1) 2.88

SOLUBILITY IN WATER: soluble ODOR THRESHOLD: 50 ppm VAPOR DENSITY: 2.1

SOLVENT SOLUBILITY: Soluble in ethanol, ether, chloroform, acetone, benzene; insoluble in salt solutions.

VISCOSITY: 2.1 cP @ 25 C

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
Dangerous fire hazard when exposed to heat or flame

Vapors are heavier than air and may travel a considerable distance to a source of ignition and flash back.

Vapor-air mixtures are explosive above flash point.

FLASH POINT: 53 F (12 C) (CC) UPPER EXPLOSIVE LIMIT 12.7% @ 93 C

LOWER EXPLOSIVE LIMIT: 2.0% AUTOIGNITION TEMP.: 750 F (399 C)

FLAMMABILITY CLASS(OSHA): IB

FIREFIGHTING MEDIA:
Dry chemical, carbon dioxide, water spray or alcohol-resistant foam (1990 Emergency Response Guidebook, DOT P 5800.5).

For larger fires, use water spray, fog or alcohol-resistant foam (1990 Emergency Response Guidebook, DOT P 5800.5)

Alcohol foam
(NFPA 325M, Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids, 1991).

FIREFIGHTING:
Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles. If this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire. Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire (1990 Emergency Response Guidebook, DOT P 5800.5, Guide Page 26)

Extinguish only if flow can be stopped; use water in flooding amounts as fog, solid streams may not be effective. Cool containers with flooding quantities of water, apply from as far a distance as possible. Avoid breathing toxic vapors, keep upwind.

Water may be ineffective (NFPA 325M, Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids, 1991)

TRANSPORTATION DATA

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER, 49 CFR 172.101
Isopropyl alcohol-UN 1219

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION, 49 CFR 172.101
3 - Flammable liquid

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP, 49 CFR 172.101
PG II

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS, 49 CFR 172.101 AND SUBPART E:
Flammable liquid

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS:
EXCEPTIONS: 49 CFR 173.150
NON-BULK PACKAGING: 49 CFR 173.202
BULK PACKAGING: 49 CFR 173.242

U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS 49 CFR 172.101
PASSENGER AIRCRAFT OR RAILCAR: 5 l
CARGO AIRCRAFT ONLY: 60 l

TOXICITY

ISOPROPYL ALCOHOL (ISOPROPANOL; 2-PROPANOL)
IRRITATION DATA: 500 mg skin-rabbit mild, 100 mg/eye-rabbit severe, 10 mg eye-rabbit moderate; 100 mg/24 hours eye-rabbit moderate
TOXICITY DATA: 16,000 ppm/4 hours inhalation-rat LCLo, 12,800 ppm/3 hours inhalation-mouse LCLo; 12,800 mg/kg skin-rabbit LD50, 5272 mg/kg oral-man LDLo; 14,432 mg/kg oral-man TDLo; 3570 mg/kg oral-human LDLo, 223 mg/kg oral-human TDLo; 5045 mg/kg oral-rat LD50; 3600 mg/kg oral-mouse LD50, 6410 mg/kg oral-rabbit LD50; 1537 mg/kg oral-dog LDLo; 6 gm/kg subcutaneous-mammal LDLo; 6 gm/kg subcutaneous-mouse LDLo, 1088 mg/kg intravenous-rat LD50, 1509 mg/kg intravenous-mouse LD50, 1184 mg/kg intravenous-rabbit LD50; 1963 mg/kg intravenous-cat LDLo, 1024 mg/kg intravenous-dog LDLo; 2735 mg/kg intraperitoneal-rat LD50, 4477 mg/kg intraperitoneal-mouse LD50; 667 mg/kg intraperitoneal-rabbit LD50, 2560 mg/kg intraperitoneal-guinea pig LD50; 3444 mg/kg intraperitoneal-hamster LD50; 2770 mg/kg unreported-man LDLo, mutagenic data (RTECS); reproductive effects data (RTECS)

(IARC GROUP-3). Strong acid manufacturing process: Human Sufficient Evidence (IARC Group 1). Workers involved in the manufacture of isopropyl alcohol by the strong-acid process, involving the formation of isopropyl oils, showed an increase in paranasal and laryngeal cancer.
LOCAL EFFECTS: Irritant- inhalation, eye.
ACUTE TOXICITY LEVEL: Slightly toxic by ingestion, dermal absorption.
TARGET EFFECTS: Central nervous system depressant.
AT INCREASED RISK FROM EXPOSURE: Persons with pre-existing skin disorders, impaired liver, renal and/or pulmonary function.
ADDITIONAL DATA: Potentiates the effect of carbon tetrachloride and other hepatotoxic chlorinated aliphatic hydrocarbons

HEALTH EFFECTS AND FIRST AID

INHALATION:
ISOPROPYL ALCOHOL (ISOPROPANOL; 2-PROPANOL):
IRRITANT/NARCOTIC. 12,000 ppm Immediately Dangerous to Life or Health
ACUTE EXPOSURE- Human subjects exposed to 400 ppm for 3-5 minutes had mild irritation of the nose and throat. At 800 ppm the irritation was not severe but uncomfortable. Higher concentrations may cause effects as detailed in acute ingestion. The length of time required to produce deep narcosis in animals was inversely proportional to the concentration: The onset of deep narcosis ranged from 460 minutes at 3250 ppm to 100 minutes at 24,500 ppm.
CHRONIC EXPOSURE- Mice subjected to 10900 ppm isopropyl alcohol in air for about 4 hours/day until they had accumulated 123 hours of exposure were narcotized but survived. Reversible fatty changes were observed in the liver. Male mice exposed to either 1000 or 5000 ppm of isopropyl alcohol vapor for 6 hours a day for 9 exposures exhibited hyaline droplet nephropathy. Reproductive effects have been reported in animals. There has been an increased incidence of cancer of the paranasal sinuses, and possibly of the larynx, in the manufacture of isopropyl alcohol by the strong acid process, involving the formation of isopropyl oils. It is not clear which substances are responsible.

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:
ISOPROPYL ALCOHOL (ISOPROPANOL; 2-PROPANOL):
NARCOTIC.
ACUTE EXPOSURE- Contact with the skin may cause slight irritation. Contact dermatitis has been reported in a few sensitive individuals. Substance may be dermally absorbed resulting in systemic toxicity as detailed in acute ingestion. Toxic effects may become more marked if absorption and inhalation occur concurrently.
CHRONIC EXPOSURE- Repeated or prolonged exposure may cause dermatitis due to the defatting action on the skin. Repeated and prolonged exposure to the skin of rabbits caused slight erythema, drying, and superficial desquamation.

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:
ISOPROPYL ALCOHOL (ISOPROPANOL; 2-PROPANOL):
IRRITANT.
ACUTE EXPOSURE- 400-800 ppm may cause irritation. In rabbit eyes, a drop caused mild transitory injury and a 50% aqueous solution after 3 minutes caused moderate irritation. Contact with a 70% solution caused conjunctivitis, iritis, and corneal opacity.
CHRONIC EXPOSURE- Prolonged or repeated exposure to vapors may cause conjunctivitis.

FIRST AID- Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:
ISOPROPYL ALCOHOL (ISOPROPANOL; 2-PROPANOL):
NARCOTIC.
ACUTE EXPOSURE- Ingestion may cause abdominal pain, hematemesis, nausea, vomiting, and hemorrhage. Central nervous system depression may occur with headache, dizziness, flushing, incoordination, stupor, confusion, hypotension, areflexia, and refractory narcosis. Oliguria followed by diuresis and coma may also occur. Other symptoms may include hypoglycemia, tenderness and edema of muscles, and arrhythmias. Vomiting with aspiration may cause aspiration pneumonia. Depressed respiration and death due to respiratory paralysis may occur in a few hours after exposure. Severe and prolonged shock may lead to serious or fatal renal damage after several days. Pathologic findings have included extensive hemorrhagic tracheobronchitis, bronchopneumonia and hemorrhagic pulmonary edema.
CHRONIC EXPOSURE- No adverse effects resulted in humans following daily ingestion of 2.6 and 6.4 mg/kg for 6 weeks. Rats that ingested 0.5 to 10.0% isopropyl alcohol in drinking water for 27 weeks showed decreased

body weight. Prolonged oral administration in rabbits produced anesthesia and death. Reproductive effects have been reported in animals

FIRST AID- In respiratory depression, give oxygen by artificial respiration. Give activated charcoal. Gastric lavage with protected airway is useful even if delayed. Do not attempt emesis if respiration is depressed. Maintain blood pressure. Treatment should be administered by qualified medical personnel (Dreisbach, Handbook of Poisoning, 12th Ed.). Get medical attention

ANTIDOTE:
No specific antidote. Treat symptomatically and supportively

REACTIVITY

REACTIVITY:
ISOPROPYL ALCOHOL (ISOPROPANOL; 2-PROPANOL):
Stable under normal temperatures and pressures. May slowly peroxidise on exposure to air under normal storage conditions. An explosion hazard may exist if the substance is distilled or allowed to evaporate to dryness

INCOMPATIBILITIES:
ISOPROPYL ALCOHOL (ISOPROPANOL; 2-PROPANOL).
ACIDS: Incompatible.
ACIDS ANHYDRIDES: Incompatible.
ALUMINUM: Dissolution is exothermic.
BARIUM PERCHLORATE: Formation of explosive compound
2-BUTANONE (METHYL ETHYL KETONE): Accelerates the peroxidation of the alcohol.
CHROMIUM TRIOXIDE (GRANULAR): Ignition.
COATINGS: May be attacked.
DIOXYGENYL TETRAFLUOROBORATE: Ignition at ambient temperatures.
HALOGENS: Incompatible.
HYDROGEN + PALLADIUM (PARTICLES): Ignition on exposure to air
HYDROGEN PEROXIDE: Formation of explosive compound.
KETONES: Markedly increases the possibility of peroxidation.
NITROFORM (TRINITROMETHANE): Dissolves liberating heat and possibly exploding.
OLEUM: Temperature and pressure increase in closed container
OXIDIZERS (STRONG): Fire and explosion hazard.
OXYGEN (GAS): Autoxidation, on exposure to light, results in formation of ketones and potentially explosive hydrogen peroxide.
PHOSGENE: In the presence of iron salts, may explode.
PLASTICS: May be attacked.
POTASSIUM TERT-BUTOXIDE: Ignition.
RUBBER: May be attacked.
SODIUM DICHROMATE + SULFURIC ACID: Exothermic reaction with possible incandescence.
See also alcohols.

DECOMPOSITION:
Thermal decomposition products may include toxic oxides of carbon.

POLYMERIZATION:
Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

STORAGE AND DISPOSAL

Observe all federal, state and local regulations when storing or disposing of this substance.

Storage

Preserve in tight containers, remote from heat (U.S. Pharmacopeia, national formulary, 1985).

Store in accordance with 29 CFR 1910.106.

Bonding and grounding: Substances with low electroconductivity, which may be ignited by electrostatic sparks, should be stored in containers which meet the bonding and grounding guidelines specified in NFPA 77 1983 Recommended Practice on Static Electricity.

Store away from incompatible substances.

Disposal

Disposal must be in accordance with standards applicable to generators of hazardous waste, 40 CFR 262. EPA Hazardous Waste Number D001
100 pound CERCLA Section 103 Reportable Quantity

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CONDITIONS TO AVOID

Avoid contact with heat, sparks, flames, or other sources of ignition. Vapors

may be explosive and poisonous, do not allow unnecessary personnel in area. Do not overheat containers; containers may violently rupture and travel a considerable distance in heat of fire.

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SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:
Shut off ignition sources. Stop leak if you can do it without risk. Use water spray to reduce vapors. For small spills, take up with sand or other absorbent material and place into containers for later disposal. For larger spills, dike far ahead of spill for later disposal. No smoking, flames or flares in hazard area. Keep unnecessary people away; isolate hazard area and deny entry.

PROTECTIVE EQUIPMENT

VENTILATION:
Provide general dilution ventilation to meet published exposure limits. Ventilation equipment must be explosion-proof.

RESPIRATOR:
The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH Pocket Guide to Chemical Hazards, NIOSH criteria documents or by the U.S. Department of Labor, 29 CFR 1910 Subpart Z.
The specific respirator selected must be based on contamination levels found in the work place, must not exceed the working limits of the respirator and be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

ISOPROPYL ALCOHOL:

1000 ppm- Any powered, air-purifying respirator with organic vapor cartridge(s).
Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).

10,000 ppm- Any supplied-air respirator operated in a continuous flow mode.

12,000 ppm- Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister.
Any self-contained breathing apparatus with a full facepiece.
Any supplied-air respirator with a full facepiece.

Escape- Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister.
Any appropriate escape-type, self contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

CLOTHING:
Employee must wear appropriate protective (impervious) clothing and equipment to prevent repeated or prolonged skin contact with this substance.

GLOVES:
Employee must wear appropriate protective gloves to prevent contact with this substance.

EYE PROTECTION:
Employee must wear splash-proof or dust-resistant safety goggles to prevent eye contact with this substance.

Emergency eye wash: Where there is any possibility that an employee's eyes may be exposed to this substance, the employer should provide an eye wash fountain within the immediate work area for emergency use.

AUTHORIZED - FISHER SCIENTIFIC, INC.
CREATION DATE: 02/26/85 REVISION DATE: 01/15/94

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SULFURIC ACID
SULFURIC ACID
SULFURIC ACID

MATERIAL SAFETY DATA SHEET

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SUBSTANCE IDENTIFICATION

SUBSTANCE: **SULFURIC ACID** CAS-NUMBER 7664-93-9

TRADE NAMES/SYNONYMS:
OIL OF VITRIOL; BOV, DIPPING ACID; VITRIOL BROWN OIL; HYDROGEN SULFATE; NORDHADSEN ACID; DIHYDROGEN SULFATE; SULPHURIC ACID; MATTING ACID; DITHIONIC ACID; STCC4930040; UN 1830; A300; A300C; A300SI; A300S; A298; A510; A468; SOA174; A484; SA170; SA176; A302; A305; H2O4S, ACC22350

CHEMICAL FAMILY:
Inorganic acid

MOLECULAR FORMULA: H2-S-O4

MOLECULAR WEIGHT: 98.07

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=2 PERSISTENCE=0
NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=0 REACTIVITY=2

COMPONENTS AND CONTAMINANTS

COMPONENT: SULFURIC ACID PERCENT: 70.0-100.0
CAS# 7664-93-9

COMPONENT: WATER PERCENT: 0-30.0

OTHER CONTAMINANTS: NONE.

EXPOSURE LIMITS:
SULFURIC ACID:
1 mg/m3 OSHA TWA
1 mg/m3 ACGIH TWA; 3 mg/m3 ACGIH STEL
1 mg/m3 NIOSH recommended TWA
1 mg/m3 DFG MAK TWA;
2 mg/m3 DFG MAK 5 minute peak, momentary value, 8 times/shift

Measurement method: Silica gel tube, sodium bicarbonate/sodium carbonate, ion chromatography; (NIOSH Vol. III # 7903, Inorganic Acids).

1000 pounds SARA Section 302 Threshold Planning Quantity
1000 pounds SARA Section 304 Reportable Quantity
1000 pounds CERCLA Section 103 Reportable Quantity
Subject to SARA Section 313 Annual Toxic Chemical Release Reporting

PHYSICAL DATA

DESCRIPTION: Odorless, clear, colorless, dense hygroscopic oily liquid with a marked acid taste when pure. BOILING POINT: 626 F (330 C)

MELTING POINT: 50 F (10 C) SPECIFIC GRAVITY: 1.84

VAPOR PRESSURE: 0.001 @ 20 C PH: 3 SOLUBILITY IN WATER: soluble

ODOR THRESHOLD: 1 mg/m3 (mist) VAPOR DENSITY: 3.4

SOLVENT SOLUBILITY: Decomposes in alcohol.

@ 340 C it decomposes into sulfur trioxide and water

FIRE AND EXPLOSION DATA

FIRE AND EXPLO HAZARD:
Negligible fire h when exposed to heat or flame.

Oxidizer: Oxidizers decompose, especially when heated, to yield oxygen or other gases which will increase the burning rate of combustible matter. Contact with easily oxidizable, organic, or other combustible materials may result in ignition, violent combustion or explosion.

FIREFIGHTING MEDIA:
Dry chemical or carbon dioxide
(1990 Emergency Response Guidebook, DOT P 5800.5).

For larger fires, flood area with water from a distance
(1990 Emergency Response Guidebook, DOT P 5800.5).

FIREFIGHTING:
Do not get water inside container. Do not get solid stream of water on spilled material. Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks (1990 Emergency Response Guidebook, DOT P 5800.5 Guide Page 39).

Use agent suitable for type of fire; use flooding amounts of water as a fog. Cool containers with flooding amounts of water, apply from as far a distance as possible. Avoid breathing corrosive vapors, keep upwind.

TRANSPORTATION DATA

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER, 49 CFR 172.101:
Corrosive liquid, n.o.s. (contains sulfuric acid)-UN 1760

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION, 49 CFR 172.101:
8 - Corrosive material

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP, 49 CFR 172.101:
PG II

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS, 49 CFR 172.101 AND SUBPART E:
Corrosive

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS:
EXCEPTIONS: None
NON-BULK PACKAGING: 49 CFR 173.202
BULK PACKAGING: 49 CFR 173.242

U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS 49 CFR 172.101:
PASSENGER AIRCRAFT OR RAILCAR: 1 l
CARGO AIRCRAFT ONLY: 30 l

TOXICITY

SULFURIC ACID:
IRRITATION DATA: 250 ug eye-rabbit severe; 5 mg/30 seconds rinsed eye-rabbit severe.
TOXICITY DATA: 3 mg/m3/24 weeks inhalation-human TCLo; 510 mg/m3/2 hours inhalation-rat LC50; 320 mg/m3/2 hours inhalation-mouse LC50; 18 mg/m3 inhalation-guinea pig LC50; 2 g/kg skin-rabbit LD50 2140 mg/kg (Olin MSDS); oral-rat LD50; 135 mg/kg oral-man LDLo (Kennecott MSDS); 135 mg/kg unreported-man LDLo; mutagenic data (RTECS); reproductive effects data (RTECS).
CARCINOGEN STATUS: None. Human Sufficient Evidence (IARC Group-1 for occupational exposure to strong-inorganic-acid mists containing sulfuric acid). Occupational exposure to strong-inorganic-acid mists containing sulfuric acid has produced an excess risk of nasal sinus, laryngeal, and lung cancer.
LOCAL EFFECTS: Corrosive- inhalation, skin, eye and ingestion.
ACUTE TOXICITY LEVEL: Highly toxic by inhalation; moderately toxic by ingestion; slightly toxic by dermal absorption.
TARGET EFFECTS: No data available.

HEALTH EFFECTS AND FIRST AID

INHALATION:
SULFURIC ACID:
CORROSIVE/HIGHLY TOXIC. 80 mg/m3 Immediately Dangerous to Life or Health.
ACUTE EXPOSURE- Inhalation of mists may cause mucous membrane irritation principally affecting the respiratory tract epithelium. Low concentrations, 0.35-5 mg/m3, may cause increased pulmonary air flow resistance and subsequent shallower and more rapid breathing. Hot concentrated mists may cause rapid loss of consciousness with possible damage to lung tissue. Vapors may cause nasal secretions, sneezing, a burning or tickling sensation in the nose and throat and retrosternal region, followed by cough, respiratory distress, tracheobronchitis, chemical pneumonitis and possible spasm of the vocal cords. High concentrations may produce bloody nasal secretions and sputum, hematemesis gastritis, and pulmonary edema. A single overexposure may lead to

in the face with sulfuric acid liquid experienced delayed symptoms of pulmonary fibrosis, residual bronchitis, and pulmonary emphysema. Vapors from dilute solutions may irritate mucous membranes. The lethal dose reported in rats is 510 mg/m3/2 hours.
CHRONIC EXPOSURE- Repeated exposure to the mist may cause inflammation of the upper respiratory tract, chronic bronchitis and etching of the dental enamel. The central and lateral incisors are primarily affected. Repeated excessive exposure over long periods of time have resulted in bronchitic symptoms, rhinorrhea, frequent respiratory tract infections, emphysema, stomatitis and digestive disturbances. Chronic inhalation may cause alkaline depletion of the body producing an acidosis which affects the nervous system and produces agitation, hesitant gait and generalized weakness. An epidemiological study of workers at a refinery and chemical plant suggests an increased risk of laryngeal cancer from exposure to high concentrations of sulfuric acid. Reproductive effects have been reported in animals.

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, give artificial respiration. Maintain airway and blood pressure and administer oxygen if available. Keep affected person warm and at rest. Treat symptomatically and supportively. Administration of oxygen should be performed by qualified personnel. Get medical attention immediately.

SKIN CONTACT:
SULFURIC ACID:
CORROSIVE.
ACUTE EXPOSURE- Contact with concentrated sulfuric acid may cause severe second and third degree skin burns with necrosis due to its affinity for water and subsequent severe dehydrating action, and its exothermic reaction with moisture. Possible charring may occur leading to shock and collapse depending on the amount of tissue involved. The resulting wounds may be long in healing and may cause extensive scarring that may result in functional inhibition. Contact with dilute solutions may cause skin irritation.
CHRONIC EXPOSURE- Repeated contact with low concentrations may cause skin desiccation and ulceration of the hands, and panaris or chronic purulent inflammation around the nails. Repeated contact with dilute solutions may cause dermatitis.

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). In case of chemical burns, cover area with sterile, dry dressing. Bandage securely, but not too tightly. Get medical attention immediately.

EYE CONTACT:
SULFURIC ACID:
CORROSIVE.
ACUTE EXPOSURE- Exposure to the vapors may cause a burning or stinging sensation in the eyes with lacrimation, blurred vision and conjunctival congestion. Splashes of acid in the eyes may produce deep corneal ulceration, kerato-conjunctivitis and palpebral lesions with severe sequelae. Irreparable corneal damage and blindness as well as scarring of the eyelids may occur. Severe sulfuric acid eye burns have included glaucoma and cataract as complications in the most severe cases. Contact with diluted acid may produce more transient effects from which recovery may be complete.
CHRONIC EXPOSURE- Repeated exposure may result in lacrimation and chronic conjunctivitis.

FIRST AID- Wash eyes immediately with large amounts of water, occasionally lifting upper and lower lids, until no evidence of chemical remains (at least 15-20 minutes). Continue irrigating with normal saline until the pH has returned to normal (30-60 minutes). Cover with sterile bandages. Get medical attention immediately.

INGESTION:
SULFURIC ACID:
CORROSIVE.
ACUTE EXPOSURE- Ingestion may cause burning pain in the mouth, throat, esophagus and abdomen, a sour taste and nausea followed by vomiting and diarrhea of charred black stomach contents. Dehydration and carbonization of tissue may occur with eschars on the lips and mouth. Brownish or yellowish stains may be found around the mouth, intense thirst, difficult swallowing, acidemia, stomatitis, rapid and weak pulse, shallow breathing, shock and possible convulsions and death may occur. Albumin, blood and casts in urine, anuria, esophageal and delayed gastric stenosis has been reported. Possible perforation of the gastrointestinal tract may result in peritonitis.
CHRONIC EXPOSURE- No data available.

FIRST AID- Do not use gastric lavage or emesis. Dilute the acid immediately by drinking large quantities of water or milk. If vomiting persists, administer fluids repeatedly. Ingested acid must be diluted approximately 100 fold to render it harmless to tissues. Maintain airway and treat shock (Dreisbach, Handbook of Poisoning, 12th Ed.). Get medical attention immediately. If vomiting occurs, keep head below hips to help prevent aspiration.

ANTIDOTE:
No specific antidote. Treat symptomatically and supportively.

REACTIVITY

REACTIVITY:
SULFURIC ACID:
Violent exothermic reaction with water.

INCOMPATIBILITIES:
SULFURIC ACID:
ACETALDEHYDE: Violently polymerized by concentrated acid.
ACETIC ANHYDRIDE: Temperature and pressure increase in closed container.
ACETONE + NITRIC ACID: Violent decomposition.
ACETONE + POTASSIUM DICHROMATE: Ignition.
ACETONE CYANHYDRIN: Pressure increase with possible explosive rupture of vessel.
ACETONITRILE: Violent exotherm on heating; sulfur trioxide reduces initiation temperature.
ACROLEIN: Temperature and pressure increase in closed container.
ACRYLONITRILE: Vigorous exothermic polymerization.
ALCOHOL: Exothermic reaction and contraction of volume.
ALCOHOLS AND HYDROGEN PEROXIDE: Possible explosion.
ALLYL ALCOHOL: Temperature and pressure increase in closed container.
ALLYL CHLORIDE: Violent polymerization.
ALKYL NITRATES: May cause violent reaction.
2-AMINOETHANOL: Temperature and pressure increase in closed container.
AMMONIUM HYDROXIDE: Temperature and pressure increase in closed container.
AMMONIUM IRON(III) SULFATE DODECAHYDRATE: Violent, exothermic reaction on heating.
AMMONIUM TRIPERCHROMATE: Fire or explosion hazard
ANILINE: Temperature and pressure increase in closed container.
BASES: Violent reaction.
BENZYL ALCOHOL: May decomposes explosively at about 180 C.
BROMATES + METALS: Possible ignition.
BROMINE PENTAFLUORIDE: Violent reaction with possible ignition.
TERT-BUTYL-M-XYLENE: Violent exothermic reaction without agitation.
N-BUTYRALDEHYDE: Temperature and pressure increase in closed container.
CARBIDES: Hazardous mixture.
CESIUM ACETYLIDE: Ignition on contact.
1-CHLORO-2,3-EPOXYPROPANE: Violent interaction.
4-CHLORONITROBENZENE AND SULFUR TRIOXIDE: Possible explosive reaction
CHLORATES: All chlorates, when brought in contact with sulfuric acid may give off explosive chlorine dioxide gas. A violent explosion is usual.
CHLORATES + METALS: Possible ignition.
CHLORINE TRIFLUORIDE: Violent reaction.
CHLOROSULFONIC ACID: Temperature and pressure increase in closed container
CHROMATES: Fire and explosion hazard.
COATINGS: Attacked.
COMBUSTIBLE MATERIALS (FINELY DIVIDED): May ignite.
COPPER: Evolution of sulfur dioxide.
CUPROUS NITRIDE: Violent reaction.
2-CYANO-4-NITROBENZENEDIAZONIUM HYDROGEN SULFATE: Exothermic reaction.
2-CYANO-2-PROPANOL: Violent reaction with increase in pressure.
CYCLOPENTADIENE: Violent or explosive reaction.
CYCLOPENTANONE OXIME: Violent reaction.
1,3-DIAZIDOBENZENE: Ignition followed by explosive reaction.
DIETHYLAMINE: Exothermic reaction.
DIISOBUTYLENE: Temperature and pressure increase in closed container.
DIMETHYLBENZYLCARBINOL + HYDROGEN PEROXIDE: Explodes.
DIMETHOXYANTHRAQUINONE: Exothermic reaction above 150 C.
4-DIMETHYLAMINOBENZALDEHYDE: Exothermic reaction.
2,5-DINITRO-3-METHYLBENZOIC ACID + SODIUM AZIDE: Explosive reaction.
1,5-DINITRONAPHTHALENE + SULFUR: Exothermic reaction.
EPICHLOROHYDRIN: Violent reaction.
ETHOXYLATED NONYLPHENOL: Possible ignition.
ETHANOL + HYDROGEN PEROXIDE: Possible explosion.
ETHYLENE CYANOHYDRIN: Violent reaction.
ETHYLENE DIAMINE: Temperature and pressure increase in closed container.
ETHYLENE GLYCOL: Temperature and pressure increase in closed container.
ETHYLENIMINE: Temperature and pressure increase in closed container.
FULMINATES: Extremely hazardous mixture.
HEXALITHIUM DISILICIDE: Incandescent reaction.
HYDROCHLORIC ACID: Temperature and pressure increase in closed container.
HYDROGEN PEROXIDE (50%): Explosive reaction after evaporation.
HYDROFLUORIC ACID: Temperature and pressure increase in closed container.
INDANE + NITRIC ACID: Possible explosion.
IODINE HEPTAFLUORIDE: The acid becomes effervescent.
IRON: Possible explosion due to hydrogen gas from the acid-metal reaction.
ISOPRENE: Temperature and pressure increase in closed container.
LITHIUM SILICIDE: Incandescent reaction.
MERCURY NITRIDE: Explosion on contact.
MESITYL OXIDE: Temperature and pressure increase in closed container.
METALS: May liberate flammable hydrogen gas.
METALS (POWDERED): Extremely hazardous mixture.
METAL ACETYLIDES: Ignition reaction.
METAL CHLORATES: Violent explosion unless properly cooled.
METAL PERCHLORATES: Formation of explosive perchloric acid.
4-METHYLPYRIDINE: Exothermic reaction.

NITRAMIDE: May decompose explosively on contact.
NITRATES: Incompatible.
NITRIC ACID + GLYCERIDES: Explosion.
NITRIC ACID + ORGANIC MATERIAL: May cause violent reaction.
NITRIC ACID + TOLUENE: Possible violent reaction or explosion.
NITROARYL BASES AND DERIVATIVES: May cause violent reaction or explosion.
NITROBENZENE: Exothermic reaction at elevated temperatures.
3-NITROBENZENESULFONIC ACID: Exothermic reaction.
NITROMETHANE: Formation of explosive mixture.
N NITROMETHYLAMINE: Explosive decomposition.
4-NITROTOLUENE: Explosive at 80 C.
ORGANICS: Violent exothermic reaction.
PENTASILVER TRIHYDROXYDIAMIDOPHOSPHATE: Explosion on contact.
PERCHLORATES: Possible explosion.
PERCHLORIC ACID: Formation of dangerous anhydrous perchloric acid.
PERMANGANATES: Formation of permanganic acid.
PERMANGANATES + BENZENE: Possible explosion.
1-PHENYL-2-METHYL-PROPYL ALCOHOL + HYDROGEN PEROXIDE: Possible explosion.
PHOSPHORUS (WHITE OR YELLOW): Ignition in contact with boiling acid.
PHOSPHORUS ISOCYANATE: Violent reaction.
PHOSPHORUS TRIOXIDE: Violent oxidation with possible ignition.
PICRATES: Extremely hazardous mixture.
PLASTICS: Attacked.
POLYSILYLENE: Explosion on contact.
POTASSIUM: Explosive interaction.
POTASSIUM TERT-BUTOXIDE: Ignition.
POTASSIUM CHLORATE: Possible fire and explosion.
POTASSIUM PERMANGANATE: Possible explosion in the presence of moisture.
POTASSIUM PERMANGANATE + POTASSIUM CHLORIDE: Violent explosion.
PROPIOLACTONE (BETA): Temperature and pressure increase in closed container.
PROPYLENE OXIDE: Temperature and pressure increase in closed container.
3 PROPYNOL: Possible explosion unless adequately cooled.
PYRIDINE: Temperature and pressure increase in closed container.
REDUCING AGENTS: Reacts.
RUBBER: Attacked.
RUBIDIUM ACETYLIDE: Ignition on contact.
SILVER PERMANGANATE (MOIST): Explosive reaction.
SILVER PEROXOCHROMATE: Explosive reaction.
SODIUM: Explosive reaction with aqueous acid.
SODIUM CARBONATE: Violent reaction.
SODIUM CHLORATE: Possible fire or explosion.
SODIUM HYDROXIDE: Temperature and pressure increase in closed container.
SODIUM TETRAHYDROBORATE: Violent, exothermic reaction.
SODIUM THIOCYANATE: Violent exothermic with evolution of carbonyl sulfide.
STEEL: Possible explosion due to hydrogen gas from the acid-metal reaction.
STYRENE MONOMER: Temperature and pressure increase in closed container.
SUCROSE: Formation of carbon monoxide.
TETRAMETHYLBENZENES: Violent reaction in closed containers.
1,2,4,5-TETRAZINE: Violent decomposition on contact.
THALLIUM(I) AZIDIDITHIOCARBONATE: May explode on contact.
1,3,5-TRINITROSOHEXAHYDRO-1,3,5-TRIAZINE: Explosive decomposition on contact.
VINYL ACETATE: Temperature and pressure increase in closed container.
ZINC CHLORATE: Likely to cause fires and explosions.
ZINC IODIDE: Violent interaction.

DECOMPOSITION:
Thermal decomposition may release toxic oxides of sulfur.

POLYMERIZATION:
Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

STORAGE AND DISPOSAL

Observe all federal, state and local regulations when storing or disposing of this substance.

Storage

Store in cool, dry, well-ventilated location. Separate from combustibles and other reactive materials. Separate from carbides, chlorates, fulminates, nitrates, picrates, and powdered metals. (NFPA 49, Hazardous Chemicals Data, 1991).

Store in a tightly closed container.

Avoid direct sunlight.

Store away from incompatible substances.

Threshold Planning Quantity (TPQ):
The Superfund Amendments and Reauthorization Act (SARA) Section 302 requires that each facility where any extremely hazardous substance is present in a quantity equal to or greater than the TPQ established for that substance notify the state emergency response commission for the state in which it is located. Section 303 of SARA requires these facilities to participate in local emergency response planning (40 CFR 355.30).

Disposal

Disposal must be in accordance with standards applicable to generators of hazardous waste, 40 CFR 262. EPA Hazardous Waste Number D002.
100 pound CERCLA Section 103 Reportable Quantity.

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CONDITIONS TO AVOID

May ignite other combustible materials (wood, paper, oil, etc.). Violent reaction with water. Flammable, poisonous gases may accumulate in confined spaces. Runoff to sewer may create fire or explosion hazard.

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SPILL AND LEAK PROCEDURES

SOIL SPILL:
Dig holding area such as lagoon, pond or pit for containment.

Dike flow of spilled material using soil or sandbags or foamed barriers such as polyurethane or concrete.

Use cement powder or fly ash to absorb liquid mass.

Neutralize spill with slaked lime, sodium bicarbonate or crushed limestone.

AIR SPILL:
Apply water spray to knock down and reduce vapors. Knock-down water is corrosive and toxic and should be diked for containment and later disposal.

WATER SPILL:
Neutralize with agricultural lime, slaked lime, crushed limestone, or sodium bicarbonate.

OCCUPATIONAL SPILL:
Keep combustibles (wood, paper, oil, etc.) Away from spilled material. Do not touch spilled material. Do not get water inside container. Stop leak if you can do it without risk. Use water spray to reduce vapors. Do not put water on leak or spill area. Clean up only under the supervision of an expert. Dike spill for later disposal. Do not apply water unless directed to do so. Keep unnecessary people away. Isolate hazard area and deny entry. Ventilate closed spaces before entering.

Reportable Quantity (RQ): 1000 pounds
The Superfund Amendments and Reauthorization Act (SARA) Section 304 requires that a release equal to or greater than the reportable quantity for this substance be immediately reported to the local emergency planning committee and the state emergency response commission (40 CFR 355.40). If the release of this substance is reportable under CERCLA Section 103, the National Response Center must be notified immediately at (800) 424-8802 or (202) 426-2675 in the metropolitan Washington, D.C. area (40 CFR 302.6).

PROTECTIVE EQUIPMENT

VENTILATION:
Provide local exhaust or process enclosure ventilation to meet published exposure limits.

RESPIRATOR:
The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH Pocket Guide to Chemical Hazards; NIOSH criteria documents or by the U.S. Department of Labor, 29 CFR 1910 Subpart Z.
The specific respirator selected must be based on contamination levels found in the work place, must not exceed the working limits of the respirator and be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

SULFURIC ACID:

25 mg/m3- Any powered air-purifying respirator with an acid gas cartridge(s) and having a high-efficiency particulate filter.
Any supplied-air respirator operated in a continuous flow mode.

50 mg/m3- Any chemical cartridge respirator with a full facepiece and acid gas cartridge(s) in combination with a high-efficiency particulate filter.
Any self-contained breathing apparatus with a full facepiece.
Any supplied-air respirator with a full facepiece.
Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted acid gas canister having a high-efficiency particulate filter.

80 mg/m3- Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.

Escape- Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted acid gas canister having a high-efficiency particulate filter.
Any appropriate escape-type self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

CLOTHING:
Wear appropriate protective clothing to avoid any possibility of skin contact with liquids containing more than 1% sulfuric acid. Avoid repeated or prolonged skin contact with liquids containing 1% or less sulfuric acid.

GLOVES:
Employee must wear appropriate protective gloves to prevent contact with this substance.

EYE PROTECTION:
Employee must wear splash-proof or dust-resistant safety goggles and a faceshield to prevent contact with this substance.

Emergency wash facilities:
Where there is any possibility that an employee's eyes and/or skin may be exposed to this substance, the employer should provide an eye wash fountain and quick drench shower within the immediate work area for emergency use.

AUTHORIZED - FISHER SCIENTIFIC, INC.
CREATION DATE: 11/28/84 REVISION DATE: 01/28/94

-ADDITIONAL INFORMATION-

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APPENDIX D

ACCIDENT REPORTING

ACCIDENT REPORTING

Contractor (A-E) reporting requirements to USACE.
Report on ENG form 3394.

(1) Notify within 24 hours of the event.
(2) Report within (2) working days sufficient information to allow completion of ENG 3394 in accordance with AR 385-40 and USACE Supplement 1 to that regulation.
   (a) First-Aid
   (b) Lost-time
   (c) Property damage; $1,000 or more to government or contractor property.
   (d) $50,000 or more damage to government or contractor property, requires immediate board of investigation.
   (e) Questionable property damage.
   (f) Fatalities, 5 or more people taken to a hospital.

Immediate reporting required by OSHA. (29 CFR 1904).

1. Fatalities or catastrophe (5 or more people sent to hospital).

All other personal injury requiring first aid or resulting in lost time must be recorded on OSHA form 200. OSHA does not require this to be sent in, but the contractor is required to keep a record for the purpose of inspections by OSHA.

Reporting required by Army Installations. (AR 385-40).

Army Regulation 385-40 applies to those injured and Army and non-Army property damage on active Army Installations. With respect to contractor employees, considered civilians, the regulation applies to those injured and Army/non-Army property damage on the installation in nonduty activities. The Army classifies injuries and personal property damage into Classes A, B, C, and D.

NOTIFICATION REQUIREMENTS

Unanticipated field conditions will occasionally require field modifications of the SSHP. Any PPE upgrade two working levels higher than the assumed working level discussed in the SSHP for the task involved will require notification of the USACE prior to conduct of the activity. Any situations immediately dangerous to life and health (as defined by NIOSH), confined space entry, or physical hazard the result of which would lead to possible death or permanent injury, shall also require prior notification of the activity if not specifically covered in the SSHP. Any PPE upgrades of one level will be reported on the Job Exposure Report. Minor changes not affecting the degree of protection need not be reported.

APPENDIX E

RUST E&I'S HEALTH AND SAFETY FIELD FORMS

RUST ENVIRONMENT & INFRASTRUCTURE

Supervisor's Incident Report

Fax this report within 24 hours to Rust International Inc.: 708-916-0592 *Telephone: 708-684-7832*
Attention: Claims Management Department

Date of this report: ____/____/____

Fax Sent by: _____ (Print Name) Telephone No.: _____

Group: **R66** (Rust E&I) **Region:** _____ **Employee Office Location Name:** _____

TYPE OF INCIDENT: Inspection:_____ Accident:_____ Injury:_____ Spill:_____ Fire:_____ Other:_____
Agency: _____ Inspector's Name: _____ Type Inspection: _____
Agency Address: _____ Phone: _____

EMPLOYEE INFORMATION:
Employee's Name: _____ Social Security No.: _____
Address: _____ Phone: _____
Date of Birth: _____ Number of Minor Dependents: _____ Marital Status: Single _____ Widowed _____ Married _____ Divorced _____
Date of Hire: _____ Wage Rate: $_____ Hourly: _____ Annually: _____ Job No.: _____
Employee Hours on Date of Incident: _____ Employee Hrs. on Project: _____ Days/Wk.: _____ Hrs./Day: _____
Employee's Occupation When Incident Occurred?: _____ Years of Experience in This Occupation?: _____

INCIDENT INFORMATION:
Date of Incident: _____ Time: _____ Witness(s): _____
Date Reported to Supervisor: _____ Was Incident Believed to be Result of Employment?: Yes _____ No _____
If on Job Site, Name of Job: _____ Location on Job Site Where Incident Occurred: _____
Address Where Incident Occurred: _____
If First Aid Applied, by Whom: _____
Type of Injury and Part of Body Affected: _____
Name/Address Medical Provider: _____
Brief Description of Incident: _____

Employee Activity at Time of Incident: _____

Description of Property Damaged: _____

OSHA 200 LOG INFORMATION:

Is incident OSHA recordable?: Yes ☐ No ☐
Does incident involve fatality?: Yes ☐ No ☐
Does incident involved lost time/restricted activity?: Yes ☐ No ☐
Does incident involve medical treatment?: Yes ☐ No ☐
Does incident involve first aid only?: Yes ☐ No ☐
Current Status: _____

Employee's Supervisor: _____ (Print Name)
Project Manager: _____ (Print Name)

Telephone No.: _____ Telephone No.: _____

Rev. 2/95

See reverse side for instructions.

F036/Corp.H&S

RUST ENVIRONMENT & INFRASTRUCTURE

Job Exposure Report

Instructions: This report is to be completed by the Site Safety Officer at the end of each Rust E&I Employee's participation in site activities. A copy of this report must be submitted to the REHSM for placement in the employee's medical file.

Employee Name: _____

Social Security Number: _____

Project Name: _____

Project Number: _____

Location: _____

Site Function: _____

Level of Protection: _____

Dates of Site Participation: _____

1. Were action levels exceeded in the work area (breathing zone)? Yes _____ No _____

2. If yes, list type of monitoring and readings: _____

3. List known or suspected contaminants on-site (list from HASP):

4. Personal exposure monitoring data attached? Yes _____ No_____ N/A _____

SSO Name (Print): _____

SSO Signature: _____

Date: _____

RUST ENVIRONMENT & INFRASTRUCTURE

Health and Safety Plan
Field Modification Form

Page No. _____ of _____

Project: _____

Project Location: _____

Project No.: _____

Site Safety Officer: _____

Field Modification to HASP: _____

Prepared By: _____
Site Safety Officer — Date

Accepted By: _____
Rust Environment & Infrastructure Field Manager — Date

Accepted By: _____
Contractor Representative (If Applicable) — Date

Approved By: _____
Rust Environment & Infrastructure Region Environmental Health and Safety Manager or Alternate HASP Reviewer — Date

NOTE: Field Modifications to HASPs must be discussed with the Rust Environment & Infrastructure REHSM or CEHSD with subsequent written approval. Secure approval through fax.

RUST ENVIRONMENT & INFRASTRUCTURE

Site Safety Meeting

Page _____ of _____

Project: _____ Date: _____

Project Number: _____ Time: _____

Meeting Conducted By: _____ _____

Name Signature

Summary Of Items Discussed: _____

_____

_____

_____

_____

Personnel Present

	Name	Representing	Signature
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			

NOTE: Place in project files.

RUST **Rust Environment & Infrastructure**

Atmospheric Monitoring Log
Field Health and Safety

Page _____ of _____

Date _____ / _____ / _____

Circle: Sun Mon Tue Wed Thu Fri Sat

Site: _____ Project No.: _____

Site Safety Officer: _____

Action Levels: D ☐ → C ☐ → B ☐ → (stop work, call in for instructions on all upgrades)

(Check box and write in levels for upgrade)

Task/Equipment: _____

Weather: _____

Location	Time	O_2 %	LEL %	H_2S PPM	Circle one: HNu/OVA Readings (ppm)				Comments
					Back ground	Breathing Zone	Sample Location	Head Space	

Additional Comments: _____

Signature: _____

Checked by: _____ Date: _____ / _____ / _____

NOTE: Place in project files.

Rev. 4/95

F024/Corp.H&S

RUST **Rust Environment & Infrastructure** *Daily Sign-In/Out Log*

PROJECT: _____

PROJECT LOCATION: _____

PROJECT NO.: _____

SITE SAFETY OFFICER: _____

DATE: _____

PAGE NO.: _____

TIME IN	TIME OUT	NAME	FIRM	PURPOSE ON-SITE

Note: This form is to be completed on a daily basis by all personnel working on the site.

Rev. 5/95

F064/Corp.H&S

APPENDIX F

RUST E&I'S RESPIRATORY PROTECTION PLAN

RESPIRATORY PROTECTION PROGRAM

1.0 INTRODUCTION

In accordance with OSHA 29 CFR 1910.134, Rust E&I has established a Respiratory Protection Program. Elements of the program which are presented in this document include the following:

- Respiratory Protection Program purpose and scope
- Program administration
- Written standard operating procedures governing the selection and use of respirators
- Surveillance of work area conditions
- Selection of respirators based on hazards to which the employee is exposed
- Use of approved respirators
- Medical monitoring
- Employee training
- Respirator cleaning and maintenance
- Respirator inspection protocols
- Respirator fit testing
- Assignment of respirators for individual use
- Respirator storage requirements
- Program evaluation and inspection
- Documentation procedures

2.0 PURPOSE AND SCOPE

2.1 Purpose

The purpose of this program is to ensure that Rust E&I employees are provided protection from occupational respiratory hazards through the proper use of respiratory protection and to comply with OSHA 29 CFR 1910.134 - Respiratory Protection.

2.2 Scope

This program applies to Rust E&I employees who, through the course of their work, are required to wear respiratory protective equipment.

3.0 PROGRAM ADMINISTRATION

The Rust E&I CEHSD is responsible for the overall administration of the Respiratory Protection Program.

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4.0 RESPONSIBILITIES

4.1 Corporate Environmental, Health and Safety Director (CEHSD)

The CEHSD is responsible for supervising the Respiratory Protection Program and for the maintenance and interpretation of the standard.

4.2 Region Environmental, Health and Safety Manager (REHSM)

The REHSM is responsible for administering and coordinating the Respiratory Protection Program for division/office locations assigned to their respective region. This includes conducting training for Safety Representatives in the implementation of the Respiratory Protection Program at the division/office level and maintaining copies of employee respirator training and fit-testing records and fitness for duty documentation.

4.3 Safety Representative (SR)

The SR is responsible for assisting their REHSM in implementing the Respiratory Protection Program for their assigned division/office. This includes performing employee respirator training and fit-testing, conducting inspections of Level B respiratory protective equipment prior to use and completing inspection records. In addition, the SR shall maintain employee respirator training and fit-testing, and fitness for duty records for their assigned division/office location.

4.4 Employer

Employer responsibilities include maintenance of the Respiratory Protection Program and providing appropriate respiratory protection when such equipment is necessary to protect employee health.

4.5 Employee

Employee responsibilities include using the assigned respiratory protection only in association and accordance with the project HASP or site safety procedures and training received. Employees shall guard against damage to their assigned respirator and shall be responsible for the care and cleaning of their respirator. Employees shall report any malfunction or need for parts for their respirator to their SR or Site Safety Officer (SSO).

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5.0 STANDARD OPERATING PROCEDURES GOVERNING THE SELECTION AND USE OF RESPIRATORS

The Rust E&I Respiratory Protection Program will be implemented whenever employee exposure to dusts, fumes, mists, or gases/vapors, exceed the action level of established limits (OSHA/PELs - ACGIH/TLVs), or the work area is oxygen deficient (less than 19.5%) and:

- Engineering controls are not feasible, or
- As a temporary measure while engineering controls are in the process of being implemented.

The "standard operating procedures" to be utilized in implementing the Respiratory Protection Program include:

5.1 Surveillance of the Work Area

Determination for the need for respiratory protection, or additional protection, will be based on appropriate surveillance of work area conditions and the degree of employee exposure or stress. The nature and extent of respiratory protection will depend upon the activity being performed and the contaminant concentration present in the employee "breathing zone".

5.2 Medical Certification

Participation in the Rust E&I Respiratory Protection Program is restricted to those employees who have been evaluated by a physician and have received written documentation of fitness for such duty. Annual examinations will be conducted to determine continued fitness for duty and as a guide in measuring program effectiveness.

5.3 Respirator Training

Training specific to the selection, inspection, fitting, utilization, maintenance, cleaning, and storage of respirators will be conducted by experienced personnel for Rust E&I employees prior to their participation in the Respiratory Protection Program and on an annual basis. In addition, respirator training specific to each site operation will be included in site specific Health and Safety Plans (HASPs).

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5.4 Respirator Fit Testing

Qualitative respirator fit testing, using established protocols, shall be conducted annually to establish and document proper respirator fit. Fit testing shall be performed every 6 months if working with asbestos. Respirator fit-testing will be conducted on a more frequent schedule if changes in the employee's facial structure have occurred (weight loss or gain, severe scars, denture application, etc.) or at any time when the employer or employee confidence with the respirator fit is low. Each employee will be given the opportunity of wearing and handling the respirator to assure him/her self of the proper fit prior to entering a contaminated environment.

5.5 Respirator Restrictions

5.5.1 Hair - Stubble, moustaches, sideburns, beards, low hairlines, and bangs which pass between the face and sealing surface of the respirator will produce a break in the face-to-respirator seal and allow the introduction of contaminants into the breathing zone; therefore, persons with these hair conditions will be required to modify the hair condition prior to respirator use.

5.5.2 Spectacles - Corrective spectacles or goggles must be worn in a manner which does not interfere with the respirator seal. "Spec-kits" for full-face respirators will be furnished by Rust E&I when vision correction is necessary and respiratory protection is required.

5.5.3 Contact Lenses - **Wearing of contact lenses while utilizing full-face respiratory protection is not permitted - OSHA 29 CFR 1910.134.**

5.6 Respirator Distribution

Each Rust E&I employee who is required to use respiratory protection will be issued the appropriate respirator for the type of exposure anticipated.

5.7 Respirator Cleaning and Inspection

Rust E&I employees are responsible for the cleaning and inspection of their assigned respirator(s). When air-purifying respirators are used on a routine basis, they must be cleaned daily. Respirators will be cleaned using the manufacturer's recommended procedures as guidelines. When the cleaning process is complete, each part of the respirator will be checked by the employee during the reassembly process. Level B (air-supplied type) respiratory protective equipment will be inspected when taken out of storage and will be cleaned and inspected daily when in use. Level B respiratory protective equipment identified for emergency use will be inspected monthly while in storage.

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5.8 Respirator Maintenance

Rust E&I employees are responsible for the maintenance of respiratory protection issued for their use. Any alteration of respirators voids the safety approval of the appliance. In the event respirator parts are identified as worn or defective, the employee will report to the division/office SR or SSO for replacement parts. When the facepiece is identified as defective, it will be returned to the manufacturer for replacement. When the facepiece is identified as worn/damaged, parts which are in good condition will be removed and stored and the remaining facepiece will be discarded.

5.9 Respirator Storage

Rust E&I employees shall store respirators in a manner that will protect them against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Respirators shall be stored to prevent distortion of rubber or elastic parts. They shall not be stored in such places as lockers and tool boxes unless they are protected from contamination, distortion, and damage. Emergency and rescue-use respirators that are placed in work areas shall be quickly accessible at all times, and the storage cabinet or container in which they are stored shall be clearly marked.

5.10 Respiratory Protection Program Evaluation

The Rust E&I Respiratory Protection Program will be evaluated annually by the CEHSD, REHSM, and division/office Safety Representative to determine the program's effectiveness. The annual evaluation will include both the critical evaluation of policies and procedures and the inspection of respiratory protective equipment.

5.11 Respiratory Protection Documentation

Copies of Rust E&I Respiratory Protection Program documentation records will be retained in each division/office by the SR with originals forwarded to the appropriate REHSM for retention.

6.0 SURVEILLANCE OF WORK AREA CONDITIONS

Occupational respiratory hazards exist in many forms and may be encountered in various locations. The preliminary steps of identifying and evaluating respirable hazards in the workplace must be taken in order to select and maintain appropriate respiratory protective equipment.

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6.1 Identifying Types of Respiratory Hazards

There are two distinct categories of respiratory hazards: toxic contaminants (dusts, fumes, mists, gases, and vapors), or oxygen deficiencies. These categories may exist as single or combined concerns. Depending on the classification of respiratory hazards, the biological effect upon the human body can be detrimental. (See Attachment I - Table 1)

6.1.1 Toxic Contaminants

6.1.1.1 Particulate Contaminants - Particulate contaminants are made up of tiny particles of a substance. These particles are often so small that they float around in the air and are easily inhaled. There are three types of particulate contaminants:

- Dusts - Dusts are solid particles produced by such processes as grinding, crushing, and mixing of powder compounds. (Examples: silica, plaster, asbestos, lead, talc, etc.)

- Fumes - Fumes are solid condensation particles of extremely small particle size typically produced by heating metals past their melting points. (Examples: soldering, welding, brazing.)

- Mists - Mists are tiny droplets given off whenever a liquid is sprayed, vigorously mixed, or otherwise agitated. (Examples: Acid mists around diptanks, oil mists near newspaper printing presses.)

6.1.1.2 Gaseous Contaminants - Gaseous contaminants are generally invisible and can easily mix with the air we breathe. Gaseous contaminants can create a hazardous environment by displacing oxygen or by the introduction of toxic characteristics into the work area. There are two types of gaseous contaminants:

- Gases - Gases are typically invisible in form and can readily mix with the air we breathe to gain entrance into the body. However, gases may change their form depending upon the environment in which they are housed. (Example: Carbon dioxide is a gas at room temperature, a solid "dry ice" at low temperatures, or a liquid in pressurized tanks.)

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- Vapors - Vapors, like gases, are typically invisible in form and can readily mix with the air that is breathed to gain entrance into the body. Vapors are formed by evaporation of a liquid substance such as acetone or trichloroethylene. The characteristics of the vapor will be the same as those of the substance from which it is formed.

6.1.2 Oxygen Deficient Atmospheres - An atmosphere is considered "oxygen deficient" when concentrations of oxygen in the air drop below 19.5% at sea level. Oxygen deficient atmospheres are classified as Immediately Dangerous to Life and Health and thus unsuitable for human habitation without the application of respiratory protective equipment. Oxygen deficient atmospheres are created when:

- Oxygen in the Area is "Used Up" - This condition is caused when oxygen is depleted by a chemical reaction such as a fire, or degradation of organic matter such as may be found in sewer systems.

- Oxygen is Displaced - Oxygen may be replaced by another gas. (Example: Heavier than air gases, when released into the atmosphere, can migrate into low-lying work areas such as manholes, trenches, etc., filling the area from the bottom up while forcing oxygen out. The gas remaining in the area may be toxic or simply displace the oxygen. In either case, the remaining gas will not support human respiration.)

6.1.3 Combination Contaminant Atmospheres - It is important to note that gaseous and particulate contaminants can frequently occur together. (Example: Paint spraying operations produce a paint mist which is particulate, and solvent vapors which are gaseous.) When such conditions are present, it is important to address both types of contaminant when selecting respiratory protective equipment.

6.1.4 Immediately Dangerous to Life and Health Atmospheres - Atmospheres are classified as Immediately Dangerous to Life and Health (IDLH) when the concentration of contaminant in the area is increased to a point where serious injury may result from exposure, or when the oxygen concentration in the air is reduced to a level incompatible with human life. Employee unprotected exposure to IDLH atmospheres can cause:

6.1.4.1 Acute Reaction - Serious injury or death within a short time. (Example: Exposure to high concentrations of carbon monoxide or hydrogen sulfide.)

6.1.4.2 Chronic Reaction - Serious delayed effects. (Example: Exposure to low concentrations of radioactive materials or cancer causing agents.)

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6.2 Evaluating Respirable Hazards

Once the hazardous substance(s) in the workplace have been identified, it is necessary to evaluate the concentration of these materials in the area. This information, combined with the identification of the substance(s) will be used in the selection of respiratory protective equipment thus reducing the health risk to Rust E&I employees.

6.2.1 Gaseous and Vapor Contaminants - Gaseous and vapor contaminants are typically measured in parts per million (ppm) - parts of contaminant(s) per million parts of air, or parts per billion (ppb) - parts of contaminant(s) per billion parts of air. Instruments usually used by Rust E&I for measuring gas and vapor contaminants include:

6.2.1.1 Detector Tubes - Detector tubes are a commonly used screening device. These tubes are available for many of the gasses found in the work environment. Only detector tubes approved by NIOSH for the specific contaminant will be used by Rust E&I. Since detector tubes generally have a variety of interference substances, it is important to note that they should be used for screening purposes only and results should not be considered conclusive.

6.2.1.2 Organic Vapor Analyzer (OVA) - The OVA is a direct reading, flame ionization instrument used to survey the work area for organic vapors. Results taken from this instrument are considered nonspecific when it is used in the survey mode; however, a column and strip-chart may be added to the instrument allowing it to function in a gas chromatograph mode. (The gas chromatograph mode requires extensive training to be able to read the results on the strip-chart with a level of accuracy.) The OVA is limited to the detection of organic vapors. This instrument is not intrinsically safe and should not be used in combustible/flammable environments.

6.2.1.3 HNU - The HNU is a photoionization device (PID) typically used to survey the workplace for organic vapors. Results taken from this instrument are considered nonspecific as it measures all organic vapors in the area and not specific elements. The HNU measures organic vapors and some inorganic vapors.

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6.2.2 Particulate Contaminants - The majority of regulated particulate contaminants are measured in milligrams per cubic meter (mg/m^3) - milligrams of contaminant per cubic meter of air, or fibers per cubic centimeter (fibers/cc) - the number of fibers per cubic centimeter of air. In contrast to the availability of measuring devices for gas and vapor contaminants, few direct reading instruments are available for measurement of particulates. Those that are available indicate the total dust concentration and do not distinguish between the various materials making up the total dust concentration. The best process for determining actual dust and fiber contamination is accomplished by using air sampling pumps, a collection media, and follow-up laboratory analysis. This process should be used as a follow-up when total respirable dust levels are measured in excess of PEL/TLV levels established for suspected or known site contaminants.

6.2.3 Oxygen Deficient Atmosphere Determination - There are numerous direct reading instruments which may be used to measure the oxygen concentration in the work environment.

6.3 Interpretation/Application of Measurements

The measured concentration (in appropriate units) is compared with either the permissible exposure limit (PEL) - mandated by OSHA regulations, or the threshold limit value (TLV) - recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). In the event of ambiguity, the level most protective of the employee shall be used by Rust E&I personnel. The listed PEL or TLV is the maximum concentration of a contaminant to which a worker may be exposed, day after day, without adverse health affects. When the level of contaminant(s) in the breathing zone exceeds the defined level(s), action must be taken to protect the employee through engineering controls, administrative controls (when appropriate), or the application of appropriate respiratory protective devices.

7.0 TYPES OF RESPIRATORY PROTECTIVE EQUIPMENT

There are numerous types of respiratory protective equipment available for utilization dependent upon the contaminant/condition from which the employee must be protected. The Rust E&I Respiratory Protection Program typically applies three types of respiratory protective equipment.

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7.1 Full-Facepiece, Air-Purifying Respirators

Full-facepiece, air-purifying respirators (APRs) are often called dust, mist or fume respirators. The particular equipment used by Rust E&I seals against the face and when the user inhales, a negative pressure is created inside the respirator which causes contaminated air from the outside environment to be pulled to the inside of the respirator through filter cartridges which remove contaminants before they can be inhaled.

When determined to be appropriate for the contaminants of concern present, full-face APRs shall be used by Rust E&I employees involved with soil intrusive activities during investigation, study, or design phases of projects.

7.1.1 Filters/Cartridges/Canisters - The filters, cartridges, or canisters used for air-purifying respirators must be selected on a site specific basis. Work on some sites may not require the use of respiratory protective equipment; however, other situations may require the use of filters, chemical cartridges, combination filter/cartridges or canisters.

Filters, cartridges, and canisters are specific to the manufacturer of the respirator facepiece and may not be interchanged from one manufacturer's facepiece to another. Manufacturers may be consulted to determine the appropriate filter, cartridge, or canister for a specific contaminant and, in addition, filters, cartridges, and canisters are color coded for ease in identification. (See Attachment I-Table 2 - Color Codes for Cartridges and Gas Mask Canisters [ANSI K13.1-1973]).

7.1.2 Limitations - Air-purifying respirators are limited for the following :

- Warning Properties - When the equipment is to be used for protection against toxic materials, the user must be able to smell, taste, or feel irritation from any potential leakage into the facepiece before concentrations inside could exceed PEL/TLV concentrations.

  Note: Rust E&I personnel will be instructed by the SSO to immediately remove themselves from a contaminated environment at any time leakage into the respirator is noted or questioned.

- Oxygen Deficiency - These respirators function to filter air only. When oxygen concentrations in the work area drop below 19.5% oxygen at sea level, respirators which supply breathing air must be used.

- IDLH Atmospheres - This respirator type must not be used (except for escape) in atmospheres IDLH.

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- Manufacturer's Recommendation - The manufacturer's information for the specific equipment being used must be checked. There are chemicals listed for which the manufacturer does not recommend the use of this equipment under any circumstances. (See Attachment IV - Conditions Which Exclude Use of Air-Purifying Respirators and Attachment V - Contaminants for Which Air-Purifying Respirators Should Not be Used.)

7.1.3 Problems - The following problems have been associated with air-purifying respirators:

- Air Flow Resistance - The air flow resistance of a air-purifying respirator particulate filter element increases as the quantity of particles retained increases, thus increasing the breathing resistance. As a rule of thumb, when comfortable breathing is impaired because of dust buildup, the filter should be replaced.

- Open Storage - Performance of some filter materials is affected by open storage in very humid atmospheres. Care should be taken in storing filters, cartridges, or canisters.

7.2 Half-Facepiece, Air-Purifying Respirators

Half-face, air-purifying respirators (APRs) cover the face from below the chin to over the nose. Air filtered from the outside environment is pulled to the inside of the respirator through filter cartridges which remove contaminants before they can be inhaled (refer to Sections 7.1.1 through 7.1.3). Half-facepiece APRs can be used when airborne contaminants have been identified. Half-facepiece APRs may be used by Rust E&I personnel during non-intrusive type activities associated with site assessments, industrial facility surveys, and during some forms of asbestos sampling. The selection and use of half-face APRs must be approved by the REHSM.

7.3 Powered Air-Purifying Respirators (PAPRs)

PAPRs include a hood, helmet, or full facepiece; a filter; a breathing tube; and a blower. Contaminated air is drawn through the filter and clean, breathable air is supplied to the facepiece, hood, or helmet. As long as the worker's air demand does not exceed the flow rate of the PAPR, a slight positive pressure is maintained in the hood or facepiece, preventing inward leakage of contaminated air. These units are approved against dusts, fumes, mists and radon daughters having a time weighted average less than 0.05 mg/m^3. PAPRs are not suitable for use in IDLH or oxygen deficient atmospheres. PAPRs may be used by Rust E&I personnel during asbestos and lead abatement-type projects. Use of PAPRs must be approved by the REHSM.

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7.4 Air-Supplied Respirators

Air-Supplied respirators use a central source of breathing air that is delivered to the wearer through an air supply line or hose. (See Attachment VI.)

7.4.1 Operation - The distinction of airline devices is that they use a stationary source of compressed air delivered through a high-pressure hose. Airline respirators can be used for protection against either particulates, gases, or vapors. A great advantage of airline respirators is that they can be used for long continuous periods.

7.4.2 Air Supply System - Supply air sources for airline respirators must meet the following requirements:

- Compressed air used in cylinders for SCBA and airline respirators will meet all appropriate standards as stated in 29 CFR 1910.134(d)-Air Quality. Cylinders shall be tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation, 49 CFR, 178.

- Breathing air quality must meet the requirements of Grade D breathing air as described by the Compressed Gas Association. Grade D requirements are:

  - The oxygen content of the compressed air should be between 19.5-23.5% oxygen and the rest mainly nitrogen;

  - Hydrocarbon concentrations must not exceed 5 ppm;

  - Carbon monoxide concentration must not exceed 20 ppm;

  - Carbon dioxide concentrations must not exceed 1,000 ppm; and

  - There must not be any pronounced odor present.

7.4.3 Air Quality Reports - It shall be the responsibility of the SSO to secure air quality reports from the vendor on each shipment of breathing air delivered to a project site. These reports must certify that the breathing air meets the required standards set forth in Section 7.4.2.

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7.4.4 Limitations - Airline respirators are restricted as follows:

- IDLH Atmospheres - These devices must not be used in atmospheres immediately dangerous to life or health since the user is dependent upon an air hose, which, if cut, crushed, or damaged, leaves him with little or no protection.

- Widely Separated Work Stations - The trailing air supply hose of the airline respirator severely restricts the wearer's mobility. This may make the airline respirator unsuitable for those who must move frequently between widely separated work stations. The minimum air hose length is 25 feet and the maximum allowable length is 300 feet.

7.5 Self-Contained Breathing Apparatus (SCBA)

The self-contained breathing apparatus (SCBA allows the user to carry a breathing air supply with him/her, and does not need a stationary air source such as a compressor to provide breathable air). The air supply may last from three (3) minutes to four (4) hours depending on the nature of the device. Of the various types of SCBAs available on the market, that most commonly used by Rust E&I is the pressure-demand, open circuit unit.

7.5.1 Operation - The open circuit SCBA exhausts the exhaled air to the atmosphere instead of recirculating it. A tank of compressed air carried on the back supplies air, via a regulator, to the facepiece. Because there is no recirculation of air, the service life of the open circuit SCBA is shorter than a closed circuit system. The regulator and valve design of this respirator maintains a positive pressure in the facepiece at all times regardless of the "demand" of the user. There is no problem of contaminant leakage into the facepiece.

7.5.2 Conditions of Use - Because they provide a respirable breathing air supply, all SCBAs may be used in oxygen deficient atmospheres as well as against particulates, vapors, and gases. However, approvals for SCBAs stated in equipment information are based on:

- Entering into and escaping from;

- Escape only from a hazardous atmosphere (oxygen deficient or contaminated); and

- The work setting.

When using an SCBA, check the approval label to ascertain the conditions of use.

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7.5.3 Limitations - Open circuit, pressure-demand SCBAs are limited as follows:

- Limited Air Supply - The air supply is limited to the amount in the cylinder and therefore the respirator cannot be used for extended periods without recharging or replacing the cylinder.

- Size/Weight - Because these respirators are bulky and heavy, they are often unsuitable for strenuous work or use in confined spaces.

8.0 SELECTION OF RESPIRATORY PROTECTIVE EQUIPMENT

Respiratory protective equipment selection is based upon the type, concentration, and characteristics of the contaminant; concentrations of oxygen in the area; NIOSH recommendations and the limitations, capabilities and protection factors of the available equipment. (See Attachment I Table 3.)

Respiratory protection used by Rust E&I typically is identified in one of three levels, each of which carries a specific requirement for personnel.

8.1 Levels of Respiratory Protection

8.1.1 Level D - When there have been no hazards of a respirable nature identified in the work area, and respiratory protective equipment is not a requirement. Personnel requirement for work area - two (2) - buddies.

8.1.2 Level C - When contaminants identified or suspected in the work area are of a type and concentration in the breathing zone for which air-purifying respirators are recommended and oxygen concentrations in the work area are not, and reasonably will not, be compromised. Personnel requirement for work area - two (2) - buddies.

8.1.3 Level B - When contaminants identified or suspected in the work area are of a type and concentration in the breathing zone for which self-contained or supplied air respirators are recommended. Supplied air respirators must not be used when IDLH atmospheres are a concern. Personnel requirement for work area - three (3) - buddies plus one rescue/emergency.

8.2 Approvals

Respiratory protective equipment used by Rust E&I Personnel will be limited to that equipment which has been approved by the National Institutes of Occupational Safety and Health (NIOSH) and Mine Safety and Health Administration (MSHA).

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8.3 Selection Procedure

When the process of identification and quantification of respiratory hazards on a site has been completed, a decision tree should be used to select the appropriate type of protection to be used. (See Attachment II-Figure 1 - RPE Selection Decision Tree)

9.0 MEDICAL ASPECTS OF RESPIRATORY PROTECTION EQUIPMENT USAGE

Each Rust E&I employee who is required to use respiratory protective equipment will receive a complete medical examination to provide reference information for evaluation of subsequent periodic examinations and to establish if an employee is fit for duty.

9.1 Rust E&I Medical Surveillance Program

Employees are examined annually and on an intermittent basis depending on the employee's involvement in site operations. The following tests are standard elements of the Rust E&I Medical Surveillance Program:

- Pulmonary Function Test (FEV_1, FVC, FEV 25-75)
- Electrocardiogram
- PA (Posterior/Anterior) Chest X-Ray
- Audiometry (500-8000 Hz, Bilateral)
- Visual Acuity
- Complete Blood Count with Differential
- Blood Chemistry Screen (SMA-24)
- Urinalysis (Dip-stick and Microscopic)
- Medial/Occupational History
- Physical Examination
- Project - Specific Testing as Necessary

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9.2 Medical Concerns Related to Respirator Utilization

Some factors to be considered by the examining physician in determining the prospective user's ability to wear a respirator include:

- Emphysema - The individual may be unable to breathe adequately against the additional resistance of a respirator.
- Asthma - If the user suffers an asthma attack, he/she would be likely to remove the respirator because of being unable to breathe properly.
- Chronic Bronchitis - The user will have difficulty breathing and/or clearing the lungs by coughing.
- Heart Disease - An additional burden is placed on the heart by the use of respiratory protective equipment.
- Anemia - The oxygen-carrying capacity of blood may be compromised in the anemic employee.
- Hemophilia - In addition to bleeding problems, the hemophiliac can experience complications with the respiratory process.
- Poor Eyesight - Vision correction must be addressed in conjunction with respiratory protective equipment because regular glasses and contact lenses may not be used.
- Poor Hearing - The use of respiratory protection can cause pressure changes in the ear making it more difficult for the user to hear. In addition, if the poor hearing is caused by a ruptured eardrum, the breach in the eardrum will allow contaminants to enter the user's body.
- Hernia - A hernia can be aggravated by wearing/carrying respiratory protective equipment.
- Lack of Use of Fingers or Hands - Respirators such as gas masks, supplied-air respirators, and self-contained breathing apparatus require connection and disconnection of parts, and manipulation of valves, and fittings during use. Persons with missing or disabled fingers may have difficulty in using these devices, particularly in an emergency where there is no one present to assist them.

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- Epileptic Seizures - The safety of the user and fellow workers can be compromised if the epileptic has a seizure while respiratory protection procedures are being implemented.

9.3 Emotional/Mental Factors

Mental factors must also be taken into consideration when employees are required to wear respirators. Some individuals become claustrophobic when wearing a respirator. These individuals should not be required to wear respirators if the condition is severe enough to cause panic.

9.4 Other Factors

Scars, hollow temple, very prominent cheekbones, deep skin creases, and lack of teeth or dentures may cause respirator facepiece sealing problems. Full dentures should be retained when wearing a respirator, but partial dentures may or may not have to be removed, depending upon the possibility of swallowing them.

10.0 EMPLOYEE TRAINING

Experienced personnel (SRs) will train Rust E&I employees in the appropriate use of respiratory protective equipment. Minimum training shall include the following:

- The identification of respiratory hazards;
- The consequences of improper utilization of respiratory protective equipment;
- The relationship between engineering and administrative controls and the application of respiratory protection;
- Instruction in the selection, use, sanitary care, maintenance, proper storage, and limitations of each applicable respirator type;
- An opportunity to handle the respirator and to wear it in a safe atmosphere for an adequate period of time to ensure that the wearer is familiar with the operational characteristics of the respirator;
- An opportunity to wear the respirator in a test atmosphere (such as atmospheres generated by smoke tubes or isoamyl acetate) to demonstrate that the respirator protects the worker;
- Instructions in how to recognize and cope with emergency situations requiring respiratory protection;

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- An explanation of the requirement for a self-contained breathing device for work in unknown concentrations and IDLH atmospheres, and for fire fighting;
- Equipment donning and doffing procedures;
- An explanation of the medical surveillance program as it relates to the use of respiratory protective equipment.
- An explanation of the requirements for maintaining the respirator gas-tight seal, including beard and facial hair policies, and the policy prohibiting the use of contact lenses while wearing respirators.

Employee respirator training will be required on a minimum annual basis and will be documented in writing. Copies of training records will be retained at the division/office with the originals retained by the REHSM.

11.0 RESPIRATOR CLEANING AND MAINTENANCE

The Respiratory Protection Program shall include a maintenance program consisting of at least the following:

- Cleaning and disinfecting
- Inspections
- Part repair and replacement
- Storage

The maintenance program can be tailored to suite the particular operation and hazards involved. All region maintenance programs must include at least the minimum elements given above, with careful consideration to individual respirator manufacturer's instructions for cleaning and maintenance for each respirator type. Inspections shall be documented using the inspection forms presented in Attachment III.

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11.1 Cleaning and Disinfecting

Each individual to whom a respirator has been issued shall be responsible for its cleaning and disinfection. The respirator should be disassembled and washed with detergent in warm water (120-140°F) using a soft brush, rinsed thoroughly in clean water, and air dried in a clean place. Precautions should be taken to prevent damage from rough handling during this procedure. Disinfection is not absolutely necessary if the respirator is reused by the same person. Avoid using alcohol wipes since alcohol will damage the respirator. However, disinfection can be accomplished by adding approximately one-half (0.5) teaspoon bleach (i.e., Clorox) to one quart of water and immersing the respirator in this solution for two minutes. Rinsing respirators with warm water after being disinfected will prevent dermatitis. Respirators should be dried after disinfection by laying on a clean surface in room air. When thoroughly dried, the respirators shall be placed in clean plastic bags before being placed in a dry sanitary storage area. These bags shall be used to transport and store the respirators while in the field.

11.2 Inspections

11.2.1 Introduction - Wearing poorly maintained or malfunctioning respirators may be more dangerous than not wearing a respirator at all. Manufacturers' instructions for inspection should be followed to ensure that the respirator continues to function properly. Respirators shall be checked by the wearer before and after each use. Supervisors, the SR, or the SSO will also perform spot-checks of respirators.

11.2.2 Air-Purifying Respirators - Routinely used air-purifying respirators should be checked as follows before and after each use:

11.2.2.1 Facepiece - Examine the facepiece for:

- Excessive dirt;
- Cracks, tears, holes or physical distortion of shape from improper storage;
- Inflexibility of rubber facepiece (stretch and knead to restore flexibility);
- Cracked or badly scratched lenses in full facepieces;
- Incorrectly mounted full facepiece lenses, or broken or missing mounting clips; and

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- Cracked or broken air-purifying element holder(s), badly worn threads or missing gasket(s) if required.

11.2.2.2 Head Straps - Examine the head straps or head harness for:

- Breaks;
- Loss of elasticity;
- Broken or malfunctioning buckles and attachments; and
- Excessively worn serrations on head harness, which might permit slippage (full facepieces only).

11.2.2.3 Exhalation Valve - Examine the exhalation valve for the following after removing its cover:

- Foreign material such as detergent residue, dust particles or human hair under the valve seat;
- Cracks, tears or distortion in the valve material;
- Improper insertion of the valve body in the facepiece;
- Cracks, breaks or chips in the valve body, particularly in the sealing surface;
- Missing or defective valve cover; and
- Improper installation of the valve in the valve body.

11.2.2.4 Air-Purifying Element - Examine the air-purifying element for:

- Incorrect filter, cartridge, or canister for the hazard;
- Incorrect installation, loose connections, missing or worn gasket or cross threading in the holder;
- Expired shelf-life date on the filter, cartridge, or canister; and

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- Cracks or dents in the outside case of the filter, cartridge or canister indicated by the absence of sealing material, tape, foil, etc., over the inlet.

11.2.2.5 Corrugated Breathing Tube - If the device has a corrugated breathing tube, examine it for:

- Broken or missing connectors;
- Missing or loose hose clamps; and
- Deterioration, determined by stretching the tube and looking for cracks.

11.2.2.6 Harness of Gas Mask - Examine the harness of a front or back-mounted gas mask for:

- Damage or wear to the canister holder, which may prevent its being held in place;
- Broken harness straps for fastening.

11.2.3 Air-Supplied Respirators - An inspection of routinely used air-supplied respirators should follow these steps:

11.2.3.1 Tight-Fitting Facepiece - If the respirator has a tight-fitting facepiece, use the procedures outlined under air-purifying respirators, except those pertaining to the air-purifying elements.

11.2.3.2 Hood, Helmet, Blouse, or Full Suit - If the device is a hood, helmet, blouse or full suit, use the following procedures:

- Examine the hood, blouse or full suit for rips and tears, seam integrity, etc.;
- Examine the protective headgear, if required, for general condition with emphasis on the suspension inside the headgear;
- Examine the protective face shield, if any, for cracks or breaks, or scratches which could impair vision; and

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- Make sure the protective screen is intact and secured correctly over the face shield of abrasive blasting hoods and blouses.

11.2.3.3 Air-Supply System - Examine the air supply system for:

- Integrity and good condition of air supply lines and hoses, including attachment and end fittings;
- Correct operation and condition of all regulators; and
- Grade D Breathing Air Certification - Each delivery of breathing air cylinders must be accompanied by a written certificate of air quality. Do not accept delivery without a certificate. In addition, *each* cylinder must have a label affixed to it that clearly states it contains breathing air. Do not use a cylinder that does not have a label affixed to it.

11.2.4 Self-Contained Breathing Apparatus (SCBA) - For SCBA units, the inspection should include all criteria listed in the sections above, plus determine that:

11.2.4.1 High-Pressure Cylinder - The high pressure cylinder of compressed air is sufficiently charged for the intended use, preferably fully charged.

Note: Compressed air used in cylinders for SCBA and airline respirators will meet all appropriate standards as stated in 29 CFR 1910.134(d)-Air Quality. Cylinders shall be tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation, 49 CFR, 178.

11.2.4.2 Closed-Circuit SCBA - On closed circuit SCBA, a fresh canister of CO_2 (carbon dioxide) sorbent must be installed.

11.2.4.3 Open-Circuit SCBA - On open circuit SCBA, the cylinder has been recharged if less than 25% of the useful service time remains

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11.3 Part Repair and Replacement

Respirator maintenance, replacement, or repair shall be conducted by experienced persons. Respirator maintenance activities must be recorded. (See Attachment III - Forms.) Manufacturer's instructions for maintenance shall be closely followed, and only replacement parts supplied by the manufacturer of the specific respirator in question shall be used. Substitution of parts from a different brand of respirator invalidates MSHA/NIOSH certification of the device. This practice is specifically prohibited.

12.0 RESPIRATOR FIT TESTING

Every respirator wearer shall receive fitting instructions including demonstrations and practice in how the respirator should be worn, how to adjust it, and how to determine if it fits properly. Respirators shall not be worn when conditions prevent a good face seal. Such conditions as a growth of beard, sideburns, facial scarring or the temple or nose piece on a set of eye glasses may prevent proper sealing. Also, any dental changes or cosmetic surgery may seriously affect the fit of the facepiece. If an individual has a weight gain or loss of twenty or more pounds, he or she must be fit tested again to ensure a proper seal. The respirator shall be checked by the wearer each time the respirator is donned. Fit testing shall be documented using the Qualitative Respirator Fit Test Form presented in Attachment III.

Rust E&I personnel using air-purifying respirators shall be fit-tested using both isoamyl acetate and smoke irritant methods as described within this section.

12.1 Isoamyl Acetate Fit Test Procedure

12.1.1 Pre-Exposure - Prior to testing, the test subject will be exposed to a varied concentration of isoamyl acetate to assure that he/she can detect the odor.

12.1.2 Donning the Respirator - The wearer dons the respirator in the normal manner.

12.1.3 Positive Pressure Test - The wearer covers the exhalation valve(s) with the palm of the hand and exhales. A positive pressure should be formed inside the facepiece with no leakdown during a ten (10) second period.

12.1.4 Negative Pressure Test - The wearer covers the inhalation opening on the filter, cartridge, or canister and attempts to inhale. A negative pressure should be created inside the facepiece with no leakdown for a period of ten (10) seconds.

12.1.5 Tent Enclosure - The wearer enters a test enclosure (plastic bag, test tent, etc.) which is to become contaminated with the isoamyl acetate.

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12.1.6 Exposure - A saturated cloth, stencil brush, or ampule is passed close to the respirator sealing surfaces. Care should be taken to avoid touching the skin of the respirator wearer. The person administering the test should wear rubber gloves.

- If the wearer smells banana oil, he returns to clean air and readjusts the facepiece and/or adjusts the head straps without unduly tightening them.
- The wearer repeats the second step. If he does not smell banana oil, he is assumed to have satisfactory fit. If he smells the vapor, an attempt should be made to find the leakage point. If the leak cannot be located, another respirator of the same type and brand should be tried.
- During the test, the employee should perform movements that approximate a normal working situation. These may include:
  - Normal breathing.
  - Deep breathing, as during heavy exertion (this should not be done long enough to cause hyperventilation symptoms).
  - Side-to-side and up-and-down movements should be exaggerated, and should approximate those that take place on the job.
  - Talking. This is most easily accomplished by asking the wearer to recite something familiar or by reading a prepared text loudly enough to be understood by someone standing nearby.
  - Additional exercises may be added depending upon the situation.

Note: Respirators equipped with organic vapor cartridges must be used for this fit test method.

12.2 Irritant Smoke Fit Test Procedure

12.2.1 Donning the Equipment - The wearer puts on the respirator in the normal manner, taking care not to tighten the head straps uncomfortably.

12.2.2 Positive Pressure Test - The wearer covers the exhalation valve(s) with the palm of the hand and exhales. A positive pressure should be formed inside the facepiece with no leakdown during a ten (10) second period.

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12.2.3 Negative Pressure Test - The wearer covers the inhalation opening on the filter, cartridge, or canister and attempts to inhale. A negative pressure should be created inside the facepiece with no leakdown during a period of ten (10) seconds.

12.2.4 Prepare Test Material - both ends of a ventilation smoke tube are broken. One end of the tube is connected to a two-way positive pressure aspirator bulb while the other end has a 2" to 3" length of plastic tubing attached. The test smoke is generated by squeezing the aspirator bulb.

12.2.5 Tent Enclosure - The wearer enters a test enclosure (plastic bag, test tent, etc.) which is to become contaminated with the irritant smoke.

12.2.6 Contaminant Exposure - The smoke will be generated by aiming the end of the smoke tube with the plastic near the sealing surface of the respirator. Issue 8 to 10 puffs of smoke per exercise while the wearer is instructed to execute:

- Normal breathing.
- Deep breathing, as during heavy exertion (this should not be done long enough to cause hyperventilation symptoms).
- Side-to-side and up-and-down movements should be exaggerated, and should approximate those that take place on the job.
- Talking. This is most easily accomplished by asking the wearer to recite something familiar or by reading a prepared text loudly enough to be understood by someone standing nearby.
- Additional exercises may be added depending upon the situation.

Note: Respirators equipped with high efficiency filters must be used for this test. If a half-mask respirator is being tested, the test employee shall be instructed to wear goggles at all times during this test.

12.3 Field Fit Check Procedures

Each time the equipment is donned the fit should be tested using the following procedures.

12.3.1 Positive Pressure Test - The wearer covers the exhalation valve(s) with the palm of the hand and exhales. A positive pressure should be formed inside the facepiece with no leakdown during a ten (10) second period.

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12.3.2 Negative Pressure Test - The wearer covers the inhalation opening on the filter, cartridge, or canister and attempts to inhale. A negative pressure should be created inside the facepiece with no leakdown for a period of ten (10) seconds.

13.0 ASSIGNMENT OF RESPIRATORS FOR INDIVIDUAL USE

Each Rust E&I employee who, during the course of his work, is required to use respiratory protection will be assigned an air-purifying respirator for his individual use. The employee shall be responsible for the care, maintenance, inspection and utilization of the respirator as instructed. In the event the employee terminates his employment with Rust E&I, the respirator must be returned in good working order.

14.0 RESPIRATOR STORAGE REQUIREMENTS

Respirators shall be stored in a manner that will protect them against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Respirators shall be stored to prevent distortion of rubber or elastic parts. They shall not be stored in such places as lockers and tool boxes unless they are protected from contamination, distortion, and damage. Emergency and rescue-use respirators that are placed in work areas shall be quickly accessible at all times, and the storage cabinet or container in which they are stored shall be clearly marked.

15.0 PROGRAM EVALUATION AND INSPECTION

The Respiratory Protection Program will be inspected and evaluated on a minimum annual basis. The periodic evaluation of the effectiveness of the Rust E&I Respiratory Protection Program is essential to ensure that employees are being provided with adequate respiratory protection and that compliance requirements of OSHA 29 CFR 1910.134 - Respiratory Protection are being met.

SR shall assume responsibility for the implementation, inspection and evaluation of the Respiratory Protection Program at the division/office level. The REHSM will review reports and consult with the SR on problem areas in the program and communicate them to the CEHSD. The overall responsibility for the evaluation, inspection and implementation of the program is retained by the CEHSD.

16.0 DOCUMENTATION PROCEDURES

The SR or SSO will be responsible for documenting the various actions required by the Respiratory Protection Program. When completed, documents must be retained at the division/office by the SR, and at site locations by the SSO. (See Attachment III - Forms.)

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ATTACHMENT - I

TABLES

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TABLE I: **Classification of Respiratory Hazards According To Their Biological Effect. (Page 1 of 2)**

Oxygen Deficiency	Gas and Vapor Contaminants	Particulate Contaminants (dust, fog, fume, mist, smoke, and spray)
Minimum legal requirements: 19.5% by volume for respirable air at sea-level conditions. Occurrence: Confined or unventilated cellars, wells, mines, ship holds, tanks, burning buildings, and enclosures containing inert atmospheres. Atmospheric oxygen content (percent by volume) versus expected conditions: 20.9% Oxygen content of normal air at sea-level conditions. OXYGEN VOLUME PERCENT AT SEA LEVEL AND RELATED PHYSIOLOGICAL EFFECTS: 16%-12%--loss of peripheral vision, increased breathing volume, accelerated heartbeat, impaired attention and thinking, impaired coordination. 12%-10%--very faulty judgement, very poor muscular coordination, muscular exertion causes fatigue that may cause permanent heart damage, intermittent respiration.	Asphyxiants: Interfere with utilization of oxygen in the body. Simple asphyxiants: Physiologically inert substances that dilute oxygen in the air (for example: nitrogen, hydrogen, helium, methane). See Oxygen Deficiency. Chemical asphyxiants: Low concentrations interfere with supply or utilization of oxygen in the body (for example: carbon monoxide, hydrogen cyanide, cyanogen, and nitriles). Anesthetics: Cause loss of feeling and sensation with unconsciousness and death possible (for example: nitrous oxide, hydrocarbons, and ethers). Some anesthetics injure body organs (for example: carbon tetrachloride [liver and kidneys], chloroform [liver and heart], benzene [bone marrow], and carbon disulfide [nervous system]).	Relatively inert: May cause discomfort and minor irritation, but generally without injury at reasonable concentrations (for example: marble, gypsum). Pulmonary-fibrosis-producing: Produce nodulation and fibrosis in the lung, possibly leading to complications (for example: quartz, gypsum). Carcinogens: Produce cancer in some individuals after latent period (for example: asbestos, chromates, radioactive particulates). Chemical irritants: Product irritation, inflammation, and ulceration in upper respiratory tract (for example: acidic mists, alkalines). Systemic poisons: Produce pathological reactions in various systems of the body (for example: lead, manganese, cadmium). Allergy-producing: Produce reactions such as itching, sneezing, and asthmas (for example: pollens, spices, and animal fur). Febrile-reaction-producing: Produce chills followed by fever (for example: fumes of zinc and copper).

TABLE I: **Classification of Respiratory Hazards According To Their Biological Effect. (Page 2 of 2)**

Oxygen Deficiency	Gas and Vapor Contaminants	Particulate Contaminants (dust, fog, fume, mist, smoke, and spray)
10%-6%--Nausea, vomiting, inhabitability to perform vigorous movement, unconsciousness followed by death.	Sensitizers: Cause increased probability of physiological reactions (for example: isocyanates, epoxy resin system).	
Less than 6%--Spasmatic breathing, convulsive movements, death in minutes.	Systemic poisons: Damage organs and systems in the body (for example: mercury [nervous system and various organs], phosphorus [bone], hydrogen sulfide [respiratory paralysis], and arsine [red blood cells and liver]).	
	Carcinogen: Produce cancer in some individuals after a latent period (for example: vinyl chloride, benzene).	

Combination of Gas, Vapor, and Particulate Contaminants

Combinations of contaminants may occur simultaneously in the atmosphere. Contaminants may be entirely different substances (dusts and gases from blasting) or the particulate and vapor forms of the same substance. Synergistic effects (joint action of two or more agents that results in an effect which is greater than the sum of their individual effects) may occur. Such effects may require extraordinary protective measures.

Source: American National Standard Institute Z88.2, 1980.

TABLE II Color Code for Cartridges and Gas Mask Canisters (ANSI K13.1-1973).

Atmospheric Contaminants to be protected against	Color Assigned
Acid gases	White
Organic vapors	Black
Ammonia gas	Green
Carbon monoxide gas	Blue
Acid gases and organic vapors	Yellow
Acid gases, ammonia, and organic vapors	Brown
Acid gases, ammonia, carbon monoxide, and organic vapors	Red
Other vapors and gases not listed above	Olive
Radioactive materials (except tritium and noble gases)	Purple
Dusts, fumes, and mists (other than radioactive materials)	Orange

Notes:

- A purple stripe shall be used to identify radioactive material in combination with any vapor or gas;
- An orange stripe shall be used to identify dusts, fumes, and mists in combination with any vapor or gas;
- Where labels only are colored to conform with this table, the canister or cartridge body shall be gray or a metal canister or cartridge body may be left in its natural metallic color; and
- The user shall refer to the wording of the label to determine the type and degree of protection the canister or cartridge will afford.

Source: American Industrial Hygiene Association, 1980.

TABLE III SUMMARY OF RPE LIMITATIONS, CAPABILITIES, AND PROTECTION FACTORS[a]. (Page 1 of 4)

Type of Respirator	Permitted for Use in Oxygen-Deficient Atmosphere	Permitted for Use in IDLH Atmosphere[f]	Respirator Protection Factor	
			Qualitative Test	Quantitative Test
Particulate-filter, quarter-mask or half-mask facepiece[b,e]	No	No	10	As measured on each person with maximum of 100.
Vapor- or gas removing, quarter-mask or half-mask facepiece[e]	No	No	10, or maximum use limit of cartridge or canister for vapor or gas, whichever is less.	As measured on each person with maximum of 100, or maximum use limit of cartridge or canister for vapor or gas[ij], whichever is less.
Combination particulate-filter and vapor- or gas-removing, quarter-mask or	No	No	10, or maximum use limit of cartridge or canister for vapor or gas, whichever is less.	As measured on each person with maximum of 100, or maximum use limit of cartridge or canister for vapor or gas[ij], whichever is less.
Particulate-filter, full facepiece[b]	No	No	100	As measured on each person with maximum of 100 if dust, fume, or mist filter is used, or maximum of 1,000 if high-efficiency filter is used.
Vapor- or gas-removing, full facepiece	No	No	100, or maximum use limit of cartridge or canister for vapor or gas, whichever is less.	As measured on each person with maximum of 1,000, or maximum use limit of cartridge or canister for vapor or gas[ij], whichever is less.
Combination particulate-filter and vapor- or gas-removing, full facepiece[b]	No	No	100, or maximum use limit of cartridge or canister for vapor or gas, whichever is less.	As measured on each person with maximum of 100 if dust, fume, or mist filter is used and maximum of 1,000 if high-efficiency filter is used, or maximum use limit of cartridge or canister for vapor or gas[ij], whichever is less.

TABLE III SUMMARY OF RPE LIMITATIONS, CAPABILITIES, AND PROTECTION FACTORS[a]. (Page 2 of 4)

Type of Respirator	Permitted for Use in Oxygen-Deficient Atmosphere	Permitted for Use in IDLH Atmosphere[f]	Respirator Protection Factor	
			Qualitative Test	Quantitative Test
Powered particulate-filter, any respiratory-inlet covering[b,c,d]	No	No (yes, if escape provisions are provided[d])	N/A	N/A
			No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 100 if dust, fume, or mist filter is used and 3,000 if high-efficiency filter is used.	
Powered vapor- or gas-removing, any respiratory-inlet covering[c,d]	No	No (yes, if escape provisions are provided[d])	N/A	N/A
			No tests are required due to positive pressure operation of respirator. The maximum protection factor is 3,000 or maximum use limit of cartridge of canister for vapor or gas[i,j], whichever is less.	
Powered combination particulate-filter and vapor- or gas-removing, any respiratory inlet covering[b,c,d]	No	No (yes, if escape provisions are provided[d])	N/A	N/A
			No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 100 if dust, fume, or mist filter is used and 3,000 if high-efficiency filter is used, or maximum use limit of cartridge or canister for vapor or gas[i,j], whichever is less.	
Air-line, demand, quarter-mask or half-mask facepiece, with or without escape provisions[ce]	Yes[f]	No	10	As measured on each person, but limited to the use of the respirator in concentrations of contaminants below the IDLH values.
Air-line, demand, full facepiece, with or without escape provisions[e]	Yes[f]	No	100	As measured on each person, but limited to the use of the respirator in concentrations of contaminants below the IDLH values.
Air-line, continuous-flow or pressure-demand type, any facepiece, without escape provisions[e]	Yes[f]	No	N/A	N/A
			No tests are required due to positive-pressure operation of respirator. The protection factor provided by the respirator is limited to use of the respirator in concentrations of contaminants below the IDLH values.	
Air-line, continuous-flow or pressure-demand type, any facepiece, with escape provisions[ce]	Yes[f]	Yes	N/A	N/A
			No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 10,000 plus[h].	

TABLE III SUMMARY OF RPE LIMITATIONS, CAPABILITIES, AND PROTECTION FACTORS[a]. (Page 3 of 4)

Type of Respirator	Permitted for Use in Oxygen-Deficient Atmosphere	Permitted for Use in IDLH Atmosphere[f]	Respirator Protection Factor	
			Qualitative Test	Quantitative Test
Air-line, continuous flow, helmet, hood, or suit, without escape provisions	Yes[f]	No	N/A	N/A
			No tests are required due to positive-pressure operations of respirator. The protection factor provided by the respirator is limited to the use of the respirator in concentration of contaminants below the IDLH values.	
Air-line, continuous flow, helmet, hood, or suit, without escape provisions[e]	Yes[f]	Yes	N/A	N/A
			No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 10,000 plus[h].	
Hose mask, with or without blower, full facepiece	Yes[f]	No	10	As measured on each person, but limited to the use of the respirator in concentrations of contaminants below the IDLH values.
Self-contained breathing apparatus, demand-type open-circuit or negative-pressure-type closed-circuit, quarter-mask or half-mask facepiece[e]	Yes[f]	No	10	As measured on each person, but limited to the use of the respirator in concentrations of contaminants below the IDLH values.
Self-contained breathing apparatus, demand-type open-circuit or negative-pressure-type closed-circuit, full facepiece or mouthpiece/nose clamp[e]	Yes[f] (Yes[f] if respirator is used for mine recovery operations).	No (yes, if respirator)	100	As measured on each person, but limited to the use of the respirator in concentrations of contaminants below the IDLH values, except for mine rescue and mine recovery operations.
Self-contained breathing apparatus, pressure-demand-type open-circuit or positive-pressure-type closed-circuit, quarter-mask or half-mask facepiece, full facepiece, or mouth-piece/nose clamp[e]	Yes[f]	Yes	N/A	N/A
			No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 10,000 plus[h].	

TABLE III SUMMARY OF RPE LIMITATIONS, CAPABILITIES, AND PROTECTION FACTORS[a]. (Page 4 of 4)

Type of Respirator	Permitted for Use in Oxygen-Deficient Atmosphere	Permitted for Use in IDLH Atmosphere[f]	Respirator Protection Factor	
			Qualitative Test	Quantitative Test
Combination respirators not listed.	The type and made of operation having the lowest respirator protection factor shall be applied to the combination respirator.			

N/A means not applicable since a respirator-fitting test is not carried out.

[a] A respirator protection factor is a measure of the degree of protection provided by a respirator to a respirator wearer. Multiplying the permissible time-weighted average concentration or the permissible ceiling concentration, whichever is applicable, for a toxic substance, or the maximum permissible airborne concentration for a radionuclide, by a protection factor assigned to a respirator gives the maximum concentration of the hazardous substance for which the respirator can be used. Limitations of filters, cartridges, and canisters used in air-purifying respirators shall be considered in determining protection factors.

[b] When the respirator is used for protection against airborne particulate matter having a permissible time-weighted average concentration less than 0.05 milligram particulate matter per cubic meter of air or less than 2 million particles per cubic foot of air, or for protection against airborne radionuclide particulate matter, the respirator shall be equipped with a high-efficiency filter(s).

[c] If the air contaminant causes eye irritation, the wearer of a respirator equipped with a quarter-mask or half-mask facepiece or mouthpiece and nose clamp shall be permitted to use a protective goggle or to use a respirator equipped with a full facepiece.

[d] If the powered air-purifying respirator is equipped with a facepiece, the escape provision means that the wearer is able to breathe through the filter, cartridge, or canister and through the pump. If the powered air-purifying respirator is equipped with a helmet, hood, or suit, the escape provision shall be an auxiliary self-contained supply of respirable air.

[e] The escape provision shall be auxillary self-contained supply of respirable air.

[f] For definition of "oxygen deficiency - not immediately dangerous to life or health" see Section 3.0.

[g] For definition of "oxygen deficiency - immediately dangerous to life or health" see Section 3.0.

[h] The protection factor measurement exceeds the limit of sensitivity of the test apparatus. Therefore, the respirator has been classified for use in atmospheres having unknown concentrations of contaminants.

[i] The service life of a vapor- or gas-removing cartridge or canister depends on the specific vapor or gas, the concentration of the vapor or gas in air, the temperature and humidity of the air, the type and quantity of the sorbent in the cartridge or canister, and the activity of the respirator wearer. Cartridges and canisters may provide only very short service lives for certain vapors and gases. Vapor/gas service life testing is recommended to ensure that cartridges and canisters provide adequate service lives. Reference should be made to published reports which give vapor/gas life data for cartridges and canisters.

[j] Vapor- and gas-removing respirators are not approved for contaminants that lack adequate warning properties of odor, irritation, or taste at concentrations in air at or above the permissible exposure limits.

Note: Respirator protection factors for air-purifying-type respirators equipped with a mouthpiece/nose clamp form of respiratory-inlet covering are not given, since such respirators are approved only for escape purposes.

Source: Ameri)ational Standard Institute Z88.2, 1980.

ATTACHMENT - II

FIGURES

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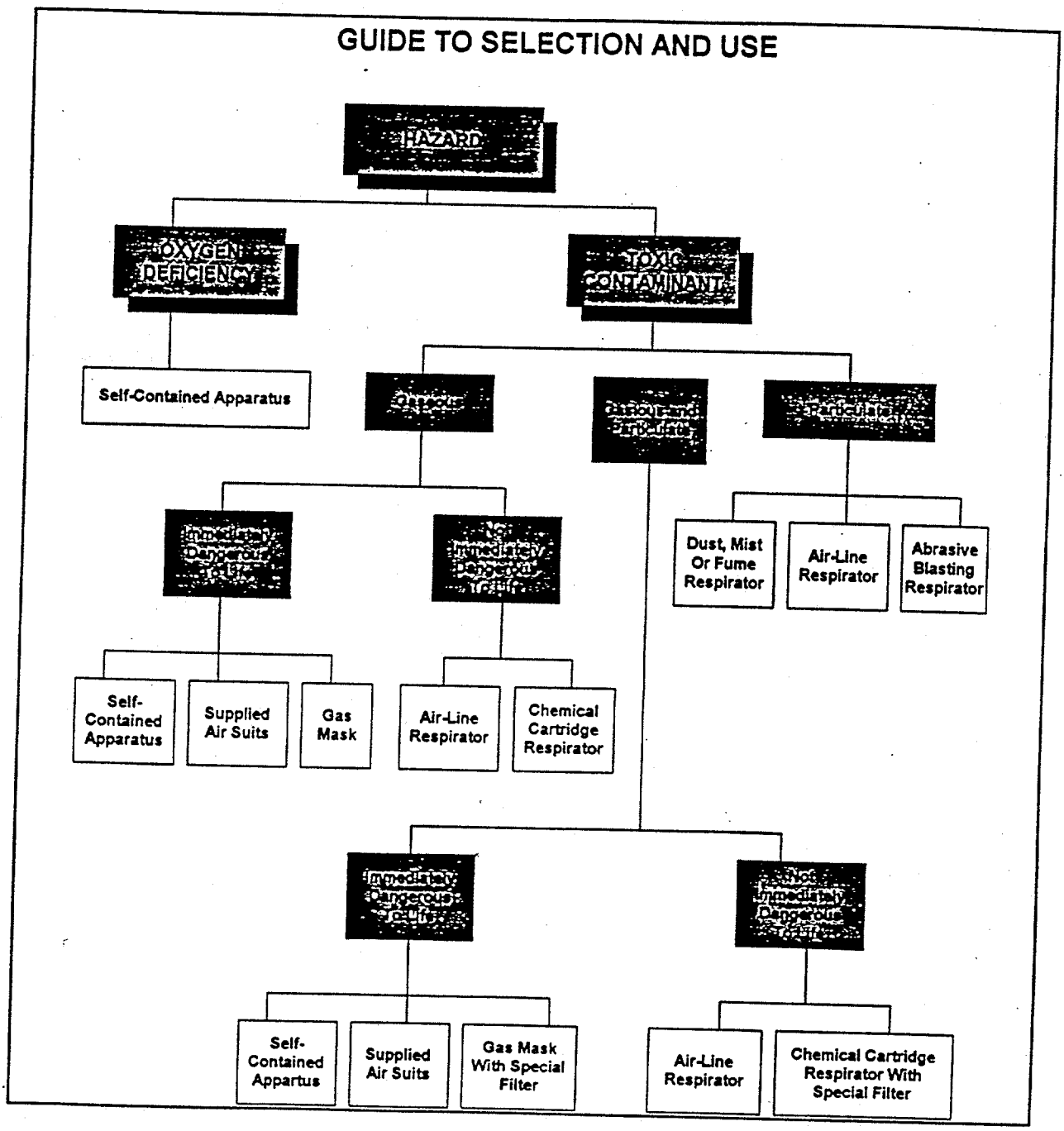
RPE SELECTION DECISION TREE
FIGURE 1

American Industrial hygiene Association, 1980



ATTACHMENT - III

FORMS

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RUST ENVIRONMENT & INFRASTRUCTURE

Air-Purifying Respirators
Assignment and Service Log

RESPIRATOR TYPE (Full-face or Half-face): _____

MANUFACTURER: _____

MODEL NUMBER: _____

SIZE: _____

DATE ASSIGNED: _____

ASSIGNED TO WHOM: _____

INSPECTION AND MAINTENANCE RECORD (TO BE MAINTAINED BY EMPLOYEE)

DATE	SERVICED BY

Note: After each project, submit completed form to your Division Safety Representative.

RUST E & I
INSPECTION & MAINTENANCE CHECKLIST FOR SELF-CONTAINED BREATHING APPARATUS UNIT NO. ____

MONTHLY INSPECTION

DATE INSPECTED	CYLINDER PRESSURE	CYLINDER CHANGED	REGULATOR OK	FACEPIECE & BREATHING TUBE OK	CLEANED AND SANITIZED	ENTIRE APARATUS OK	REMARKS	INSPECTED BY

WEEKLY INSPECTION

DATE	CYLINDER PRESSURE	CYLINDER CHANGED	DATE	CYLINDER PRESSURE	CYLINDER CHANGED	DATE	CYLINDER PRESSURE	CYLINDER CHANGED	DATE	CYLINDER PRESSURE	CYLINDER CHANGED

RUST E & I
INSPECTION & MAINTENANCE CHECKLIST FOR SELF-CONTAINED BREATHING APPARATUS UNIT NO. ____

INSPECTION AFTER EACH USE

DATE USED	CYLINDER PRESSURE	CYLINDER CHANGED	FACEPIECE & BREATHING TUBE OK	ENTIRE APARATUS OK	CLEANED AND SANITIZED	CONNECTIONS OK	REMARKS	INSPECTED BY	DATE

DONOSERV/FORM005B.CHP

RUST E & I
INSPECTION & MAINTENANCE CHECKLIST FOR SELF-CONTAINED BREATHING APPARATUS TANK NO. ____ (CYLINDERS ONLY)

MONTHLY INSPECTION

DATE INSPECTED	CYLINDER PRESSURE	CYLINDER CHANGED	REGULATOR OK	HYDROSTATIC TEST DATE	REMARKS	INSPECTED BY

WEEKLY INSPECTION

DATE	CYLINDER PRESSURE	CYLINDER CHANGED	DATE	CYLINDER PRESSURE	CYLINDER CHANGED	DATE	CYLINDER PRESSURE	CYLINDER CHANGED	DATE	CYLINDER PRESSURE	CYLINDER CHANGED

DONOSERV/FORM006A.CHP

RUST E & I
INSPECTION & MAINTENANCE CHECKLIST FOR AIR-LINE BREATHING APPARATUS UNIT NO. ____

MONTHLY INSPECTION

DATE INSPECTED	CYLINDER PRESSURE	CYLINDER CHANGED	REGULATOR OK	FACEPIECE & BREATH-ING TUBE OK	CLEANED AND SANITIZED	ENTIRE APARATUS OK	REMARKS	INSPECTED BY

WEEKLY INSPECTION

DATE	CYLINDER PRESSURE	CYLINDER CHANGED	DATE	CYLINDER PRESSURE	CYLINDER CHANGED	DATE	CYLINDER PRESSURE	CYLINDER CHANGED	DATE	CYLINDER PRESSURE	CYLINDER CHANGED

DONOSERV/FORM004B.CHP

RUST E & I
INSPECTION & MAINTENANCE CHECKLIST FOR AIR-LINE BREATHING APPARATUS UNIT NO. ____

INSPECTION AFTER EACH USE

DATE USED	CYLINDER PRESSURE	CYLINDER CHANGED	FACEPIECE & BREATHING TUBE OK	ENTIRE APARATUS OK	CLEANED AND SANITIZED	CONNECTIONS OK	REMARKS	INSPECTED BY	DATE

DONOSERV/FORM005A.CHP

RUST E & I
INSPECTION & MAINTENANCE CHECKLIST FOR ESCAPE PACKS BREATHING APPARATUS UNIT NO. ____

MONTHLY INSPECTION

DATE INSPECTED	CYLINDER PRESSURE	CYLINDER CHANGED	REGULATOR OK	FACEPIECE & BREATH-ING TUBE OK	CLEANED AND SANITIZED	ENTIRE APARATUS OK	REMARKS	INSPECTED BY

WEEKLY INSPECTION

DATE	CYLINDER PRESSURE	CYLINDER CHANGED	DATE	CYLINDER PRESSURE	CYLINDER CHANGED	DATE	CYLINDER PRESSURE	CYLINDER CHANGED	DATE	CYLINDER PRESSURE	CYLINDER CHANGED

RUST E & I
INSPECTION & MAINTENANCE CHECKLIST FOR ESCAPE PACKS BREATHING APPARATUS UNIT NO. ____

INSPECTION AFTER EACH USE

DATE USED	CYLINDER PRESSURE	CYLINDER CHANGED	FACEPIECE & BREATHING TUBE OK	ENTIRE APPARATUS OK	CLEANED AND SANITIZED	CONNECTIONS OK	REMARKS	INSPECTED BY	DATE

DONOSERV/FORM008A.CHP

RUST ENVIRONMENT & INFRASTRUCTURE

Qualitative Respirator Fit Test

Name: _____ SSN# _____

Division: _____ Date: _____

Location: _____

		FULL FACE		HALF FACE	
		PASS	FAIL	PASS	FAIL
1.	Challenge test subject with testing agent	____	____	____	____
2.	Positive pressure fit test	____	____	____	____
3.	Negative pressure fit test	____	____	____	____
4.	Normal breathing	____	____	____	____
5.	Deep breathing	____	____	____	____
6.	Turn head from side to side	____	____	____	____
7.	Nod head up and down	____	____	____	____
8.	Talking	____	____	____	____
9.	Jogging in place	____	____	____	____
10.	Normal breathing	____	____	____	____
11.	Sensitivity check	____	____	____	____

Respirator Identification

		FULL FACE	HALF FACE
A.	Manufacturer	_____	_____
B.	Model	_____	_____
C.	Size	_____	_____
D.	Approval Number (TC#)	_____	_____

Testing Agent*

1. Irritant Fume _____
2. Saccharin Solution _____
3. Isoamyl Acetate _____

* Testing must be conducted with agent No. 1 and either agent No.2 or No. 3

Qualitative fit testing shall be:

1. Conducted for full face and half face respirators.
2. Performed immediately when the test subject has a weight change of 20 pounds or more, significant facial scarring, significant dental changes, reconstructive or cosmetic surgery or any other condition that may interfere with facepiece sealing.
3. Performed only on test subjects without hair growth or any other obstruction between the skin and facepiece.
4. Fit-testing for asbestos to be conducted every six months.

_____ _____

Test Conductor Signature/Date Employee Signature/Date

ATTACHMENT - IV

CONDITIONS WHICH EXCLUDE USE OF AIR-PURIFYING RESPIRATORS

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CONDITIONS WHICH EXCLUDE USE OF AIR-PURIFYING RESPIRATORS

- Oxygen deficiency
- IDLH concentration
- Entry into an unventilated or confined area
- Firefighting
- Situation requires a protection factor greater than 50
- Presence of unidentified contaminants
- Contaminant concentrations unknown or exceeding designated maximum use concentration
- Identified chemicals have inadequate or no warning properties
- One or more airborne contaminants that may be sorbed are shock sensitive
- Presence of two or more incompatible contaminants on-site that might react in the cartridge or canister to produce a toxic or hazardous condition
- Relative humidity greater than 65 percent

ATTACHMENT - V

CONTAMINANTS FOR WHICH AIR-PURIFYING RESPIRATORS SHOULD NOT BE USED

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CONTAMINANTS FOR WHICH AIR-PURIFYING RESPIRATORS SHOULD NOT BE USED

Acrolein
Aniline
Arsine
Bromine
Carbon Monoxide
Dimethylaniline
Dimethyl Sulfate
Hydrogen Cyanide
Hydrogen Fluoride
Hydrogen Selenide
Hydrogen Sulfide
Methanol
Methyl Bromide
Methyl Chloride
Methylene Bisphenyl Isocyanate
Nickel Carbonyl*
Nitrobenzene
Nitrogen Oxides
Nitroglycerin
Nitromethane
Ozone
Phosgene
Phosphorus Trichloride
Stibine
Sulfur Chloride
Toluene Diisocyanate
Vinyl Chloride

CAUTION: This list is a partial list only, contact the Health & Safety Department for additional information, as appropriate.

*Requires SCBA/Air-line for all exposures.

ATTACHMENT - VI

CONTAMINANTS FOR WHICH NIOSH RECOMMENDS AIR-SUPPLIED RESPIRATORS

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CONTAMINANTS FOR WHICH NIOSH RECOMMENDS AIR-SUPPLIED RESPIRATORS

CONTAMINANT	AIR SUPPLIED RESPIRATOR REQUIRED ABOVE
Acetylene Tetrabromide	1 ppm
Acrylamide	0.3 mg/m^3
Allyl Chloride	1 ppm
2-Aminophyridine	0.5 ppm
Boron Trifluoride	1 ppm
tert-Butyl Chromate	0.1 mg/m^3
Carbaryl (Sevin)	5 mg/m^3
Carbon Dioxide	5,000 ppm
Carbon Monoxide	50 ppm
Carbon Tetrachloride	10 ppm
Chlorinated Diphenyl Oxide	0.5 mg/m^3
Chlorine Trifluoride	0.1 ppm
(PCB) (42% Chlorine)	1 mg/m^3
(PCB) (54% Chlorine)	0.5 mg/m^3
Chloroform	50 ppm
Chloroprene	25 ppm
Cyanide (KCN, NaCN and others)	5 mg/m^3
Cyclohexane	300 ppm
Decaborane	0.3 mg/m^3
Demeton (Systox)	0.1 mg/m^3
Diazomethane	0.2 ppm
Diborane	0.1 ppm
Dibutyl Phosphate	1 ppm
1,1-Dichloro-1-Nitroethane	10 ppm
Dichlorodifluoromethane	1,000 ppm
Dichloromonofluoromethane	1,000 ppm
Dichlorotetrafluoroethane	1,000 ppm
Dichlorovos (DDVP)	1 mg/m^3
Diethylamino Ethanol	10 ppm
Difluorodibromomethane (Freon 12 B-2)	100 ppm
Diisopropylamine	5 ppm
Dimethyl Acetamide	10 ppm
Dimethyl Formamide	10 ppm
Dimethylaniline	5 ppm
Dimethylsulfate	1 ppm
Dinitrotoluene	1.5 mg/m^3
Dioxane	100 ppm
Dipropyleneglycol Methyl Ether	100 ppm
Epichlorohydrin	5 ppm
EPK	0.5 mg/m^3
2-Ethoxyethanol	200 ppm
Ethyl Bromide	200 ppm

CONTAMINANT	AIR SUPPLIED RESPIRATOR REQUIRED ABOVE
Ethyl Chloride	1,000 ppm
Ethylamine	10 ppm
Ethylene Chlorohydrin	5 ppm
N-Ethylmorpholine	20 ppm
Fluorine	0.1 ppm
Fluorotrichloromethane (Freon II)	1,000 ppm
Glycidol	50 ppm
Heptachlor	0.5 mg/m^3
Hexachloroethane	1 ppm
Hydrogen Cyanide	5 ppm
Hydrogen Peroxide (90%)	1 ppm
Hydrogen Selenide	0.05 ppm
Hydrogen Sulfide	10 ppm
Iodine	0.1 ppm
Ketene	0.5 ppm
Liquified Petroleum Gas (LPG)	1,000 ppm
Inorganic Mercury	0.1 mg/m^3
Methyl Acetylene	1,000 ppm
Methyl Acrylate	10 ppm
Methyl Alcohol	200 ppm
Methyl Bromide	20 ppm
Methyl Cellosolve	25 ppm
Methyl Chloride	100 ppm
Methyl Formate	100 ppm
Methyl Iodide	5 ppm
Methyl Isocyanate	0.02 ppm
Methylal	1,000 ppm
Methylamine	10 ppm
Methylcyclohexanol	100 ppm
Methylene Bisphenyl Isocyanate (MDI)	0.02 ppm
Methylene Chloride	500 ppm
Monomethyl Aniline	2 ppm
Morpholine	20 ppm
Nickel Carbonyl	SCBA - 0.001 ppm
Nicotine	0.5 mg/m^3
p-Nitroaniline	1 ppm
Nitroethane	100 ppm
Nitrogen Trifluoride	10 ppm
Nitropropane	100 ppm
1-Nitropropane	25 ppm
Nitrotoluene	5 ppm
Octachloronaphthalene	0.1 mg/m^3
Organic (Alkyl) Mercury	0.01 mg/m^3
Osmium Tetroxide	0.002 mg/m^3
Oxygen Difluoride	0.05 mg/m^3

CONTAMINANT	AIR SUPPLIED RESPIRATOR REQUIRED ABOVE
Pentaborane	0.005 ppm
Pentachloronaphthalene	0.5 mg/m^3
Perchloromethyl Mercaptan	0.01 ppm
Perchloryl Fluoride	3 ppm
p-Phenylene Diamine	0.1 mg/m^3
Phosdrin (Mevinphos)	0.1 mg/m^3
Phosgene	0.1 ppm
Phosphorus Pentachloride	1 mg/m^3
Phosphorus Pentasulfide	1 mg/m^3
Propane	1,000 ppm
Propylene Imine	2 ppm
Quinone	0.1 ppm
Selenium Hexafluoride	0.05 ppm
Stibine	0.1 ppm
Sulfur Pentafluoride	0.025 ppm
Sulfuryl Fluoride	5 ppm
TEDP	0.2 mg/m^3
Tellurium Hexafluoride	0.02 ppm
TEPP	0.05 mg/m^3
1,1,2-Tetrachloro-2,2-Difluoroethane (112)	500 ppm
1,1,1,2-Tetrachloro-2,2-Difluoroethane (112a)	500 ppm
Tetrachloronaphthalene	2 mg/m^3
Tetraethyl Lead	0.075 mg/m^3
Tetramethyl Lead	0.075 mg/m^3
Thiram	5 mg/m^3
Tributyl Phosphate	5 mg/m^3
1,12-Trichloroethane	10 ppm
Trichloronaphthalene	5 mg/m^3
1,1,2-Trichloro-1,2,2-Trifluoroethane (113)	1,000 ppm
Triethylamine	25 ppm
Trifluoromonobromomethane (Halon 1301)	1,000 ppm
Trinitrotoluene (TNT)	1.5 mg/m^3

APPENDIX G

SPILL PREVENTION CONTROL AND COUNTERMEASURE (SPCC) PLAN/INSTALLATION SPILL CONTINGENCY PLAN (ISCP) FOR OIL AND HAZARDOUS SUBSTANCES

U.S. ARMY MISSLE COMMAND

REDSTONE ARSENAL

SPILL PREVENTION CONTROL

AND

COUNTERMEASURE (SPCC) PLAN

AND

INSTALLATION SPILL CONTINGENCY PLAN (ISCP)

FOR

OIL AND HAZARDOUS MATERIAL

REVISED: AUGUST 91

REVIEWED BY:

BOBBY R. MULLINIX
Deputy Director, Directorate of
Engineering and Housing

PREPARED BY:

JERRY HOLTON
Environmental Protection
Specialist
AMSMI-RA-EH-EQ

APPROVAL RECOMMENDED BY:

DAVID S. BRANHAM
Director, Directorate of Engineering
and Housing
Redstone Arsenal Support Activity
AMSMI-RA-EH

APPROVED BY:

JOSEPH M. MABRY
COL, QM
Deputy Post Commander

1. Management Approval

Full approval is extended by the Management of Redstone Arsenal at a level with authority to commit the necessary resources. The SPCC and ISCP will be implemented as herein described.

Signature_____ Date 23 Jan 92
JOSEPH MABRY
COLONEL, QM
Commander, RASA

Signature_____ Date 10/29/
DAVID S. BRANHAM
Environmental Officer
Redstone Arsenal Support Activity
AMSMI-RA-EH

SPCCP CERTIFICATION

I hereby certfy that I have examined the facility and being familiar with the provisions of 40 CFR 110, 112, 116, 117, 302, AR200-1, and all related regulations attest that this SPCCP has been prepared in accordance with good engineering practices.

Initial Certification

Engineer: [illegible]

Signature: [illegible]

License No: 8259

Date: 10/12/91

SEAL

Amendment 1 Certification

Engineer: _____

Signature: _____

License No. _____

Date: _____

SEAL

Amendment 2 Certification

Engineer: _____

Signature: _____

License: _____

Date: _____

SEAL

Date of Next Biennial Review and Evaluation of Entire Installation and SPCCP to be Accomplished Not Later Than: August 1993.

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Comptroller Office	7k	ISCP-1
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SPCC BACKGROUND INFORMATION

1. General: Regulations have been issued by the US Environmental Protection Agency (EPA), as required by the Federal Water Pollution Control Act (FWPCA), amendments of 1972, to prevent discharges of oil and hazardous substances into the navigable waters of the United States and to contain these discharges if they do occur. These regulations require installations having certain non-transportation related onshore and offshore oil storage facilities to prepare and maintain a Spill Prevention Control and Countermeasure Plan (SPCC Plan) to prevent and control the discharge of oil and hazardous substances before they occur.

a. The SPCC Plan will identify potential sources of oil and hazardous substances and the measures required to prevent and contain any accidental discharge resulting from equipment or storage facility failure. The SPCC Plan is directed by Title 40 CFR Part 112, copies of which are available from the EPA, Washington, DC 20242 or from any EPA Regional Office.

b. This Spill Prevention Control and Countermeasure (SPCC) Plan has been prepared in accordance with AR 200-1, Chapter 8, and MICOM Regulation 420-5.

This Plan is required by the MICOM Disaster Control Plan for Redstone Arsenal (MICOM - DCP).

This Plan has been prepared in two parts. Part I consists of the responsibilities, equipment, supplies, and methods that will be required to prevent contamination of water by oil and hazardous products at Redstone Arsenal.

Part II is a countermeasure plan and describes procedures that will be initiated in the event of a discharge or spill of oil and hazardous substances at Redstone Arsenal.

Annexes I and II are lists of petroleum product storage facilities on Redstone Arsenal containing more that 250 gallons and the sites where other specified chemicals are stored.

Appendix D is a discussion and description of the sites where the largest amounts of petroleum and hazardous waste substances are stored where the potential for a large spill is greatest.

2. General description of Redstone Arsenal, Alabama:

Redstone Arsenal is located in the southwestern portion of Madison County (Figure 1) with its southern border formed by the Tennessee River. It is roughly rectangular, being about 6 miles wide and 10 miles long and occupying 60.4 square miles (38,303 acres). The installation is adjacent to the southwest limits of

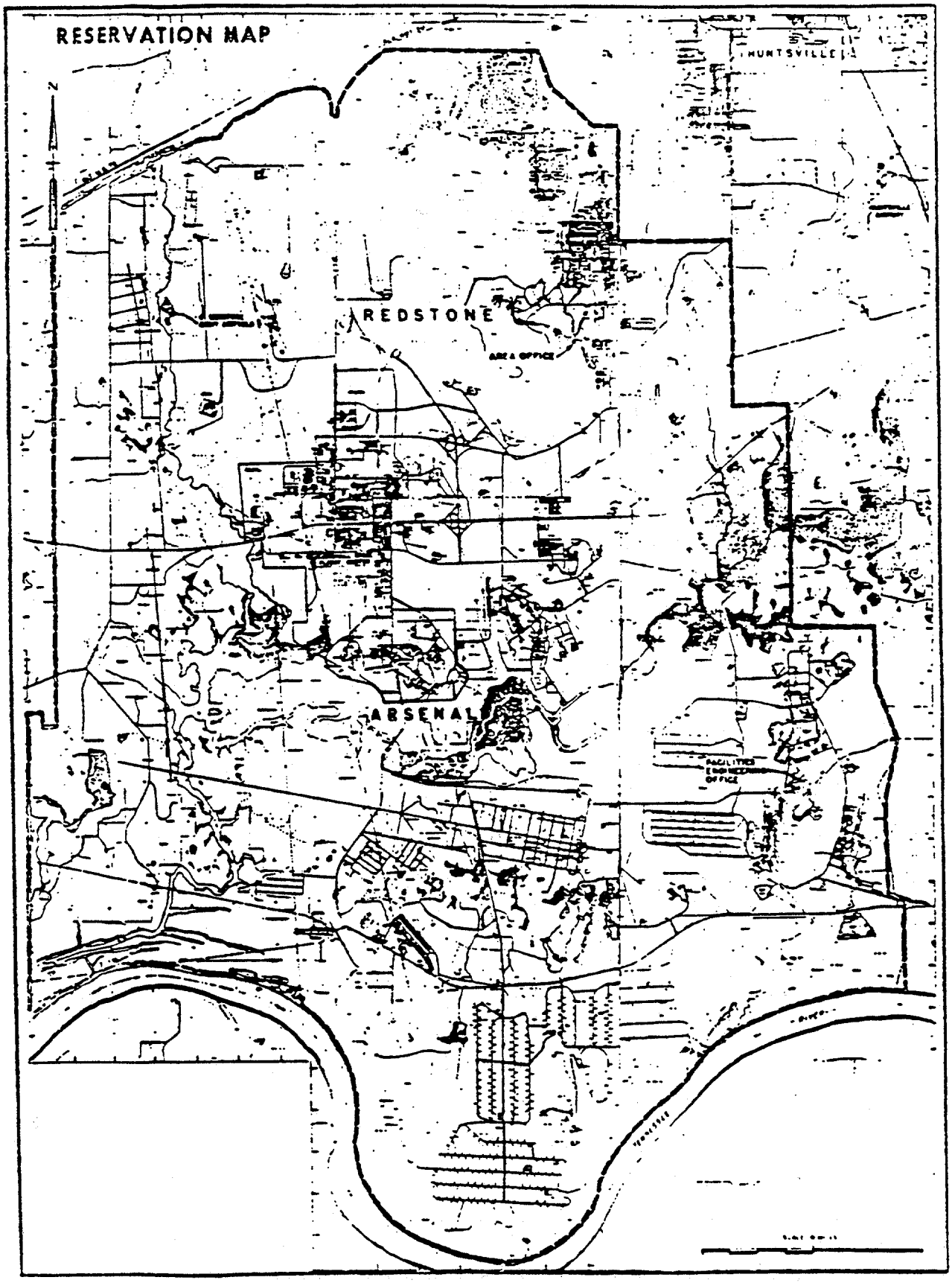

Figure 1 - Redstone Arsenal
SPCC-1a

Huntsville; other cities within a 100-mile radius include Birmingham, Chattanooga, and Nashville.

Of the installation's total acreage, 36,818 acres are controlled by Department of the Army (DA) and 1,840 acres are covered by a long-term grant to the George C. Marshall Space Flight Center, National Aeronautics and Space Administration (NASA) of irrevocable use and occupancy with option to renew. In addition, 2,900 acres are owned by the Tennessee Valley Authority (TVA) but are made available to DA by a use permit, and about 4,100 acres of the Wheeler National Wildlife Refuge lie within the Redstone Arsenal boundary which are also utilized by DA according to the provisions of a permit.

Woodlands occupy about 15,500 acres; approximately 10,000 acres are leased for agricultural use (primarily grazing), and more than 31,000 acres are classified as improved, semi-improved and unimproved. The improved category encompasses 5,365 acres including lawns, athletic fields, golf course, parade grounds, cemeteries, and road shoulders. The semi-improved category includes 515 acres; and in the unimproved category are 25,368 acres of roads, streets, railroads, buildings, ammunition storage, flight ranges, safety zones, demolition and contaminated areas.

3. General description of hydrology at Redstone Arsenal:

a. Surface water:

Surface drainage on the reservation is generally in a southerly direction into the Tennessee River mainly via the three streams shown on Figure 2 and described below.

(1) Huntsville Spring Branch flows for about 1.2 miles through the Arsenal before merging with McDonald Creek (a tributary) and eventually forms Wheeler Reservoir (5 miles in length from the point of merging) to become a tributary of the lower reaches of Indian Creek. Huntsville Spring Branch drains a total area of about 86 square miles and flows from the City of Huntsville in a southwesterly direction, meandering more than 13 miles across the installation before emptying into Indian Creek. The area of Redstone Arsenal drained by this creek is 5,000 acres of which 84 acres are roofs and surfaced areas. The average slope of this drainage is 3 percent.

(2) McDonald Creek enters the northern-most section of the Arsenal and flows for about 1.7 miles to the southeast leaving the installation for a distance of .6 miles. The stream reenters the reservation and flows for approximately 3.3 miles before merging with Huntsville Spring Branch. McDonald Creek drains about 6,000 acres of the installation.

(3) Indian Creek flows north to south through the western portion of the Arsenal for about 6 miles before merging with its

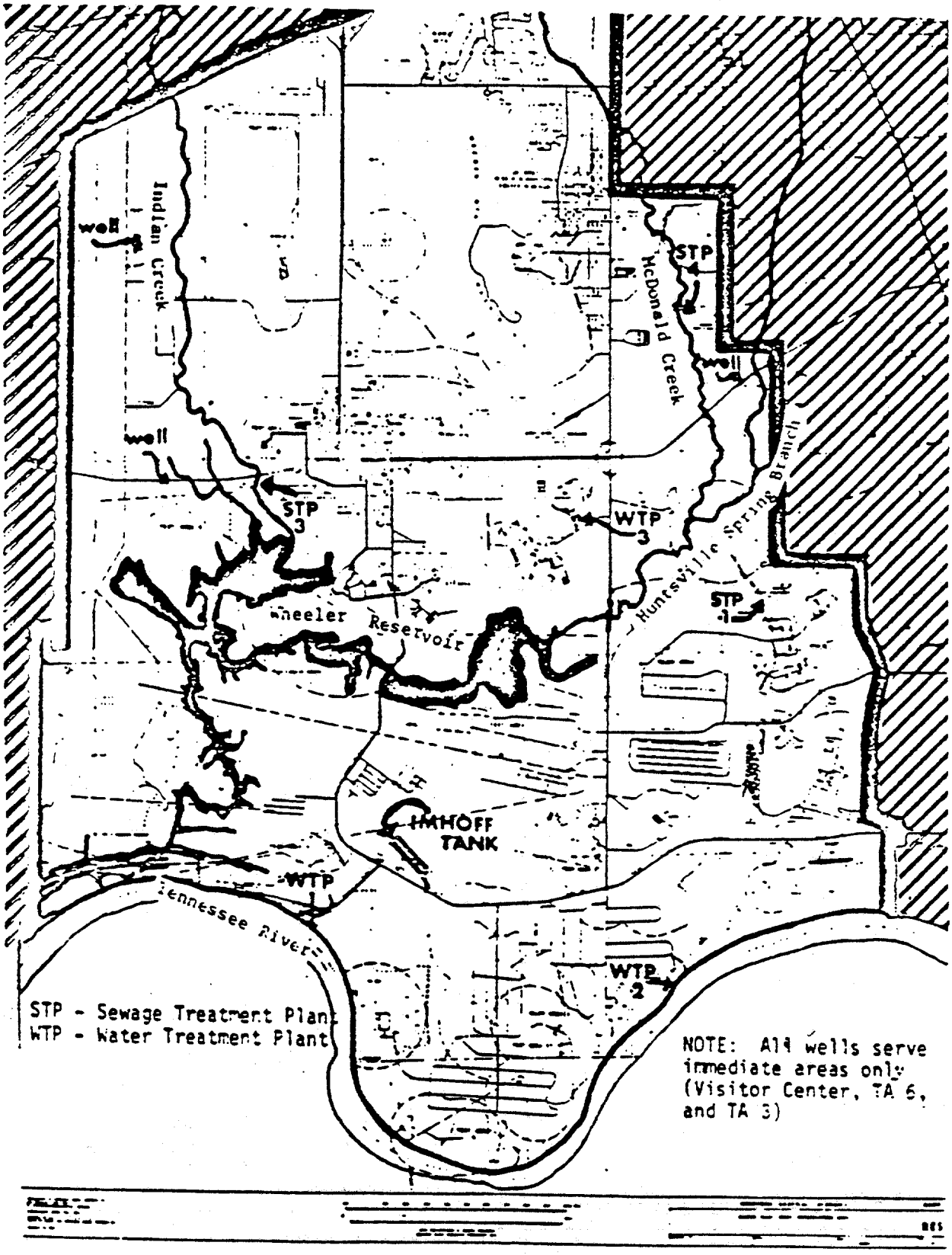

Figure 2. Major Water Courses on Redstone Arsenal.

SPCC-2a

major tributary on Redstone Arsenal (Huntsville Spring Branch). Indian Creek then twists its way for another 4 miles before leaving the reservation boundary. Indian Creek is a tributary of the Tennessee River and drains an area of 143 square miles within the installation boundaries. The average slope of this stream is 5 percent.

b. Ground water:

In the southern part of Madison County (the location of Redstone Arsenal), water encountered in wells penetrating solution cavities generally rises above the point at which it is first encountered. The limestone or chert overlying the solution cavity system is under hydrostatic pressure caused by the weight of the water at higher levels in the solution channels. The water table is highest during February and March in response to recharge from heavy winter rains. During this period, water in most all solutions cavities is under hydrostatic pressure. The water table is generally lowest during October and November and during this period, the water in many of the cavities nearest to the recharge area is under water table conditions.

The general direction of movement of ground water within the intricate system of fracture and solution cavities is to the south.

c. Spill flow pattern:

(1) The greatest potential for a spill is at the storage sites listed in Appendix D - Spill Problem Areas. At Storage Site 1, Building 4725, the storm drainage flow is southwesterly through open drainage ditches toward Indian Creek. All aboveground tanks are diked at this area, eliminating the possibility of a large flow outside the area.

(2) At Storage Site 2, Building 3624, the storm drainage flow is south and then east via open drainage ditches to McDonald Creek. All aboveground tanks are diked in this area, minimizing the possibility of a large flow outside the area.

(3) At Storage Site 3, Petroleum Storage Yard, Building 5631, the storm drainage flow is easterly towards an old railroad bed culvert. This culvert has a quick closing valve attached to prevent spills from flowing through the culvert. The flow is then to the open ditch which drains to the Wheeler Wildlife area, just south of this site. All above ground tanks are diked in this area, and the loading dikes are provided with oil water separators which are large enough to contain spills of 1,000 gallons. These separators are maintained on a monthly basis to assure no oil accumulates in the storage compartment of the separator.

(4) At Storage Site 4, Hazardous Waste Storage Area, the

storm drainage flow is westerly and passes under McAlpine Road via two large culverts. The culverts could easily be blocked in case of spill event. Access to the DRMO Igloos is controlled by DRMO ZWT, 876-3528. Access to the overflow Igloos is controlled by AMSMI-RA-L-SU-ES, 876-2532, or through Test Area 5 by permission of the Test Area 5 Director, 876-5565. The storm drainage flow continues west to a drainage ditch which in turn drains into a ponding area north of the explosive demolition area, Building 8404. This pond then drains to the Tennessee River.

4. General description of geography at Redstone Arsenal:

a. Topography:

The topography rolls gently with some relatively level areas. Elevations on the installation range from 556 feet (normal water level of the Tennessee River) on the southern boundary to a maximum elevation of 1,239 feet on Madkin Mountain in the north-central sector. About 1,450 acres in the southern portion of the installation (part of the Wheeler National Wildlife Refuge) are permanently inundated. An additional 10,400 acres are classified as low areas affected by high stages of the Tennessee River. Mountainous areas comprise about 2,800 acres of Redstone Arsenal.

b. Geology:

The greater part of Redstone Arsenal is underlain by Tuscumbia Limestone. However, the southern-most portion of the installation is characterized by Ste. Genevieve Limestone and Hartselle Sandstone while Fort Payne Chert is characteristic of the bedrock of the northwest corner of the Arsenal. Both Weeden Mountain and Madkin Mountain rise above the surrounding Tuscumbia Limestone in a succession of: Ste. Genevieve Limestone, Hartselle Sandstone, and Bangor Limestone (at the top of the mountains). Bradford Mountain rises above the Tuscumbia Limestone in two distinct zones of Ste. Genevieve Limestone underlying the mountain top composed of Hartselle Sandstone.

5. Spill events:

There were no reportable spill events during the last 12 months at Redstone Arsenal.

PART I

SPILL PREVENTION

1. PURPOSE: To establish standard procedures to prevent discharge of petroleum products and hazardous materials at Redstone Arsenal.

2. SCOPE: This plan applies to all organizations on Redstone Arsenal, including all contractors who receive, store, or use petroleum products and/or hazardous materials.

3. DEFINITIONS:

a. Discharge: Includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying, or dumping that poses a threat to environmental security, and public health or welfare. A discharge that poses a substantial threat to the public health or welfare, or results in critical concern by officials of other agencies or the general public, will be classed as a major discharge.

b. Spill event: A discharge of oil or hazardous material on land, or into, or upon navigable waters of the United States or adjoining shorelines in harmful quantities. For oil, a harmful quantity is that oil in excess of established State of Alabama water quality standards; or that which causes a film, sheen, or discoloration on the surface of the water of adjoining shorelines, or quantities in excess of 1,000 US gallons on land. It is emphasized that any spill of a hazardous substance in a reportable quantity or which poses a substantial threat to the public health or welfare is classed as a medium or major discharge. The cleanup of minor spills of non-hazardous material is the responsibility of the user or contractor causing the spill.

c. Hazardous substance: Any substance designated in accordance to Subsection (b) (2) of Section 311 of the Federal Water Pollution Control Act PL 92-500. See Appendix E of this plan.

d. Installation on-scene coordinator (IOSC): The official predesignated by the Installation Commander to coordinate and direct cleanup efforts at the scene of an oil or hazardous substance discharge on or adjacent to the installation.

e. Installation response team (IRT): Those collective individuals on the installation designated to act in an emergency to perform functions directed by the IOSC.

f. Installation response center (IRC): The center for coordination of activities during a spill event.

g. Regional response team (RRT): The members of a spill control team designated by the Regional EPA Office.

h. Incident Commander: The senior fire officer on duty who is in charge of the incident until it is safe to turn over to the IOSC for clean up.

4. POLICIES:

a. Petroleum products: All petroleum products will be handled, used, and stored to avoid or minimize the possibility of an accidental spill or discharge and pollution of land and water at this installation.

b. Hazardous materials: Spills of hazardous substances in quantities exceeding the reportable quantity (RQ) require reporting (see para 8-3, AR 200-1), immediate action to eliminate the source and contain the spill, and initiation of efforts to mitigate damage. Remedial actions to correct or neutralize spills that could result in additional damage and thus increase the extent of legal liability caused by the spill will be taken only after consultation with the EPA, National Response Center,spill cleanup contractors, or the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA).

c. Storage facilities for petroleum products will be designed and constructed with safeguards such as dikes, catchment areas, skimmers and relief vessels to contain the flow of oil and to minimize the con- tamination of land and water.

d. Contracts for disposal of petroleum products or hazardous substances will contain provisions that require the disposal method to be in accordance with Federal, State and/or Local regulations.

e. The responsibility of implementation of the SPCC shall rest with the Environmental Management Office, Directorate of Engineering and Housing Division, RASA, including the maintenance and periodic updating of the plan.

f. The Spill Prevention and Countermeasure Plan shall be reviewed and evaluated at least once every three years. If the review shows that more effective prevention and control techniques will significantly reduce the likelihood of a spill event, and if the techniques are field-proven and can be procured at the time of the review, the Spill Prevention and Countermeasure Plan shall be amended to reflect the new techniques.

g. Interim amendments may need to be made to this SPCCP when any of the following occur:

(1) There is a change in facility design, construction,

operation or maintenance which materially affects the potential for discharge of oil into or upon the navigable waters of the United States or adjoining shorelines or of hazardous substances in quantities equal to or greater than the reportable quantities. This SPCCP will be amended when the change occurs.

(2) The U.S. EPA Regional Administrator directs that this SPCCP be amended following a discharge of oil in quantities more than 1,000 gallons of oil into or upon navigable waters in a single spill event or two harmful discharges of oil in any 12 month period of time. This SPCCP will be amended within 30 days of notice from the EPA.

h. All amendments to this SPCCP, except those directed by the EPA Regional Administrator, will be certified by a PE registered in the state in which the installation is located. The interim amendment certifications, if applicable, will be incorporated in addition to the three year certification. All amendments to this SPCCP will be implemented as soon as possible, but not later than 6 months after the three year review, after a change in facility, or after the effective date of an EPA directed amendment.

5. RESPONSIBILITIES:

a. All organizations, building custodians, and contractors on Redstone Arsenal that receive, store, or dispense petroleum products or hazardous materials will be responsible for:

(1) Visually inspecting storage containers and areas at least once every week, for leaks or spills.

(2) Having a responsible person in attendance when filling containers in case of a spill or leak.

(3) Developing a written spill plan that summarizes all emergency situations and procedures.

(4) REPORTING ALL SPILLS OR LEAKS IMMEDIATELY TO THE FOLLOWING PERSONS:

FIRE DEPARTMENT EMERGENCY NUMBER 117 (or 876-2117)

b. The Directorate of Engineering and Housing, AMSMI-RA-EH, will be responsible for:

(1) Review and revision of spill plans and programs.

(2) Inspection for compliance and adequacy, and rendering final decisions when necessary.

(3) Requiring concerned supervision to implement that part of Spill Prevention Control and Countermeasure Plan for which

they are responsible.

(4) Notifying the Commander of RASA and providing current information throughout cleanup operations.

(5) A regular program of pressure testing of each of the underground storage tanks as listed in Annex II.

c. Installation On-Scene Coordinator, (IOSC), MICOM Environmental Office, will be responsible for:

(1) OVERALL SUPERVISION OF THE IMPLEMENTATION OF THE SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN, INCLUDING DIRECTION OF ALL CLEANUP EFFORTS REQUIRED BY ANY SPILL AND DIRECTION OF ALL BAMSI SUB-ELEMENTS ASSIGNED RESPONSIBILITIES ELSEWHERE WITHIN THIS PLAN. THE MICOM INSTALLATION SPILL CONTINGENCY PLAN (ISCP) WILL SERVE AS A GUIDE FOR ACTION AT THE SCENE OF A SPILL.

(2) Providing assistance and coordinating with appropriate agencies tasked to aid in cleanup of non-Army spills and recovery of cost in accordance with AR-500-60, Disaster Relief.

d. BAMSI Environmental Coordinator will be responsible for:

(1) Overall supervision of storage handling and use of fuel oil within the Directorate of Engineering and Housing.

(2) Preparing a list of positions, phone numbers, addresses and alternates to be notified in case of a spill occurrence.

(3) Providing space in Building 5414 to be used as Installation Response Operations Center during a spill occurrence.

(4) Assuring that in case of a spill event, protective action be taken for waters at Redstone Arsenal in the following priority:

(a) The intake at Water Treatment Plants 1 and 2 in case of an upstream spill.

(b) Waters that discharge directly to the Wheeler Wildlife Refuge.

(c) Waters that discharge indirectly to Wheeler Wildlife Refuge.

e. Mechanical Section, BAMSI, will be responsible for:

(1) Formulating detailed inspection, maintenance, and repair programs to ensure that all equipment and facilities used in/or related to the unloading and storage of oil or hazardous substances at this installation are maintained at acceptable levels of operating efficiency. Specifically, this will include

a regular program of calibrating the level gages on the applicable tanks as listed in Annexes I and II.

(2) Assuring that periodic communications are made with personnel of the Structures and Grounds Branch to ascertain the operating condition of major items of equipment which may be required for containing and controlling petroleum product spills.

(3) Assuring that acceptable temporary storage tanks are provided for transfer of petroleum products from ruptured storage tanks. One of the three tanks at Building 4234 will be set aside as temporary storage space.

f. Boiler Plant Unit, BAMSI, will be responsible for:

(1) Supervision of the implementation of inspection, maintenance, and repair programs concerning all equipment and facilities used in/or related to the unloading, storage, or transportation of petroleum pro- ducts at the Boiler Plant Buildings 3624 and 4725.

(2) Assuring that storage tanks such as 4234a, 4234b, & 4234c designated as temporary storage tanks, will be maintained in a high state of readiness.

(3) Assuring that sufficient stocks of oil absorbent materials are established and maintained at Buildings 3624 and 4725 for cleanup of petroleum product spills up to and including 1,000 gallons in quantities as listed below:

(a) Building 4725:

3M Oil Sorbent

Type 126	12 bales
Type 156	12 bales
Type 210	4 bags
Type 240	4 bags

Mining Chemical Company
Oil Sorbent Clay
(50-lb bags) 10 bags

(b) Building 3624:

3M Oil Sorbent

Type 126	12 bales
Type 156	12 bales
Type 210	4 bags
Type 240	4 bags

Mining Chemical Company

Oil Sorbent Clay (50-lb bags)	10 bags

(4) Establishing emergency stock levels of absorbent materials with Supply Division sufficient to cleanup oil spills greater than 1,000 gallons.

(5) Assuring that containers are provided at major unloading sites for draining oil from tank truck hoses.

(6) Assuring that small oil spills encountered while unloading oil into storage tanks are cleaned up using materials stored at unloading sites. The following #2 fuel oil boiler plants should be inspected regularly:

BLDG No.	BLDG No.	BLDG No.	BLDG No.
115	5298	7362	7855
130	5410	7416	8009
376	5561	7425	8014
1500	6100	7437	8019
3220	6260	7579	8028
3230	7102	7604	8038
3772	7105		8716
4100	7153	7668	8786
4813	7289		8874
4816	7291	7770	8977,8999

g. Heating Systems Unit, BAMSI, will be responsible for:

(1) Reporting oil spills to the Fire Department Emergency number 117 (or 876-2117) as soon as they occur.

(2) Performing inspections of unloading operations to determine that correct procedures are followed regarding cleanup of oil spills, draining of oil hoses, pickup of oil from sumps by contractor personnel, and storage of oil absorbent materials at unloading sites.

(3) Reporting of habitual oil spills caused by careless and inefficient procedures during unloading operations.

(4) Assuring that all valves used in draining water from dikes are normally closed and are opened by mechanics only after permission is granted by the concerned foreman. The foreman shall perform an inspection of the drainage operation before starting to determine if oil is in the water and, after completion, to be sure that all drainage valves are closed.

(5) Performing inspections of oil unloading, storage, and in-house transfer equipment for operating readiness, oil leaks,

and proper use; inspections of all dikes, berms, and drainage equipment; and inspection of oil drainage sumps for quality of performance by the contractor charged with disposal of drainage oil.

(6) Initiating Maintenance Service Orders and Individual Job Orders for any work relating to the maintenance and repair of oil unloading equipment, storage tanks, berms, drainage equipment, and all equipment associated with pumping oil from the storage tanks to the heating units.

h. Water/Waste Water Section, BAMSI, will be responsible for:

(1) Ensuring that chlorine, sodium fluoride, liquid caustic and liquid alum is stored and handled in accordance with RA-SOP-385-10-9.

(2) Assuring that all water treatment plant, waste water treatment plant, and swimming pool operators are cognizant of hazards involved with chlorine and that the spill prevention and control procedures are followed as necessary.

(3) Performing inspections of the liquid alum and liquid caustic systems located at Water Treatment Plants No. 1 and 2 for leaks and necessary maintenance.

(4) Assuring that unloading operations are performed in a manner that eliminates spillage and that unloading equipment meets the required standards.

i. Electrical Section, BAMSI, will be responsible for:

(1) Inspecting on a quarterly basis electrical transformers, capacitors and switching circuits in service which have reportable quantities of oils which could be a possible source of spills of oil or hazardous materials. These reports must be promptly sent to the Environmental Office, AMSMI-RA-EH-EQ.

(2) Provide service and assistance at any spill scene requiring electrical network involvement.

j. Structures and Grounds Branch, BAMSI, will be responsible for:

(1) Furnishing manual assistance, equipment, and materials such as straw, fill dirt. etc., as required to assist in the cleanup of oil and hazardous property spills.

(2) Maintaining communications with and preparing a list of names and addresses of private contractors, National Guard units and/or Reserve units that would be available for assistance in case of a major spill occurrence.

(3) Providing assistance and coordinating with the IOSC to

help appropriate agencies tasked to aid in cleanup of non-Army spills.

k. Engineering Branch, BAMSI, will be responsible for:

(1) Preparing plans and specifications for new installation or modification of spill prevention and control projects.

(2) Furnishing technical assistance where necessary.

(3) Assuring that necessary contracts for work at Redstone Arsenal provide specifications pertaining to the SPCC for control of oil and hazardous materials in accordance with this plan and MICOM Reg 420-5.

l. Material Control Section, BAMSI, will be responsible for:

(1) Storing materials for issue and turn-in in such a manner as to prevent spills of oil or hazardous material.

(2) Providing tools and protective clothing for issue to personnel for use in spill cleanup actions.

m. Chief, Fire Prevention and Protection, AMSMI-RA-EH-FD, will be responsible for:

(1) Being the First Responder at all spill events.

(2) Setting up the Incident Command System at spill events, if necessary.

(3) Being the Incident Commander at spill events.

(4) Ensuring sufficient firefighters are trained on all shifts to the Operational Level and Technician Level as required by 29 CFR 1910.1200.

(5) Providing fire prevention and protection and emergency first aid at the scene of a spill event until hazards are eliminated.

n. Chief, Environmental Management Office, AMSMI-RA-EH-EQ, will be responsible for:

(1) Providing necessary reports and correspondence to higher headquarters as required by AR 200-1, Chapter 8, paragraph 11.

(2) Overall supervision, periodic review, and updating of Spill Prevention Control and Countermeasure Plan.

(3) Assuring that plans and programs are followed except where deviation is necessary and in the best interest of the Government.

(4) Assuring that records are maintained which are adequate to evaluate the effectiveness of the Spill Prevention and Countermeasure Plan.

(5) Conducting periodic inspections to evaluate the effectiveness of this plan.

(6) Providing the Installation On Scene Coordinator (IOSC).

o. Chief, Supply Division, BAMSI, will be responsible for:

(1) Receiving, storing and running inventory of all oil stored at Redstone Arsenal.

(2) Controlling oil and hazardous materials in accordance with this plan and RA-SOP 385-5. (excluding explosives)

(3) Furnishing oil tanker trucks for transporting oil from above or below ground oil storage tanks to other designated temporary storage areas.

(4) Maintain a stock of oil absorbent materials to be used in cleaning up oil spills. Materials and stocking levels are as follows:

(a)	3M Company Oil Sorbent, Type 156	100 bales
(b)	3M Company Oil Sorbent, Type 126	100 bales
(c)	3M Company Oil Sorbent, Type 210	40 bags
(d)	3M Company Oil Sorbent, Type 240	40 bags
(e)	Oil Sorbent Clay	40 bags
(f)	Miniboom, 3M T12 (12'x3"	10 ea

These items are stored in Building 8026 in the custody of the Supply Office, phone number 876-4883.

(6) Performing inspections to assure that metal containers are maintained at oil unloading sites for use in draining oil from hoses.

(7) Assuring that all Supply Division foremen, mechanics, and operators are thoroughly acquainted with the requirement for reporting spills as soon as they occur.

p. Equipment Management Division, BAMSI, will be responsible for:

(1) Furnishing manual assistance and emergency wrecker service as necessary to aid in removal of equipment from scene of spill events.

(2) Assuring that all Equipment Management branch chiefs, foremen, mechanics and operators are thoroughly acquainted with the requirement for reporting spills of oil or hazardous substances as soon as they occur.

q. Chief, Defense Reutilization/Marketing Office, DRMO-ZWT, is responsible for:

(1) Reutilizing within DoD, transferring to another Federal Agency, donating to an authorized donee, selling, or awarding and managing a contract for disposal of waste oil. The contractor will be responsible for disposing of this waste oil by a method that will not pollute waters of the United States. The waste oil is stored in containers or tanks near the following buildings and removed by the purchasing contractor:

Building No. 3338 - Equipment Motor Pool - OMMCS.
Building No. 3665 - Motor Pool.
Building No. 3777 - Equipment Management.
Building No. 4500 - Mechanical Laboratory.
Building No. 5400 - Laboratory.
Building No. 5427 - Oil/Water Separator/Storage.
Building No. 8024 - Box and Crate Shop.

(2) Awarding and managing contracts for the disposal of hazardous wastes for which the Defense Logistics Agency has assumed responsibility.

r. George C. Marshall Space Flight Center (MSFC).

(1) The US Army is responsible for supplying steam, electricity, water and waste water treatment services to MSFC, a separate agency located on Redstone Arsenal. The US Army is responsible for spills which occur in association with these services.

(2) Coordination between Redstone Arsenal Directorate of Engineering and Housing and MSFC Pollution Control Office will be initiated in the event of a spill on MSFC property.

(3) MSFC Notification will be as follows:

(a) Facilities Engineer AB01, 544-7843

(b) Pollution Control Office AB44, 544-7931/7932

(c) Plant Management Division AB31, 544-7886

(d) MICOM Environmental Office, 876-6122

(4) MSFC will be responsible for spills caused by activities

and services not related to Army Support Activities. MSFC has an SPCC plan for this purpose. A copy of MSFC's SPCC is on file at the Environmental Office, AMSMI-RA-EH-EQ, 876-6122.

(5) MSFC will notify the Director of Engineering and Housing AMSMI-RA-EH, 876-3516, of any spill, regardless of responsibility, as soon as possible after the occurrence.

s. Thiokol, Corporation:

(1) The US Army is responsible for supplying utility services to THIOKOL, Inc, a government-owned contractor-operated organization on Redstone Arsenal. The US Army is responsible for spills which occur in association with these services.

(2) THIOKOL, Corporation has its own SPCC Plan for control of oil and hazardous materials generated by their separate activities. Spills in the THIOKOL area should be reported as follows:

(a) Environmental Control Office, (205) 882-8496.

(b) Manager, Facilities Maintenance, (205) 882-8183.

(c) Safety Officer, 882-8438.

(3) THIOKOL will call the Fire Department through a direct line at Visitor Control, and notify the Director of Engineering and Housing, AMSMI-RA-EH, 876-3516, as soon as possible after a spill occurs, regardless of whose responsibility it is.

t. Commander, USA MEDDAC, HSXW-CO, will be responsible for:

Advising the IOSC on the safe handling of hazardous substances.

6. TRAINING:

a. Responsible Division Chiefs, Branch Chiefs, and Supervisors, as described in paragraph 5, Part I, will ensure that personnel receive proper training in the areas of their concern and that these personnel will attend Environmental Protection Agency, Army Training Schools or other applicable schools for the purpose of spill control and countermeasure training.

b. Responsible Division Chiefs, Branch Chiefs, and Supervisors will:

1. ensure that appropriate personnel are instructed in the use of the Spill Prevention Control and Countermeasure Program as it affects the work areas.

2. ensure that all individuals who, within the course of

their duties, may discover a hazardous materials release be trained to the Awareness Level in accordance with 29 CFR 1910.120.

PART II

COUNTERMEASURES

1. SCOPE: This part describes the procedures and activities that will be initiated in the event of an oil spill or the discovery of a leak in any of the aboveground or underground storage tanks that are listed in Annexes I and II of the basic plan.

2. ACTIVITIES: The actions required in case of an actual spill are described in the MICOM Installation Spill Contingency Plan (ISCP). Activities designated in Part I will assure that all personnel involved with this plan (SPCC) are also familiar with the ISCP.

3. EQUIPMENT: The following equipment will be available on the installation in the event of an oil spill or tank leak:

a. One 5,500-gallon tank truck and one 1,200-gallon tank truck with reversible pumps, available from Chief, BAMSI Chief, Logistics Division.

b. One 1,000-gallon tank truck with vacuum pump liquid removal system available from Water and Sewage Maintenance Unit, BAMSI, 876-1739.

c. The following equipment is available from the Heavy Equipment Unit, 876-2545:

(1) Three bulldozers.

(2) Five dump trucks (5 CY each).

(3) Three front-end loaders (1 CY, 1-1/2 CY, and 2-1/2 CY).

(4) One truck mounted crane (3/4 CY).

(5) One gradall (1/2 CY).

4. OPERATIONS: Operations at Supply Division, BAMSI fuel and transfer locations:

a. Equipment: One 5,000-gallon tank truck and three 1,200-gallon tank trucks, total of four tank trucks, one 1/2 ton pickup truck for support.

b. Transfer rate: Highest rate of transfer at fuel storage area is 85 gallons per minute.

c. Secondary containment: Secondary containment of fuel oil spills is in drainage ditches surrounding the site. The outlet for this ditch has a "Quick Closing" valve to contain any

fuel oil spills prior to leaving the drainage system.

d. Runoff handling: Runoff in the fuel storage area is controlled by using a collection system and oil water separators at each of the three loading sites.

e. Operating procedures: Operating procedures for fuel transfer sites are on file at the storage locations. Copies are on file at the MICOM Environmental Office, AMSMI-EQ.

f. Monitoring: Qualified personnel at the fuel storage operations site monitor the loading and unloading procedures to ensure against premature departure by the tank trucks. Daily monitoring of the operations is provided by assigned personnel and transfer devices are inspected on a regular basis of daily operations. Maintenance is performed as necessary.

5. NOTIFICATION PROCEDURES:

a. IN THE EVENT OF ANY SPILL DURING OR AFTER WORKING HOURS, NOTIFY:

FIRE DEPARTMENT EMERGENCY NUMBER, 117 (or 876-2117)

6. SPILL COUNTERMEASURES: In the event of an oil spill, the following actions will be taken by the IOSC:

a. An earth dike will be immediately built enclosing the area covered by the spill to contain the oil.

b. All of the oil that can be removed by pumps on the tank trucks will be removed.

c. Earth, hay, or other absorbent material will then be used to absorb the rest of the oil that cannot be removed by pumping.

d. All contaminated earth, hay and other absorbent material will then be removed from the area and disposed of in a manner approved by existing EPA regulations.

7. <u>LEAK COUNTERMEASURES</u> - In the event that a leak is discovered in one of the storage tanks, the following actions will be taken by the IOSC:

a. Underground:

(1) The oil in the tank will be removed by the tank trucks and stored in any other tanks available until used or disposed of through proper channels.

(2) The tank will then be removed, repaired, and tested or replaced as necessary.

(3) All contaminated earth will be removed and disposed of in a manner approved by existing EPA regulations.

b. Aboveground:

(1) All of the oil remaining in the tank will be removed and stored in any other available tanks until used or disposed of through proper channels.

(2) All of the oil within the diked area that can be removed by pumps will be removed by tank trucks to other available tanks and disposed of through proper channels. There is an empty tank available at Building 4234 with a capacity of 700,000 gallons not being used due to safety regulations which could be waived in an emergency.

8. HAZARDOUS SUBSTANCES COUNTERMEASURES:

a. Hazardous materials: Spills of hazardous substances in quantities exceeding the reportable quantity (RQ) require reporting (see para 8-3, AR 200-1), immediate action to eliminate the source and contain the spill, and initiation of efforts to mitigate damage. The Chief, Environmental Mangement Office, or his representative is responsible for reporting Reportable Quantity spills to the proper agencies. Remedial actions to correct or neutralize spills that could result in additional damage and thus increase the extent of legal liability caused by the spill will be taken only after consultation with the EPA, National Response Center,spill cleanup contractors, or the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA).

b. Hazardous substances located on Redstone Arsenal that are handled in large quantities with a potential to cause a spill event are listed below along with the reportable quantity level for each material.

Hazardous substance	Reportable Qty (pounds)
Chlorine	10
Sodium Hypochlorite (laundry bleach)	100
Trichloroethylene	1000
Sodium Hydroxide (liquid caustic)	1000
Aluminum Sulfate (liquid alum)	5000
Sodium Silicofluoride	1000
Polychlorinated Biphenyls	10
Methylene Chloride	100
1,1,1 Trichloroethane	1000

Spills in excess of the above listed quantities into navigable waters shall be immediately reported to EPA, telephone

number 404-881-4062 and the National Response Center, 800-424-8802.

c. Approved actions for liquid alum and liquid caustic countermeasures on land:

(1) Spills of liquid alum or liquid caustic: When a spill is discovered, the area of the spill will immediately be flushed with large amounts of water to dilute the hazardous substances to the point of having no adverse effect.

(2) Leaks of liquid alum or liquid caustic:

(a) The hazardous substances will be retained in a containment area and pumped from there back into the water treatment system for use.

(b) After the tank is repaired or replaced the containment area will be flushed with water and the effluent returned to the head of the water treatment plant for treatment.

9. FOLLOW-UP ACTIONS:

a. In the event that any of the above emergencies occur, the streams in the vicinity will be inspected regularly by the Water Quality Chemist, 876-4062, for the next 30 days. If spill contamination is discovered, it will be removed by EPA-approved methods.

b. The Director of Engineering and Housing will forward to EPA Regional Office in Atlanta, a written report of the occurrence in accordance with Table 9-2, AR 20-1, within 60 days.

10. ANNUAL ENACTMENT OF SPCC: This plan will be simulated at least annually by notification of an incident by Chief, Environmental Management Office, Directorate of Engineering and Housing, RASA.

11. CORROSION CONTROL: Corrosion protection systems are installed on most underground fuel tanks. Due to oil soaked sand surrounding the aboveground tanks, corrosion is not likely to occur unless water is allowed to stand in the diked area.

12. CONTAINMENT: Each aboveground tank is diked separately to contain the holding capacity of that tank. Dikes are constructed of red clay and compacted to at least a density of 95 percent. Typical plan and elevation views are shown in Figures 3 and 4.

INSTALLATION SPILL CONTINGENCY PLAN

1. GENERAL INFORMATION:

A National Oil and Hazardous Substances Pollution Contingency Plan was developed in accordance with the provisions of the Federal Water Pollution Control Act (FWPCA) Amendments of 1972 (33 USC 1151 et seq.) and requires Federal agencies to develop a plan to clean up discharges of oil and hazardous substances for which they are responsible. Commanders will maintain an Installation Spill Contingency Plan (ISCP) to identify resources to be used to clean up discharges on Army installations and will be prepared to provide assistance to non-DA agencies when requested. AR 500-60 provides policy and guidance for the DA response to the National Oil and Hazardous Substance Pollution Contingency Plan to assist EPA and the National Response Center in spills caused by other than DA agencies.

2. PURPOSE OF ISCP:

The Installation Spill Contingency Plan (ISCP) has been prepared in accordance with AR 200-1, Chapter 8, MICOM Disaster Control Plan, and MICOM Regulation 420-5. This plan implements the requirements described in the Spill Prevention Control and Countermeasure (SPCC) plans for Redstone Arsenal, Alabama.

3. CONCEPT OF ISCP:

The concept of this plan is a five-phase operation beginning with the initial notification of a spill. The spill is then evaluated for severity and a determination is made as to the action required to contain it. When containment has been accomplished, cleanup and restoration operations are conducted. The final phase is primarily administrative and consists of determining financial responsibility, enforcement, and submission of reports. These phases may become intermingled or some may occur simultaneously; however, they are established and described separately for the purpose of clarity.

4. NOTIFICATION PROCEDURES:

a. IN THE EVENT OF ANY SPILL DURING WORKING HOURS, CALL:

FIRE DEPARTMENT EMERGENCY NUMBER, 117 (or 876-2117)

The Fire Department Dispatcher will call:

INSTALLATION ON-SCENE COORDINATOR, 876-6125/6122, 842-0314

MILITARY POLICE, 876-2222/4135

b. IN THE EVENT OF A SPILL AFTER WORKING HOURS, CALL:

FIRE DEPARTMENT EMERGENCY NUMBER 117 (or 876-2117)

The Fire Department Dispatcher will call:

MICOM OFFICER OF THE DAY, 876-3331.

EMERGENCY RESPONSE CENTER, 876-3331

HOME PHONE NUMBERS OF SPILL RESPONSE PERSONNEL

5. INITIAL RESPONSE ACTIONS

The primary concern in any spill situation is to protect personnel from harm. Whenever a spill is discovered by an employee, the employee shall notify his/her supervisor immediately. The person finding the spill shall report the spill to the Fire Department Emergency Number, telephone 117 (or 876-2117). In most cases, the initial observer will know what material has been spilled, and should be aware of the safety precautions required. If there is any doubt, the observer should get safely away, and await the arrival of the Installation Response Team. Individuals working around hazardous materials should be instructed and well informed of the safety measures and spill procedures applicable to the materials. The initial response actions outlined below can prevent a small incident from becoming a major event if carried out in a prompt and efficient manner by well trained personnel.

a. Protect yourself and others from harm. If you find a spill, your safety and the safety of others is the primary concern. Promptly call the Fire Department Emergency Number 117 (or 876-2117), evacuate the area, extinguish smoking materials, and remove potential sources of ignition.

b. Stop the flow of material if you and others are protected from harm. Once you have protected yourself and others from harm, you should attempt to stop the flow of the spilled materials ONLY IF ALL OF THE FOLLOWING APPLY:

(1) You have been trained in spill response procedures.
(2) You know what the material is.
(3) You have proper personal protective equipment.
(4) You have proper tools and supplies on hand.
(5) You have reported the spill to telephone 117 (or 876-2117)
(6) You are not alone.

Measures to stop the flow include closing valves, uprighting ruptured containers, plugging leaks, or using absorbents to pick up the spilled material.

c. Contain the spill if possible, ONLY IF ALL OF THE FOLLOWING APPLY:

(1) You have been trained in spill response procedures.
(2) You know what the material is.
(3) You have proper personal protective equipment.
(4) You have proper tools and supplies on hand.
(5) You have reported the spill to telephone 117 (or 876-2117).
(6) You are not alone.

Spills can be contained by building dikes, covering drains, or placing absorbents in and around the spill.

d. The senior occupant or supervisor in charge of the area where the spill has occurred will report to the Incident Command Post set up by the Fire Departent at the scene to act as the subject matter expert for the Incident Commander and will render technical advice about the spilled substance.

6. Fire Department Dispatcher Action for Spill Notification

a. WHEN A SPILL, OF A CHEMICAL, OIL, OR UNKNOWN SUBSTANCE IS REPORTED DURING DUTY HOURS, FIRE DEPARTMENT DISPATCHER WILL NOTIFY:

A. Environmental Office/Installation On-Scene Coordinator, Mr. Holton	876-6125
(If not available, notify)	842-0314
Mr. Hagler/Ms. Bowers/Mr. Souza/	876-6122/6124
B. Military Police, AMSMI-RA-PM	876-2222/4135
Environmental Office will notify:	
1. Dr. Branham/Dr. Mullinix, AMSMI-RA-EH	876-3516/2423
AMSMI-RA-EH, will notify Colonel Mabry, Deputy Post Commander	876-8861/8863
2. Mr. Caraway (COR), AMSMI-RA-EH-RM-SA	876-1001
(If not available, notify)	
Mssrs. Jarvis/ Gregg/ or Freeman	876-2285/4245
AMSMI-RA-EH-RM-SA, will notify BAMSI, Mr. Lewter, BAMSI Spill Coordinator	876-2545
(If not available notify)	
BAMSI,	876-2801/4984
3. MICOM Safety Office	876-2944
4. As appropriate:	
National Response Center	1-800-424-8802
(If no response, notify)	
EPA Emergency Number	1-404-347-4062
HQ AMC AMCEN-A	DSN 284-9016
Occupational Health, HSXW-PM	876-8831
Public Affairs Office, AMSMI-IN	876-4161
Legal Office, AMSMI-GC	876-6131

AFTER DUTY HOURS:

Emergency Operations Center	876-2801
MICOM Officer Of The Day	876-3331
Homes of spill response personnel, if necessary.	

FIGURE 1. SPILL NOTIFICATION PROCEDURE.

c. The following is a list of State and Federal Agencies that might be notified in case of a spill event:

AGENCY	TELEPHONE NO.
Decatur Water Treatment Plant	(205) 552-1480
National Response Center	(800) 424-8802
US EPA, Region IV, Atlanta, GA	(404) 347-4062 FTS 257-4062
AMC Headquarters, Environmental Office	(703) 274-9016 AV 284-9016
Wheeler National Wildlife Refuge, Decatur, AL	(205) 353-7243
Alabama Department of Environmental Management (ADEM), Water Programs	(205) 271-7834
State of Alabama, Division of Game and Fish	(205) 353-2634

d. Requests for assistance from civilian sources are as follows:

(1) Requests for assistance to civilian sources will be made only when sufficient assistance is not available from military sources.

(2) The Installation Commander will approve all requests for assistance to civilian sources.

(3) Outside Agencies. Listed below are civilian agencies and telephone numbers of those agencies which may be contacted for additional support in the event of an emergency. Other agencies, not listed below, may be contacted when authorized by the Installation Commander:

AGENCY	TELEPHONE NO.
Alabama State Troopers	(205) 533-4202
Huntsville City Police	911
Huntsville Emergency Management	(205) 532-7290
Madison County Sheriff	(205) 532-3403
Ambulance Service and Rescue Squad	(205) 536-6658
Huntsville Fire Department	911

Huntsville Hospital	(205) 533-8020
American Red Cross	(205) 536-0084
Chemical Waste Management, Emelle, AL	(205) 652-9721/976

7. RESPONSIBILITIES:

a. The Directorate of Engineering and Housing, AMSMI-RA-EH, will:

(1) Assume responsibilities of Chief, Installation Response Center (IRC), and activate the Installation Response Team (IRT) when requirements of spill dictate. See Appendix B.

(2) Brief Installation Commander on a medium (discharge of 1,000 to 10,000 gallons of oil into a navigable water), a major (discharge of more than 10,000 gallons) spill, or a spill of hazardous substance greater than the reportable quantity as specified in 40 CFR, Part 117, Appendix E, and gain concurrence in requesting Federal aid if required.

(3) Keep Installation Commander informed during the period this plan is in effect.

(4) Conduct an annual alert to activate the IRC and require personnel and equipment to be transported to a simulated spill site.

(5) Instruct the Arsenal Support Services Contractor to furnish manual assistance, equipment, and materials such as straw, fill dirt, etc., as required to assist in the cleanup of oil or hazardous substance spills.

(6) Inform the Chief, MICOM Public Affairs Office, of spill for news media coverage.

(7) Upon the occurrence of a reportable spill event, immediately notify the National Response Center at 800-424-8802.

(8) If it is impractical to notify the National Response Center, then the EPA 24-hour/7-day emergency number, 404-881-4062, should be called and notified of the spill event.

(9) Headquarters, AMC Environmental Quality Division, AMCEN-A, shall be notified promptly by telephone (AUTOVON 284-9016) upon the confirmation of a reportable spill event.

(10) The Alabama Department of Environmental Management will be notified promptly by telephone (205-260-2700) upon the confirmation of a reportable spill event.

(11) Forward the written follow-up spill reports as required by paragraph 8-3, AR 200-1 to the EPA Region IV Office.

b. The Contracting Officer's Representative (COR), AMSMI-RA-EH-RM-SA will:

(1) Serve as coordinator and liaison between the Director of Engineering and Housing and the contractor, BAMSI, who will

provide a responsible individual to act as spill coordinator to the IOSC and provide personnel and equipment as indicated in Appendix B and paragraph 5d.

c. The Installation On-Scene Coordinator (IOSC) will be provided by the MICOM Environmental Office, and will:

(1) assist the Chief, IRC, in activating the Installation Response Team (IRT).

(2) assist the Incident Commander at the spill site. See Appendix A-2 for on-site action.

(3) be responsible for leading clean up actions after the Incident Commander has declared the immediate threat to life and health has passed and has shut down the Incident Command Post.

(4) initiate an incident log and record all significant information, actions, and telephonic reports.

d. Structures and Grounds Branch, BAMSI, will: Provide the following equipment as necessary.

(1) Four bulldozers.

(2) Seven dump trucks (5 CY each).

(3) Three front-end loaders (1 CY, 1-1/2 CY, and 2-1/2 CY).

(4) One truck-mounted crane (3/4 CY).

(5) One gradall (1/2 CY).

(6) Clean up materials, protective clothing and safety equipment as shown on the list below:

Building 3624:	Amount
Oil Sorbent Pads	1/2 Bale
Shredded Oil Sorbent	1 bag
Oil Sorbent Clay	5 bgs

Building 4725:	
Oil Sorbent Pads	2 1/2 bales
Sorbent Filler	3 bags
Oil Sorbent Clay	33 bags
Self-Contained Breathing Apparatti	2 each
Battery Powered Breathing Apparatti	4 each
Vacuum Pump for Mercury Clean-up	1 each

Building 5428 (Chemistry Lab):

Disposable Gloves		4 dozen
Cleaning Fluids:	Acetone	4 gallons
	Methylene Chloride	4 gallons
	Methanol (Methyl Alcohol)	4 gallons
Vacuum Pump for Mercury Clean-Up		1 each
Self-Contained Breathing Apparatti		2 each

Building 5668:

Oil Sorbent Pads:	Type 126	12 Bales
	Type 151	12 Bales
	Type 156	19 Bales
Vinyl splash Coveralls		20 each
Rubber Gloves		24 pair
Chemical Splash Goggles		10 each

Building 8025:

80 Gallon Salvage Drums	64 each

Building 8038:

Oil Sorbent Pads	10 Boxes
Self-Contained Breathing Apparatti	2 each

e. Chief, Fire Prevention and Protection, AMSMI-RA-EH-FD, will be responsible for:

(1) Being the First Responder at all spill events.

(2) Setting up the Incident Command System at spill events, if necessary.

(3) Being the Incident Commander at spill events.

(4) Ensuring sufficient firefighters are trained on all shifts to the Operational Level and Technician Level as required by 29 CFR 1910.120 and MICOMR 385-15.

(5) Providing fire prevention and protection and emergency first aid at the scene of a spill event until hazards are eliminated.

f. Equipment Management Division, BAMSI, will: Provide wrecker service when requested to the scene of spill events involving vehicles on Redstone Arsenal.

g. Chief, Supply Division, BAMSI will:

(1) Receive, store, and inventory oil and hazardous

substances stored at Redstone Arsenal in accordance with this plan and RA-SOP 385-5. (excluding explosives)

(2) Notify the Fire Department Emergency Number 117 (or 876-2117) giving location and type of spill.

(3) Furnish oil tanker trucks for transporting oil from damaged above or below ground oil storage tanks to other designated temporary storage areas.

(4) Issue absorbent materials for use in cleanup operations after a spill event.

(5) Assure that small oil spills encountered while unloading oil into storage tanks are cleaned up using materials stored at unloading sites.

(6) Provide one representative to the IRC when activated by Chief, IRC. (See Appendix B.)

h. Chief, Provost Marshall Office, AMSMI-RA-PM will:

(1) Instruct the Senior Military Police Officer at the scene to report to the Incident Commander to be briefed on actions to take at the scene which may include the following.

(a) Cordon off affected area until cleanup is accomplished.

(b) Provide traffic control at the spill area.

(c) Assist in the evacuation of the area, if necessary.

(2) Provide one representative to the IRC when activated by Chief, IRC. (See Appendix B.)

i. Commander, Support Troops, AMSMI-RA-ST will: Provide assistance to the Chief, Security Directorate, as necessary.

j. Chief, Public Affairs Office, AMSMI-IN, will:

(1) Monitor the local news media and public reaction in regard to the spill.

(2) Coordinate all spill news releases with the Chief, IRC.

(3) Keep higher headquarters fully informed of actions taken and public reaction.

(4) Provide one representative to the IRC when activated by Chief, IRC. (See Appendix B.)

k. Comptroller Office, AMSMI-CO, will: Handle all funding requirements in matters pertaining to the reimbursement of monies

expended for personnel, equipment and materials. Provide one representative to the IRC when activated by Chief, IRC. (See Appendix B.)

l. Chief, Legal Office, AMSMI-GC, will:

(1) When requested by Chief, IRC, conduct an on-scene visit to determine the requirements with regard to subsequent legal matters pertaining to the spill.

(2) Provide legal guidance in referring any enforcement actions to the Regional Response Team.

m. Chief, Procurement Directorate, AMSMI-PC, will:

(1) Maintain a list of qualified contractors to assist in spill control and cleanup of oil or hazardous materials.

(2) Provide assistance for negotiation of emergency contract services, as necessary.

(3) Assure that all contracts for spill assistance and cleanup are conducted in accordance with the applicable Federal, State and Local regulations.

(4) Coordinate all actions for contractor assistance in spill cleanup with the MICOM Environmental Office, AMSMI-EQ, 876-6122.

(5) Provide one representative to the IRC when activated by Chief, IRC. (See Appendix B.)

n. Commander, USA MEDDAC, HSXW-CO, will:

(1) Advise the IOSC on protective measures required for persons involved in spills of hazardous substances.

(2) Provide one representative to the IRC when activated by Chief, IRC. (See Appendix B.)

o. Chief, Preventive Medicine Service, HSXW-PM, will: Manage and coordinate MEDDAC ISCP responsibilities for the Commander, MEDDAC, HSXW-CO.

p. Chief, Safety Office, AMSMI-SF will:

(1) Provide a representative to the Command Post to advise the Incident Commander and IOSC on safety measures required during spill events.

(2) Provide one representative to the IRC when activated by Chief, IRC. (See Appendix B)

q. Other MICOM elements will:

(1) Ensure that fuels, oils, and hazardous substances (such as acids, bases, organic solvents, and other toxic chemicals) are used, stored, and handled to avoid or minimize the possibilities of environmental pollution.

(2) Prepare a Standard Operating Procedure (SOP) for any operation that could lead to an environmental pollution problem if operated in an improper manner IAW MICOMR 420-5.

r. RSA tenant organizations are required to:

(1) Ensure that all fuels, oils, and hazardous substances (acids, bases, organic solvents, and other toxic chemicals) are used, stored, and handled to avoid or minimize the possibility of environmental pollution.

(2) Prepare a Standard Operating Procedure (SOP) for any operation that could lead to an environmental pollution problem if operated in an improper manner IAW MICOMR 420-5.

8. COORDINATING INSTRUCTIONS:

a. The Chief, IRC, will be responsible for the training of those personnel assigned to the IRC.

b. The IRT will be trained to, or have experience qualifying members to the following OSHA 1910.120 and MICOMR 385-15 levels:

(1) Fire Department Incident Commander - Incident Command Role. The Incident Commander has completed at least first responder qualifications and maintains retraining requirements.

(2) IOSC - Level 3, Hazardous Materials Technician and Incident Command.

(3) Firemen - Level 2, Operational
Level 3, Hazardous Materials Technician
Level 4, Hazardous Materials Specialist
(All Firemen will be trained to Level 2. Selected Firemen will be trained to Levels 3 and 4)

(4) BAMSI spill response personnel - Level 3, Hazardous Materials Technician

c. The IRC will be activated annually for a simulated spill incident.

9. COMMUNICATIONS:

a. Primary means of communication during spill cleanup operations between the IRC and the IRT will be the BAMSI Facilities Engineer Emergency Operations Center, EOC, located in Building 5414, 876-2525.

b. The EOC radio traffic will be held to a minimum during critical periods when this plan is implemented.

c. Telephonic communications will be used to supplement radio communications whenever necessary.

10. CONTROL: Location of the IRC will be at Building 5414, BAMSI Facilities Engineer Office, unless otherwise announced. The telephone number is 876-2007/6318/4984.

11. TECHNICAL INFORMATION:

a. Physical properties of oil - The type of oil stored and handled at Redstone Arsenal is listed in Annexes I and II of the SPCC. All these materials are flammable and persons handling them should be aware of the hazard.

b. Physical properties of hazardous materials - The types of hazardous materials stored and handled in bulk at Redstone Arsenal covered by the ISCP and SPCC are listed in Annex I of the SPCC. The properties of these materials are listed below:

(1) Chlorine: A greenish yellow gas, highly irritant to the respiratory system, has a suffocating odor. Do not breathe. Use prescribed self-contained breathing apparatus if necessary to handle leaking containers.

(2) Aluminum Sulfate (liquid alum): Colorless crystals, odorless and astringent taste, soluble in water. Burns in mouth and throat, vomiting and diarrhea by mass swallowing or intake. Wear rubber gloves, safety glasses and coveralls when handling.

(3) Sodium Hydroxide (liquid caustic): White flakes soluble in water. Irritation of respiratory tract, if ingested, burns mouth and throat and causes severe internal reactions.

(4) Sodium Hypochlorite (laundry bleach): Unstable crystals, soluble in cold water, decomposed by hot water. Irritates eyes, skin and throat. Causes severe internal disorders.

(5) Sodium Silicofluoride: White granular powder, soluble in water. Poisonous if inhaled or swallowed. Avoid breathing dust, wash thoroughly after handling. Cleanup spillage immediately, wear respirator and goggles when handling material.

(6) Trichloroethylene (degreaser): Colorless, heavy liquid with chloroform-like odor. Slightly soluble in water. Irritates nose and throat, causes severe internal disorders if swallowed. Affects the liver and nervous systems.

(7) Polychlorinated Biphenyls (PCBs): A complex chemical compound, normally in a liquid form. Extremely stable in the

environment. Causes skin and eye irritation and is a proven carcinogen (cancer-causing agent). Causes birth defects and poor health.

(8) Methylene Chloride: Colorless liquid with an odor like chloroform. Causes skin and eye irritation and is itself an anesthetic. Forms a toxic gas containing hydrogen chloride, phosgene and carbon monoxide when vaporized. It may contain a red dye for identification.

c. Training school for spill control - Spill control courses are conducted at: National Spill Control School, Corpus Christi, Texas 78412, (512) 991-8692, Texas A&M University, College Station, Texas 77843, telephone (713) 845-2122/7621. Other spill control courses are conducted by the EPA on an unscheduled basis. Information about these courses can be obtained from the MICOM Environmental Office, AMSMI-EQ, (205) 876-6122.

d. A spill response library: A Spill Response Library is maintained at the MICOM Environmental Office and is available to any concerned organization by contacting AMSMI-EQ, (205) 876-6122.

e. A spill notification procedure: A Spill Notification Procedure for removal or copying is attached as Appendix C, page App C- 1. This procedure should be posted in areas and on bulletin boards where oils and hazardous substances are handled.

APPENDIX A

OPERATIONAL RESPONSE PHASES

A-1. Phase I - DISCOVERY AND NOTIFICATION:

a. Discovery of a spill may be made by:

(1) Deliberate discovery procedures such as inspections, security patrols and inventory discrepancies.

(2) Random discovery made by incidental observations by installation personnel or the general public (cases where DA caused spill is off the installation).

a. WHEN A SPILL, OF A CHEMICAL, OIL, OR UNKNOWN SUBSTANCE IS FOUND DURING DUTY HOURS, CALL FIRE DEPT at 117 (OR 876-2117)

FIRE DEPARTMENT DISPATCHER WILL NOTIFY:

A.	Environmental Office/Installation On-Scene Coordinator, Mr. Holton	876-6125
	(If not available, notify) Mr. Hagler/Ms. Bowers/Mr. Souza/	876-6122/6124
B.	Military Police, AMSMI-RA-PM	876-2222/4135

Environmental Office will notify:

1.	Dr. Branham/Dr. Mullinix, AMSMI-RA-EH	876-3516/2423
	AMSMI-RA-EH, will notify Colonel Mabry, Deputy Post Commander	876-8861/8863
2.	Mr. Caraway (COR), AMSMI-RA-EH-RM-SA	876-1001
	(If not available, notify) Mssrs. Jarvis/ Gregg/ or Freeman	876-2285/4245
	AMSMI-RA-EH-RM-SA, will notify BAMSI, Mr. Lewter, BAMSI Spill Coordinator	876-2545
	(If not available notify) BAMSI,	876-2801/4984
3.	MICOM Safety Office	876-2944
4.	As appropriate:	
	National Response Center	1-800-424-8802
	(If no response, notify) EPA Emergency Number	1-404-347-4062
	HQ AMC AMCEN-A	DSN 284-9016
	Occupational Health, HSXW-PM	876-8831
	Public Affairs Office, AMSMI-IN	876-4161

Legal Office, AMSMI-GC	876-6131

AFTER DUTY HOURS:

Emergency Operations Center	
MICOM Officer Of The Day	876-2801
Homes of spill response personnel, if necessary.	876-3331

A-2. Phase II - EVALUATION AND INITIATION OF ACTION:

a. Based on all available information and on-scene investigation, the IOSC will:

(1) Evaluate the severity and magnitude of the discharge.

(2) Determine the type of removal required.

b. After verifying the severity and magnitude of the spill, the IOSC will determine if the ISCP should be initiated. If no other assistance is required, BAMSI personnel and equipment will be used to contain and clean up the spill.

c. If Regional Response Team (RRT) assistance is necessary and the Chief, IRC, concurs, the following procedure will be followed:

(1) Gain concurrence of the Installation Commander.

(2) Make telephonic request to Region IV, EPA, through HQ AMC, AMCEN-A, AUTOVON 284-9016.

d. Priority waters to be protected in order of importance are:

(1) Intake waters to WTP #1 at the Tennessee River.

(2) Waters that flow directly to Wheeler Wildlife Refuge.

(3) Waters that flow indirectly to Wheeler Wildlife Refuge.

A-3. Phase III - CONTAINMENT AND COUNTERMEASURES:

a. Containment - This is the defensive action taken to halt the continued contamination of a spill. These actions may include: public health and welfare protection activities, source control procedures, salvage operations, emplacement of physical barriers to halt the spread of a pollutant or to protect specific areas, control of water discharge from upstream impoundments, and the employment of certain materials to restrain the effects of a pollutant on water sources.

b. The IOSC will instruct cleanup forces Branch personnel to:

(1) Build an earth dike enclosing the area covered by the spill to contain the material.

(2) Reclaim as much of the material as possible by use of pumps on tank trucks.

(3) Use earth, hay or other absorbent material to absorb the oil that cannot be removed by pumping.

(4) Remove contaminated earth, hay, and other absorbent material to an area for burning or burying as determined by existing Federal, State and local regulations.

(5) Remove, repair and test or replace any ruptured tank.

(6) Inspect the streams daily for the next 30 days in the event of a spill.

c. Hazardous substances countermeasures:

(1) Spills of hazardous substances, as defined in 40 CFR 116, Appendix E, will be treated similar to oil spills, with appropriate fire and safety precautions added. Spills of hazardous substances in excess of the reportable quantiites require reporting (see para 8-3, AR 200-1), immediate action to eliminate the source and contain the spill, and initiation of efforts to mitigate damage. Remedial actions to correct or neutralize spills that could result in additional damage and thus increase the extent of legal liability caused by the spill will be taken only after consultation with the EPA, National Response Center, spill cleanup contractors, or the US Army Environmental Hygiene Agency (AUTOVON 584-3919 or 3618).

(2) Known hazardous substances located in bulk on Redstone Arsenal are listed below along with the harmful quantity level for each material.

Hazardous substance	Reportable qty (lbs)
Chlorine	10
Sodium Hypochlorite (laundry bleach)	100
Trichloroethylene	1000
Sodium Hydroxide (liquid caustic)	1000
Aluminum Sulfate (liquid alum)	5000
Sodium Silicofluoride	5000
Polychlorinated Biphenyls	10
Methylene Chloride	100
1,1,1 Trichloroethane	1000

Spills in excess of the above listed quantities into navigable waters shall be immediately reported to the National Response Center, 1-800-424-8802 and to Region IV EPA, 1-404-881-4062.

d. Approved actions for liquid alum and liquid caustic countermeasures on land:

(1) Spills: When a spill is discovered, the area of the spill will immediately be flushed with large amounts of water to dilute the hazardous substances to the point of having no adverse effect.

(2) Leaks:

(a) The hazardous substances will be retained in a containment area and pumped from there back into the water treatment system for use.

(b) After the tank is repaired or replaced, the containment area will be flushed with the effluent returned to the head of the water treatment plant for treatment.

A-4. Phase IV - CLEANUP, DISPOSAL, AND RESTORATION:

a. Cleanup:

(1) This action will include the use of sorbers and skimmers. Absorbents, as listed in the SPCC, are in sufficient quantities on the installation and will be used as required.

(2) The use of aeration or other methods to minimize damage resulting from dissolved or emulsified pollutants will be initiated as necessary.

b. Disposal:

(1) The disposal of contaminated oil will be handled by the Defense Reutilization and Marketing Ofice (DRMO).

(2) Hazardous or toxic materials will be disposed of in accordance with Federal, State, or local regulations or instructions from the EPA.

(3) Oil-contaminated dirt will be disposed of in an area of the Sanitary Landfill that is designated for this purpose.

c. Restoration: This action will be taken to return the environment to its original condition. Directorate of Engineering and Housing will perform restoration within its capabilities. Major restoration efforts will be accomplished by commercial contractors.

A-5. Phase V - RECOVERY OF DAMAGES:

Resultant damages will be classified as minor if the Directorate of Engineering and Housing has available in-house funds, manpower, equipment, and time to repair the damage. The Directorate of Engineering and Housing will classify damages as major if commercial support is required in accordance with AR 500-6, Disaster Relief.

APPENDIX B

TASK ORGANIZATION

B-1. INSTALLATION RESPONSE CENTER (IRC): The IRC is an operation center established to direct the containment, cleanup, and related activities of a medium or major spill of oil or hazardous materials. The IRC is located in Building 5414. The IRC is under the control of the Director of Engineering and Housing, AMSMI-RA-EH, and consists of the following personnel:

(1)	AMSMI-RA-EH, Dr. Branham	876-3516/3814
	Dr. Mullinix	876-1692/2423
(2)	AMSMI-RA, COL Mabry	876-8861/8862
	Mr. Steve Carter	876-8863/8864
(3)	AMSMI-RA-L-CS, Ms. Hudson	876-1771/5809
	Mr. McGee	876-5561
(4)	AMSMI-RA-PM, LTC Holloway	876-0762
	-LE Mr. Clift	842-2440
	-LE-PO 1LT Soto	842-2441
(5)	AMSMI-PC-FCC, Ms. Metcalf	876-8391
(6)	AMSMI-IN, Mr. Harris	876-4161
	Mr. Peters	842-0560
(7)	AMSMI-RM-PB-OP-SP, Mr. Manley	876-5223
	Ms. Haygood	876-8091
(8)	AMSMI-GC-LS, Ms. Wilkinson	842-0532
	Mr. Points	876-8924
(9)	HSXW-PM, Mr. Skaggs	876-8857
	Mr. Parker, Alt	876-8858
(10)	AMSMI-SF, Mr. Frost	842-8634
	Mr. Lynn	842-8625

All organizations listed above must appoint alternates in case those listed above are not available to perform their spill functions.

B-2. INSTALLATION RESPONSE TEAM (IRT): Based on the situation, the number of personnel and organizational structure of the IRT will be determined by the DEH, IRC, and the IOSC. Initially, the IRT will consist of the following:

(1) RASA Fire Prevention and Protection Division

(2) Installation On Scene Coordinator

(3) BAMSI Spill Coordinator

(a) BAMSI Facilities Engineering Department (as required).

(b) BAMSI Mechanical & Electrical (as required).

(c) BAMSI Structures and Grounds Branch (as required).

(d) BAMSI Supply Division, Storage Branch (as required).

(e) Safety Office (1 person)

(f) MEDDAC Preventive Medicine Activity (1 person).

B-3 SPILL RESPONSE PROCEDURES

1. The Fire Department (FD) is the initial responder. The senior FD official on scene is the Incident Commander and exercises control over everyone at the scene. The Incident Commander is in charge until he decides the immediate threat to life and health has passed. At that point he turns the scene over to the Installation On Scene Coordinator for cleanup.

2. The initial responder takes actions within the limitations of his training and equipment to:

a. Initiate the Incident Command System

b. Detect and identify the materials involved.

c. Assess the immediate effects of the incident

(1) risk of harmful or fatal exposures to emergency personnel and civilians

(2) potential for fire or explosions

(3) degree of undesirable exposure to nearby property or the environment

d. Get information about the facility an/or the material involved from employees or other on-site persons who may have special expertise.

e. Set tactical objectives to confine and control the incident.

(1) Decides if evacuation is necessary and the evacuation boundaries.

(2) Sets up hot, warm, and cold zones.

(3) Sets up decontamination area.

(4) Regulates entry of personnel to the scene.

(5) Prevents spread of material if possible by trenching, diking, etc.

f. Rescue considerations:

(1) Nature of the HM and incident assessment.

(2) Availability of personnel with adequate protective equipment.

(3) Number of victims to be rescued and their condition.

(4) Time needed (w/safety margin) to effect rescue.

(5) Tools, equipment, and other devices needed to effect rescue.

4. The MICOM Installation On-Scene Coordinator will:

a. Respond to notification of spill occurences.

b. Report to and assist the Fire Dept Incident Commander.

c. Take over command and direction of the cleanup when the Incident Commander has determined the immediate threat to life and health has passed and the FD retires from the scene.

5. The BAMSI Spill Coordinator will:

a. Report to the Incident Commander or IOSC, stand by and be prepared to provide:

(1) Spill cleanup personnel. These personnel must be certified to wear self-contained breathing apparatus and be part of an established Respiratory Protection Program which sets forth training and testing guidelines to be able to enter the hazard area.

(2) Spill containment supplies (absorbent, acid and base neutralizing substances, oil booms, sand, gravel)

(3) Spill containment equipment (non sparking tools, such as shovels, rakes, wrenches, drum patching kits, plastic sheeting, diking equipment)

(4) Heavy equipment (backhoes, bulldozers, dump trucks) to prevent the further spread of spills and to clean up spills.

(5) Personal protective equipment (self-contained breathing apparatus, rubber boots, gloves and aprons, face shields and other eye protection, respirators (organic vapor and particulate), protective clothing and hoods effective against the chemicals commonly found on the Arsenal.

6. Due to the multitude of materials that could be spilled on the installation, it is impossible to establish one cleanup procedure that would be safe and effective for every spill. The Incident Commander and the IOSC have the responsibility to determine the most effective cleanup procedure for each particular spill, and to ensure that these procedures are followed by appropriate

personnel. Oil, acids, caustics, flammables, combustibles, and propellants institute the majority of materials stored on Redstone Arsenal. Response and cleanup of all types of hazardous materials and hazardous wastes are taught in courses which meet the OSHA Emergency Responder training requirements.

APPENDIX C

TO REPORT A SPILL

OF OIL OR A HAZARDOUS SUBSTANCE

CALL 117

FIRE DEPARTMENT EMERGENCY NUMBER 117 (or 876-2117)

1. When reporting a spill, give as much information as possible.

   a. Where the spill is.
   b. Is anybody injured?
   c. What the spill is (chemical name, color, odor, liquid, solid)
   d. How much is spilled.
   e. Is the spill moving?
   f. Does the spill endanger people or property?
   g. Where are you reporting from?
   h. Who else has been notified?

2. INITIAL RESPONSE ACTIONS

The primary concern in any spill situation is to protect personnel from harm. Whenever a spill is discovered by an employee, the employee shall notify his/her supervisor immediately. The person finding the spill shall report the spill to the Fire Department Emergency Number, telephone 117 (or 876-2117). In most cases, the initial observer will know what material has been spilled, and should be aware of the safety precautions required. If there is any doubt, the observer should get safely away, and await the arrival of the Installation Response Team. Individuals working around hazardous materials should be instructed and well informed of the safety measures and spill procedures applicable to the materials. The initial response actions outlined below can prevent a small incident from becoming a major event if carried out in a prompt and efficient manner by well trained personnel.

a. Protect yourself and others from harm. If you find a spill, your safety and the safety of others is the primary concern. Promptly evacuate the area, extinguish smoking materials, and remove potential sources of ignition.

b. Stop the flow of material if you and others are protected from harm. Once you have protected yourself and others from harm, you should attempt to stop the flow of the spilled materials ONLY

IF ALL OF THE FOLLOWING APPLY:

(1) You have been trained in spill response procedures.
(2) You know what the material is.
(3) You have proper personal protective equipment.
(4) You have proper tools and supplies on hand.
(5) You have reported the spill to telephone 117 (or 876-2117)
(6) You are not alone.

Measures to stop the flow include closing valves, uprighting ruptured containers, plugging leaks, or using absorbents to pick up the spilled material.

c. Contain the spill if possible, ONLY IF ALL OF THE FOLLOWING APPLY:

(1) You have been trained in spill response procedures.
(2) You know what the material is.
(3) You have proper personal protective equipment.
(4) You have proper tools and supplies on hand.
(5) You have reported the spill to telephone 117 (or 876-2117).
(6) You are not alone.

Spills can be contained by building dikes, covering drains, or placing absorbents in and around the spill.

b. WHEN A SPILL, OF A CHEMICAL, OIL, OR UNKNOWN SUBSTANCE IS REPORTED DURING DUTY HOURS, FIRE DEPARTMENT DISPATCHER WILL NOTIFY:

A.	Environmental Office/Installation On-Scene Coordinator, Mr. Holton	876-6125
	(If not available, notify) Mr. Hagler/Ms. Bowers/Mr. Souza/	876-6122/6124
B.	Military Police, AMSMI-RA-PM	876-2222/4135

Environmental Office will notify:

1.	Dr. Branham/Dr. Mullinix, AMSMI-RA-EH	876-3516/2423
	AMSMI-RA-EH, will notify Colonel Mabry, Deputy Post Commander	876-8861/8863
2.	Mr. Caraway (COR), AMSMI-RA-EH-RM-SA	876-1001
	(If not available, notify) Mssrs. Jarvis/ Gregg/ or Freeman	876-2285/4245
	AMSMI-RA-EH-RM-SA, will notify BAMSI, Mr. Lewter, BAMSI Spill Coordinator	876-2545
	(If not available notify) BAMSI,	876-2801/4984
3.	MICOM Safety Office	876-2944
4.	As appropriate:	
	National Response Center	1-800-424-8802
	(If no response, notify) EPA Emergency Number	1-404-347-4062
	HQ AMC AMCEN-A	DSN 284-9016
	Occupational Health, HSXW-PM	876-8831
	Public Affairs Office, AMSMI-IN	876-4161
	Legal Office, AMSMI-GC	876-6131

AFTER DUTY HOURS:

Emergency Operations Center	876-2801
MICOM Officer Of The Day	876-3331
Homes of spill response personnel, if necessary.	

APPENDIX D
POTENTIAL SPILL AREAS

D-1. STORAGE SITE 1:

a. General information.

(1) Name of facility: Building 4725, Steam Generating Plant.

(2) Type: Site consists of two aboveground storage tanks with receiving stations for commercial tankers, unloading docks, pumps and transfer lines plus one underground tank. About 1/2 mile northeast of Bldg 4725, the standby tank site consists of three aboveground storage tanks.

(3) Location: 4000 area, west of Rideout Road.

(4) Person in charge of facility: Mr. Harold Brooks, 876-5432/4833/3501.

(5) Person accountable for oil spill prevention facility: Mr. Harold Brooks. This steam plant has been placed on 24 hour standby and is not normally operated. Tank 4717 has been drained and tank 4721 contains 250,000 gallons of #5 fuel oil. Loading and unloading of fuel will not normally take place. The standby tank site, tank numbers 4234 a, b, and c are normally empty.

(6) Potential spills - prediction and control.

Source	Number	Total Gals. Quan.	Oil Type	Major Type of Failure	Contain-ment	Direction of Flow
Steel Tank	4717	1,000,000	#5	Overflow	Dike	See Fig.
Steel Tank	4721	1,000,000	#5	Overflow	Dike	See Fig.
Steel Tank	4725	20,000	#5	Overflow or Leak	Graveled Area	See Fig.
Steel Tank	4234a	450,000	#2	Overflow	Dike	See Fig.
Steel Tank	4234b	450,000	#2	Overflow	Dike	See Fig.
Steel Tank	4234b	450,000	#2	Overflow	Dike	See Fig.

(7) Spill event - last 12 months: None.

(8) Containment capability: Containment is adequate to prevent oil from reaching navigable waters. The containment has outlet valves and oil/water separators.

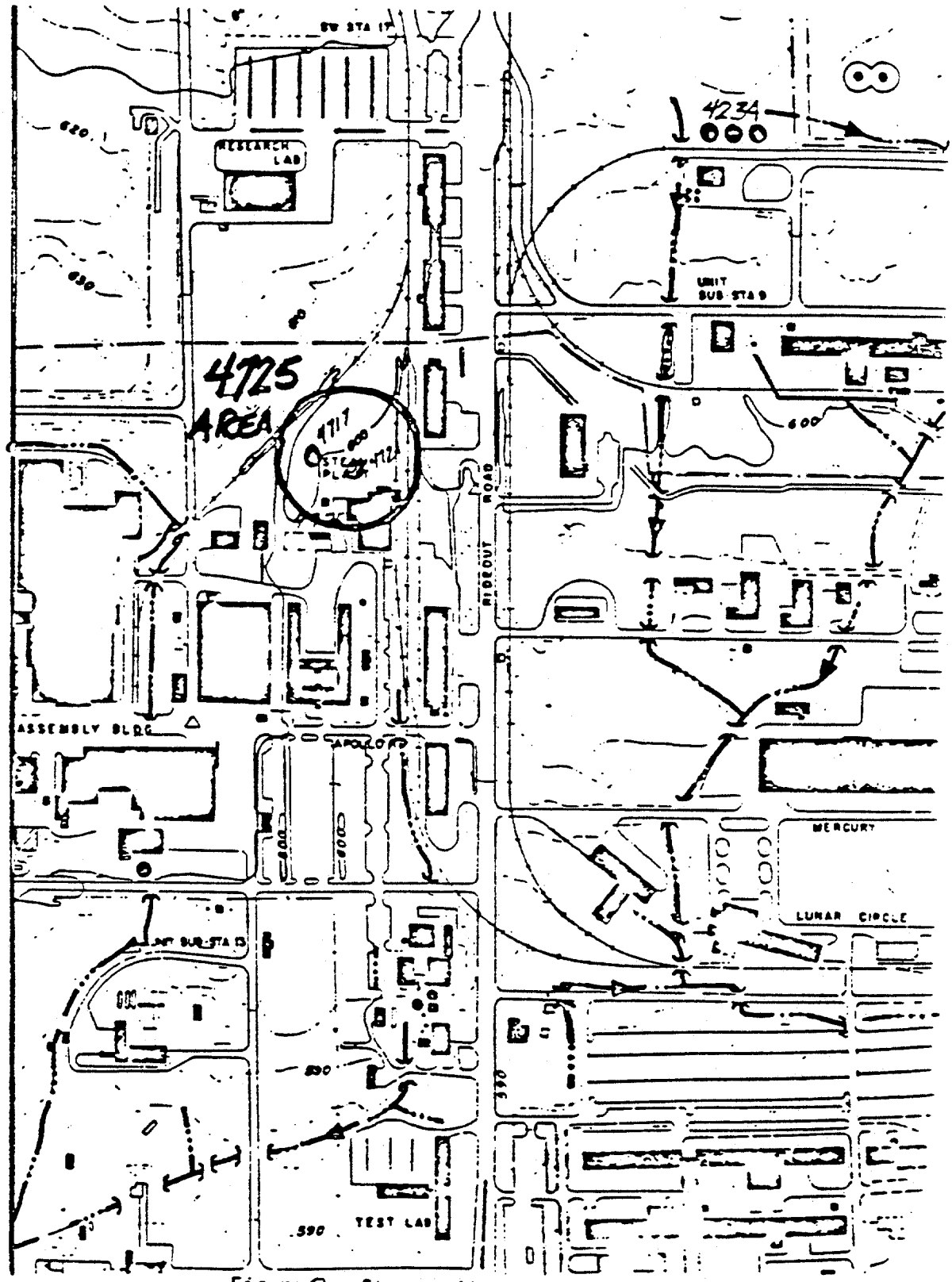

Figure 3 - Storage Site #1

b. Drainage and operating information.

(1) Facility drainage: Drainage from this area will initially flow SE towards the abandoned railroad, then south through open and covered ditches, then SW towards the NASA Industrial Lagoon which empties into Indian Creek.

(2) Facility loading - unloading operations:

3 - 118 GPM turbine pumps for loading and unloading.

2 - 100 GPM turbine pumps for transfer operations.

(3) Security provisions: Workers use Building 4725 as an office and are there every day.

APPENDIX D

POTENTIAL SPILL AREAS

D-2. STORAGE SITE 2:

a. General information.

(1) Name of facility: Building 3624, Steam Generating Plant.

(2) Type: Site consists of two aboveground storage tanks with receiving station for commercial tankers, unloading docks, pumps and transfer lines and one underground tank.

(3) Location: 3000 area, east of Ajax Road, north of Cajun Drive, and west of Patton Road.

(4) Person in charge of facility: Mr. Harold Brooks, 876-5432/4833/3501.

(5) Person accountable for oil spill prevention facility: Mr. Harold Brooks, 876-5432. This facility has been placed in one week standby and is not normally operational. Tank numbers 3620 and 2621 are empty.

(6) Potential spills - prediction and control.

Source	Number	Total Gals. Quan.	Oil Type	Major Type of Failure	Contain-ment	Direction of Flow
Steel Tank	3620	500,000	#5	Overflow	Dike	See Fig. :
Steel Tank	3621	1,500,000	#5	Overflow	Dike	See Fig. :
Steel Tank	3624	20,000	#5	Overflow	Under-ground	See Fig. :

(7) Spill event - last 12 months: None.

(8) Containment capability: Containment is adequate to prevent oil from reaching navigable waters.

b. Drainage and operating information.

(1) Facility drainage: Drainage from 3624 flows east towards Patton Road where it ponds in ditches on both sides. Drainage from the storage area flows south to a branch which flows to McDonald Creek.

(2) Loading - unloading operations.

(3) Security provisions: Plant is locked, tanks are empty.

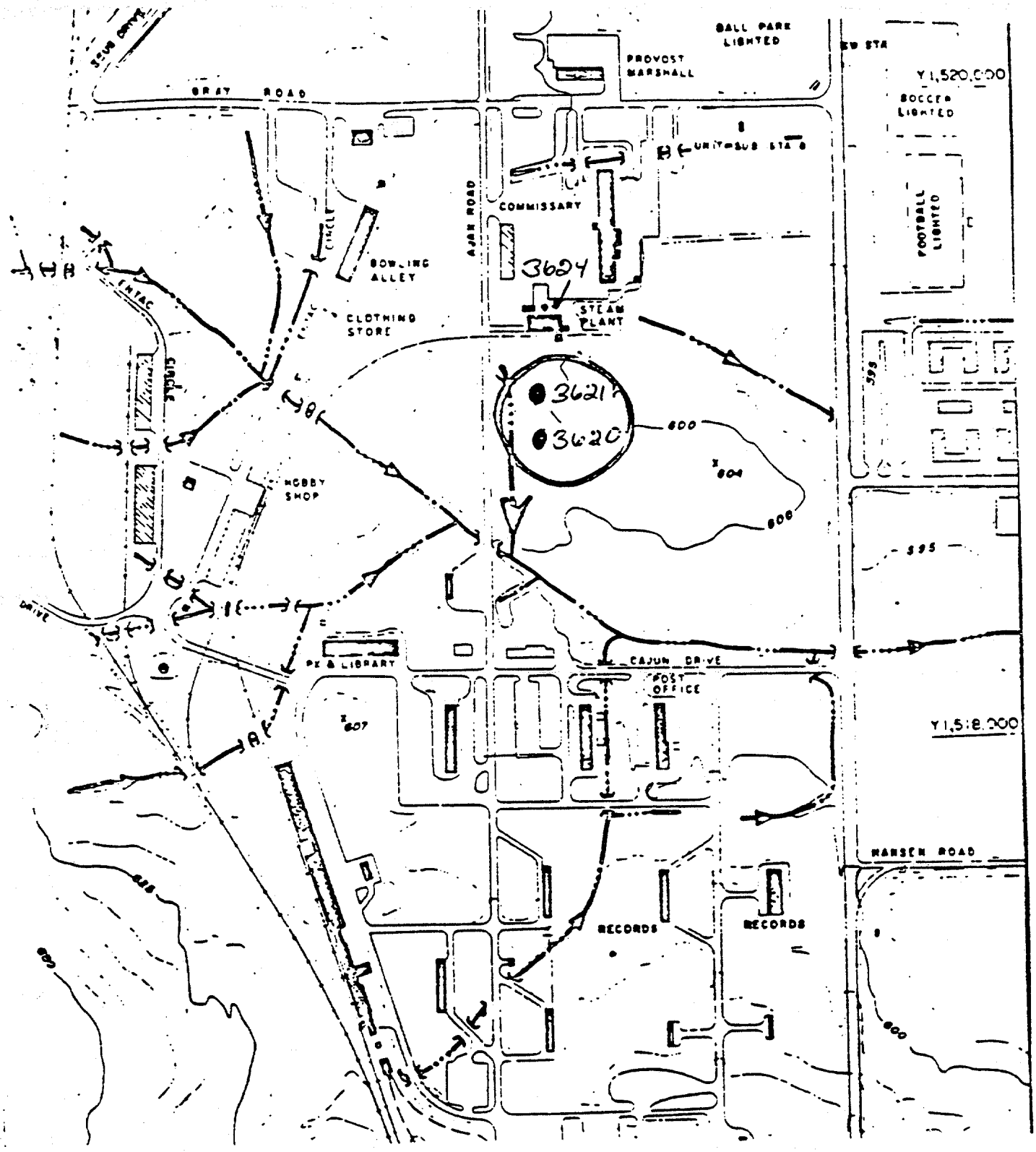

Figure 4 - Storage Site #2

APPENDIX D

POTENTIAL SPILL AREAS

D-3. STORAGE SITE 3:

a. General information.

(1) Name of facility: Petroleum Storage Yard. Building 5631, Storage Branch, BAMSI Chief, Logistics Div

(2) Type: POL site has aboveground storage tanks, receiving stations for commercial tankers, unloading docks, pumps and transfer lines.

(3) Location: 5600 area, SE, off Mills Road and north of Wheeler Wildlife Refuge.

(4) Person in charge of facility: Chief Operator, 876-7590.

(5) Person accountable for oil spill prevention facility: As above.

(6) Potential spills - prediction and control.

Source	Number	Total Gals. Quan.	Oil Type	Major Type of Failure	Contain-ment	Directio of Flow
Steel Tank	5631	20,000	Kerosene	Overflow	Dike	See Fig.
Steel Tank	5691	24,000	Gasoline	Overflow	Dike	See Fig.
Steel Tank	5692	260,400	#2 Oil	Overflow	Dike	See Fig.
Steel Tank	5693	84,000	#2 Oil	Overflow	Dike	See Fig.
Steel Tank	5694	84,000	#2 Oil	Overflow	Dike	See Fig.
Steel Tank	5695	193,000	Diesel	Overflow	Dike	See Fig.
Steel Tank	5696	94,500	#2 Oil	Overflow	Dike	See Fig.
Steel Tank	5697	109,000	Gasohol	Overflow	Dike	See Fig.
Steel Tank	5698	168,000	#2 Oil	Overflow	Dike	See Fig.
Steel Tank	5699	168,000	#2 Oil	Overflow	Dike	See Fig.

(7) Spill event - last 12 months: None.

(8) Containment capability: Each tank is diked separately to contain holding capacity of tank.

b. Drainage and operating information.

(1) Facility drainage: Flow is mostly southeast to a drainage ditch that goes under an abandoned railroad bed, then easterly to a channel that flows south to Huntsville Spring Branch and Wheeler Wildlife Refuge.

(2) Facility loading - unloading operations: Bulk fuel is off- loaded from commercial carriers into both above and below ground bulk storage tanks via means of electric powered pumps and/or gravity flow. Bulk fuel is loaded into Government owned mobile tankers at storage sites via means of electric powered pumps. Bulk fuel loading and off- loading is accomplished under direct guidance of a representative of the Supply Division.

(3) Security provisions: Security of bulk fuel storage areas is maintained in accordance with Chapter 14, FM 10-69. Security measures include: lighting, chain link fence, signal bell and lock and key control.

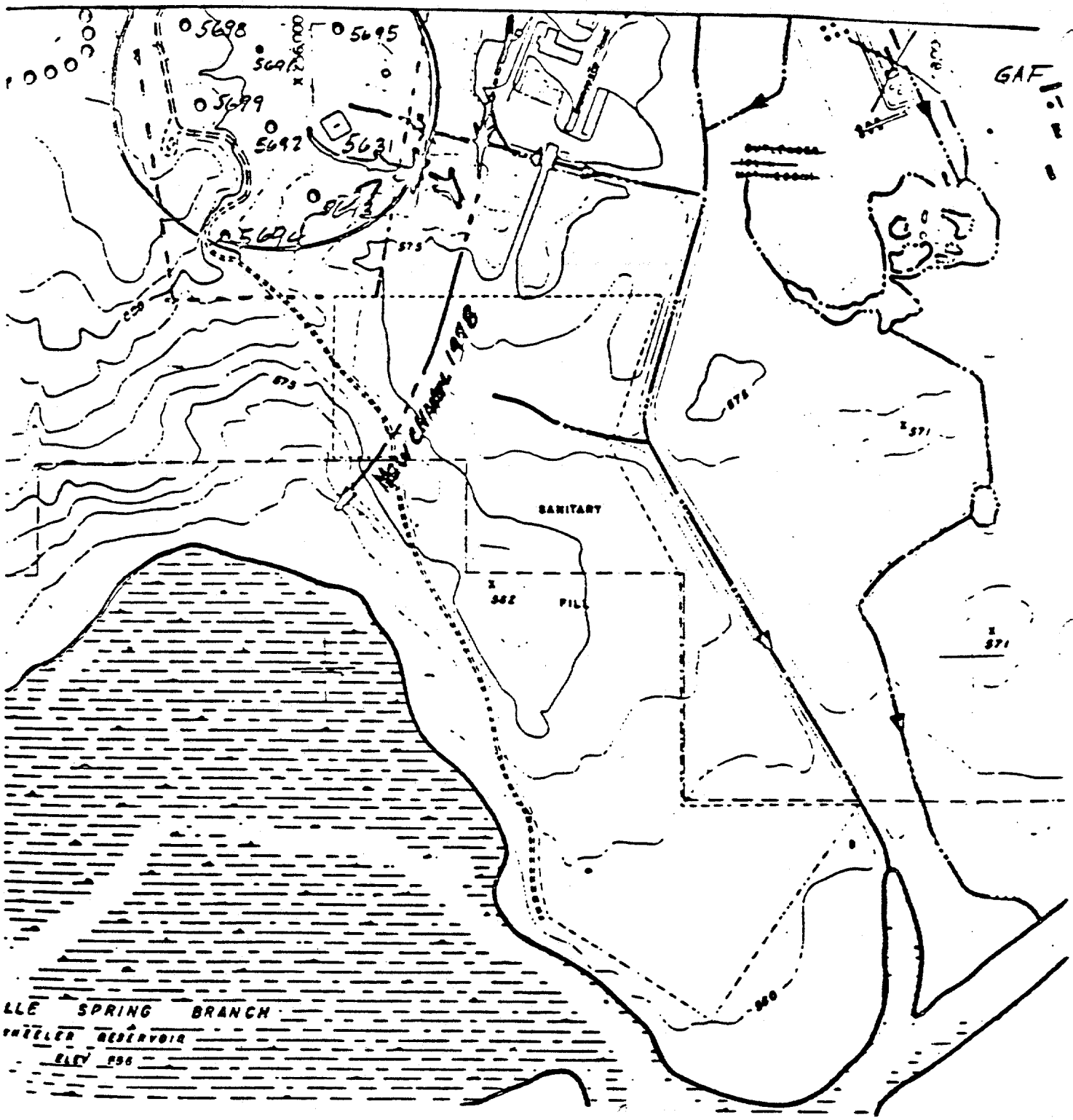

Figure 5 - Storage Site #3

D-5a

D-4. STORAGE SITE 4:

a. General information.

(1) Name of facility: Hazardous Waste Storage Area. Igloos 8621, 8622, 8623, 8624, 8630, 8631, are controlled by Defense Reutilization and Marketing Office (DRMO-ZWT). Igloos 8624, 8625, 8626, 8627, 8628, 8632, 8633, 8634, are controlled by Explosive Storage and Demolition Branch (ESDB), Supply Division, AMSMI-RA-L-SU-ES.

(2) Type: Igloo storage bunkers modified to meet EPA requirements for hazardous waste storage. The DRMO Igloos are normally used for storage of hazardous waste. The ESDB igloos are standby for overflow.

(3) Location: 8000 area south of Buxton Road on McAlpine Road. Entrance to the igloos is through Gate 11 or Test Area 5 Main Gate.

(4) Person in charge of facility: Mr. Garret Whalen, 876-1332/2532, (Bldgs 8624, 8625, 8626, 8627, 8628, 8632, 8633, 8634; Mr. Jim Pyle, 876-3528 (Bldgs 8621, 8622, 8623, 9630, and 8631).

(5) Person accountable for spill prevention at facility: Mr. Garret Whalen, 876-2532; Mr. Jim Pyle, DRMO, 876-3528.

(6) Potential spills.

Operator	Igloo Number	Material Stored
DRMO	8621	Ignitable
DRMO	8622	Corrosives
DRMO	8623	Oxidizers
ESDB	8624	Hazardous Waste
ESDB	8625	Hazardous Waste
DRMO	8630	Toxics and PCB
DRMO	8631	Hazardous Waste
ESDB	8632	Corrosives

(7) Storm drainage flow is westerly as shown in Figure 4.

(8) Major spillage would cause contamination of nearby ground, as there is no active surface drainage in this area.

(9) Igloos are curbed and have no drains. Each igloo is power vented with explosion proof equipment. DRMO igloos have showers and eyewashes.

(1) Facility loading - unloading operations: These operations will be supervised by trained individuals to assure that all possible precautions against spills are taken.

(11) Security provisions include a locked, fenced area with individual locks on each storage igloo. Key control is with the facility operator. Igloos are inspected weekly.

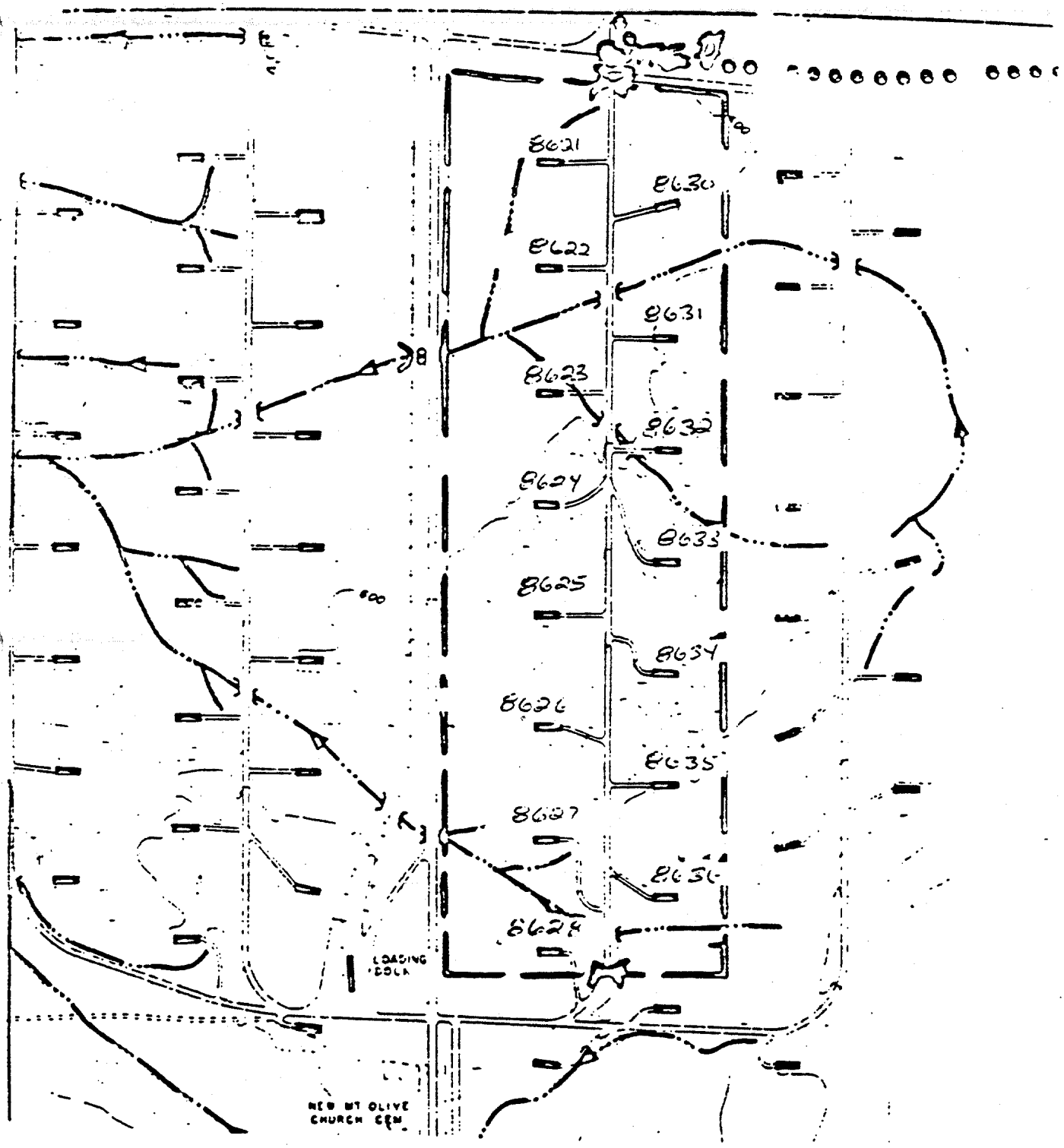

Figure 6 - Storage Site #4

APPENDIX E

LIST OF REPORTABLE QUANTITIES

NOTE: The following materials have been designated by EPA as hazardous substances and are listed in the Code of Federal Regulations, Title 40, Part 117, Table 117.3, 29 Sep 86.

MATERIAL	EPA CATEGORY	REPORTABLE QUANTITY	
		POUNDS	KILOS
Acetaldehyde.....	C	1,000	454
Acetic acid.....	D	5,000	2,270
Acetic anhydride.....	D	5,000	2,270
Acetone cyanohydrin.....	A	10	4.54
Acetyl bromide.....	D	5,000	2,270
Acetyl chloride.....	D	5,000	2,270
Acrolein.....	X	1	0.454
Acrylonitrile.....	B	100	45.4
Adipic acid.....	D	5,000	2,270
Aldrin.....	X	1	0.454
Allyl alcohol.....	B	100	45.4
Allyl chloride.....	C	1,000	454
Aluminum sulfate.....	D	5,000	2,270
Ammonia.....	B	100	45.4
Ammonium acetate.....	D	5,000	2,270
Ammonium benzoate.....	D	5,000	2,270
Ammonium bicarbonate.....	D	5,000	2,270
Ammonium bichromate.....	C	1,000	454
Ammonium bifluoride.....	B	100	45.4
Ammonium bisulfite.....	D	5,000	2,270
Ammonium carbamate.....	D	5,000	2,270
Ammonium carbonate.....	D	5,000	2,270
Ammonium chloride.....	D	5,000	2,270
Ammonium chromate.....	C	1,000	454
Ammonium citrate.....	D	5,000	2,270
Ammonium fluoborate.....	D	5,000	2,270
Ammonium fluoride.....	B	100	45.4
Ammonium hydroxide.....	C	1,000	454
Ammonium oxalate.....	D	5,000	2,270
Ammonium silicofluoride.....	C	1,000	454
Ammonium sulfamate.....	D	5,000	2,270
Ammonium sulfide.....	B	100	45.4
Ammonium sulfite.....	D	5,000	2,270
Ammonium tartrate.....	D	5,000	2,270
Ammonium thiocyanate.....	D	5,000	2,270
Ammonium thiosulfate.....	D	5,000	2,270
Amyl acetate.....	D	5,000	2,270

Aniline.....	D	5,000	2,270
Antimony pentachloride.....	C	1,000	454
Antimony potassium tartrate.	B	100	45.4
Antimony tribromide.....	C	1,000	454
Antimony trichloride.....	C	1,000	454
Antimony trifluoride.....	C	1,000	454
Antimony trioxide.....	C	1,000	4.54
Arsenic disulfide.....	D	5,000	2,270
Arsenic pentoxide.....	D	5,000	2,270
Arsenic trichloride.....	D	5,000	2,270
Arsenic trioxide.....	D	5,000	2,270
Arsenic trisulfide.....	D	5,000	2,270
Barium cyanide.....	A	10	4.54
Benzene.....	C	1,000	454
Benzoic acid.....	D	5,000	2,270
Benzonitrile.....	D	5,000	2,270
Benzoyl chloride.....	C	1,000	454
Benzyl chloride.....	B	100	45.4
Beryllium chloride.....	D	5,000	2,270
Beryllium fluoride.....	D	5,000	2,270
Beryllium nitrate.....	D	5,000	2,270
Butyl acetate.....	D	5,000	2,270
Butylamine.....	C	1,000	454
n-Butyl phthalate.....	A	10	4.54
Butyric acid.....	D	5,000	2,270
Cadmium acetate.....	B	100	45.4
Cadmium bromide.....	B	100	45.4
Cadmium chloride.....	B	100	45.4
Calcium arsenate.....	C	1,000	454
Calcium arsenite.....	C	1,000	454
Calcium carbide.....	A	10	4.54
Calcium chromate.....	C	1,000	454
Calcium cyanide.....	A	10	4.54
Calcium dodecylbenzene-sulfonate.....	C	1,000	454
Calcium hypochlorite.....	A	10	4.54
Captan.....	A	10	4.54
Carbaryl.....	B	100	45.4
Carbofuran.....	A	10	4.54
Carbon disulfide.....	B	100	45.4
Carbon tetrachloride.....	D	5,000	2,270
Chlordane.....	X	1	0.454
Chlorine.....	A	10	4.54
Chlorobenzene.....	B	100	45.4
Chloroform.....	D	5,000	2,270
Chlorpyrifos.....	X	1	0.454
Chlorosulfonic acid.....	C	1,000	454
Chromic acetate.....	C	1,000	454
Chromic acid.....	C	1,000	454
Chromic sulfate.....	C	1,000	454
Chromous chloride.....	C	1,000	454
Cobaltous bromide.....	C	1,000	454
Cobaltous formate.....	C	1,000	454
Cobaltous sulfamate.....	C	1,000	454

Coumaphos.....	A	10	4.54
Cresol.....	C	1,000	454
Crotonaldehyde.....	B	100	45.4
Cupric acetate.....	B	100	45.4
Cupric acetoarsenite.....	B	100	45.4
Cupric chloride.....	A	10	4.54
Cupric nitrate.....	B	100	45.4
Cupric oxalate.....	B	100	45.4
Cupric sulfate.....	A	10	4.54
Cupric sulfate ammoniated...	B	100	45.4
Cupric tartrate.....	B	100	45.4
Cyanogen chloride.....	A	10	4.54
Cyclohexane.....	C	1,000	454
2,4-D Acid.....	B	100	45.4
2,4-D Esters.....	B	100	45.4
DDT.....	X	1	0.454
Diazinon.....	X	1	0.454
Dicamba.....	C	1,000	454
Dichlobenil.....	C	1,000	454
Dichlone.....	X	1	0.454
Dichlorobenzenes.....	B	100	45.4
Dichloropropane.....	C	1,000	454
Dichloropropene.....	B	100	45.4
Dichloropropene	B	100	45.4
Dichloropropane Mixture:	B	100	45.4
2,2-Dichloropropionic acid..	D	5,000	2,270
Dichlorvos.....	A	10	4.54
Dieldrin.....	X	1	0.454
Diethylamine.....	B	100	45.4
Dimethylamine.....	C	1,000	454
Dinitrobenzene.....	B	100	45.4
Dinitrophenol.....	A	10	4.54
Dinitrotoluene.....	C	1,000	454
Diquat.....	C	1,000	454
Disulfoton.....	X	1	.454
Diuron.....	B	100	45.4
Dodecylbenzenesulfonic acid.	C	1,000	454
Endosulfan.....	X	1	0.454
Endrin.....	X	1	0.454
Epichlorohydrin.....	C	1,000	454
Ethion.....	A	10	4.54
Ethylbenzene.....	C	1,000	454
Ethylenediamine.....	D	5,000	2,270
Ethylene Dibromide.....	C	1,000	454
Ethylene Dichloride.....	D	5,000	2,270
EDTA.....	D	5,000	2,270
Ferric ammonium citrate.....	C	1,000	454
Ferric ammonium oxalate.....	C	1,000	454
Ferric chloride.....	C	1,000	454
Ferric fluoride.....	B	100	45.4
Ferric nitrate.....	C	1,000	454
Ferric sulfate.....	C	1,000	454
Ferric ammonium sulfate.....	C	1,000	454
Ferrous chloride.....	B	100	45.4

Ferrous sulfate.....	C	1,000	454
Formaldehyde.....	C	1,000	454
Formic acid.....	D	5,000	2,270
Fumaric acid.....	D	5,000	2,270
Furfural.....	D	5,000	2,270
Guthion.....	X	1	0.454
Heptachlor.....	X	1	0.454
Hexachlorocyclopentadiene...	X	1	0.454
Hydrochloric acid.....	D	5,000	2,270
Hydrofluoric acid.....	D	5,000	2,270
Hydrogen cyanide.....	A	10	4.54
Hydrogen sulfide.....	B	100	45.4
Isoprene.....	B	100	45.4
Isopropanolamine dodecylbenzenesulfonate...	C	1,000	454
Kelthane.....	A	10	4.54
Kepone.....	X	1	0.454
Lead acetate.....	D	5,000	2,270
Lead arsenate.....	D	5,000	2,270
Lead chloride.....	B	100	45.4
Lead fluoborate.....	B	100	45.4
Lead fluoride.....	B	100	45.4
Lead iodide.....	B	100	45.4
Lead nitrate.....	B	100	45.4
Lead stearate.....	D	5,000	2,270
Lead sulfate.....	B	100	45.4
Lead sulfide.....	D	5,000	2,270
Lead thiocyanate.....	B	100	45.4
Lindane.....	X	1	0.454
Lithium chromate.....	C	1,000	454
Malathion.....	B	100	45.4
Maleic acid.....	D	5,000	2,270
Maleic anhydride.....	D	5,000	2,270
Mercaptodimethur.....	A	10	4.54
Mercuric cyanide.....	X	1	0.454
Mercuric nitrate.....	A	10	4.54
Mercuric sulfate.....	A	10	4.54
Mercuric thiocyanate.....	A	10	4.54
Mercurous nitrate.....	A	10	4.54
Methoxychlor.....	X	1	0.454
Methyl mercaptan.....	B	100	45.4
Methyl methacrylate.....	C	1,000	454
Methyl parathion.....	B	100	45.4
Mevinphos.....	A	10	4.54
Mexacarbate.....	C	1,000	454
Monoethylamine.....	B	100	45.4
Monomethylamine.....	B	100	45.4
Naled.....	A	10	4.54
Naphthalene.....	B	100	45.4
Naphthenic acid.....	B	100	45.4
Nickel ammonium sulfate.....	D	5,000	2,270
Nickel chloride.....	D	5,000	2,270
Nickel hydroxide.....	C	1,000	454
Nickel nitrate.....	D	5,000	2,270

Nickel sulfate.....	D	5,000	2,270
Nitric acid.....	C	1,000	454
Nitrobenzene.....	C	1,000	454
Nitrogen dioxide.....	A	10	4.54
Nitrophenol.....	B	100	45.4
Nitrotoluene.....	C	1,000	454
Paraformaldehyde.....	C	1,000	454
Parathion.....	X	1	0.454
Pentachlorophenol.....	A	10	4.54
Phenol.....	C	1,000	454
Phosgene.....	A	10	4.54
Phosphoric acid.....	D	5,000	2,270
Phosphorus.....	X	1	0.454
Phosphorus oxychloride.....	C	1,000	454
Phosphorus pentasulfide.....	B	100	45.4
Phosphorus trichloride.....	C	1,000	454
Polychlorinated biphenyls...	A	10	4.54
Potassium arsenate.....	C	1,000	454
Potassium arsenite.....	C	1,000	454
Potassium bichromate.....	C	1,000	454
Potassium chromate.....	C	1,000	454
Potassium cyanide.....	A	10	4.54
Potassium hydroxide.....	C	1,000	454
Potassium permanganate.....	B	100	45.4
Propargite.....	A	10	4.54
Propionic acid.....	D	5,000	2,270
Propionic anhydride.....	D	5,000	2,270
Propylene oxide.....	B	100	45.4
Pyrethrins.....	X	1	0.454
Quinoline.....	D	5,000	2,270
Resorcinol.....	D	5,000	2,270
Selenium oxide.....	A	10	4.54
Silver nitrate.....	X	1	0.454
Sodium.....	A	10	4.54
Sodium arsenate.....	C	1,000	454
Sodium arsenite.....	C	1,000	454
Sodium bichromate.....	C	1,000	454
Sodium bifluoride.....	B	100	45.4
Sodium bisulfite.....	D	5,000	2,270
Sodium chromate.....	C	1,000	454
Sodium cyanide.....	A	10	4.54
Sodium dodecylbenzene-sulfonate.....	C	1,000	454
Sodium fluoride.....	C	1,000	454
Sodium hydrosulfide.....	D	5,000	2,270
Sodium hydroxide.....	C	1,000	454
Sodium hypochlorite.....	B	100	45.4
Sodium methylate.....	C	1,000	454
Sodium nitrite.....	B	100	45.4
Sodium phosphate, dibasic...	D	5,000	2,270
Sodium phosphate, tribasic..	D	5,000	2,270
Sodium selenite.....	B	100	45.4
Strontium chromate.....	C	1,000	454
Strychnine.....	A	10	4.54

Styrene.....	C	1,000	454
Sulfuric acid.....	C	1,000	454
Sulfur monochloride.....	C	1,000	454
2,4,5-T Acid.....	C	1,000	454
2,4,5-T Amines.....	D	5,000	2,270
2,4,5-T Esters.....	C	1,000	454
2,4,5-T Salts.....	C	1,000	454
2,4,5-TP Acid.....	B	100	45.4
2,4,5-TP Acid Esters.....	B	100	45.4
TDE.....	X	1	0.454
Tetraethyl lead.....	A	10	4.54
Tetraethyl pyrophosphate....	A	10	4.54
Thallium sulfate.....	B	100	45.4
Toluene.....	C	1,000	454
Toxaphene.....	X	1	0.454
Trichlorfon.....	B	100	45.4
Trichloroethylene.....	C	1,000	454
Trichlorophenol	A	10	4.54
Triethanolamine dodecylbenzenesulfonate...	C	1,000	454
Triethylamine.....	D	5,000	2,270
Trimethylamine.....	B	100	45.4
Uranyl acetate.....	B	100	45.4
Uranyl nirate.....	B	100	45.4
Vanadium pentoxide.....	C	1,000	454
Vanadyl sulfate.....	C	1,000	454
Vinyl acetate.....	D	5,000	2,270
Vinylidene chloride.....	D	5,000	2,270
Xylene.....	C	1,000	454
Xylenol.....	C	1,000	454
Zinc acetate.....	C	1,000	454
Zinc ammonium chloride.....	C	1,000	454
Zinc borate.....	C	1,000	454
Zinc bromide.....	C	1,000	454
Zinc carbonate.....	C	1,000	454
Zinc chloride.....	C	1,000	454
Zinc cyanide.....	A	10	4.54
Zinc fluoride.....	C	1,000	454
Zinc formate.....	C	1,000	454
Zinc hydrosulfite.....	C	1,000	454
Zinc nitrate.....	C	1,000	450
Zinc phenolsulfonate.....	D	5,000	2,270
Zinc phosphide.....	B	100	45.4
Zinc silicofluoride.....	D	5,000	2,270
Zinc sulfate.....	C	1,000	454
Zirconium nitrate.....	D	5,000	2,270
Zirconium potassium fluoride	C	1,000	454
Zirconium sulfate.....	D	5,000	2,270
Zirconium tetrachloride.....	D	5,000	2,270

ANNEX I

POTENTIAL SOURCES OF SPILLS AT REDSTONE ARSENAL

ABOVE GROUND STORAGE INVENTORY

This Annex is a tabulated list, by building number, of oils and hazardous material stored aboveground in quantities large enough to cause a spill event.

Transfer and handling occurs at each of these sites; however, the largest potentials for spill events are listed in Appendix D.

A list of chemicals that are handled by various organizations on Redstone Arsenal is maintained at the Environmental Management Office, AMSMI-RA-EH-EQ. This list is updated annually in accordance with the Resource Conservation and Recovery Act (RCRA) of 1976.

The annual inventory is reviewed for chemicals that would be stored in quantities large enough to cause a spill in accordance with the Code of Federal Regulations, Title 40, Part 117, as shown in Appendix E of this document.

Chemicals in quantities exceeding the Hazardous Quantity (HQ) will be listed and attached as an amendment to Annex I as necessary. Removal of these chemicals should never be attempted without approval from the EPA Regional Coordinator.

ANNEX I
ABOVEGROUND TANK INVENTORY
1988

BUILDING NUMBER	TANK CAPACITY GALS	LIQUID STORED	CONTAINMENT PROTECTION	YEAR INSTALLED
3620	500,000	#5 Oil	Diked	1970
3621	500,000	#5 Oil	Diked	1970
3636a	1,000	Lube Oil	Contained	1961
3636b	1,000	Lube Oil	Contained	1961
3669	10,000	Diesel Oil	Diked	1965
4234a	700,000	#5 Oil	Diked	1971
4234b	700,000	#5 Oil	Diked	1971
4234c	700,000	#5 Oil	Diked	1971
4497a	1,000	Propane	Not Needed	1985
4497b	1,000	Propane	Not Needed	1985
4632	20,000	Gasoline	Diked	1955
4633	20,000	Gasoline	Diked	1955
4636	15,000	Gasoline	Diked	1956
4717	1,000,000	#5 Oil	Diked	1970
4721	1,000,000	#5 Oil	Diked	1970
4815	1,000	Propane		
4815	1,000	Propane		
4815	1,000	Propane		
4815	1,000	Propane		
5489a	1,000	Diesel	Diked	1986
5489b	1,000	Gasoline	Diked	1986
5489c	350	Gasoline	Diked	1986
5498	500	Propane	Not Needed	1978
5559 g	72,000cu.ft	Carbon Monoxide		
5568 g	8,000cu.ft	Carbon Monoxide		
5570 g	3,300	Iron pentacarbonyl		
5575 g	10,000	Ammonia	Diked	1968
---- g	325	Propane		
---- g	77,000cu.ft	Hydrogen tank bank		
5578 g	2,000cu.ft	Ammonia		
5592 g	57,000cu.ft	Ammonia	Diked	1968
5631 *	20,000	Kerosene	Diked	1951
5686 *	81,000	Inactive	Diked	1951
5691 *	23,500	Gasoline	Diked	1951
5692 *	260,500	#2 Oil	Diked	1950
5693 *	84,000	#2 Oil	Diked	1950
5694 *	84,000	#2 Oil	Diked	1950
5695 *	193,000	Diesel	Diked	1951
5696 *	94,500	#2 Oil	Diked	1950
5697 *	109,000	Gasohol	Diked	1952
5698 *	168,000	#2 Oil	Diked	1950
5699 *	168,000	#2 Oil	Diked	1950
6309	5,000	WEMCO CI Oil	Undiked	1985
7106a	350	Gasoline	Undiked	1985
7106b	1,000	Gasoline	Undiked	1985
7142a	600	Diesel	Diked	1986

7142b		1,000	Diesel	Diked	1986
7159		5,000	Liquid Nitrogen	Not Needed	1976
7290		26,000	Methylene Chloride	Undiked	1956
7405 **		600	#2 Oil	Diked	1970
7407		1,000	#2 Oil	Diked	1971
7408		280	Gasoline	Undiked	1975
7416		2,000	#2 Oil	Double wall	1990
7420 **	(3)	600 ea	#2 Oil	Diked	1972
7422		1,000	#2 Oil	Diked	1975

ANNEX I

ABOVEGROUND TANK INVENTORY (Cont)

1988

BUILDING NUMBER	TANK CAPACITY GALS	LIQUID STORED	CONTAINMENT PROTECTION	YEAR INSTALLED
7354**	500	Acetone/ Methylene Cl	Diked	1953
7427	1,000	#2 Oil	Diked	1975
7575	250	Trichloroethane	Contained	
7630 **	250	Diesel	Contained	1972
7630 **	1,000	Diesel	Contained	
7740**	1,500	Trichloro-ethylene	Contained	1962
7822***	1,000	Liquid Carbon Dioxide	Not Needed	1984
R&D-156***	1,000	Liquid Carbon Dioxide	Not Needed	1984
7848	10,000	Liquid Carbon Dioxide	Not Needed	1985
7853	2,000	Liquid Carbon Dioxide	Not Needed	1985
7857	5,000	Liquid Carbon Dioxide	Not Needed	1985
8023a	2,000	Propane	Not Needed	1976
8023b	1,000	Propane	Not Needed	1976
8038a	1,000	#2 Oil	Diked	1973
8038b	18,000	NaOH	Diked	1963
8038c	16,000	Alum	Diked	1963
8039	1,500	#2 Oil	Diked	1970
8878	500	Gasoline	Undiked	1975
8999a	12,000	NaOH	Diked	1963
8999b	8,500	Alum	Diked	1963

GAF g
Tank Farm *
Thiokol **
Test Area #1 ***

ANNEX I

BULK STORAGE OF HAZARDOUS MATERIALS

BLDG NO	MATERIAL	QUANTITY
108	Chlorine *	1 ea 1 ton Cylinder
1500	Chlorine *	1 ea 1 ton Cylinder
3468	Chlorine *	1 ea 1 ton Cylinder
3772	Chlorine *	2 ea 1 ton Cylinder
4100	Ethylene Oxide	2 ea 200 lb Cylinder
4489	Acetic Acid Sulfuric acid	55 gals (440 lbs)
4689	Chlorine *	2 ea 1 ton Cylinder
4812	Solvents	Greater than 1,000 lbs
5400	Numerous chemicals in less than liter quantities	
	Acetic acid	5 gals
	Sulfuric acid	Lab quantities
	Toluene	"
	Napthalene	"
	Nitric Acid	"
	Sodium Dichromate	"
5428	Chlorine *	1 ea 1 ton Cylinder
5428a	Sodium Silicofluoride	2,500 lbs (25 lb bags)
5428b	Sodium Silicofluoride	2,500 gals (underground w/ secondary containment)
5477	Plating Chemicals	Greater than 1,000 lbs
5575	Ammonia	10,000 gallons (Diked)
5578	Ammonia	2,000 cubic feet
GAF	Hydrogen	77,000 cubic feet
7115	Sodium Hypochlorite (bleach)	50 gals (480 lbs)
7120	Trichloroethylene	55 gals/ 550 lbs
	Sulfuric acid	Lab quantities
	Toluene	"
	Xylene	"

	Methylene Chloride	700 lbs
7216	Overflow PCB Transformer Storage	Drip pans on each
7290	Methylene Chloride	26,000 gals (aboveground, undiked)
7395	Chlorine *	1 ea 1 ton Cylinder
7403	Trichloroethylene, 55 gl drums	22,000 lbs
7740	Trichloroethylene	1,500 gals (contained)
8018	Chlorine *	1 ea 1 ton Cylinder
8022	Sodium Hypochlorite	400 gals- 3,200 lbs
8026	Sodium Silicofluoride	5,000 lbs
8038	Aluminum Sulfate (liquid alum)	16,000 gals (aboveground tank, diked)
	Sodium Hydroxide (liquid caustic)	18,000 gals (aboveground tank, diked)
8038a	Sodium Silicofluoride	(50 lb bags) 2,500 lbs
8038b	Sodium Silicofluoride	3,500 gals (Underground with secondary containment)
8040	Chlorine	15 ea 1 ton Cylinder
8107	Propellant Monomoth Hydrazine Anhydrous	4 drums (1325 lbs)
	Hydrazine, Anhydrous	4 drums (1860 lbs)
8999	Aluminum Sulfate (liquid alum)	8,500 gallons (Aboveground Tank Diked)
	Sodium Hydroxide (liquid caustic)	12,000 gallons (Aboveground Tank Diked)

* Secondary Containment is available at all chlorine locations.
Note: Sodium Silicofluoride is a powder and will not flow

THIOKOL TEMPORARY STORAGE PADS

BLDG NO	Material	Quantity	Spill Containment and Capacity (gal)
7309	Propellant wastes, 1.3 and Solvents	12ea,55 gal drums	Dike
7339	Propellant Wastes 1.3	32ea,55 gal drums	Dike
7340	Propellant Wastes 1.3	12ea,55 gal drums	No containment
7344	Paint Waste Solvents MEK,Trichlorethylene,Toluene	12ea,55 gal drums	No containment
7346	Propellant waste/ 1.1 and Solvents	12ea,55 gal drums	Dike
7347	Propellant waste/ 1.1 and Solvents	12ea,55 gal drums	Dike
7352	Propellant waste/ 1.1 and Solvents	12ea,55 gal drums	Dike
7353	Propellant waste/ 1.1 and Solvents	12ea,55 gal drums	Dike
7354	Propellant waste/ 1.1 and Solvents	12ea,55 gal drums	Dike
7354	Propellant waste/ 1.1 and Solvents	12ea,55 gal drums	Dike
7356	Propellant waste/ 1.3 and Solvents	12ea,55 gal drums	Dike
7358	Propellant waste/ 1.1 and Solvents	12ea,55 gal drums	Dike
7359E	Propell 1.3/Solvent	32ea,55 gal drums	Dike
7359W	Propell 1.3/Solvent	32ea,55 gal drum	Dike
7359W	Propell 1.3/Solvent	32ea,55 gal drum	Dike
7360	Solvent Bulk Propellant Waste 1.3	12ea,55 gal drum	Dike
7363	Inert waste	32ea,55 gal drum	Dike

7368S	Inert waste/ Solvent	32ea,55 gal drum	Dike
7368N	Propell waste 1.3	32ea,55 gal drum	Dike
7369	Solvent Waste Raw Mat. Waste	32ea,55 gal drum	Dike
7382	Propellant Waste 1.3/ Solvent	32ea,55 gal drum	Dike
7386	1.1 Propell Waste/ Solvent	12ea,55 gal drum	Dike
7387	1.1 Propell Waste/ Solvent	12ea,55 gal drum	Dike
7555	1.1 Propell Waste/ Solvent	12ea,55 gal drum	Dike
7555	1.1 Propell/Solvent	12ea,55 gal drum	Dike
7575	Inert waste/Solvent	12ea,55 gal drum	Dike
7578	1.3 Propell/Solvent	32ea,55 gal drum	Dike
7593	Solvents Propellants 1.3	12 ea,55 gl drum	Dike
7594	Propellant waste 1.3/ Solvent	12ea,55 gal drum	Dike
7595	Propell waste 1.3 Solvent	12ea,55 gal drum	Dike
7601	Inert waste/Solvent	3ea,55 gal drum	Dike
7603	Inert waste/Solvent	3ea,55 gal drum	Dike
7625	Propell 1.3/ Solvent	32ea, 55 gal drum	Dike
7630	Inert waste/Solvent	32ea,55 gal drum	Dike
7632	Solvent Bulk Propellant 1.3	24ea,55 gal drum	Dike
7632	1.1 Propell/Solvent	12ea,55 gal drum	Dike
7636	Propell 1.3	12ea,55 gal drum	Dike
7636	Propell 1.1	12ea,55 gal drum	Dike

7654	Propell 1.1	12ea,55 gal drum	Dike
7660	Propell 1.3	24ea,55 gal drum	Dike
7667	Propell 1.3	12ea,55 gal drum	Dike
7667	Propell 1.1	12ea,55 gal drum	Dike
7688	Ammon Perchlorate inert waste	12ea,55 gal drum	Dike
7690	Ammon Perchlorate inert waste	12ea,55 gal drum	Dike
7691	AP/inert waste	24ea,55 gal drum	Dry
7724	Solvents Propellant 1.1	12ea,55 gal drum	Dike
7726	Propell 1.3/Solvent	32ea,55 gal drum	Dike
7740	Inert waste/Solvent	32ea,55 gal drum	Dike
7742	Propell 1.3/Solvent	12ea,55 gal drum	Dike

* Note: Except as noted at Pad 7347, all "solvents" are Trichloroethane.

ANNEX II

UNDERGROUND TANK INVENTORY

1991

BUILDING NUMBER	TANK CAPACITY GALS	LIQUID STORED	CONSTRUC-TION MATERIAL	CATHODIC PROTECTION YES,NO,FIBER GLASS	YEAR INSTALLED
0115	12,000	#2 F.O.	Steel	Yes	1970
28a	500	Gasoline	Steel	No	1985
0128b	500	Gasoline	Steel	No	1985
0128c	500	Diesel	Steel	No	1985
0130	5,000	#2 F.O.	Steel	No	1975
0376	2,000	#2 F.O.	Steel	Yes	1965
1500	2,000	#2 F.O.	Steel	Yes	1965
3220	3,000	#2 F.O.	Steel	No	1965
3230	1,000	#2 F.O.	Steel	No	1965
3240a	10,000	Gasoline	Steel	No	1968
3240b	10,000	Gasoline	Steel	No	1968
3240c	6,000	Gasoline	Steel	No	1968
3240d	500	Used Oil	Steel	No	1968
3338	1,000	Used Oil	Steel	No	1969
3617	1,000	Used Oil	Steel	No	1970
3624	20,000	#5 F.O.	Steel	Yes	1955
3639a	10,000	Gasohol	Figlass	No	1986
3639b	10,000	Gasohol	Figlass	No	1986
3639c	5,000	Diesel	Steel	No	1955
3665	1,000	Used Oil	Steel	No	1972
3670a	8,000	Gasohol	Steel	Yes	1986
3670b	6,000	Gasohol	Steel	Yes	1986
3670c	6,000	Diesel	Steel	Yes	1986
3770	6,000	Diesel	Steel	Yes	1986
3772	1,500	#2 F.O.	Steel	No	1974
4100a	5,000	Diesel	Steel	Yes	1958
4100b	30,000	#2 F.O.	Steel	Yes	1958
4505	1,000	Diesel	Steel	No	1984
4725	20,000	#5 F.O.	Steel	Yes	1958
4812a	12,000	JP4	Figlass	No	1984
4812b	12,000	JP4	Figlass	No	1984
4812c	6,000	AVGAS	Figlass	No	1984
4812d	6,000	AVGAS	Figlass	No	1984
4812e	1,000	Used Oil	Steel	No	1969
4813	1,000	#2 F.O.	Steel	Yes	1960
4827	4,000	AVGAS	Steel	No	1985
4832	10,000	#2 F.O.	Steel	No	1988
5410	7,500	#2 F.O.	Steel	Yes	1983
5428	2,500	NaSiFl	Stain Steel	No	1986
5435	40	Hyd Oil	Steel	No	1982
5561	5,000	#2 F.O.	Steel	No	1960

6101	1,000	#2 F.O.	Steel	No	1980
6260	8,000	#2 F.O.	Steel	No	1986
7105a	10,000	#2 F.O.	Steel	No	1973
7153	5,000	#2 F.O.	Steel	Yes	1965
7156	1,000	#2 F.O.	Steel	Yes	1960I
7289	7,500	#2 F.O.	Steel	Yes	1961
7291a	10,000	#2 F.O.	Steel	Yes	1961
7291b	10,000	#2 F.O.	Steel	No	1961
7425	1,500	#2 F.O.	Steel	No	1980
7578 *(I)	2,000	#2 F.O.			
7604a*	10,000	#2 F.O.	Steel	No	1980
7604b*	10,000	#2 F.O.	Steel	No	1980
7604c*	10,000	Gasohol	Steel	No	1983
7622a* (I)	200	Propane	Steel	No	1957
7622 * (I)	2,000	#2 F.O.	Steel	No	1960
7668a*	10,000	#2 F.O.	Steel	No	1980
7668b*	10,000	#2 F.O.	Steel	No	1980
7668c*	10,000	#2 F.O.	Steel	No	1980
7668d*	10,000	#2 F.O.	Steel	No	1980
7770	5,000	#2 F.O.	Steel	Yes	1962
7855	5,000	#2 F.O.	Steel	Yes	1960
8009	2,000	#2 F.O.	Steel	No	1961
8012	750	#2 F.O.	Steel	No	1960
8014	2,000	#2 F.O.	Steel	No	1958I
8019	2,000	#2 F.O.	Steel	Yes	1960
8028a	12,000	#2 F.O.	Steel	Yes	1960
8028b	12,000	#2 F.O.	Steel	Yes	1960
8038b	3,500	NaSiFl	StainSteel	No	1980
8716	5,000	#2 F.O.	Steel	Yes	1962
8786	2,000	#2 F.O.	Steel	Yes	1965
8874b	1,500	#2 F.O.	Steel	Yes	1965
8977a	12,000	#2 F.O.	Steel	Yes	1966
8999	1,000	#2 F.O.	Steel	Yes	1967

Thiokol*
I=Inactive

ANNEX III

LOCATION OF OIL/WATER SEPARATORS

Number and Type Facility	Location	Effluent To
1 O/W Separator - Golf Course	0107	Environment
1 O/W Separator - Boiler House	0115	San. Sewer
1 O/W Separator - PX	3221	San. Sewer
1 O/W Separator - AAFES Serv Sta	3240	San. Sewer
1 O/W Separator - Firehall	3320	San. Sewer
1 O/W Separator - OMMCS	3338	Environment
1 O/W Separator - OMMCS	3367	San. Sewer
1 O/W Separator - Auto Craft Shop	3617	San. Sewer
1 O/W Separator - Boiler House	3620	Environment
1 O/W Separator - Boilerhouse	3621	Environment
1 O/W Separator - Training	3627	San. Sewer
1 O/W Separator - Bus wash	3631	San. Sewer
1 O/W Separator - Car wash	3633	San. Sewer
1 O/W Separator - Equipment Mgmt	3664	San. Sewer
1 O/W Separator - OMMCS	3665	San. Sewer
1 O/W Separator - Boiler House	4709	Environment
2 O/W Separator - Boiler House	4717	Environment
1 O/W Separator - Airfield	4812	Environment
2 O/W Separator - Airfield	4833	San. Sewer
1* Coalescing Plate O/W Separator	5427	San. Sewer
1 O/W Separator - Research Lab	5435	San. Sewer
1 O/W Separator - Bldgs Grds Wshrck	5494	San. Sewer
1 O/W Separator - Fuel/wash rack	5498	Environment
3 O/W Separators - POL Farm	5689	Environment
	5690	
	5699	
1 O/W Separator - POL Farm	5693	Environment
1 O/W Separator - Boiler House	7105	San. Sewer
1 O/W Separator - Boiler House	7288	San. Sewer
1 O/W Separator - Boiler House	7291	San. Sewer
1 O/W Separator - Boiler House	7579	San. Sewer
1 O/W Separator - Firehall	7802	San. Sewer
1 O/W Separator - Test Area 1	7829	Environment
1 O/W Separator - Test Area 2	7842	~~San. Sewer~~ Envr
1 O/W Separator - Test Area 5	8874	San. Sewer?

*This is the only separator where POL spill mixtures may be processed.

Oil/water separators are inspected monthly and pumped as needed.

REFERENCES

1. AR 200-1, Chapter 8 - Oil and Hazardous Substances Spill Control and Contingency Plans, 23 May 1990.

2. AR 500-60 - Disaster Relief, Aug, 1981.

3. MICOMR 420-5 - Prevention, Control, and Abatement of Air, Water, and Ground Pollution, 15 Mar 1985.

4. Spill Prevention Control and Countermeasure (SPCC) Plan, Redstone Arsenal, Alabama, August, 1988.

5. MICOM Disaster Control Plan (MICOM-DCP), 1986.

6. RSA Plan 500-5 - Redstone Arsenal Chemical Accident/Incident Control Plan (CAIC), May, 1984.

7. Installation Spill Contingency Plan (ISCP), Redstone Arsenal, Alabama, August, 1988.

8. RSA, SOP 385-10-9 - Safety Precautions for Performance of Operations at Water Treatment Plants.

9. NASA, George C. Marshall Space Flight Center - SPCC Plan, 1986.

10. RSA, SOP 385-5 - Control of Oil and Hazardous Materials.

11. RSA Installation Natural Resources Report, 15 Sep 86.

12. Thiokol Corporation, Spill Prevention Control and Countermeasure Plan, July 1990.

13. 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response.

14. MICOMR 385-15, Hazardous Waste Operations and Emergency Response

15. 40 CFR 110, 112, 116, 117, 302.

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MSFC (George C. Marshall Space Flight Center)
Seabees RMN-CB-24
Olin Chemical
BAMSI (6 cys)

LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ACM	Asbestos Containing Material
ADEM	Alabama Department of Environmental Management
A/E	Architect/Engineer
AEC	Army Environmental Center
ANRC	American National Red Cross
ANSI	American National Standards Institute
APR	Air Purifying Respirator
ASTM	American Society for Testing Materials
AUTODIN	Automatic Digital Network
BIFC	Boise Interagency Fire Center
CAIRA	Chemical Accident or Incident Response and Assistance
CB	Citizen's Band
CEIL	Ceiling Limit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CEHSM	Corporate Environmental Health and Safety Manager
COE	Chief of Engineers
CONUS	Continental United States
CPR	Cardio-pulmonary Resuscitation
CRP	Community Relations Plan
CWM	Chemical Warfare Material
DB	Dry Bulb Temperature
DCC	Disaster Control Coordinator
DCS	Defense Communications System
DEMP	Directorate of Environmental Management and Planning
DOT	Department of Transportation
DQCR	Daily Quality Control Report
DQOs	Data Quality Objectives
DSN	Defense Switched Network
EAO	Emergency Action Officer
ECT	Equivalent Chill Temperature
EM	Electromagnetic Radiation
EOC	Emergency Operations Center
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ESE	Environmental Science & Engineering, Inc.
ETWN	Emergency Telephone Warning Net
FAR	Federal Acquisition Regulation
FCO	Federal Coordinating Officer
FDAA	Federal Disaster Assistance Administration

LIST OF ACRONYMS (Continued)

FEMA	Federal Emergency Management Agency
FID	Flame Ionization Detector
GAF	General Aniline and Film
GC/MS	Gas Chromatography/Mass Spectrometry
GT	Globe Temperature
HASP	Health and Safety Plans
HP	Hydropunch
HPII	Hydropunch II™
HSA	Hollow Stem Auger
HSO	Health Safety Officer
HUD	Housing and Urban Development
I.D.	Inside Diameter
IDW	Investigation Derived Waste
IDLH	Immediately Dangerous to Life and Health
IOSC	Installation On-Scene Coordinator
IRP	Incident Response Plan
ISCP	Installation Spill Contingency Plan
ISP	International Specialty Products
LIMS	Laboratory Information Management System
LL	Liquid Limit
MICOM	Missile Command
Mmhos/m	Milli-Mhos per meter
MSDS	Material Safety Data Sheet
MSFC	Marshall Space Flight Center
MSHA	Mine Safety and Health Administrator
msl	Mean Sea Level
NASA	National Aeronautics and Space Administration
NIOSH	National Institute for Occupational Safety and Health
NPL	National Priorities List
NWB	Natural Wet Bulb Temperature
O.D.	Outside Diameter
OEW	Ordnance and Explosive Wastes
OSHA	Occupational Safety and Health Administration
OVA	Organic Volatile Analyzer
PAPR	Powered Air Purifying Respirators
PEL	Permissible Exposure Limit
PELA	P.E. LaMoreaux & Associates, Inc.
PI	Plasticity Index
PID	Photo-ionization Detector
PL	Plastic Limit
PM	AE Project Manager
PPE	Personal Protective Equipment

LIST OF ACRONYMS (Continued)

PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
QCSR	Quality Control Summary Report
RAB	Remedial Action Boards
RCRA	Resource Conservation and Recovery Act
REHSM	Regional Environmental Health and Safety Manager
RQ	Reportable Quantity
RPD	Reletike Percent Difference
RHSS	Regional Health and Safety Supervisor
RSA	Redstone Arsenal
Rust E&I	Rust Environment & Infrastructure, Inc.
SB	Soil Boring
SC	Specific Conductance
SCBA	Self-Contained Breathing Apparatus
SD	Standard Deviation
SG	Soil Gas
SI	Site Inspection(s)
SOPs	Standard Operating Procedures
SSHP	Site Safety and Health Plan
SPCC	Spill Prevention Control and Countermeasure Plan
STEL	Short-term Exposure Limit
STU	Secure Telephone Unit
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit(s)
TCA	Trichloroetehane
TCE	Trichloroethene
TD/MS	Thermal Desorption/Mass Spectrometry
TD/GC/MS	Thermal Desorption/Gas Chromatography/Mass Spectrometry
TLV	Threshold Limit Value
TRC	Technical Review Committee
TSOW	Technical Scope of Work
TVA	Tennessee River Valley Authority
TWA	Time Weighted Average
USACE	U.S. Army Corps of Engineers
USAOMMCS	United States Army Ordnance Missile and Munitions and Command School
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USCS	Unified Soils Classification System
USCG	United Stated Coast Guard
USGS	U.S. Geologic Survey

LIST OF ACRONYMS (Continued)

VOA	Volatile Organic Analyses
VOC	Volatile Organic Compound
VSI	Visual Site Inspection
WBGT	Wet Bulb Globe Temperature
WNWR	Wheeler National Wildlife Refuge
°F	Degrees Fahrenheit

A-E RESPONSE TO COMMENTS

FOR

DRAFT SITE INSPECTION WORK PLAN

RSA -94, 95, 96, 97, 98
EPA ID NO. AL7 210 020 742

REDSTONE ARSENAL
MADISON COUNTY, ALABAMA

CONTRACT NO. DACA 2193-D-0029
DELIVERY ORDER NO. 025

Prepared For:
U.S. Army Corps of Engineers
Savannah District

Prepared By:
Rust Environment & Infrastructure, Inc.
Greenville, South Carolina

FEBRUARY 1996

RESPONSE TO USACE COMMENTS (Mr. Fred Moser)
DRAFT SITE INSPECTION WORK PLAN
DO#25
REDSTONE ARSENAL

NO.	PAGE	PARAGRAPH	COMMENT/RESPONSE
1	Figure 3-2		COMMENT: Building 7726 labeled incorrectly, it should be RSA-98.
1			RESPONSE: Figure 3-2 will be modified in accordance with the comment.
2	Figure 3-3 thru 4-6		COMMENT: Consider showing direction of expected groundwater flow as described in the text of the work plan.
2			RESPONSE: The estimated groundwater flow directions at the RSA 94 through 98 sites will be added to Figures 3-3 through 3-7 and Figures 4-2 through 4-6.

RESPONSE TO USACE COMMENTS (Mr. Franz Froelicher, Ph.D)
DRAFT SITE INSPECTION WORK PLAN
DO#25
REDSTONE ARSENAL

NO.	PAGE	PARAGRAPH	COMMENT/RESPONSE
1	Chemical Tables 4-1 & 1-1		COMMENT: The presentation or format of the tables are difficult to follow. For instance: Where are the Trip blanks listed? Are they part of the cost...and part of the total containers in the field...in the coolers? Remember there must be one with every cooler that contains liquid VOC samples. Missing is the container size, type, preservation, and holding times. Where are these listed? It would be better if they are listed as part of the table. What we really prefer is a table for each site much like the table enclosed as an example.
1			RESPONSE: Table 4-1 summarizes which media will be sampled at each site and is and to provide specifics about the sampling program (e.g., analytical methods, etc.). Table 5-1 is used to convey the specifics of the sampling program. Table 5-1 will be revised to in accordance with the comment. Table 5-1 will be formatted as requested and will include all the information indicated in the comment. Table 1-1 in Appendix A also contains information about containers, holding times, and preservation and will be modified as requested in Comment No. 4.
2	Sect. 6.3		COMMENT: Please add: Rust E&I, in addition to any validation done by the laboratory, will do their own complete validation, assign flags, report them and their reasons, and list and describe any other discrepancies in the short (a few pages at the most) Data Validation Summary Report. (Which you did not mention.) Please make sure you include a statement that YOU WILL do a Data Validation Summary Report.
2			RESPONSE: The text in Section 6.3 of Appendix A of the Technical Scope of Work has been modified to indicate that Rust will perform a complete validation of the analytical data and that the results of the validation process will be reported and explained in a Quality Control Summary Report (QCSR). Because the validation process and results will be reported in the QCSR, there is no need to produce a Data Validation Summary Report.
3	General		COMMENT: Please add: "If sample integrity, such as holding times, etc., is compromised by the Rust E&I, or their subcontractors, Rust E&I will be liable for possible resampling at no cost to the government.

NO.	PAGE	PARAGRAPH	COMMENT/RESPONSE
3			RESPONSE: Rust agrees that if sample integrity is compromised by actions of Rust or our contractors, then we (Rust) will be liable for possible resampling at no cost to the government. However, Rust believes this matter is a contractual issue between Rust and the USACE and that it does not need to be mentioned in the Work Plan.
4	Table 1-1		COMMENT: Please also reference EM 200-1-3, 1 Sep. 94, with table 1-1 through 3 (dated 31 March 95) for instructions on the holding times, preservation, and containers. State that you used the table in order to annotate your tables.
4			RESPONSE: Table 5-1 and Table 1-1 (Appendix A) will be modified in accordance with the reference indicated in the comment and the reference will be cited on the tables.

RESPONSE TO USACE COMMENTS (Mr. William M. Townsend)
DRAFT SITE INSPECTION WORK PLAN
DO#25
REDSTONE ARSENAL

NO.	PAGE	PARAGRAPH	COMMENT/RESPONSE
Site Safety & Health Plan			
1	Cover/Signature Sheet		COMMENT: I guess ED refers to Engineering Division. EN would be more correct if we in engineering actually signed the document. However, CESAS-SO Safety office officially approves the document but I believe the approval is by letter.
1			RESPONSE: ED changed to Safety Office (SO).
2	1, 1.2, 13, 14 and 15		COMMENT: These sections reference medical, training and fit testing certification, and when it may be seen/presented/viewed, etc. Per 385-1-92 Appendix B 4.d. Documentation of all safety and health training including names of employees, duration, contents, and dates of training shall be appended to the SSHP and 6.d. Certification of employees participation in the medial surveillance program shall be appended to the SSHP. This certification shall include the employees name, the date of last examination, and name of reviewing occupational physician. Note: This would include fit test certification.
2			RESPONSE: Certifications for training have not been included since individuals who will actually work on the project have not been identified or recertification may be required before field work begins. Certifications for employees will be submitted prior to the start of field work.
3	2	1.2	COMMENT: Reference No. 2, I don't understand the "Electromagnetic Radiation" (EM). Remove Electromagnetic Radiation and the ( ) and the title will be correct.
3			RESPONSE: This has been corrected.
4	Figures		COMMENT: Provide maps for sites in the SSHP. The SSHP should be able to act as a stand alone document.
4			RESPONSE: Site maps have been included.
5	12	6.1	COMMENT: What instruments (organic vapor analyzer) will be used. PID?, FID?, both? How about LEL/LFL and oxygen? Note: I found information on PID/FID in TSOW. Should be in SSHP also see No. 4 above.

NO.	PAGE	PARAGRAPH	COMMENT/RESPONSE
5			RESPONSE: An Organic Vapor Analyzer will be used. It has been clarified that the OVA is an FID. A section or LEL/O_2 readings has been included in Section 6.2.
6	Somewhere in the SSHP		COMMENT: State that 3.b.(6) At least two persons currently certified in First Aid/CPR by the American Red Cross or equivalent agency, according to EM 385-1-1, shall be present on site at all times during site operations.
6			RESPONSE: A sentence has been added to Section 12.2 - At least two employees trained in first aid/CPR will be on site during site operations.
7	15	7.2	COMMENT: Nitrile gloves are okay for acids but Silvershield or 4H are [sic] better for the acetone, TCE and TCA especially if you encounter a significant amount.
7			RESPONSE: No changes. Nitrile gloves will be used due to the wide variety and anticipated low concentration of contaminants.
8	68	12.3	COMMENT: The directions from Thiokol area to Fox Hospital would be better: South to Redstone Road right (west) to Patton Road turn right (north) to Martin Road turn left (west) travel to Toftoy Road turn right (north) follow to Rideout Road merge right and travel to Goss Road and turn right (east) the hospital will be on the right across from the golf course. To Hunstville Hospital from the Thiokol area it would be best to head south to Redstone Road and turn left (east) and exit through gate 3 and turn left (north) on Memorial Parkway (231/53) and travel (x) miles to Governors Drive 431 East and turn right (east) and travel to corner of Governors and Madison where the hospital is located. This a more direct route to one hospital and less gates and low speed limit residential areas to the other. Also, I understand that gate 3, 8, and 9 are always open, however, gates 2, 5, 7, and 10 are sometimes closed. It is always a good idea to travel both routes prior to site work for familiarization and to insure the directions are correct or could be better explained. A copy of the directions, map and emergency numbers should be posted at each site.
8			RESPONSE: Alternative directions from Thiokol area have been added.

RESPONSE TO ENVIRONMENTAL MANAGEMENT OFFICE COMMENTS (Mr. Whitt Walker)
DRAFT SITE INSPECTION WORK PLAN
DO#25
REDSTONE ARSENAL

NO.	PAGE	PARAGRAPH	COMMENT/RESPONSE
1	3-1	Section 3.0, 1	COMMENT: 2nd Sentence: Place period after "(Figures 3-1 and 3-2)" and delete remainder of sentence.
1			RESPONSE: The text will be modified in accordance with the comment.
2	3-1	Section 3.0, 1	COMMENT: 3rd Sentence: Insert "specifically" between "conducted" and "at" and insert "immediate" between "the" and "vicinity".
2			RESPONSE: The text will be modified in accordance with the comment.
3	4-6	Section 4.1.3 Top of Page	COMMENT: Change statement to reflect that the borehole will be backfilled with cuttings removed during drilling operation.
3			RESPONSE: The text will be modified to indicate that cuttings from soil borings will be used to backfill the borehole. However, if the soil boring will be used for the purpose of installing a monitoring well, then the soil or rock cuttings generated from soil borings will be containerized and handled as soil IDW.
4	4-15	Section 4.3.1, 1	COMMENT: Would it not be better if we didn't tie ourselves down to a particular number of sampling points/wells? Couldn't we say something like an adequate number to delineate the nature and extent? This comment also applies to Sections 4.3.2 and 4.3.3.
4			RESPONSE: As suggested in the comment, references to specific number of sampling points/wells for possible future investigation activities have been removed from the text. Instead, the text indicates that an adequate number of sampling points/wells to delineate the nature and extent will be determined in the future.
5	5-7	Section 5.5.1, 3	COMMENT: 2nd and 3rd Sentences: These statements should be modified to reflect our plan to put soil cuttings back into the boreholes as opposed to drumming them.
5			RESPONSE: See the response to comment No. 3.
6	5-8	Section 5.5.1,1	COMMENT: Revise paragraph by deleting statements restricting characterization to two drums.

NO.	PAGE	PARAGRAPH	COMMENT/RESPONSE
6			RESPONSE: The text will be modified in accordance with the comment.
7	5-8	Section 5.5.1, 2	COMMENT: 2nd Sentence: Place period after "MICOM Environmental Office" and delete the rest of the sentence.
7			RESPONSE: The text will be modified in accordance with the comment.
8	5-8	Section 5.5.2, 1	COMMENT: Insert sentence to state that soils not exhibiting contaminant levels above detection levels will be handled as non-regulated and disposed at the discretion of RSA.
8			RESPONSE: The text will be modified in accordance with the comment.
9	5-8	Section 5.5.2, 1	COMMENT: After 2nd Sentence: Insert statement indicating that the accumulation area may be on the site itself. This also holds true for Section 5.5.3.
9			RESPONSE: The text will be modified in accordance with the comment.
10	5-9	Section 5.5.4, 1	COMMENT: General: Why can't the debris as described be disposed into on-site dumpsters and taken to the HSV steam plant?
10			RESPONSE: The subcontractor that will provide containers for the solid waste/debris generated during the investigation will also provide disposal services. The subcontractor provides a turn-key service with the cost of the container rental and disposal combined into a single fee.