UH1203

32501.003
03.04.03.0001

N00204.AR.000144
NAS PENSACOLA
5090.3a

CONTAMINATION ASSESSMENT/ REMEDIAL ACTIVITIES INVESTIGATION WORK PLAN - GROUP J NAVAL AIR STATION PENSACOLA PENSACOLA, FLORIDA

Crash Crew Training Area (Site 3) Fuel Farm Pipeline Leak Area (Site 19)

July, 1990

Prepared for:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 Eagle Drive, P.O. Box 10068
Charleston, South Carolina 29411-0068

Contract Number N62467-88-C-0200

ecology and environment, inc.
316 SOUTH BAYLEN STREET, PENSACOLA, FLORIDA 32501, TEL. (904) 435-8925
International Specialists in the Environment

94 pgs

recycled paper

TABLE OF CONTENTS

Section		Page
1	INTRODUCTION	1-1
2	SITE DESCRIPTION	2-1
	[2.1 Site 3 _The Crash Crew Training Area	2-1
	2.2 Site 19 - The Fuel Farm Pipeline Leak	2-4]
3	SITE HISTORY	3-1
	[3.1 Site 3 - The Crash Crew Training Area	3-1
	3.2 Site 19 - The Fuel Farm Pipeline Leak	3-21
4	CLIMATOLOGY	4-1
5	BIOLOGICAL RESOURCES	5-1
	5.1 Regional Biological Resources	5-1
	5.1.1 Terrestrial	5-1
	5.1.2 Aquatic	5-4
	5.2 Site-Specific Biological Resources	5-9
6	SURFACE WATER HYDROLOGY	6-1
	6.1 General Occurrence and Significance of Surface Water	6-1
	6.2 Site-Specific Surface Water Hydrology	6-2
7	[PHYSIOGRAPHY AND] HYDROGEOLOGY	7-1
	7.1 Physiography and Regional Hydrogeology	7-1

[Bold items enclosed in brackets denote changes from original text]

Table of Contents (Cont.)

Section		Page
7.1.1	Physiography	7-1
7.1.2	Regional Iiydrogeology	7-1
7.1.2.1	Surficial/Sand-and-Gravel Aquifer	7-1
7.1.2.2	Intermediate System	7-4
7.1.2.4	Floridan Aquifer System	7-5
7.2	Site Eydrogeology	7-5
8	PROJECT MANAGEMENT PLAN	8-1
9	SITE MANAGEMENT PLAN	9-1
10	HEALTH AND SAFETY PLAN	10-1
11	QUALITY ASSURANCE PROJECT PLAN	11-1
12	AERIAL PHOTOGRAPH ANALYSIS	12-1
13	UTILITIES SURVEY	13-1
14	FIELDWORK METHODOLOGY	14-1
14.1	Phase I __ Field Screening	14-1
14.1.1	Physical Survey	14-1
14.1.1.1	Overall Physical Reconnaissance	14-1
14.1.1.2	HNu/OVA Surface Emissions Survey	14-2
14.1.1.3	Habitat/Biota Survey	14-2
14.1.2	Geophysical Survey	14-2

[Bold items enclosed in brackets denote changes from original text]

Table of Contents (Cont.)

Section | Page

14.1.3 Analytical Screening 14-3

14.1.3.1 Soil Headspace Survey 14-3

14.1.3.2 Laboratory Analysis 14-4

14.1.4 Hydrologic Assessment ..... [14-8]

14.2 Phase II -- Characterization ..... [14-8]

[14.2.1 Biota Sampling 14-91

[14.2.2] Soil Sampling ..... [14-12]

[14.2.3] Shallow Monitoring Well Installation and Development .....[14-12]

[14.2.4] Groundwater Sampling ..... [14-14]

[14.2.5] Hydrologic Assessment .....[14-14]

[14.2.6] Air Sampling ..... [14-15]

14.3 Phase III -- Extent Delineation .....[14-15]

14.3.1 Biota Sampling ..... [14-15]

14.3.2 Soil Sampling ..... [14-15]

14.3.3 Shallow Monitoring Well Installation and Development .....[14-15]

14.3.4 Intermediate and Deep Monitoring Well Installation and Development .....[14-16]

14.3.5 Groundwater Sampling .....[14-16]

14.3.6 Hydrologic Assessment .....[14-16]

14.3.7 Air Sampling ..... [14-16]

14.4 Phase IV -- Extent Delineation .....[14-17]

14.5 Topographic Survey and Base Map .....[14-17]

14.6 Field Quality Assurance/Quality Control .....[14-17]

14.6.1 Documentation .....[14-17]

[Bold items enclosed in brackets denote changes from original text]

Table of Contents (Cont.)

Section | Page

14.6.2 QA/QC Samples ..... [14-18]

14.7 Decontamination and Waste Management Procedures ..... [14-18]

14.7.1 Decontaaination Procedures .....[14-18]

14.7.2 Waste Management Procedures .....[14-18]

15 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL 15-1

16 GROUNDWATER HODELING 16-1

17 TREATABILITY STUDY 17-1

18 BASELINE RISK ASSESSMENT 18-1

18.1 Contaminant Identification 18-1

18.2 Exposure Assessment 18-2

18.3 Toxicity Assessment 18-3

18.4 Risk Characterization 18-3

19 FEASIBILITY STUDY 19-1

19.1 Screening of Applicable Remedial Technologies 19-1

19.2 Assessment of Applicable Remedial Technologies.... 19-2

19.3 Risk Assessment 19-2

19.4 Development and Evaluation of Remedial Action Alternatives 19-2

19.5 Selection of Recommended Remedial Action Alternatives 19-2

19.6 PS Report 19-3

[Bold items enclosed in brackets denote *changes* from original text]

00000'1!

Table of Contents (Cont.)

Section		Page
20	REPORT	20-1
21	DOCUMENT REVISION	21-1
22	PROJECT MANAGEMENT	22-1
23	PROJECT SCHEDULE	23-1
24	REFERENCES	24-1

Appendix

A	SITE-SPECIFIC SAFETY PLAN	A-1
B	SITE-SPECIFIC QUALITY ASSURANCE PROJECT PLAN	B-1
C	THREATENED AND ENDANGERED FLORA AND FAUNA ASSOCIATED WITH NAS PENSACOLA	C-1

[Bold items enclosed in brackets denote changes from original text]

LIST OF TABLES

Table		Page
14-1	Phase I Sampling and Analytical Requirements--Group J	14-5
14-2	Phase II Sampling and Analytical Requirements--Group J	[14-10]

[Bold items enclosed in brackets denote changes from original text]

LIST OF ILLUSTRATIONS

Figure		Page
2-1	Location Map--NAS Pensacola Sites 3 and 19	2-2
2-2	Site Map--NAS Pensacola Sites 3 and 19	2-3
14-1	Tentative Soil Boring and Temporary Monitoring Well Locations, Sites 3 and 19--Phase I	[14-7]
14-2	Tentative Soil Boring and Monitoring Well Locations, Sites 3 and 19--Phase II	[14-13]
23-1	[Phase I Project Schedule--Sites 3 and 19]	23-2
[23-2	Phase II Project Schedule — Sites 3 and 19	23-3
23-3	Phase III Project Schedule--Sites 3 and 19	23-4
23-4	Phase IV Project Schedule--Sits 3 and 19	23-51

[Bold items enclosed in brackets denote changes from original text].

1. INTRODUCTION

The purpose of this work plan is to outline the procedures and methodologies to be used in conducting a Contamination Assessment/ Remedial Activities Investigation at the Crash Crew Training Area (Site 3) and the Fuel Farm Pipeline Leak (Site 19) located at the Naval Air Station (NAS) in Pensacola, Escambia County, Florida. This work plan has been prepared by Ecology and Environment, Inc. (E & E) for the Southern Division, U.S. Navy, Naval Facilities Engineering Command, under Contract No. N62467-88-C-0200. The work plan has been developed based on information and file documents provided by the Navy, and on information gathered by E & E during preliminary site inspections conducted during January of 1989.

E & E has developed a phased approach for performing the NAS Pensacola site investigations. Phase I (Field Screening) is directed toward identifying the principal area(s) and primary contaminants of concern at a site, thereby providing a mechanism for focusing of the sampling and analytical efforts during subsequent phases of the investigation. Phase II (Characterization) is directed toward the formal confirmation and quantification of the full spectrum of site contaminants (if any), thereby allowing determination of whether further investigation is warranted. Thus, the necessity of implementing Phases III and IV (Extent Delineation) will be dependent on the results of Phases I and 11. Phases III and IV, if required, will be directed not only toward fully identifying the horizontal and vertical extents of contamination, but also toward providing the quantitative data base necessary to support the screening and evaluation of potential remedial alternatives. The main objectives/advantages of this phased approach are as follows:

- Efficient identification of those sites where environmental contamination has actually occurred as a result of past and/or present operations, thereby allowing non-contaminated sites to be eliminated from the program in the most environmentally sound, cost-effective, and timely manner possible;

- Focused placement of sampling locations and focused selection of analytical parameters in later phases of the investigation, thereby allowing full characterization of site contamination in the most environmentally sound, cost-effective, and timely manner possible; and

- Early screening of potential remedial alternatives, vhich, in turn, allovs critical parameters necessary to the evaluation of these alternatives to be incorporated into the analytical program in later phases of the investigation.

It is anticipated that some of the NAS Pensacola sites may not require investigation beyond Phase II and hence will comprise Contamination Assessment-type investigations. On the other hand, sites which have documented contamination will likely require the additional phases of work, and hence will comprise a full-scale CERCLA Remedial Investigation/Feasibility Study (RI/FS). For simplicity, the investigations for all NAS Pensacola sites will be referred to as Contamination Assessment/Remedial Activities Investigations. The final results of site investigations that do not require study beyond Phase II will be incorporated into a Contamination Assessment Report. If appropriate, these sites will be recommended for No Further Action. The final results of site investigations that require work beyond Phase II will be incorporated into a Remedial Investigation Report, vhich will provide all the information necessary for the development and completion of a Feasibility Study.

[Bold items enclosed in brackets denote changes from original text]

2. SITE DESCRIPTION

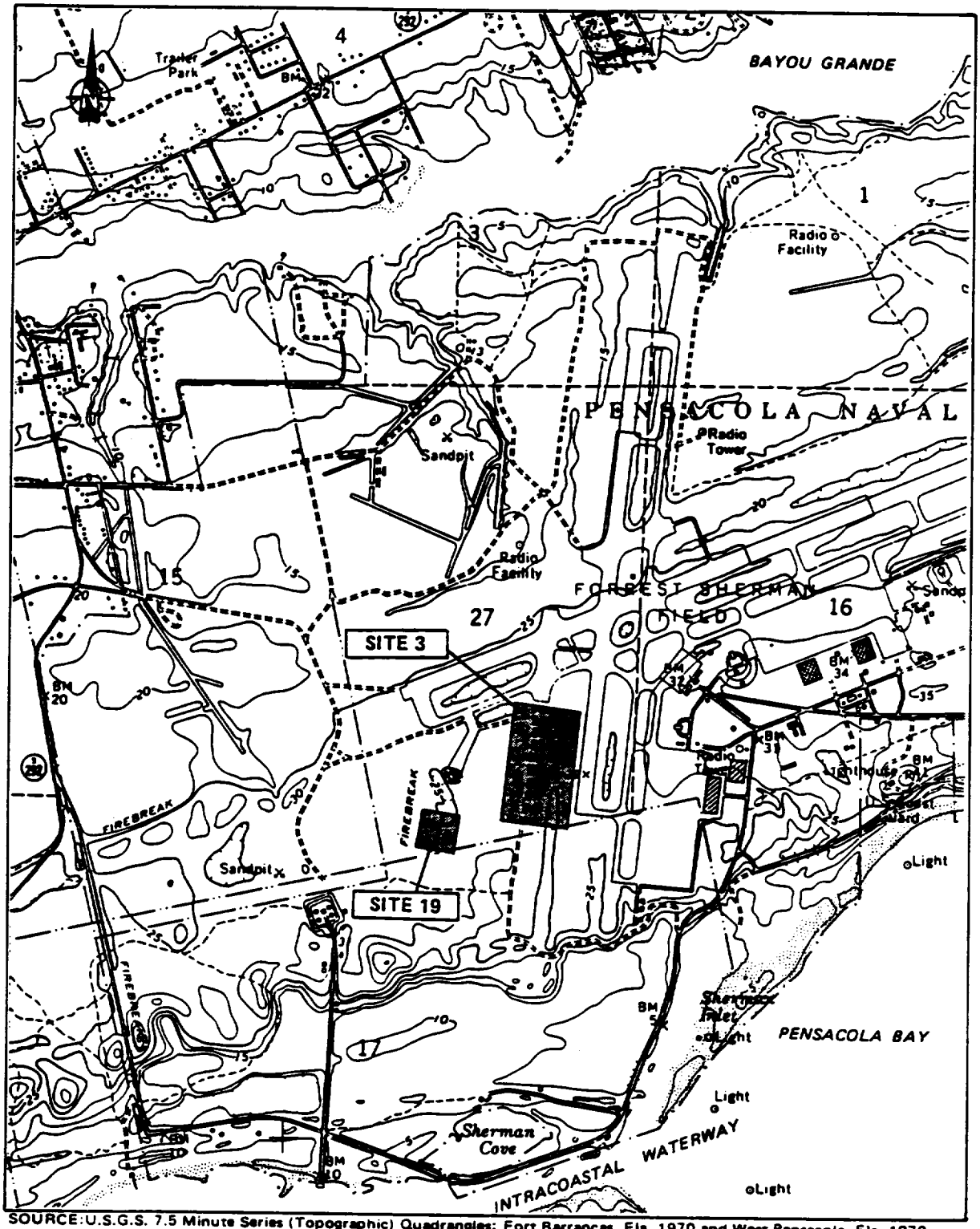
2.1 Site 3 - The Crash Crew Training Area

The Crash Crew Training Area (Site 3) occupies an open area of land approximately 900 feet by 2,300 feet along the southwestern border of Forrest Sherman Field (see Figures 2-1 and 2-2). The site is bounded to the east by aircraft runway 36; to the north by a paved aircraft taxiway; to the west by a scattered brush and woods area; and to the south by an open field. An unimproved jeep trail runs north and south across the western portion of the site and connects with several other dirt roads. Four hundred feet west-southwest of Site 3 is NAS Pensacola Site 19, the Fuel Farm Pipeline Leak site.

Site 3 contains at least eight different burn areas. The two most northern burn areas are currently being used for training exercises (see Figure 2-2). Several of the burn areas contain miscellaneous pieces of equipment including: a fuel trailer, a cockpit simulator, and other airplane parts. The equipment is used as part of the fire fighter training program. The surficial soil in each of the pits is blackened, and several pits have fuel stains and oily residue.

The site area topography is generally flat with site elevations ranging from 24 to 29 feet above mean sea level (MSL). The site is sandy and well drained, however, excess surface drainage flows into a shallow depression parallel to runway 36. The depression is drained by two separate catch basin systems which are part of the stormwater drainage system for the airfield. One catch basin located near well GM-22 drains to the north, while another located near well GM-23 drains to the south (see Figure 2-2)(Geraghty and Miller [G & M] 1984).

[Bold items enclosed in brackets denote changes from original text]



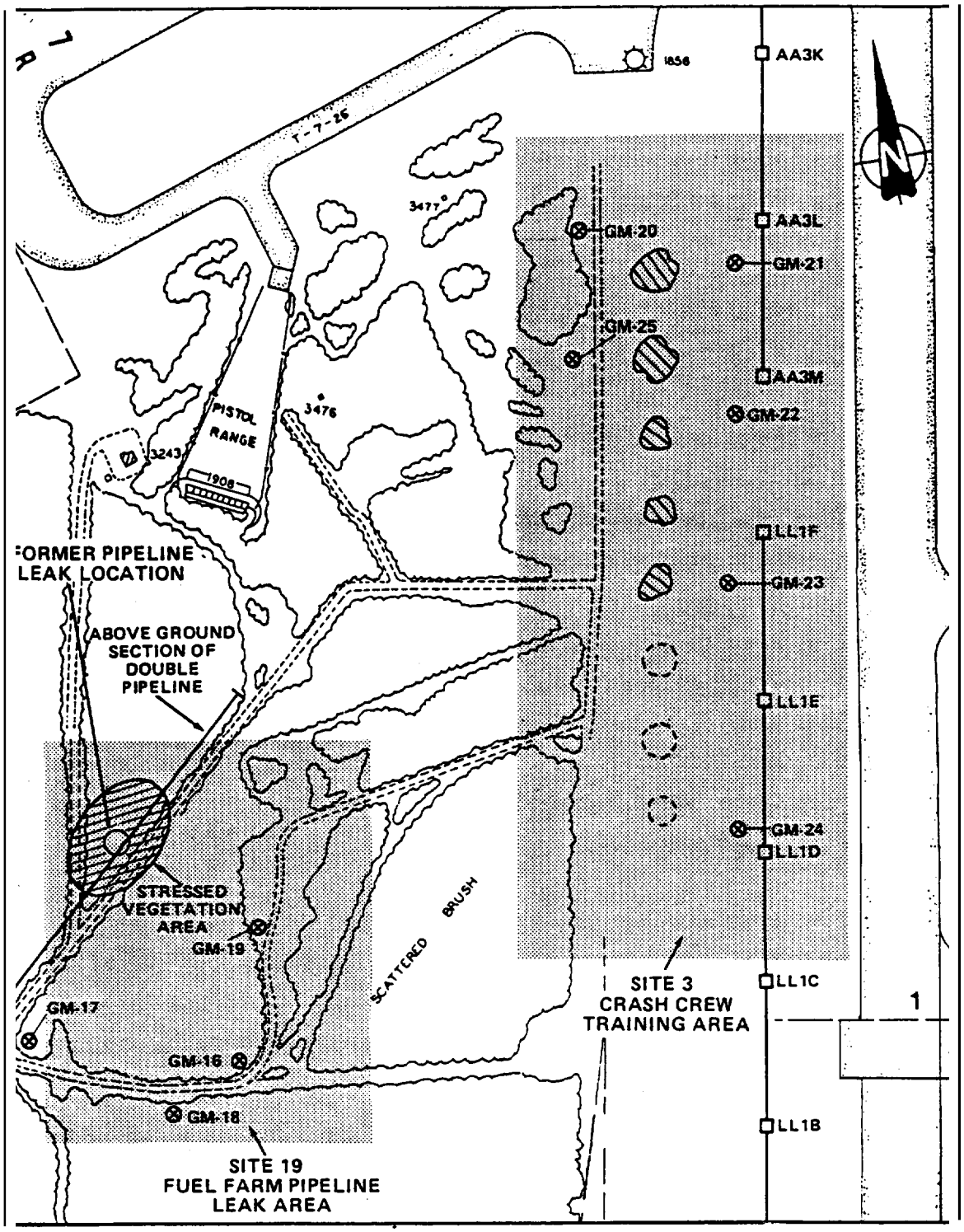
SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangles: Fort Barrancas, Fla. 1970 and West Pensacola, Fla. 1970, Photorevised 1987

SCALE

0 1 MILE

0 1 KILOMETER

Figure 2–1 LOCATION MAP – NAS PENSACOLA SITES 3 and 19



OURCE: U.S. Naval Air Station. Pensacola, Florida, 1987; and Geraughty and Miller, 1986.

KEY:
- Existing Monitoring Well
- Burn Areas
- Possible Former Burn Areaa
- Storm Drain Catch Basin

SCALE
0 200 400 600 800 FEET

Figure 2–2 SITE MAP NAS PENSACOLA, SITES 3 & 19

There are six monitoring wells (GH-20, GH-21, GH-22, GM-23, GM-24, and GH-25) located on-site (see Figure 2-2). Each of the wells is completed to a depth of 11.5 feet and screened from approximately 9 to 11.5 feet (G & H 1984). A sand pack filter, installed in each well, extends from the bottom of the borehole to approximately 5 feet below land surface. The top of the sand pack is graded to a fine sand and the remaining annulus is filled with cement grout. An above-ground protective security cover, set into the cement, was installed at each well.

22 Site 19 - The Fuel Farm Pipeline Leak

The Fuel Farm Pipeline leak (Site 19) is located southwest of Forrest Sherman field, approximately 1,300 feet west of the southern portion of aircraft runway 36 (see Figures 2-1 and 2-2). The pipeline leak occurred near the center of an above ground section of double pipeline, which runs between the fuel farm tanks and the tank truck loading facility at Forrest Sherman Field. Surrounding the location of the leak is a stressed area of vegetation, measuring approximately 200 feet by 400 feet. As recently as 1983, no significant regrowth had taken place and dead trees were still present at the site during E & E's preliminary reconnaissance (January 1989).

The site area measures approximately 850 by 1,000 feet (see Figure 2-2). Several jeep trails and unimproved roads traverse the site, one of which lies parallel to the above ground pipeline. The site is generally flat with land surface elevations averaging approximately 27 to 28 feet above MSL. The soils are generally sandy and well drained.

In addition to the six shallow monitoring vells located on Site 3, there are four shallow monitoring wells (GM-16, GH-17, GH-18, and GH-19) located in the immediate vicinity of Site 19 (see Figure 2-2). Each of the wells is completed to a depth of 11.5 feet and constructed as discussed in Section 2.1.1 (G & M 1984).

The area surrounding Site 19 consists of scattered brush and woods. The only building located in the immediate site vicinity is a naval base pistol range, which is approximately 1,300 feet north of the site.

[Bold items enclosed in brackets denote *changes* from original text]

There are two ecologically sensitive marsh areas located in the site area. One marsh area is located approximately 3,000 feet to the northwest and the second marsh area is located 2,000 feet south of the site (USGS 1970a). As discussed in Section 2.1.1, Site 3 is located approximately 400 feet east of Site 19.

[Bold items enclosed in brackets denote changes from original text]

3. SITE HISTORY

3.1 Site 3 - The Crash Crew Training Area

Site 3 has been used to train firefighters for aircraft crash situations since 1955 (National Energy and Environmental Support Activity [NEESA] 1983). During training, approximately 30 to 50 gallons of fuel, which may include JP-4, JP-5, AVGAS or lube oil is poured into unlined pits or on various pieces of equipment and ignited to simulate aircraft crash conditions. The fire is then extinguished using AFFF (aqueous film form foam), a solution which may contain any of several foaming agents used by the Navy (G & M 1984). NEESA has reported that as many as five training fires may be set at the site, each week, using up to 250 gallons of fuel. It has been estimated, however, that 200 additional gallons of fuel per week are disposed of on-site (NEESA 1983).

In June 1983, an Initial Assessment Study (IAS) of 29 sites on NAS Pensacola was completed by NEESA. In the IAS Site 3 was evaluated based on historical records, field inspections, and personnel interviews. No soil or water samples were taken at the site; however, based on the information they had gathered the IAS team concluded that contamination at Site 3 was not sufficient to constitute a threat to human health or the environment. NEESA recommended no further study at the site. However, at a November 17, 1983 meeting between the Navy and the Florida Department of Environmental Regulation (FDER), Site 3 was re-appointed to the list of sites to be investigated during a Verification Study.

In July 1984, G & M conducted a Verification Study of 18 sites on NAS Pensacola. Included in this Verification Study was Site 3. During the Verification Study, eighteen shallow soil borings were completed on-site

[Bold items enclosed in brackets denote changes from original text]

in an effort to determine whether free-floating product was present on the'water table. In addition, six shallow monitoring wells were installed on Site 3 (G & M 1984).

Soil borings conducted at the site did not reveal any free product contamination. Groundwater samples collected from each of the six monitoring wells were analyzed for volatile organic compounds (VOCs). Three of the wells (GH-20, GH-21, and GH-23) were found to contain low level concentrations of VOCs. Groundvater samples collected from monitoring wells GH-20 and GH-21 were found to contain chloroform (0.3 ug/L and 0.6 ug/L, respectively), 1,2-dichloroethane (1.0 ug/L and 2.0 ug/L, respectively) and 1,1,1-trichloroethane (1.1 ug/L and 1.0 ug/L, respectively). Sample GH-21 was also found to contain 1,1-dichloroethane at a concentration of 11 ug/L. In addition, each of the three wells were found to contain methylene chloride at concentrations up to 6.2 ug/L (G & M 1984).

The Navy Civil Engineering Lab (NCEL), Port Hueneme California, conducted a separate study of the site which included the collection and analysis of soil and groundwater samples (G & H 1984). The results of this study are presently unknown.

The Verification Study recommended that no further studies be conducted at the site (G & H 1984); consequently, Site 3 was not included in the Characterization Study.

On January 6, 1989, E & E conducted a preliminary site reconnaissance of Site 3 to establish the areas of possible contamination and to confirm the locations of the existing monitoring wells.

3.2 Site 19 - The Fuel Farm Pipeline *Leak*

The Fuel Farm Pipeline Leak is reported to have occurred in 1958. The amount of fuel discharged was not measured; however, NEESA reported that more than 360,000 gallons of JP-4 fuel oil was discharged onto the

ground surface at the location shown in Figure 2-2. A separate section of the same report states that 860,000 gallons of fuel oil leaked onto the ground at the site (NEESA 1983).

During the June 1983 IAS conducted by NEESA, an investigation into the Fuel Farm Pipeline Leak (Site 19) was conducted. Investigation of Site 19 included a review of historical records, field inspections, and personnel interviews. NEESA concluded that further investigation at the site was warranted. The IAS recommended that an investigation be conducted regarding the possibility of free product floating on the groundwater at the site that, and, if necessary, the feasibility of recovering this free product be determined (NEESA 1983).

During the Verification Study, G & M installed four shallow monitoring wells (GM-16, GM-17, GM-18, and GM-19) and completed eleven soil borings to investigate the possible presence of free product floating on the water table. Neither the monitoring wells nor the soil borings revealed the presence of free product; however, a fuel odor was detected in soil samples collected in the area of dead trees. No laboratory analysis was performed on either soil or groundwater samples during the Verification Study. G & M suggested that because the water table in the area of the spill is sometimes above land surface, most of the fuel was removed by evaporation and biodegradation during the 25 year period following the spill. No further study was recommended for the site (G & M 1984). However, FDER recommended that further investigation be conducted at Site 19, and it was included in the list of sites to be investigated during the Characterization Study (G & M 1986).

As part of the Characterization Study, the four monitoring wells (GM-16, GM-17, GM-18, and GM-19) installed during the Verification Study were sampled and analyzed for the presence of benzene, toluene, and xylene. Groundwater from monitoring wells GM-16, GM-18, and GM-19 was found to contain extremely high concentrations of benzene (422 ug/L, 30 ug/L and 146 ug/L, respectively). In addition, wells GM-16 and GM-19 were also found to contain elevated concentrations of xylene (818 ug/L and 577 ug/L, respectively) (G & M 1986). Based on data collected from the

[Bold items enclosed in brackets denote changes from original text]

on-site monitoring wells, G & M calculated the shallov groundwater flow velocity to be approximately 130 ft/yr, assuming the following parameters: porosity - 0.20; hydraulic gradient - *0.004;* and hydraulic conductivity - 120 gpd/ft^2.

On January 6, 1989, E & E conducted a preliminary reconnaissance of Site 19 to locate areas of possible contamination and to confirm the locations of existing monitoring wells.

(Bold items enclosed in brackets denote changes from original text]

4. CLIMATOLOGY

The NAS Pensacola is located in an area that typically experiences a mild, subtropical climate. This climate is a result of the latitude (approximately 30° North) and the stabilizing effect of the adjacent Gulf of Mexico (Wolfe ~~et al~~. **1988).** The average annual temperature ranges from 55° Fahrenheit (F) in the winter to **81°** F in the summer. Although the annual temperature range is fairly stable, actual daily values can be more extreme, ranging from less than 7° F in the winter to more than **102°** F in the summer. Thunderstorms occur during approximately half of the days during the summer months and can cause a **10°** to **20°** F drop in temperature in only a few minutes (Wolfe ~~et~~. al. **1988).**

Precipitation rates in the NAS Pensacola vicinity are relatively high with an 'average annual rainfall of approximately **[60]** inches. Rainfall amounts are highest in July and August during almost daily thunderstorms (averaging **[7]** inches per month) and lowest during spring and fall (averaging **[4]** inches per month)([Kennedy **19821).** High intensity thunderstorms are common, producing as much as three to four inches of rainfall during a single hour. Evaporation rates are also highest in the summer months, which reduces the potential recharge resulting from heavy summer rains. Spring and fall rains are generally less intense, but longer in duration, producing less surface runoff and higher rates of infiltration and net recharge.

Wind velocities are generally moderate except during thunderstorms (Carlisle 1960). Prevailing winds are northerly during the winter and southerly during the summer. An ocean-land temperature differential produces a daily clockwise rotation of the surface wind direction near the coast, commonly known as the sea-breeze effect (Flood and Associates

[Bold items **enclosed** in brackets denote changes **from** original text]

1978). Hurricanes and tornadoes are infrequent but can cause substantial damage to the nearshore environment. Six hurricanes have passed within 50 miles *of* Pensacola since 1980.

[Bold items enclosed in brackets denote changes from original text]

0000081

5. BIOLOGICAL RESOURCES

The **NAS** Pensacola facility consists of approximately 5,800 acres and encompasses approximately 15 terrestrial and aquatic habitats. The majority of the land on the eastern side of the facility is developed for military use or is designated as a historical or cultural resource. However, the **NAS** Pensacola installation has approximately 3,500 acres in natural or semi-natural (plantation) condition, primarily in the western portion of the facility.

5.1 Regional Biological Resources

5.1.1 Terrestrial

Vegetation. The primary vegetated communities of the NAS Pensacola facility can be considered one of two types: north Florida coastal strand communities; and sand pine scrub communities. The north Florida coastal strand communities are stabilized coastal dunes with a sand substrate, vegetatively characterized by the plants Uniuola paniculata (sea oats), Hydrocotyle bonariensis (beach pennywort), Ipomea stolonifera (beach morning-glory), Coccoloba uvifera (sea grape), Quercus geminata (twin live oak), and the stunted shrubs species Yucca aloifolia (yucca), Opuntia, and Cereus. This community type has been ranked by the Florida Natural Areas Inventory (FNAI) as locally restricted and vulnerable to extinction due to developmental activities. This community type can have 3 to 5 distinct habitat types (Wolfe et al. 1988).

The sand pine scrub community is a more upland coastal community characterized by coastal dune formations from an older geologic age with deep, fine white sand substrate and the plants Pinus clausa (sand pine), Quercus spp. (scrub oak species, geminata, champanii, myrtifolia, and

[Bold items enclosed in brackets denote changes from original text]

inopina), Cladonia species, and Ceratiola ericoides (rosemary). This community type has been ranked by FNAI as imperiled statewide because of its rarity and because of its vulnerability to extinction due to some man-made or biological factor. This community type can have 3 to 5 distinct habitats (Uolfe et al. 1988).

Two other community types may be found in the western portions of the NAS Pensacola facility. These are flatwoods and sandhill vegetative communities. Flatwoods vegetation occupies areas which were ocean bottoms in recent geologic times. Primary overstory vegetation is dominated by Pinus palustris (longleaf pine), Pinus elliottii (slash pine), and Serenoa repens (saw palmetto). Flatvoods communities also occupy areas of lov depressions and small creeks and drainage courses, but the overstory vegetation is'usually replaced by Taxodium ascendens (pond cypress), Cliftonia monophylla (black titi), Cyrilla racemiflora (swamp titi), and other hydric or riparian species. Open moist savannah areas within flatwoods are dominated by the herbaceous plants Pinguicula spp. (butterwort), Sarracenia spp. (pitcher-plants), Uticularia spp. (bladderworts), Polygala spp. (milkworts), and Drosera spp. (sundews)(Wolfe et al. 1988).

Sandhill communities are found in dry soils which are lower in fertility than flatwoods soils. The overstory of this community type is dominated by Pinus palustris (longleaf pine), Quercus laevis (turkey oak), Q. marilandica (bluejack oak), Q. stellata (post oak), and Q. falvata (southern red oak). The understory is dominated by Diospyros virginiana (wild persimmon) and Crataegus lacrimata (Pensacola hawthorn). The more abundant herbaceous plants found in moist areas are Pteridium aquilinum (bracken fern) and Aristida stricta (wire grass). These habitats were verified with walk-through surveys and ground truthing by the Navy in March of 1986 (Navy 1986).

Freshwater Wetland Vegetation. Much of the geological material underlying the NAS Pensacola facility is deep, porous sand often containing relatively impermeable clay lenses. In combination with high annual rainfall, this geologic condition causes the formation of small

[Bold items enclosed in brackets denote *changes* from original text]

areas of perched groundwater. In areas with relatively steep slopes, groundwater seepage escapes into well-defined stream channels called steepheads as found near Site 30. In gently sloping areas, the presence of perched groundwater conditions results in the formation of wetland bogs, as found near Sherman Field. Wetland or seepage bogs are characterized by herbaceous plant species as described in the sections above for flatwoods and sandhill communities. Most of these communities and other vegetative communities east of Sherman Field have been considerably altered by development on the base that has changed surface and/or groundwater flow (NEESA 1983).

Shrub bogs are found within flatwoods, downslope of herbaceous bogs. These evergreen bogs are dominated by Cliftonia monophylla (black titi), and/or, Cyrilla racemiflora (swamp titi). Associated species include Clethra almifolia (sweet pepperbush), ~~Ilex~~ cassine (dahoon holly), and Lyonia spp. (fetterbushes)(Wolfe ~~et al~~. 1988).

Intermittent streams found on NAS Pensacola have lost most of the original vegetation associated with this habitat.' For example, at Site 30, the stream that empties the small swamp into Bayou Grande has lost a considerable amount of vegetation along the stream banks and near Bayou Grande as a result of base development. In areas unaffected by development, hardwoods dominate the canopy around the stream. Such species as Magnolia virginiana (sweetbay), Illicum floridanum (star anise), and Smilax ~~bona-nox~~ (spiked cat brier) are dominants of seepage or steephead streams (Wolfe ~~et al~~. 1988).

Biota surveys must be conducted for any wetland or stream habitat that is influenced by a site to determine which specific flora and fauna may be affected by site activities.

Birds. A literature search reveals 250 possible bird species associated with the area. Thirteen of these species are endangered and seven are species of concern (see Appendix C). In March 1986, the Navy conducted a survey and found 23 species of birds on the NAS Pensacola facility. The Navy recorded moderate size rookeries of the great blue heron, and

found large numbers of nesting osprey in the southwestern portions of the NAS Pensacola facility. Because of the large number and diversity of habitats found around the facility and considering that the survey was conducted during a predominantly non-mating season, it is likely that there are more species of birds using the facility and surrounding waters as feeding and nesting sites than have been found.

Reptiles and Amphibians. During the 1986 survey conducted by the Navy, only four out of a possible 30 species of reptiles and amphibians associated with the area were identified on the NAS Pensacola facility, none of which are endangered. A recent check of the FNAI files confirms that the presence of the gopher tortoise, Gopherus polyphemus, can most likely be found in suitable habitats on the western portions of the facility (see Appendix C). Host all of the reptiles and amphibians that may be found on the facility can be expected to use the surface water bodies in some stage of their life cycle. Any contamination of surface water bodies can be detrimental to existing populations of reptiles and amphibians utilizing that water body.

5.1.2 Aquatic

Preahvater. Little is known of the flora and fauna inhabiting the streams, swamps, and bogs found on NAS Pensacola. These habitats may have been significantly altered for drainage control and base development. Some of the species associated with aquatic habitats are Semotilus atromaculatus (creek chub), Gambusia affinis (mosquitofish), and Etheostoma sp. (darters). Birds, mammals, reptiles, and amphibians that associate with aquatic habitats may also be found in and around those sites with surface waters (Wolfe et al. 1988).

Coastal Vetlands. There are no reported coastal marshes or estuarine wetlands around the NAS Pensacola facility, principally along the low energy shores of Bayou Grande. The habitat type is usually dominated by saltmarsh cordgrass (Spartina alterniflora) or black needlerush (Juncus roemarianus). A biota survey of these and other potential habitat areas will be conducted to determine the extent of estuarine flora and fauna.

[Bold items enclosed in brackets denote changes from original text]

0000083

Seagrass beds are reported to be present within Big Lagoon along the southwestern portion of the NAS facility. These grassbeds are composed primarily of Thalassia testudinum, Syringodium filiforme, and Halodule beaudettei. Seagrass beds in the area surrounding the facility have not been historically mapped and very little is known of their composition, locality, or aerial extent. Grass beds of unknown species composition extending along the north shore of Pensacola Bay in the 1950s disappeared by 1961. An examination of historical aerial photographs .(see Section 12) may elucidate past distributions of seagrasses.

Plankton. The only existing study of the phytoplankton and zooplankton in the waters surrounding the NAS Pensacola facility was conducted by the Navy in March of 1986. The phytoplankton has been characterized as low in productivity (as compared to other Gulf coast estuaries), and mainly dominated by the diatoms Navicula tripuncata, Bacteriastrum spp., Chaetocerus spp., Thalassionema nitzschoides, and Hemiaulus spp. The zooplankton is primarily dominated by Calonoid copepods and benthic invertebrate larvae. This study is very limited by the fact that samples were collected with undefined methods and only during the early spring. This sampling protocol does not define population fluctuations that are characteristic of low population abundances commonly found in estuaries during the summer months. Examination of the zooplankton data results in the same conclusions. It should be pointed out that any contamination entering Pensacola Bay from either groundwater or surface water sources may be accumulated in the invertebrate larvae that predominate most estuarine water bodies.

Benthos. Marine soft-sediment communities are found adjacent to the northern, eastern, and southern areas of the NAS Pensacola facility in Pensacola Bay. Although no intensive benthic surveys were conducted along the perimeter of the facility, surveys at nearby sites by the Florida Department of Environmental Regulation (FDER) and the Navy have described the benthic communities within Pensacola Bay as a whole. FDER collected benthic samples in most of Pensacola Bay and found that the sediments were dominated by polychaetes (Aricidea spp., Capitella

[Bold items enclosed in brackets denote changes from original text]

spp., various spionids and Haploscoloplos spp.) and bivalves (Anodontia alba and Tellina spp.) during most of the year. FDER samples collected along the wastewater treatment plant outfall show a drastic drop in species abundance and diversity close to the sewage outfall (Navy 1986). This indicates that the benthic community may have been negatively influenced by the sewage outfall.

Samples collected by the Navy (1986) indicate a low density yet moderate diversity of benthic infuanal organisms when compared to other estuarine systems within and around the turning basin. A complete comparison of the Navy's data can not be made to other literature at this time because their data is not given in numbers per unit area. Hovever, the Navy's data reveals that very few deep dwelling organisms reside in the areas around the turning basin, and a lack of deep dwelling benthic organisms may be an indication of a benthic community under stressed conditions (Luckenbach et al. 1988).

Fish and Shellfish. Early studies of Pensacola Bay have identified 180 bony fish species and 7 cartilaginous fish species (Cooley 1978). The 13 most abundant species were spot (Leiostomus xanthurus), pinfish (Lagodon rhomboides), atlantic croaker (Hicropogonias undulatus), gulf menhaden (Brevoortia patronus), bay anchovy (Anchoa mitchilli), longspine porgy (Stenotus caprinus), silver perch (Bairdiella chrysoura), southern hake (Urophycis floridana), inshore lizardfish (Synodus foetens), gafftopsail catfish (Bagre marinus), sand seatrout (Cynoscion arenarius), and spotted hake (Urophycis regia) (Heil 1988).

Fish diversity was highest in the more saline waters near the NAS Pensacola facility during spring and summer. In the less saline waters of East Bay, diversity was lowest in summer and highest during the winter months. Fish population density was the highest in the more saline waters, with peaks throughout the summer (Cooley 1978).

Moderate densities of the blue crab (Callinectes sapidus), shrimp (Penaeus duorarum, P. setiferus, and P. aztecus), and oysters (Crassostrea virginica) have been collected throughout Pensacola Bay

[Bold items enclosed in brackets denote changes from original text]

(Heil **1989).** Shrimp are caught in greater abundances near **NAS** because of the higher salinities. Blue crabs and oysters are more readily caught in the East Bay area. . In fact, the only legal shellfishing areas recognized by **FDNR** are in the East Bay area. Scallops (Aequipecten irradians) are collected only within grassbed areas. No information is available at this time on where scallops are collected by the general public and how many are removed. The nearest seagrass beds to the NAS facility are located in the Big Lagoon along the southwest portion of the facility.

Sport and Commercial Fishing. A moderate amount of commercial fishing occurs in Escambia county, accounting for 2% of the total Florida landings for **1980-85** (Navy **1986).** The dominant finfish species in terms of total weight was the black mullet. The most economically important species of finfish was the red snapper. E & E examined the commercial landing data for Escambia county for **1987** and **1988** (Heil **1989)** and found that the most important commercial species by weight were: black mullet (24% of county landings), brown shrimp (21%), vermillion snapper **(19.5%),** red snapper **(7.6%),** porgies (4.7%), and amberjack *(4%).* Other less important commercial fish caught were Spanish mackerel, sand seatrout, black grouper, spotted seatrout, bluecrabs, and squid. This data, **as** well as the Navy's data, also suggests that a significant tuna fishery may be developing in the Pensacola Bay area *(0* pounds landed in **1983,** 1,582 pounds in **1987).**

Sport Fisheries data is not available in the state of Florida at this time due to the lack of a state saltwater fishing license (Heil **1989).** A telephone survey conducted by the **U.S.** Fish and Wildlife Service ranks the spotted seatrout as a primary fish species sought by fisherman in **1987.** Following this species were: king mackerel, red drum, spanish mackerel, groupers, red snapper, flounders, and sand seatrout. It is likely that the sport fishing catch equals or exceeds commercial landings for species sought by both interests (Navy **1986).**

The estuarine system is a very important element in the life history of most of the commercial and sport fishing species sought. Between **65** and

[Bold items enclosed in brackets denote changes from original text]

90 percent of all commercially valuable fish species are estuarine dependent during some phase of their life cycle. Shrimp, bluecrab and shellfish are known to release larvae that feed in and around estuaries until settlement. During early life history stages the juveniles reside within seagrass beds or other protected habitats until maturity. Any contamination of the water or sediments around NAS Pensacola could be detrimental to fish and shellfish population structure, or could be accumulated by the organisms residing near the facility.

Marine Mammals. Few mammals have been sighted within the area of the NAS Pensacola facility, most of the 13 species of mammals reported for the northeastern Gulf of Mexico stay predominantly in Gulf waters. The atlantic bottlenose dolphin (Tursiops truncatus), however, has been sighted regularly off the NAS Pensacola facility. Manatees have been sighted irregularly, with one recent sighting in the area recorded by the FNAI in October 1988. A goosebeaked whale (Ziphius cavirostris) was reported stranded on Santa Rosa Island, and a pilot whale (Globicephala macrorhynchus) was found stranded on a beach near Pensacola (Navy 1986).

Although no surveys of marine mammals have been conducted, it can be assumed that they are are quantitatively ranked as uncommon to common in abundance within the waters surrounding the NAS Pensacola facility.

Threatened and Endangered Species. A number of threatened and endangered species (listed in Appendix C) have been identified in the vicinity of the NAS Pensacola facility. Many rare, threatened, and endangered species are associated with the wetland or bog habitats found on NAS Pensacola. A total of 57 occurrences for six plant species were recorded in an inventory conducted by FNAI (1988b) of the NAS Pensacola facility (see Appendix C). Host of these plants were found in the area around Sherman Field and habitats to the west. Any site remediation and, more importantly, any assessment of environmental endangerment must consider the water level requirements of rare and endangered plant species and the foraging activities of birds in the waters surrounding the NAS Pensacola facility, as well as nesting and feeding animals on the facility grounds. Complete biotic surveys may be necessary to

[Bold items enclosed in brackets denote changes from original text]

determine the presence of threatened or endangered species and potential pathways of contamination to these species.

5.2 Site-Specific Biological Resources

Site 19 is located within a well developed area of pine trees maintained in semi-natural timbering conditions. This community type has a well developed overstory dominated by slash and loblolly pine species, and an understory dominated by grasses and fire-tolerant shrubs. The habitat found on this site may support a diverse assemblage of fauna that would use the habitat for feeding, nesting, and as a migration corridor to other wooded sites in the vicinity.

Site 3 has been cleared of all native vegetation during the development of the runway system at Sherman Field. The only vegetation on the site at this time is cultivated grasses. To the west lies a well maintained stand of pine trees in semi-natural plantation condition. Fauna associated with this nearby community may use Site 3 for feeding and as a migration corridor to the wooded areas east of Sherman Field.

There are no aquatic habitats found on either site. Bayou Grande and Pensacola bay lie approximately 1/2 mile to the north and south, .respectively.

[Bold items enclosed in brackets denote changes from original text]

6. SURFACE WATER HYDROLOGY

6.1 General Occurrence and Significance of Surface Water

The NAS Pensacola facility is located on a coastal peninsula bounded by Bayou Grande to the north, Pensacola Bay to the south and east, and Big Lagoon to the southwest. Pensacola Bay and Big Lagoon are partially separated from the Gulf of Mexico by Santa Rosa Island and Perdido Key, both of which are barrier islands.

Surface soils consist primarily of permeable sands which allow rapid infiltration of precipitation. This direct infiltration limits stream formation and constitutes the major source of recharge to the underlying Sand-and-Gravel Aquifer.

There are no naturally occurring perennial streams on NAS Pensacola; however, there are approximately 10 naturally occurring intermittent streams and numerous man-made drainage pathways which include many stormwater outfalls. Discharge is mainly to the south into Pensacola Bay, however, some small intermittent streams discharge into Bayou Grande to the north from Sherman Field and Chevalier Field (USGS 1970a and b).

The southwestern and northern portions of NAS Pensacola contain areas of freshwater wetlands. These are particularly sensitive areas formed by the intersection of the water table with the land surface. These systems are defined by and dependent upon a dynamic water-cycle, with periodic inundation and exposure corresponding to seasonal fluctuations in the water table.

The discharge of surface waters into Pensacola Bay, Bayou Grande, and the coastal wetland areas presents the potential for transport of

[Bold items enclosed in brackets denote changes from original text]

contaminants into these systems. This could have a significant impact on seagrass and other sensitive plant communities, as well as on shell fishing, recreational fishing, and swimming in these coastal zones. Discharges, either through the surface water or groundvater, into wetland areas found on-site could also have a significant impact on the biotic communities that are dependent on those habitats.

6.2 Site-Specific Surface Vater Hydrology

No surface water bodies are located on Sites 3 and 19 or in their immediate vicinity. The closest surface water system is a marsh, which is located approximately 1/4 mile south of Site 19. The nearest body of open water is Sherman Cove, which is located approximately 1/2 mile south of Site 19 (see Figure 2-1). Pensacola Bay lies approximately 1/2 mile to the south.

[Bold items enclosed in brackets denote changes from original text)

7. PHYSIOGRAPHY AND HYDROGEOLOGY

7.1 Physiography and Regional Eydrogeology

7.1.1 Physiography

NAS Pensacola is located in the Gulf Coastal Lowlands Subdivision of the Coastal Plain Province physiographic division (Brooks 1981). The 5,800 acre facility is located on a peninsula bounded on the east and south by Pensacola Bay and Big Lagoon, and on the north by Bayou Grande. The most prominent topographic feature on the peninsula is an escarpment or bluff which parallels the southern and eastern shorelines and on which Fort Barrancas was built. In the eastern portion of NAS Pensacola the bluff runs north-south just to the west of Chevalier Field. Seaward of the escarpment is a nearly level marine terrace with surface elevations of approximately 5 feet above mean sea level (MSL). The central part of the peninsula, located landward of the escarpment, is a broad gently rolling upland area with surface elevations up to 40 feet MSL (USGS 1970a and b). Sandy soils occur throughout the NAS Pensacola area. As a result, most of the rainfall infiltrates directly into the subsurface. Consequently there are few streams or surface water bodies on the peninsula.

7.1.2 Regional Hydrogeology

There are three principal hydrogeologic units of importance which underlie the NAS Pensacola. These are, in descending order, the Surficial Aquifer, the Intermediate System, and the Floridan Aquifer System.

7.1.2.1 Surficial/Sand-and-Gravel Aquifer

The Surficial Aquifer occurs from land surface to a depth of

[Bold items enclosed in brackets denote changes from original text]

approximately 300 feet at NAS Pensacola and is [composed] of a sequence of unconsolidated to poorly indurated clastic deposits (Wagner et al. 1984). In this portion of Florida the Surficial Aquifer constitutes an inportant source of water supply and is called the Sand-and-Gravel Aquifer (SEGS 1986). The sediments making up this aquifer belong to all or part of the Pliocene to Eolocene Series which, in this area, consist mainly of the Citronelle Formation overlain by a thin cover of marine terrace deposits. Given that the Sand-and-Gravel Aquifer is contiguous with land surface and recharge occurs principally by the direct infiltration of precipitation, the aquifer is particularly susceptible to contamination from surface sources. In the NAS Pensacola vicinity the Sand-and-Gravel Aquifer is made up of three zones based on contrasting permeabilities. These zones are referred to as the surficial zone, the lov permeability zone, and the main producing zone (Wilkins et at. 1985).

Surficial Zone. The surficial zone is contiguous with land surface and contains groundwater under water table or perched water table conditions. The results of numerous borings conducted at NAS Pensacola (G & M 1984, 1986) indicate that the surficial zone ranges in thickness between 40 and 70 feet and is (consists] of tan and brown fine to medium-grained quartz sand. Depth to the water table within the surficial zone is variable depending on location and ranges from less than one foot near surface water bodies to more than 20 feet in areas of higher elevation. In general, the direction of ground water flow is controlled by the topography and by discharge to surface water bodies. Consequently shallow groundwater in the surficial zone moves toward areas of lower elevation and/or the nearest surface water body. Overall, the surficial zone has a high permeability. Numerous aquifer (slug) tests and laboratory permeability tests conducted on wells in or sediments from the surficial zone at NAS Pensacola (G & M 1986) yielded hydraulic conductivity values ranging from 16 to 56 ft/day. Horizontal groundwater flow velocities in the surficial zone will depend on site-specific hydraulic conductivities and horizontal hydraulic gradients, however, velocities would generally be expected to be high.

[Bold items enclosed in brackets denote *changes* from original text]

Low Permeability Zone. Underlying the surficial zone is a zone of lower permeability sediments dominated by clay and silt-sized material. This zone is referred to as the low permeability zone. At NAS Pensacola this zone is generally composed of gray to blue sandy, silty, slightly fossiliferous (shelly) clay, and clayey sand ranging in thickness from **8** to **40** feet (G & M **1984, 1986).**

The results **of** laboratory permeability tests conducted on samples from this zone indicate that vertical hydraulic conductivities are low, ranging from **4.2** x 10^{-5} to **9.9** x 10^{-2} ft/day. Thus, the low permeability zone probably functions as a confining or semi-confining unit inhibiting the flow of groundwater between the surficial zone and the underlying main producing zone. The low permeability zone has been encountered in at least **16** borings at widely spread locations throughout the **NAS** Pensacola (G & M **1984, 1986).** Although additional boring or geophysical techniques would be required to confirm its presence at a given location, it is likely that this unit is ubiquitous at NAS Pensacola. Few, if any, wells are open to the low permeability zone at **NAS** Pensacola, thus, no information is'available regarding groundwater flow direction.

Main Producing Zone. The bottom portion of the Sand-and-Gravel Aquifer is called the main producing zone and [consists] mainly of sand and gravel interbedded with thin beds of silt and clay. The depth at which the main producing zone is encountered is somewhat variable, ranging from **60** to approximately 120 below land surface at NAS Pensacola. This zone generally has the highest permeability characteristics due to thicker, and more persistent sand and gravel beds, and is tapped by most of the major wells in the Pensacola area (Wilkins ~~et al~~. **1985).** NAS Pensacola has three supply wells which produce water from this zone, however, due to high iron content in the water the wells are infrequently used (G & M 1986). The principal sources of water for NAS Pensacola are wells located at Corry Field, approximately 3 miles to the north. The thickness of the main producing zone can be highly variable; however, it is estimated to be up to about 100 feet at NAS Pensacola. Insufficient data exist for wells open to the main producing zone at NAS

[Bold items enclosed in brackets **denote** changes from original text]

Pensacola to determine direction of groundwater flow within this zone; however, the flow direction is assumed to be generally southward under ambient conditions. Pumpage of the supply wells would locally cause groundwater in this zone to flow toward the wells.

As a result of the overlying low permeability zone groundwater vithin the main producing zone occurs under confined or semi-confined conditions. At one nested well location on NAS Pensacola (east of Building 648) the water level elevation in a well open to the main producing zone is approximately 7 feet lower than that in an adjacent well open to the surficial zone (G & M 1986). This indicates that a significant downward hydraulic gradient exists between these two zones. Thus, a considerable potential exists for vertical groundwater flov from the surficial to the main producing zone at this location. It is not known to what extent this potential exists elsewhere at NAS Pensacola.

7.1.2.2 Intermediate System

The lower limit of the Sand-and-Gravel Aquifer coincides with the top of a regionally extensive and vertically persistent hydrogeologic unit of much lower permeability. This unit is referred to as the Intermediate System. In the vicinity of NAS Pensacola the top of the Intermediate System generally lies within the sediments termed Miocene Coarse Clastics or corresponds to the top of the Upper Member of the Pensacola Clay and occurs at a depth of approximately 300 feet (Wilkins et. al. 1985). In general the Intermediate System consists of fine-grained sediments, and functions as an effective confining unit which retards the exchange of water betveen the overlying Sand-and-Gravel Aquifer and the underlying Floridan Aquifer System (SEGS 1986). For the most part the entire sequence is poor to non-water bearing. However, relatively thin beds of sand exist within the unit which may yield small quant ties of water. In the NAS Pensacola area the Intermediate System is approximately 1,100 feet thick and is composed of the lower portion of the Miocene Coarse Clastics, the Upper Member of the Pensacola Clay the Escambia Sand Member of the Pensacola Clay, and the Lover Member of the Pensacola Clay; all of Miocene Age.

7.1.2.3 Floridan Aquifer System

Immediately underlying the Intermediate System and occurring at a depth of approximately **1,500** feet below land surface at NAS Pensacola is the Floridan Aquifer System. The Floridan Aquifer in this area is [composed] **of** the Middle to Lower Miocene Chickasawhay Limestone and undifferentiated Tampa Stage Limestone. Groundwater within the Floridan Aquifer in this area is highly mineralized and is not used for water supply (Wagner ~~et al~~. **1984).**

7.2 Site Hydrogeology

In the immediate vicinity of Sites *3* and **19,** the surficial zone of the Sand-and-Gravel Aquifer probably occurs to a depth of about **50** feet below land surface. Although no deep borings have been completed in the immediate vicinity of either site, data from numerous borings completed at various sites on NAS Pensacola indicate a general surficial zone thickness of approximately **50** feet. Furthermore, the surficial zone thickens toward the western portion of the base. G & M *(1984)* provides drilling logs for borings conducted on **NAS** Pensacola prior to the Verification Study. Included in this report is information concerning a group of borings (Boring group 10) which were completed approximately *3/4* mile east of Sites *3* and **19.** The lithologic description of cuttings from Boring group **10,** indicates that the surficial zone primarily [consists] of tan and brown, fine to medium-grained quartz sand. A total of ten shallow monitoring wells, open to the surficial zone, have been installed during previous investigations at Sites *3* and *19.* These wells indicate that the water table generally occurs between **1** and *4* feet below land surface. Based on water level data collected from monitoring wells at Site 3, the direction of groundwater flow is generally to the east. In comparison, water level data collected from wells located on Site 19 indicate that groundwater flow in the surficial zone is to the south-southeast. The horizontal hydraulic gradient is approximately *0.004* for both sites. Based on groundwater data collected at Site *19,* G & M **(1986)** estimated a horizontal shallow ground-water flow velocity of **0.36** ft/day or **130** ft/yr. A flow velocity was not reported for Site **3;** however, due to the proximity of the sites and the

[Bold items enclosed in brackets denote changes from original text].

similarity in horizontal hydraulic gradient, it is presumed that horizontal flow velocities for groundwater at the two sites are approximately the same.

As stated above, data regarding lithologic zones deeper than 11.5 feet are not available for Sites 3 and 19 or the immediate vicinity. However, based on data collected from borings completed at other NAS Pensacola locations, it is assumed that the low permeability zone of the Sand-and-Gravel Aquifer occurs at approximately 50 feet and extends to a depth of approximately 100 feet below land surface (G & M 1984). Based on reported lithologic data from boring group 10 (G & M 1984) this zone would be expected to function as a confining or semi-confining unit restricting the flow of groundwater between the surficial zone and the main producing zone which underlies the unit. The direction of groundwater flow within the low permeability zone is unknown.

Based on data from NAS Pensacola Supply Well No. 3 (approximately 1 mile east of both sites) and data from boring group 10, it is estimated that the top of the main producing zone occurs approximately 100 feet below land surface in the site vicinity. The direction of groundwater flow vithin the main producing zone at these sites is unknown; however, a generally southward flow is expected under ambient conditions. Insufficient data exists for wells open to the main producing zone to allow a determination of hydraulic gradient at NAS Pensacola.

[Bold items enclosed in brackets denote *changes* from original text]

8. PROJECT MANAGEMENT PLAN

The Generic Project Management Plan (GPMP), submitted to the Navy for approval, defines the technical approach and schedule as well as the qualifications of personnel who will be directing and performing this Contamination Assessment/Remedial Activities Investigation. This work plan will incorporate and reference applicable technical and schedule sections, as appropriate, and will follow E & E's project management guidelines (see Section 22).

[Bold items enclosed in brackets denote changes from original text]

9. SITE MANAGEMENT PLAN

The Generic Site Management Plan (GSMP), submitted to the Navy for approval, defines the management procedures for field activities on both the site and program level. The management and implementation of all field activities conducted as part of the Contamination Assessment/ Remedial Activities Investigation of Sites 3 and 19 will follow the GSMP, and any updated versions. Data Quality Objectives (DQOs), and all applicable or relevant and appropriate requirements (ARARs) have been considered in developing the initial phases of fieldwork described here, and will be updated and revised for any subsequent phases of fieldwork.

10. HEALTH AND SAFETY PLAN

A comprehensive General Health and Safety Plan (GHSP) and individual site-specific safety plans (SSP) have been developed to provide readily available emergency information and preventative safety measures. The GHSP, submitted to the Navy for approval, outlines health and safety procedures and protocols to be followed during all field investigations at each of the 37 sites on NAS Pensacola. The plan includes: standard operating procedures (site entry, decontamination, etc.); hazard communication and training (safety training, briefings, documentation, etc.); safety equipment and instrumentation (monitoring, personnel protective equipment, etc.); hazard evaluation by contaminant class (metals, organics, etc.); and hazard evaluation for each task (drilling, sampling, etc.). The GHSP will be periodically updated, as required, during the course of this program.

In addition, the GHSP and the individual SSPs will define the toxicological properties and health hazards associated with each site. The SSP will include emergency action information pertinent to the safety of the field personnel and of the public (hospitals, ambulatory units, poison control centers, fire departments, and police/sheriff departments). The SSP will also identify first-aid and personal safety equipment, and will provide recommended site security precautions. The GHSP and the SSP will comply with the Occupational Safety and Health Administration (OSHA) Guidelines for Hazardous Waste Operations (29 CFR Section 1910).

[Bold items enclosed in brackets denote changes from original text']

11. QUALITY ASSURANCE PROJECT PLAN

A Generic Quality Assurance Project Plan (GQAPP) has been prepared and submitted to the Navy for approval. This comprehensive document will be referenced for all field and laboratory procedures for this program, and will be used to develop the Site-Specific Quality Assurance Plans (SQAP).

The **SQAP** will provide site-specific quality assurance/quality control (QA/QC) measures used to obtain accurate and precise data for all site investigation activities. The SQAP will address all phases **of** the investigation from development of the initial sampling plan through verification and reporting of the analytical results. All **of** the QA/QC procedures described in the GQAPP and SQAP will be in accordance with applicable professional technical standards, U.S. Environmental Protection Agency [(EPA)] requirements, and specific Navy goals and requirements for this project. All samples will collected, handled, packaged, preserved, and transported in accordance with the GQAPP and SQAP, and with U.S. Navy and EPA procedures.

[Bold items enclosed in brackets denote changes from original text]

12. *AERIAL* PHOTOGRAPH ANALYSIS

Prior to the initiation of fieldwork, E & E will examine all available aerial photographs of NAS Pensacola for past and present conditions, features, and developments which may have direct relevance to the fieldwork methodology. The aerial photograph analysis task will involve assembling and stereoscopically analyzing historical photographic imagery and topographic maps available for the site area. For the purpose of supporting the development of field investigation strategies, efforts will be made to obtain photographs of an appropriate scale that will allow for analysis of past and present surface conditions, drainage, and land use. Photographs showing the history of site activities will be analyzed to obtain information regarding the evolution of site features which may have affected hydrologic conditions. The historical perspective gained by studying aerial photographs will provide insight applicable to such tasks as field reconnaissance and monitoring well placement. In addition, the analysis of historical and current aerial photographs, performed in conjunction with geophysical investigation, will aid in the accurate determination of the extent of the formerly used area at the site..

(Bold items enclosed in brackets denote changes from original text]

13. UTILITIES SURVEY

Prior to conducting any augering, boring, drilling, or excavation activities, E & E will locate all underground cables, pipes, utilities, or other obstructions which may become damaged or otherwise hinder fieldwork. The appropriate authorities (e.g., NAS Pensacola Public Works and Southern Bell) will be contacted to identify the location of all underground utilities in the site area. In addition, E & E will examine available maps and documents, and will conduct a metal detector survey on-site to determine the presence of any other potentially hazardous subsurface features. If appropriate and applicable, other surface geophysical techniques may be used to locate deeper obstructions not readily detected with a metal detector. The locations of all underground utilities or obstructions will be marked with surveyors flags, day-glow paint, or by other methods as appropriate. This task may be conducted as part of the physical survey, but will be considered a separate task for cost purposes.

[Bold items enclosed in brackets denote changes from original text]

14. FIELDWORK METHODOLOGY

14.1 Phase I -- Field Screening

The primary objective of the Phase I field screening investigation is to effectively and efficiently focus the Site Characterization (Phase 11) and subsequent Extent Delineation (Phase III and IV) studies. The field screening phase will employ a variety of field investigation techniques, including the collection of samples for laboratory analysis. However, the analysis of these samples will be subject to less rigorous Quality Assurance/Quality Control (QA/QC) requirements, which reflect the "focusing" objective--rather than a formal contaminant quantification objective--of this phase. Each field screening task will utilize all existing information from preceding tasks, including aerial photograph analysis, to adjust the locations of the various surveys and sampling locations, thereby achieving optimum results. The objectives/advantages of the field screening methods are discussed in detail in Section 9.1 of the GQAPP.

14.1.1 Physical Survey

14.1.1.1 Overall Physical Reconnaissance

A field reconnaissance survey will be conducted on and around Sites 3 and 19. Available aerial photographs and maps will be used as guides in locating surface features. Visual inspections will be made regarding surface conditions, surface drainage patterns, areas of vegetational stress, burn areas, and stained areas.

[Bold items enclosed in brackets denote changes from original text]

During the reconnaissance survey, the field team will identify areas that present the most suitable conditions for the establishment of grid survey baselines. The use of a grid system as part of Phase I field investigations is discussed in the following sections.

The reconnaissance survey team will utilize air monitoring equipment during walkovers conducted at Sites 3 and 19, in accordance with Sections 6.1.1 of the GQAPP. In the event that any "hot spots" are located, the area(s) will be flagged and identified on a site map for future reference.

14.1.1.2 HNu/OVA Emissions Survey

During the establishment of the geophysical survey grid network (discussed in Section 14.1.2), an'emissions survey will be conducted using HNu and/or OVA air monitoring equipment. The survey will be conducted in accordance with Section 6.1.1 of the GQAPP. Heasurements will be made at each established grid .point and readings will be recorded in the field logbook.

[In addition, preliminary air screening will be conducted with a particulate monitor, such as a Hini-Ram, to determine if the site represents a source of particulates in'the air. The air sampling will be conducted in accordance with Section 6.1.3 of the GQAPP.]

14.1.1.3 Habitat/Biota Survey

During the physical reconnaissance, an E & E biologist/ecologist will determine the on-site terrestrial and aquatic habitats, and the surrounding habitats vhich may be affected by off-site contaminant migrations. During the walkover survey, rare, threatened, and endangered species and their potential habitats will be identified, and an evaluation will be made of general site conditions to support viable populations of plants and animals. A habitat/biota survey will be conducted for Sites 3 and 19 as well as an evaluation of the literature.

[Bold items enclosed in brackets denote changes from original text]

14.1.2 Geophysical Survey

The site areas, site fringes, and surrounding local areas will require an electromagnetic terrain conductivity survey (EM-31) and magnetometer (Mag) survey. The surveys will be performed in accordance with field methodologies and data interpretation techniques discussed in Section 6.2 of the GQAPP.

The effort will initially require the set-up of a grid system over the study area. To accomplish this, at least two baseline transects will be established (providing an x and y axis), and flagged at 50-foot intervals. A transit survey instrument will be used to establish the baselines, and a Brunton compass and tape measure will be used to complete the grid system for the study area. The grid spacing will be based on 50-foot centers. The EM-31 and Mag surveys will be conducted by obtaining measurements at each 50-foot.interval grid point.

The geophysical data will be used in conjunction with other background data obtained to identify: anomalous conditions in the site areas; water table conditions; the location of potential subsurface plumes; and the horizontal and vertical orientation of plumes, if located. Ultimately, the interpretation of this data will be a primary consideration in the development of a rationale for Phase I and II monitoring well placement strategies.

14.1.3 Analytical Screening

14.1.3.1 Soil Headspace Survey

Using the method described in Section 14.1.2, soil headspace survey grids, with 100 foot grid centers, will be established at Sites 3 and **19.** Soil headspace survey samples will be collected and composited for every 5-foot depth interval to the water table. The depth to water at each of the sites is assumed to be 5 feet, thus, it is projected that only one depth interval will be collected at each grid point. Samples will be collected using a portable drill rig with 4-inch diameter solid stem augers. In those areas where it is Impractical to use the portable

[**Bold items** enclosed in brackets denote changes from original text]

drill rig, a hand operated bucket auger will be employed. Soil headspace survey sample collection and screening will be conducted in accordance with Section 6.4 of the GQAPP. The results of the soil headspace survey will aid in making final determinations on the soil and groundwater sampling locations.

14.1.3.2 laboratory Analysis

Phase I sampling activities for Sites 3 and 19 will include a soil headspace survey, the collection of soil samples, the installation of shallow temporary monitoring wells, and groundwater sampling. All of the samples will be analyzed in the laboratory for analytical screening parameters. The analytical screening program has been developed for the Phase I effort as a measure to efficiently and cost-effectively provide focus for subsequent phases of site characterization and contamination extent delineation. Analytical screening is addressed in detail in Section 9.1 of the GQAPP. Analytical requirements for samples collected in Phase I are shown in Table 14-1.

Soil -- It is tentatively planned that composite soil samples will be collected at 33 locations on Site 3 and at 18 locations on Site 19 (see Figure 14-1). The results of the physical and soil headspace surveys will be used to adjust the final number and locations of samples. At each location soils will be collected and composited over 5 foot intervals to the water table. Assuming the depth to water is approximately 5 feet below land surface (G & M 1986), it is tentatively planned that a total of 33 soil samples will be collected at Site 3 and a total of 18 soil samples will be collected at Site 19. Samples will be collected using a portable drill rig with 4-inch diameter solid stem augers. In those areas where it is impractical to use the portable drill rig, a hand operated bucket auger will be employed. All sampling and equipment decontamination activities will be conducted between sampling intervals as discussed in Sections 6.6 and 6.10 the GQAPP.

Groundvater -- Approximately 11 temporary stainless steel monitoring wells will be installed on Site 3 and approximately 6 will be installed on Site 19. The results'of the physical survey and soil headspace

[Bold items enclosed in brackets denote changes from original text]

TABLE 14-1

PHASE I SAMPLING AND ANALYTICAL REQUIREMENTS—GROUP J

SITE 3

Medium	No. of Sampler	Duplicator	Total	Analytical suite[a,b]
Soil	33	2	35	A
Groundwater[d]	[11]	1	[12]	A
TOTAL	[44]	3	[47]	

Medium	No. of Samples	Dupli-cates	Trip Blanks	Field Blanks	Rinsate Blanks	Preservative Blanks'	Total	Analytical Suite[a,c]
Groundwater[e]	6	1	1	1	1	1	11	B

SITE 19

Medium	No. of Sampler	Duplicates	Total	Analytical Suite[a,b]
Soil	16	1	19	A
Groundwater[d]	[6]	1	[7]	A
TOTAL	[24]	2	[26]	

[Table 14-1 (Cont.)]

Medium	No. of Samples	Dupli-cates	Trip Blanks[f]	Field Blanks	Rinsate Blanks	Preservative Blanks[g]	Total	Analytical Suite[a,c]
Groundwater[e]	4	1	1	1	1	1	9	B

[a]Analytical suite designations are as follows:

A = Volatile organic compounds, polynuclear aromatic hydrocarbons, phenols, pesticides and total PCBs, total recoverable hydrocarbons, and metals (total, unfiltered).

[B = Target Compound List (TCL) volatile organic compounds plus xylene and ketones, TCL base/neutral and acid extractable organic compounds, TCL pesticides and PCBs, total recoverable hydrocarbons, TCL metals (total [i.e., unfiltered] and dissolved [i.e., millipore-filtered]), cyanide, total organic carbon, hardness (water only), and alkalinity (water only).]

[b]Specific constituents encompassed by the various chemical groups included within analytical suite A are identified in Tables 9-1 through 9-4 of the Generic Quality Assurance Project Plan.

[[c]Specific constituents encompassed by the various chemical groups included within analytical suite B are identified in Tables 9-5 through 9-13 of the GQAPP.

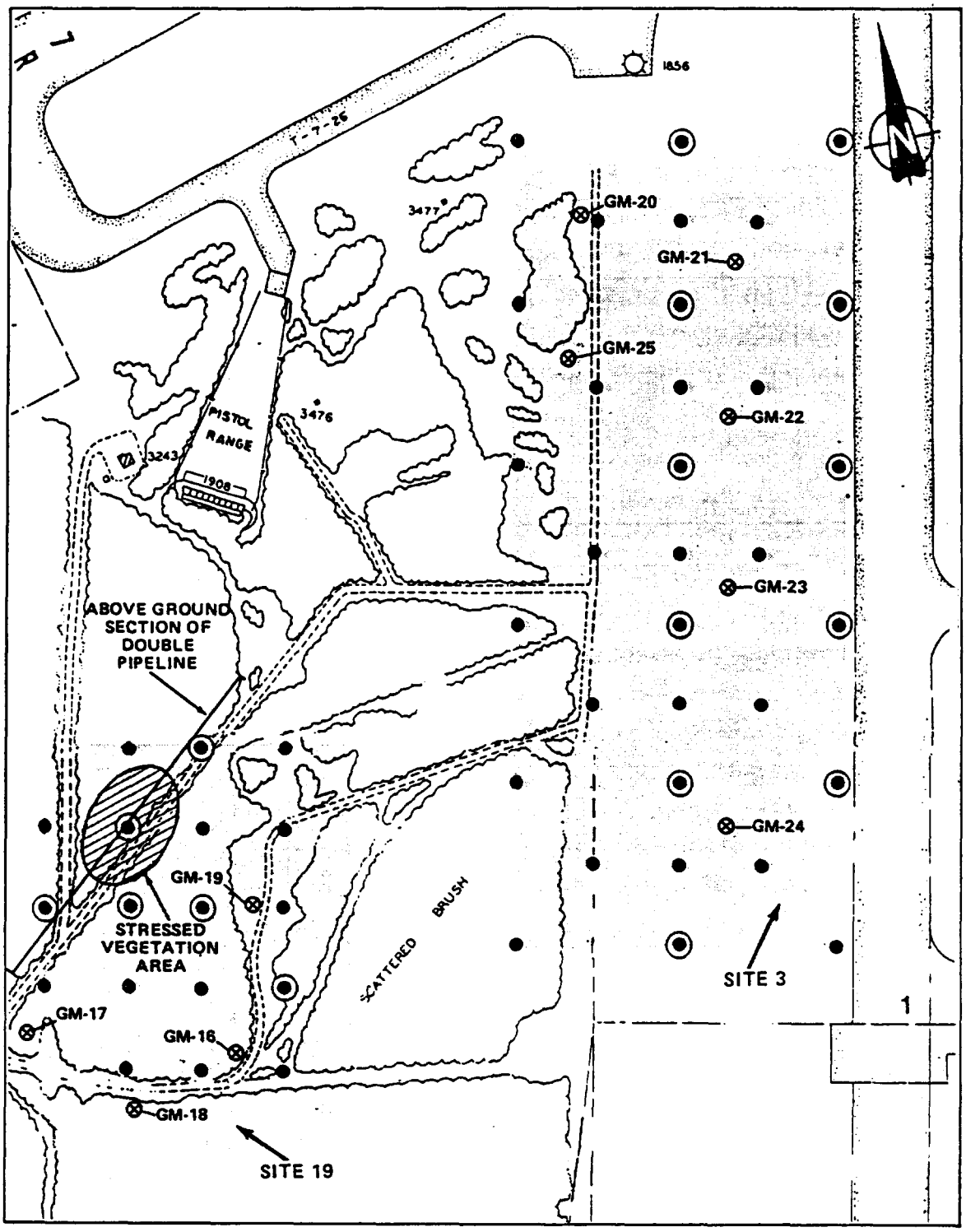
[d]Groundwater samples and analytical requirements shown are for Phase I temporary wells only.

[e]Groundwater samples and analytical requirements shown are for existing permanent wells.

[f]Trip blanks will be analyzed for TCL volatile organic compounds only.

[g]Preservative blanks will be analyzed for TCL volatile organic compounds, total recoverable hydrocarbons, total TCL metals, and cyanide.]

0000099



SOURCE: U.S. Naval Air Station, Pensacola, Florida, 1987: and Geraghty and Miller 1984, 1986

SCALE
0 200 400 600 800 FEET

KEY:

- ● Tentative Soil Boring
- ○ Tentative Temporary Monitoring Well
- ⊗ Existing Monitoring Well

Figure 14–1 TENTATIVE SOIL BORING AND TEMPORARY MONITORING WELL LOCATIONS, SITES 3 & 19 – PHASE I

surveys will be used to adjust the final number and locations of samples.

Each temporary monitoring well will be constructed of stainless steel casing terminating in 5 feet of 0.01-inch slotted, stainless steel screen. The well casing will be placed in the corresponding soil sample borehole after the soil samples have been collected. Each well will be installed so that the well screen brackets the water table (i.e., the top of the screen extends slightly above the water level).

Each of the temporary monitoring wells will be developed as provided in Section 6.7.5 of the GQAPP. Each temporary monitoring well and the ten existing monitoring wells will be purged and sampled in accordance with Section 6.8 of the GQAPP.

14.1.4 Hydrologic Assessment

The temporary wells and existing well network will be surveyed to obtain top of casing elevations referenced to USGS datum or to a suitable established benchmark located within the vicinity of Sites 3 and 19. Static water levels will be measured in each well to determine shallow groundwater flow direction and horizontal hydraulic gradient.

Eydrologic data collected during Phase I, and geophysical and analytical screening data, will all be evaluated and evidence of lateral contaminant migration in shallow groundwater will be assessed. Conclusions drawn from these evaluations will' fora the basis for permanent monitoring well installations in Phase II and III.

14.2 Phase II — Characterization

The primary objectives of the Phase II field investigation are as follows:

- To characterize the nature and magnitude of the full spectrum of potential site contaminants;

[Bold items enclosed in brackets denote changes from original text]

- To confirm and validate the contaminant distributions indicated by the Phase I analytical screening results by collecting and analyzing samples under full-scale CERCLA-type QA/QC requirements;

- To support the preliminary identification, screening, and evaluation data requirements of potential remedial alternatives.

The actual Phase II sampling locations, especially with respect to the Phase I locations, will primarily be a function of how uniform the Phase I results were with respect to contaminant type, magnitude, and distribution across the site.

Phase II investigation of Sites 3 and 19 will involve the collection of soil and groundwater samples. Additional permanent, shallow monitoring wells will be installed. Air sampling will be conducted only if warranted by the results of Phase I efforts. In addition, limited aquifer testing will be performed.

The analytical requirements for Phase II samples are provided in Table 14-2.

[During the Phase II investigations of Sites 3 and 19, which are covered by RCRA requirements, at least one sample per contaminated medium will also be analyzed for Appendix IX parameters (40 CFR, Part 264). These samples will be collected from the area of highest contamination for each medium as determined during the Phase I investigation. Additional Appendix IX samples may be required depending on the extent of contamination detected.

14.2.1 Biota Sampling

The need for formal biological sampling will be based on the results of the Phase I habitat/biota survey and analytical screening results. If biological sampling is required, a separate biological sampling plan will be prepared which outlines sample locations, sampling methodologies, analytical parameters, etc.]

TABLE 14-2

PHASE II SAMPLING AND ANALYTICAL REQUIREMENTS—GROUP J

SITE 3

Medium	No. of Samples	Dupli-cates	Trip Blanks[a]	Field Blanks	Rinsate Blanks	[Preservative Blanks[b]]	Total*	Analytical Suite[c,d]
Soil	27	3	2	[1]	2	[1]	36 (6)	A C
Groundwater	[5]	1	1	[NR]	1	[NR]	[8] 2)	A B
TOTAL	[32]	4	3	11]	3	[1]	[44](8)	

SITE 19

Medium	No. of Samples	Dupli-cates	Trip Blanks'	Field Blanks	Rinsate Blanks	[Preservative [Blanks[b]	Total.	Analytical suito[c.]
Soil	15	2	1	1	1	[1]	[21] (6)	A C
Groundwater	[3]	1	1	[NR]	1	[NR]	[6] (2)	A B
TOTAL	[18]	3	2	[1]	2	[1]	[27](8)	

[a]Trip blanks will bo analyzed for [Target] Compound List (TCL) volatile organic compounds only.

[[b]Preservative blanks rill be analyzed for TCL volatile organic compounds, total recoverable hydrocarbons, total TCL metals, and cyanide.]

[c]Analytical suite designations are as follows:

A = TCL volatile organic compounds plus xylene and ketones, TCL base/neutral and acid extractable organic compounds, TCL pesticides and PCBs, total recoverable hydrocarbons, TCL metals (total [i.e., unfiltered] and dissolved [i.e., millipore-filtered]), cyanide, total organic carbon, hardness (water only), and alkalinity (water only).]

Table 14-2 (Cont.)

B = total suspended solids, total Kjeldahl nitrogen, ammonia nitrogon, orthophosphate phosphorus, dissolved oxygon (in field), 5-day biological oxygon donand (BOD_5), and chonical oxygon donand (COD).

C = pH, alkalinity, percent moisture, grain size, BTU contont, ash contont, total organic halogens, sulfur, ignitability, and cation exchange capacity.

[d] Specific conrtituontr encompassed by tho various chemical groups included within tho above-listed analytical suites are identified in Tables 9-5 through 9-13 of tho Generic Quality Assurance Project Plan.

*The number of samples shown in parentheses will bo analyzed for tho additional parameters indicated.

[NR = Not required.]

[14.2.2] Soil Sampling

Tentative locations and numbers of soil samples for Phase II are presented in Figure 14-2. The actual number of soil samples and their locations will be determined based on the results of Phase I. For planning purposes, three soil samples are assumed at each boring location. Figure 14-2 presents nine tentative boring locations for Site 3 and five tentative boring locations for Site 19. Consequently, a' total of 27 soil samples are projected for Site 3 and a total of 15 soil samples are projected for Site 19.

Soil samples will be collected in discrete intervals using a split-spoon sampler powered by a drill rig. A composite soil sample will be collected for each of the following depth intervals: 0 to 0.5 feet, 0.5 to 2.5 feet, then every 2.5 feet to the water table assumed to be at 5 feet. All sampling, compositing, and lithologic logging will be performed in accordance with Sections 6.6 and 6.7 of the GQAPP.

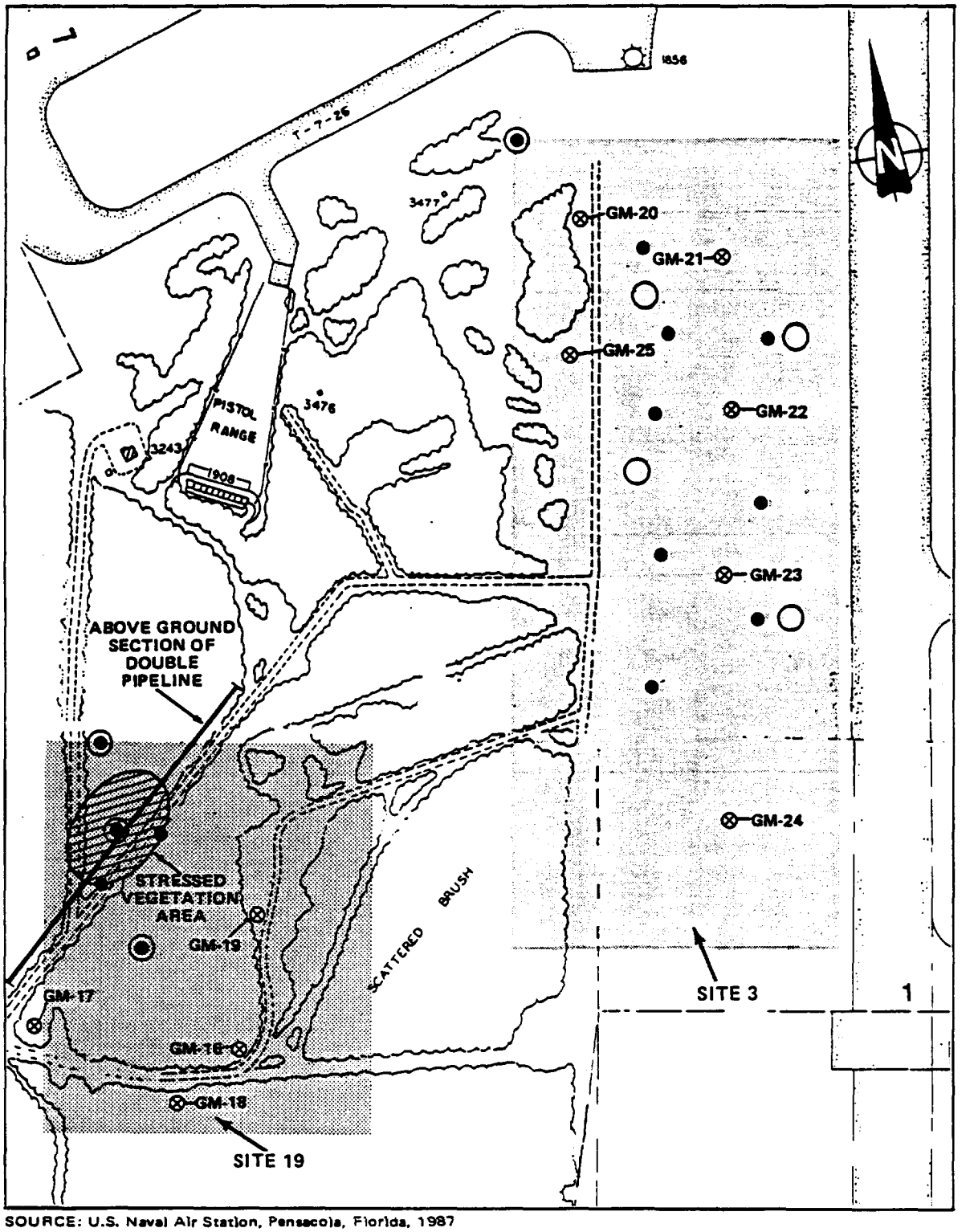
Equipment decontamination will be performed between soil sampling intervals as discussed in Section 6.10 of the GQAPP. A detailed discussion of split-spoon soil sampling procedures is provided in Section 6.7.2.3 of the GQAPP.

[14.2.3] Shallow Monitoring Well Installation and Development

Tentative locations for each of the eight Phase II monitoring wells are presented in Figure 14-2. Five new shallow monitoring wells will be installed on Site 3 and three new shallow monitoring wells will be installed on Site 19. As with the soil samples proposed for Phase II, exact sampling locations will depend upon the Phase I Field Screening results.

Shallow monitoring wells will be installed using the hollow stem auger method described in Section 6.7.2.1 of the GQAPP. Each of the shallow monitoring wells will be installed to a depth of approximately 15 feet and will be constructed using two-inch PVC casing, and will bracket the water table with 10 feet of 0.01-inch slotted screen. A detailed discussion of standard monitoring well construction practices is

[Bold items enclosed in brackets denote *changes* from original text]



SOURCE: U.S. Naval Air Station, Pensacola, Florida, 1987

KEY:

- ● Tentative Soil Boring
- ○ Tentative Shallow Monitoring Well
- ⊗ Existing Monitoring Well

SCALE 0 200 400 600 800 FEET

Figure 14 – 2 TENTATIVE SOIL BORING AND SHALLOW MONITORING WELL LOCATIONS SITES 3 & 19 – PHASE II

3 and five tentative boring locations for Site 19. Consequently, a total of 27 soil samples are projected for Site 3 and a total of 15 soil samples are projected for Site 19.

Soil samples will be collected in discrete intervals using a split-spoon sampler powered by a drill rig. A composite soil sample will be collected for each of the following depth intervals: 0 to 0.5 feet, 0.5 to 2.5 feet, then every 2.5 feet to the water table assumed to be at 5 feet. All sampling, compositing, and lithologic logging will be performed in accordance with Sections 6.6 and 6.7 of the GQAPP.

Equipment decontamination will be performed between soil sampling intervals as discussed in Section 6.10 of the GQAPP. A detailed discussion of split-spoon soil sampling procedures is provided in Section 6.7.2.3 of the GQAPP.

[14.2.3] Shallow Monitoring Well Installation and Development
Tentative locations for each of the eight Phase II monitoring wells are presented in Figure 14-2. Five new shallow monitoring wells will be installed on Site 3 and three new shallow monitoring wells will be installed on Site 19. As with the soil samples proposed for Phase 11, exact sampling locations will depend upon the Phase I Field Screening results.

Shallow monitoring wells will be installed using the hollow stem auger method described in Section 6.7.2.1 of the GQAPP. Each of the shallow monitoring wells will be installed to a depth of approximately 15 feet and will be constructed using two-inch PVC casing, and will bracket the water table with 10 feet of 0.01-inch slotted screen. A detailed discussion of standard monitoring well construction practices is provided in Section 6.7.3 of the GQAPP. All equipment used in monitoring well installation will be decontaminated as discussed in Section 6.10 of the GQAPP.

[Bold items enclosed in brackets denote changes from original text]

provided in Section 6.7.3 of the GQAPP. All equipment used in monitoring well installation will be decontaminated as discussed in Section 6.10 of the GQAPP.

[Depending on the results obtained during Phase I, the delineation of the extent of shallow groundwater contamination may be possible during Phase II by the installation of a few monitoring wells in addition to the number proposed. When and where possible and/or practical, additional monitoring vells will be installed during Phase II in order to expedite the overall investigation schedule.]

[14.2.4] Groundwater Sampling

Groundwater samples will be collected from the eight nevly installed shallow monitoring wells on Sites 3 and 19. During Phase 11, a total of **[5]** groundwater samples will be collected from Site 3 and a total of **[3]** groundwater samples will be collected from Site 19. Prior to sample collection each well will be purged using the methods described in Section 6.8.1 and 6.8.2 of the GQAPP. Samples will be collected according to the methods provided in Section 6.8.3 of the GQAPP.

[14.2.5] Hydrologic Assessment

Well head elevations will be surveyed for all newly installed monitoring wells. Water levels will be measured in all wells following procedures described in Section 14.1.4 of this workplan.

Limited aquifer testing will be conducted on all newly installed and existing monitoring wells. These will consist primarily of performing short-duration specific capacity tests during the development of the newly installed monitoring wells and slug or specific capacity on the existing monitoring wells. Specific capacity and slug tests are particularly useful for deriving first estimates of aquifer hydraulic properties (i.e., hydraulic conductivity, transmissivity).

The advantages of conducting specific capacity tests in conjunction with well development is that the test itself does not generate additional

[Bold items enclosed in brackets denote *changes* from original text]

potentially contaminated water, which requires disposal. Slug testing does not generate any potentially contaminated water.

Physical and chemical aquifer data collected during Phase II will be evaluated to determine lateral contaminant migration characteristics. A plan for deep well installation will, be developed based on the findings of Phases I and 11.

[14.2.6] Air Sampling

Formal air sampling will be performed only as required based on the results of the Phase I surface emissions survey [and particulate air sampling, and the Phase I shallow soil sampling.] If formal air sampling is necessary, sampling will be conducted [in accordance with] procedures outlined in Section 6.1 of the GQAPP.

14.3 Phase III - Extent Delineation

Phase III tasks will be conducted based on the results of Phases I and 11. Although the earlier phases are intended to identify and characterize areas and contaminants'of primary concern as they extend laterally from Sites 3 and 19, Phase III activities will be geared toward delineating the horizontal and vertical extents of contamination.

14.3.1 Biota Sampling

If deemed appropriate on the findings of Phases I and 11, [additional] biota sampling may be conducted during Phase 111. [Hovever, as for Phase II, a separate biological sampling plan will be prepared.]

14.3.2 Soil Sampling

Soil sampling will be conducted in conjunction with any new shallow, intermediate or deep well installations.

14.3.3 Shallow Monitoring Well Installation and Development

Additional shallow monitoring wells may be required to determine the horizontal extents of shallow groundwater contamination.

[Bold items enclosed in brackets denote changes from original text]

14.3.4 Intermediate and Deep Monitoring Well Installation and Development

The installation of additional monitoring wells into deeper zones of the aquifer may be required in order to assess horizontal and vertical hydraulic gradients, aquifer physical characteristics, and vertical extent of contamination. The number of wells and their locations and depths are dependent upon Phase I and II findings.

14.3.5 Groundwater Sampling

All wells installed in Phase III will be sampled and analytical requirements for the samples will be developed based on the results of previous phases. Monitoring wells installed prior to Phase III will be sampled as required.

14.3.6 Hydrologic Assessment

All wells installed during Phase III will require a well head survey to obtain top of casing elevations. Water level measurements will be made for all site monitoring wells. Horizontal and vertical gradients will be determined. Aquifer testing will be performed to ascertain aquifer physical characteristics. [On sites where contamination is found in the surficial zone during Phases I and/or II, the low permeability zone will be further characterized during Phase III and *any* subsequent phases. It is intended that soil sample results, lithologic logs, isopach maps, permeability testing, aquifer testing, etc. will be utilized as required to determine the lateral extent and/or continuity of the lov permeability zone, as well as the degree to which hydraulic connection exists between the surficial zone and underlying main producing zone at each site.]

14.3.7 Air Sampling

The need for formal air sampling [during Phase III] and the techniques to be employed are dependent upon the findings of Phase I, and any sampling performed in Phase 11.

[Bold items enclosed in brackets denote changes from original text]

0000105

14.4 Phase IV - Extent Delineation

The following tasks, if required, will be performed as a continuation in the effort of delineating contamination extent:

- Soil Sampling;
- Shallow Monitoring Well Installation and Development;
- Intermediate and Deep Monitoring Well Installations and Development;
- Groundwater Sampling; and
- Hydrologic Assessment.

14.5 Topographic Survey and Base Map

Following the completion of Phases III and IV, a topographic survey of the vicinity of Sites 3 and 19 will be conducted and a base map will be developed. Base map coverage, contour intervals, scale, and requirements for horizontal and vertical control will be established and approved by the Navy. The topographic base map will be developed for the requirements of remedial planning and will include the locations of surface features such as: roads, structures, monitoring wells, municipal supply wells, and above ground utilities. The location of subsurface utilities and drainage structures will be reflected on the base map as indicated on existing NAS Pensacola General Development and utilities maps, and/or as located during field investigations.

14.6 Field Quality Assurance/Quality Control

14.6.1 Documentation

Field activities and sample management will entail certain strict documentation requirements as described in Section 7.0 of the GQAPP.

[Bold items enclosed in brackets denote changes from original text]

14.6.2 QA/QC Samples

Samples collected for laboratory analysis (both screening and non-screening) during all phases of fieldwork will require the preparation of field QA/QC samples as described in Section 6.12 of the QAPP. The estimated numbers of required field QA/QC samples for Phases I and II are shown in Tables 14-1 and 14-2.

14.7 Decontamination and Waste Management Procedures

14.7.1 Decontamination Procedures

All equipment decontamination procedures for Sites 3 and 19 will be performed in accordance with Section 6.10 of the GQAPP.

14.7.2 Waste Management Procedures

All water generated during monitoring well purging and development activities on Sites 3 and 19 will be discharged onto the ground surface away from the well, or will be containerized., labeled, and moved to a storage area on NAS Pensacola, as directed by the Navy.

Any excess soil auger cuttings generated by soil boring or monitoring well installation activities will be disposed of on-site, or will be containerized, labeled, and moved to a storage area on NAS Pensacola, as directed by the Navy.

Other investigations derived wastes, such as potentially contaminated protective clothing and other disposable materials, will be containerized, labeled and moved to a storage area on NAS Pensacola.

[Bold items enclosed in brackets denote changes from original text]

15. LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

Laboratory QA/QC procedures are designed to ensure the accuracy, precision, completeness, representativeness, and comparability of all analytical data. Laboratory QA/QC has been addressed both in the Generic Quality Assurance Project Plan (GQAPP) and Generic Site Management Plan (GSHP). All phases of fieldwork will incorporate a different level of data quality and requisite laboratory QA/QC. These levels are discussed in detail in the GQAPP and QSMP.

[Bold items enclosed in brackets denote changes from original text]

16. GROUNDWATER MODELING

E & E will use the data generated in the previous field investigation phases to conduct limited computer modeling when applicable and appropriate. Two scenarios will be considered to assess the potential for off-site contamination, including:

- o Estimated future plume movement without any remedial actions effects (e.g., no action); and
- o Estimated total time periods required to completely extract contaminants from the aquifer in order to meet previously established standards for drinking water (ARARs), for a total contaminant mass at variable pumping rates.

E & E will use the two-dimensional analytical RANDOMWALK model (Prickett ~~et al.~~ 1981) to arrive at these estimates. E & E will calculate flow velocity field input data for the solute transport simulation from a simplified model based on Darcy's Law. E & E will utilize parameters including transmissivity, storativity, and hydraulic conductivity from the phases of fieldwork described above.

To obtain a prediction of plume extent without remediation, E & E will illustrate organic and inorganic simulations for the current time and for one, five, and ten years into the future. Additional simulations will include different remedial pumping scenarios for both organic and inorganic contamination. E & E then will use information generated by these computer simulations for remedial alternative development. Other computer models that can be utilized to assess on-site groundwater conditions include: PLASM, a two-dimensional, finite-difference groundwater flow model; GUTRANS, a two-dimensional, finite-difference solute transport model; FEMWATER, a finite-element groundwater model; and FEHWASTE, a finite-element solute transport model.

[Bold items enclosed in brackets denote changes from original text]

17. TREATABILITY STUDY

As indicated in Table 14-2, a number of the analyses to be performed on the samples collected during Phases II through IV are required in support of the treatability study. Characterization of samples in terms of parameters listed in Table 14-2, together with treatability tests, will provide the basic data required for the evaluation of physical, chemical, and biological remedial technologies. Some of the treatability tests that may be examined are incineration tests, solubility tests, soil leaching tests, and coagulation-flocculation jar tests.

[Bold items enclosed in brackets denote changes from original text]

18. BASELINE RISK ASSESSMENT

As part of the Remedial Activities Investigation, a baseline risk assessment will be conducted to determine the level of effort required in the Feasibility Study (FS) for remedial actions. The baseline risk assessment will provide an evaluation of the potential threat to human health and the environment in the absence of any remedial action, by providing the basis for determining whether or not remedial action is necessary and the justification for performing any remedial actions.

The baseline risk assessment identifies and characterizes the toxicity and levels of hazardous substances present in the media of concern (e.g., air, groundwater, soil, surface water, sediment, or biota), the environmental fate and transport mechanisms within the media of concern (e.g., physical, chemical, biological degradation processes, and hydrogeological conditions), the potential human and environmental receptors, the potential exposure routes and the extent of actual or expected exposure, the extent of impact or threat (i.e., risk characterization), and the level or levels of uncertainty associated with all of the above. The complexity of the site will determine the level of effort required to conduct the baseline risk assessment. The conclusions of the baseline risk assessment will determine the level of effort required in the risk assessment to be conducted in the FS.

The baseline risk assessment can be divided into four tasks: contaminant identification; exposure assessment; toxicity assessment; and risk characterization.

18.1 Contaminant Identification

The main purpose of this step is to screen available information on the hazardous wastes present at the site and to identify contaminants of

concern to focus on in subsequent efforts in the risk assessment process. It may be useful at some of the NAS Pensacola sites to select "indicator chemicals" to represent the most toxic, persistent, and/or mobile substances among those identified that are most likely to contribute significantly to the overall risk posed by the site. Sometimes this indicator chemical can be selected to represent a "class" of chemicals (e.g., trichloroethylene to represent all volatiles).

18.2 Exposure Assessment

In this subtask, actual or potential pathways are identified, populations potentially exposed are characterized, and the extent of exposure is determined. Identification of potential exposure pathways helps to conceptualize the migration of contaminants from an existing source to an existing or potential point of contact. An exposure pathway may be viewed as identifying four elements:

1) A source mechanism of chemical release into the environment;
2) An environmental transport medium (e.g., air, groundvater, biota);
3) A point of potential contact with the medium of concern; and
4) An exposure route to the population from the contact point.

The purpose of this analysis is to provide decision makers with an understanding of both the current risks and potential future risks if no action is taken. Therefore, as part of this evaluation a reasonable maximum exposure scenario should be developed, which reflects the type(s) and extent(s) of exposures that could occur based on the expected future use of the site.

The final step in the exposure assessment is to integrate'the information and develop a qualitative and/or quantitative estimate of the expected exposure levels resulting from the actual or potential release of contaminants from the site.

[Bold items enclosed in brackets denote changes from original text]

0000110

18.3 Toxicity Assessment

This step considers: (1) the types of adverse human or environmental effects associated with contaminant exposure; (2) the relationship between the magnitude of exposure(s) and the adverse effects; and (3) related uncertainties such as the evidence for a chemical's potential carcinogenicity in humans. Typically this process relies heavily on existing toxicity information and rarely involves the development of new data on toxicity or dose-response relationships.

18.4 Risk Characterization

In the final stages of the baseline risk assessment, a characterization of the potential adverse effects to human health or environment of each scenario derived is developed and summarized. By integrating information developed during the exposure and toxicity assessments, estimates of risk can be developed to include carcinogenic risks, noncarcinogenic risks, and environmental risks. To characterize environmental risks, the potential exposures to the surrounding ecological receptors must be identified, and the potential effects associated with such exposure(s) must be determined. Important factors to examine include disruptive effects to populations (plant and animal) and the extent of perturbations to the ecological community. [In addition, the Integrated Risk Information System (IRIS) will be utilized.

The following data will be obtained for each site as part of the baseline risk assessment:

- o Distance to the closest residence (on or off NAS Pensacola);
- o Type of barrier, if any, to prevent access;
- o Approximate population within 0.25 mile of the site (including NAS Pensacola);
- o Sensitive land uses in the vicinity of the site (e.g., schools, hospitals, retirement homes, etc.);
- o Activities (recreational and/or occupational) which take place near the sites, and the estimated number of people involved;

[Bold items enclosed in brackets denote changes from original text]

- o Records of *any* environmental and/or health complaints regarding the sites; and
- o Log of any actions taken by a health unit regarding health issues, complaints, and concerns.]

The results of the baseline risk assessment may indicate that the site poses little or no threat to human health or the environment. In such cases, the PS should be appropriately scaled down or eliminated. The results of the Remedial Activities Investigation and baseline risk assessment will serve as the primary basis of documenting a no further action decision.

[It should be emphasized that all the tasks conducted as part of the baseline risk assessment will be performed on an interactive basis between the various disciplines required (i.e., hydrogeologists, chemists, risk assessors, etc.), the Navy, and the revieving regulatory agencies (i.e., FDER and BPA) and that the goal of these tasks is to produce appropriate, sufficient, and high quality data to complete the baseline risk assessment.]

[Bold items enclosed in brackets denote *changes* from original text]

0000111

19. FEASIBILITY STUDY

Further details on the specific tasks to be performed as part of the FS will be described in detail during the update of this workplan after the initial phases of the fieldwork have been completed. However, it is anticipated that if contamination of some degree is identified on-site, the general approach described below will be followed.

As part of the initial scoping activities of the FS, E & E will prepare a summary of field data collected during the RI to compare and evaluate the concentration of the contaminants of concern against the cleanup criteria developed. E & E will prepare a qualitative and quantitative summary of contamination for the scenarios identified during risk assessment evaluation. Results of this evaluation will serve as a basis for the screening of applicable remedial technologies for the development and evaluation of remedial action technologies.

19.1 Screening of Applicable Remedial Technologies

E & E will screen and develop applicable technologies for the remediation of any on-site contamination. In the process of screening applicable technologies, E & E will consider all ARARs and identify problems, and determine pathways of contamination using a receptor-oriented approach based on the threat to the public health, welfare, and the environment. In this summary, pathways will be outlined for each medium of concern. E & E then will identify applicable remedial technologies for each general response action such as contaminant removal, treatment, disposal, and so on. The identification of technologies will be based on technical selection criteria and E & E's engineering judgment.

[Bold items enclosed in brackets denote changes from original text]

19.2 Assessment of Applicable Remedial Technologies

During the assessment process, E & E will consider the relative applicability of each technology. In addition, criteria such as environmental, institutional, and public health impacts, and technical feasibility will be applied. A discussion of the applicable technologies will be provided for each general response action. The summary will include comments as appropriate concerning the reliability and implementability of the technology.

19.3 Risk Assessment

Based on the results of the baseline risk assessment conducted during the Remedial Activities Investigation, E & E will perform a detailed risk analysis to determine the acceptable levels of risk. This will allov the Navy to balance the increase in costs associated with each alternative against gains in safety. The risk analysis will include consideration of site contaminant toxicity, transport mechanisms, persistence in the environment, and impacts on human health and the environment.

19.4 Development and Evaluation of Remedial Action Alternatives

During the preceding task, remedial technologies will be assessed independently without consideration of potential advantages or disadvantages of technologies applied in combination. In this task, individual technologies will be assembled into remedial action alternatives for the site. During the assembly and evaluation of the alternatives, criteria including technical feasibility, environmental and public health, institutional impacts, and comparative costs will be considered.

19.5 Selection of Recommended Remedial Action Alternatives

During this task, E & E will select a single remedial action alternative for the remediation of the site. The alternatives assembled during the preceding task will be compared using technical, environmental, and economic criteria. E & E will consider present worth of total costs, environmental effects, technical aspects, the extent to which alternatives comply with ARARs, community effects, and other factors,

[Bold items enclosed in brackets denote changes from original text]

when comparing alternatives. E & E will apply these evaluation criteria uniformly to each alternative along with any additional criteria that may result from the Navy project coordination. E & E will discuss the selection of the chosen alternative by means of a statement of the relative advantages of the alternative over the other alternatives considered.

19.6 PS Report

A draft and final FS report will be provided to the Navy for review and comments.

[Bold items enclosed in brackets denote changes from original text]

20. REPORT

[Following the Phase I investigation, E & E will prepare a Phase I Interim Data Report and Recommendations for each site. The purpose of this report is to summarize briefly the findings of Phase I and provide recommendations for the Phase II investigation; the Phase I interim report will not be a formal report. (In general, during the proposed multi-phase investigation process, formal reports will be generated only when little or no additional assessment work appears to be required.) Following the Phase I report the work plans for the Phase II work will be updated accordingly. If the results of Phase II indicate that no further action is warranted, a formal Phase II report will be produced. However, if the Phase II results indicate that additional investigation is required, the Phase II report will be produced as the Phase II Interim Data Report and Recommendations and will only briefly summarize the Phase II results and provide recommendations for the Phase III investigation. Thus, the Phase II interim report will not be a formal document. Following production of the Phase II interim report, the work plans for the Phase III work will be updated.]

E & E will prepare a 90% draft [for each of the above-described reports, which summarizes] the activities and results of [the investigation tasks performed.] Upon receipt of comments [from] the Navy concerning the 90% draft reports, E & E will prepare a draft final report for the Navy and the Technical Review Committee (TRC) review. The TRC review comments will be incorporated into final reports. Each report will be written as an independent document, complete in its own right, and fully supportive of the conclusions that it contains. [Where appropriate,] Public participation issues will be summarized, as will interim remedial measures necessary to protect against continued degradation of

[Bold items enclosed in brackets denote changes from original text]

but supplemental to the analytical results, will be provided in a series of appendices.

Monthly progress reports during all field activities will be submitted to keep the Navy apprised of fieldwork status and site conditions. Current and planned activities as well as cost tracking will be provided.

[Bold items enclosed in brackets denote changes from original text]

0000114

21. DOCUMENT REVISION

Periodic updating of all administrative documents (GQAPP, GSMP, GHSP, GPHP, and work plans) will be necessary due to changes in site conditions and/or program conditions or requirements. The schedules shown in the GPMP and GSMP indicate document revisions approximately every two months for the GQAPP, GSHP, GHSP, and GPMP. Work plans will be revised after each phase of fieldwork, with Phases III and IV, if required, fully developed after Phase II with separate cost estimations. Revised documents will undergo the same review process (e.g., Navy and TRC) as the original documents.

22. PROJECT MANAGEMENT

Project management will be an ongoing process throughout this investigation. This process includes preparation of bi-weekly project status reports, coordination of schedules, mobilizations, and other project incidentals with the Navy, management of project staff, coordination with the E & E support groups (e.g., publications, laboratory), and ongoing project review by E & E technical managers and directors. These project management steps are described in detail in the GPMP submitted to the Navy.

[Bold items enclosed in brackets denote changes from original text]

23. PROJECT SCHEDULE

[Figures *23-1, 23-2, 23-3,* and *23-4* show the project schedules for Phases I, II, III, and IV, respectively. Given that the scopes of work for Phase II and beyond are dependent on the results of the preceding phases, the project schedules for Phases 11, 111, and IV are tentative. In addition, the length of time between phases is subject to the schedule in the Federal Facilities Agreement Site Management Plan (FFASMP). The schedule in the FFASMP will be updated yearly.

[Bold items enclosed in brackets denote changes from original text]

0000117

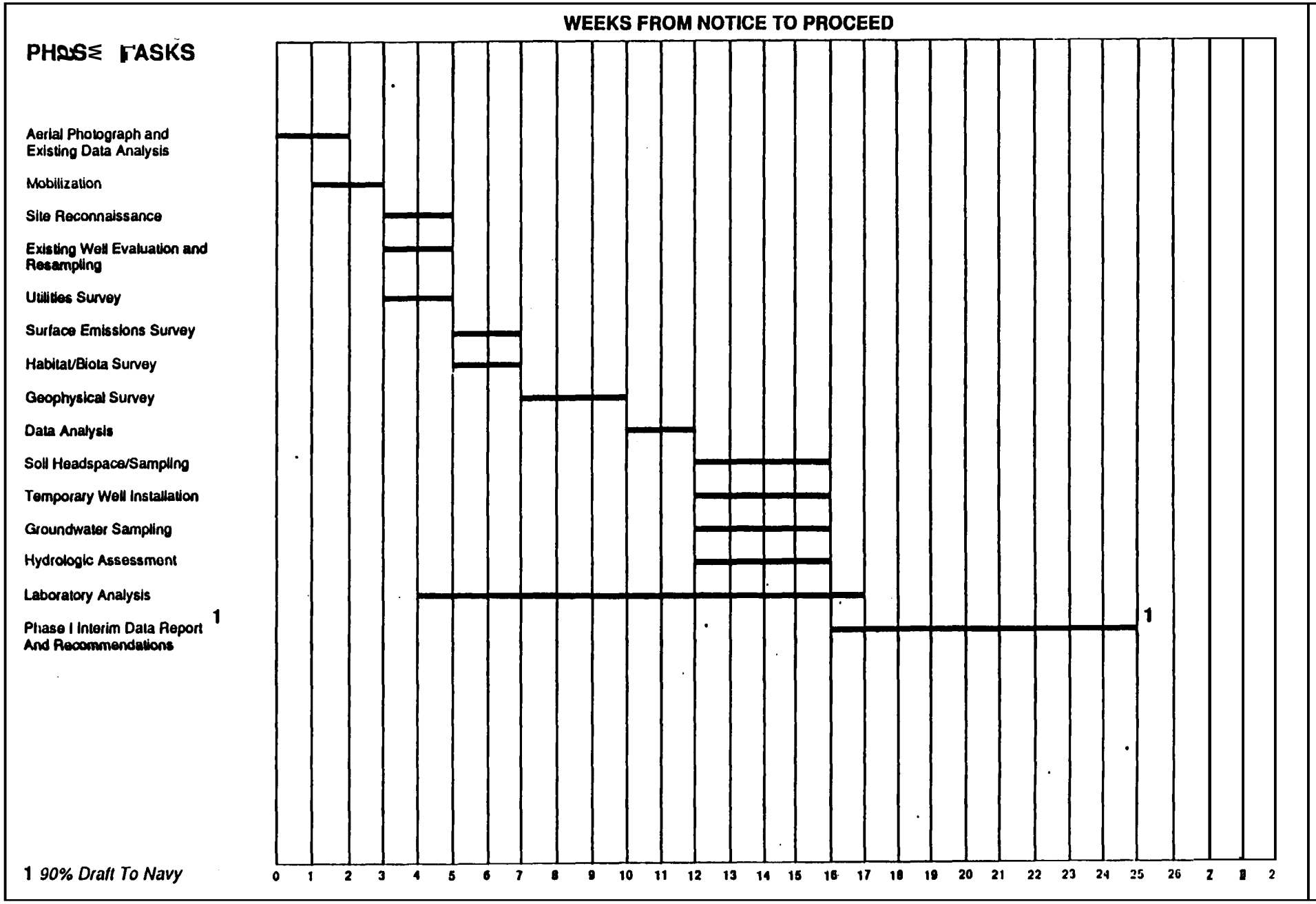


Figure 23-1 PHASE I PROJECT SCHEDULE – GROUP J

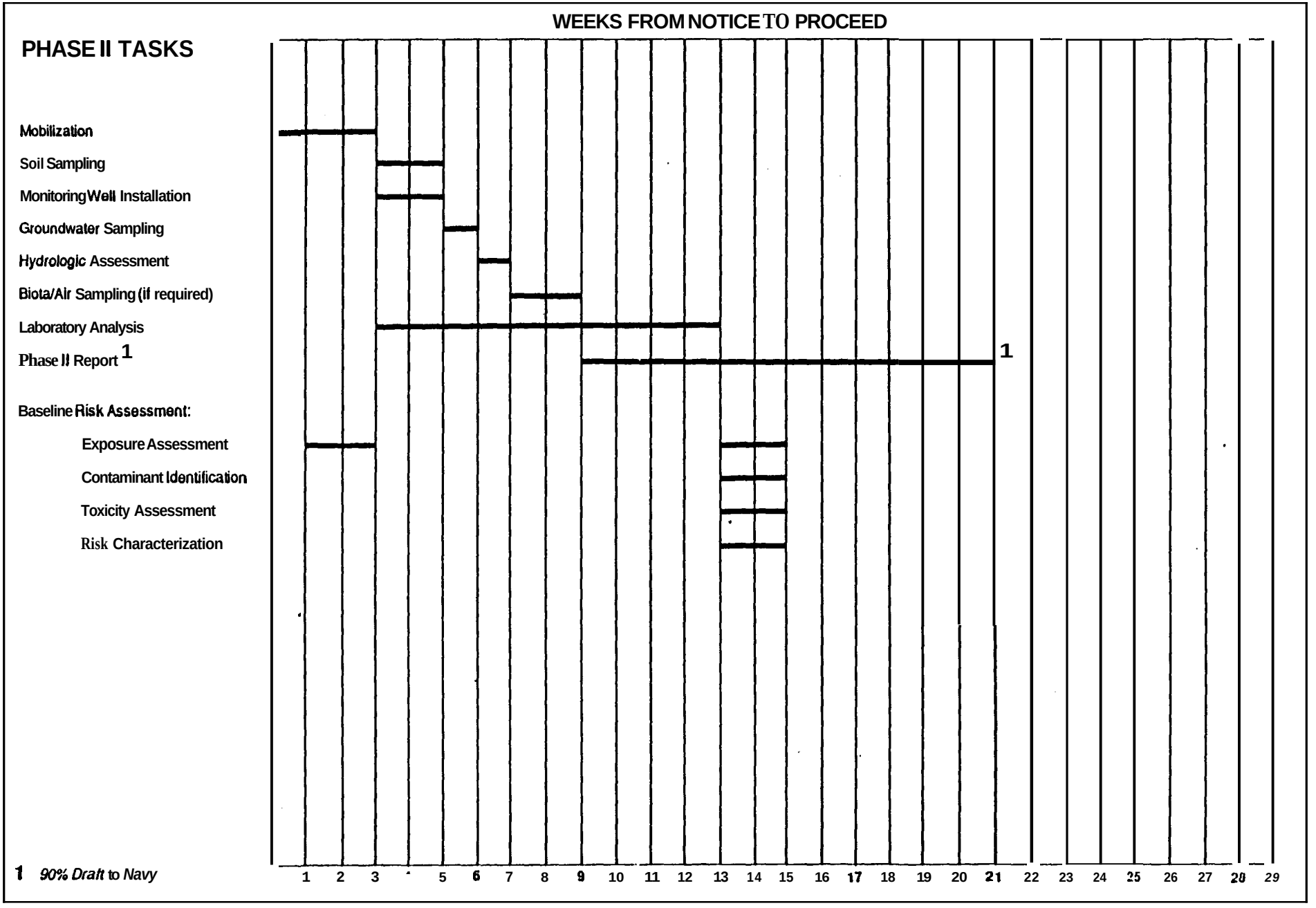


Figure 23-2 PHASE II PROJECT SCHEDULE – GROUP J

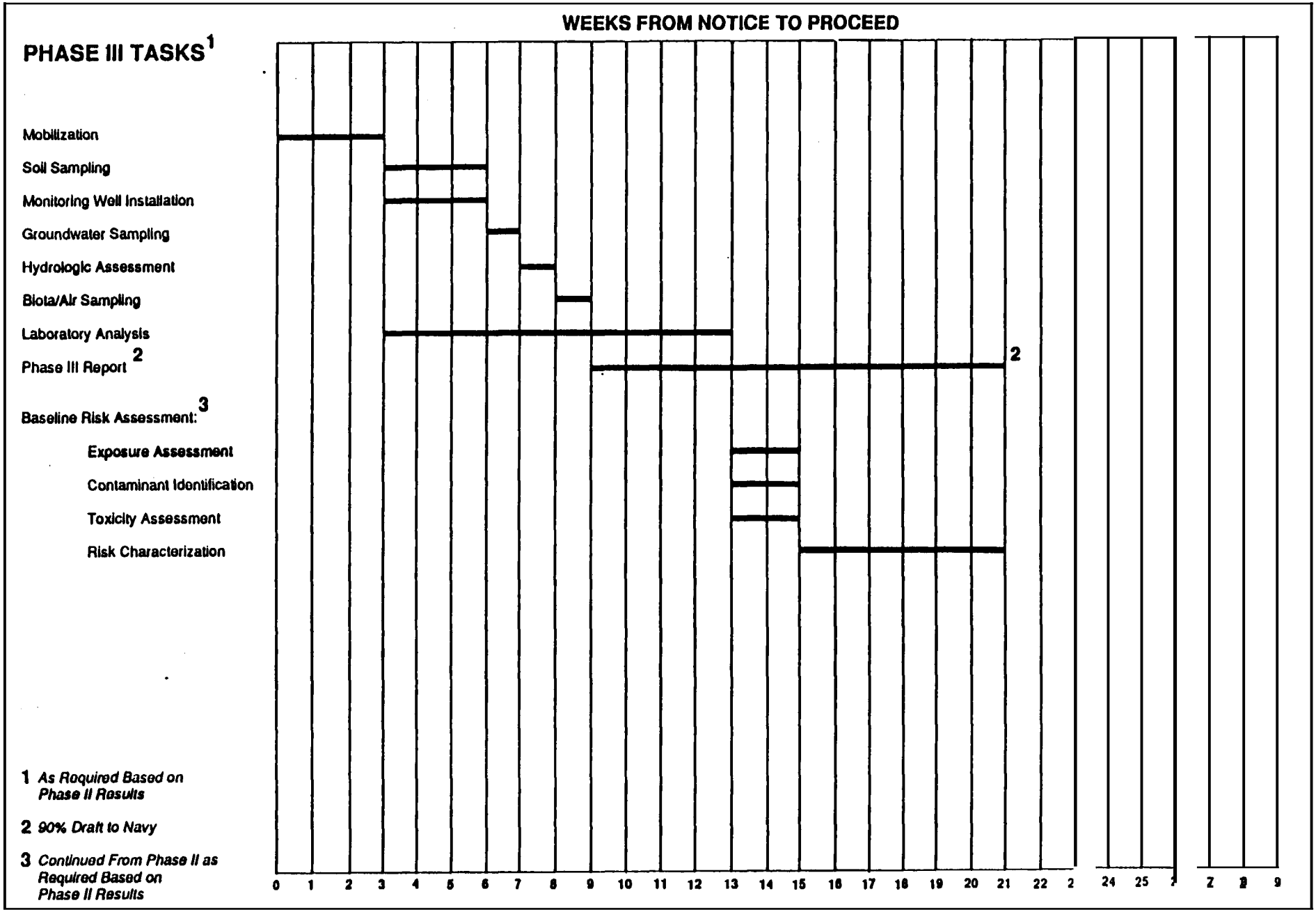


Figure 23-3 PHASE III PROJECT SCHEDULE – GROUP J

00001118

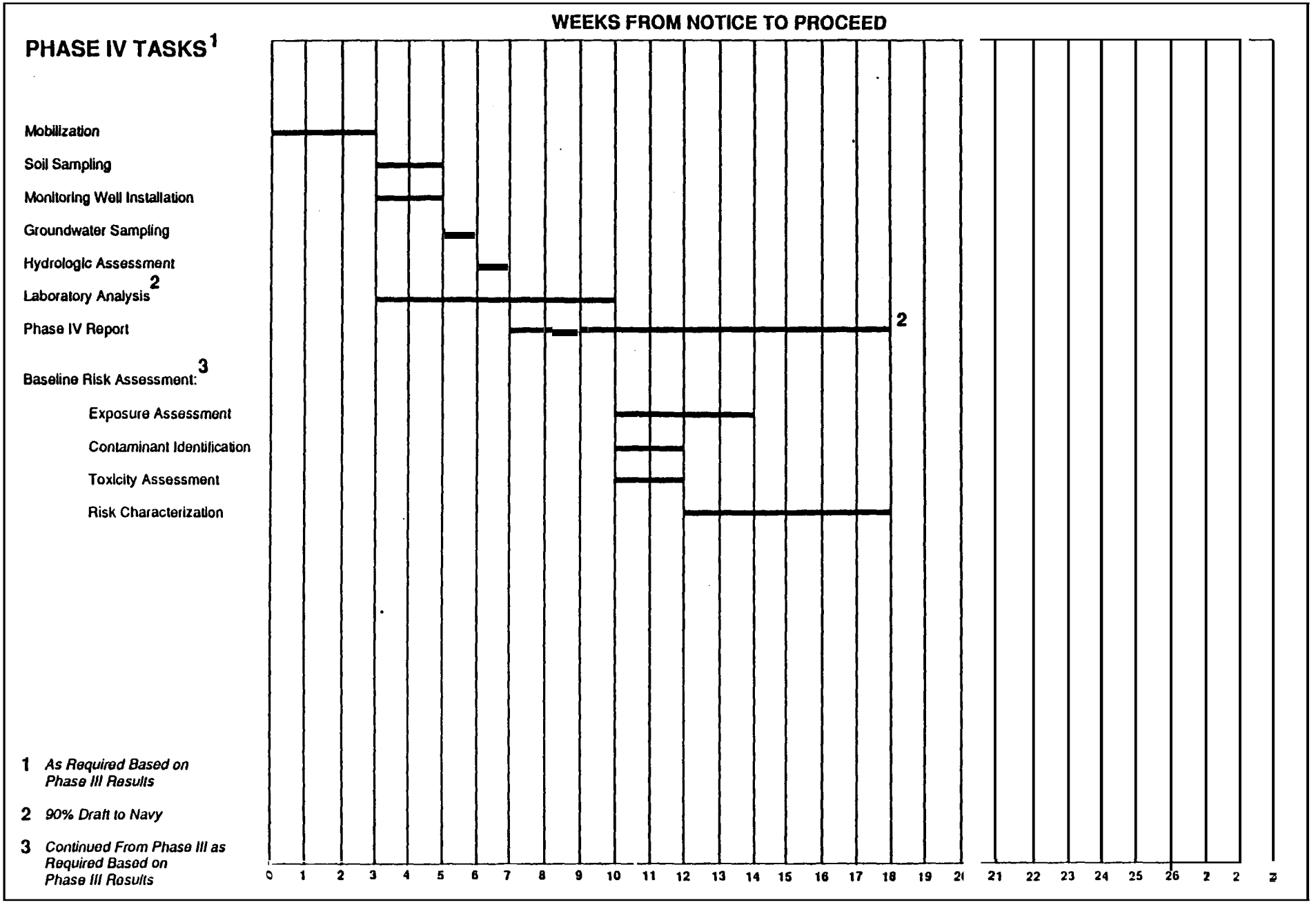


Figure 23-4 PHASE IV PROJECT SCHEDULE – GROUP J

24. REFERENCES

Barraclough, J. T. and O. T. Marsh, 1962, Aquifers and Quality of Ground Water along the Gulf Coast of Western Florida: Florida Bureau of Geology, Report of Investigations 29.

Barraclough, J. T., 1967, Ground-water Features in Escambia and Santa Rosa Counties, Florida: Florida Geological Survey, Map Series No. 26.

Brooks, H.K., 1981, Physiographic Divisions of Florida: Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, Gainesville, Florida.

Carlisle, V. W., 1960, Soil Survey of Escambia County Florida: Series 1955, No.8, U.S. Department of Agriculture, Wash ngton, D.C.

Coe, C. J., 1979, Geology of the Plio-Pleistocene Sed ments in Escambia and Santa Rosa Counties, Florida: Florida State University, Master Thesis.

Coffin, J. E., 1982, Summary of Ground-water and Surface-water Data for City of Pensacola and Escambia County, Florida: U. S. Geological Survey Open-file Report 82-361.

Cooke, C. W., 1939, Scenery of Florida Interpreted by a Geologist: Florida Geological Survey, Bulletin No. 17.

Cooke, C. W., 1945, Geology of Florida: Florida Geological Survey, Bulletin No. 29.

Cooley, N. R., 1978, An inventory of Estuarine Fauna in the Vicinity of Pensacola, Florida: Florida Marine Research Publications No. 31. Florida Department of Natural Resources, Marine Research Laboratory, St. Petersburg, Florida.

Driscoll, F.G., 1986, Groundwater and Wells, Second Edition: Johnson Division, St. Paul, Minnesota.

Ecology and Environment, Inc. (E & E), 1989a, General health and Safety Plan, Contamination Assessments and Remedial Activities, Naval Air Station, Pensacola, Florida.

[Bold items enclosed in brackets denote changes from original text]

Ecology and Environment, Inc. (E & E), 1989b, Generic Project Management Plan, Contamination Assessments and Remedial Activities, Naval Air Station, Pensacola, Florida.

Ecology and Environment, Inc. (E & E), 1989c, Generic Quality Assurance and Project Plan, Contamination Assessments and Remedial Activities, Naval Air Station, Pensacola, Florida.

Ecology and Environment, Inc. (E & E), 1989d, Generic Site Management Plan, Contamination Assessments and Remedial Activities, Naval Air Station, Pensacola, Florida.

ERM-Southeast, Inc. (ERM), 1988, Draft Site Investigation Report NIRP Site 31 at Building 649, Naval Air Station, Pensacola, Florida.

Flood and Associates, Inc, 1978, South Escambia and Santa Rosa counties. 201 Facilities Plan, City of Pensacola, Escambia and Santa Rosa counties, City of Gulf Breeze, Santa Rosa Island Authority, and Santa Rosa County Beach Administration.

Florida Department of Environmental Regulation, 1988, Unpublished marine sediment data from Pensacola Bay sediment study, 1985-1987, Tallahassee, Florida.

Florida Natural Areas Inventory, 1988a, Special plants and animals list, Escambia County, Florida. Tallahassee, Florida.

Florida Natural Areas Inventory, 1988b, Survey of Pensacola Naval Air Station and outlying Bronson Field for rare and endangered plants. Tallahassee, Florida.

Geraghty and Miller, Inc. (G & H), 1984, Verification Study, Assessment of Potential Ground-water Pollution at Naval Air Station, Pensacola, Florida.

Geraghty and Hiller, Inc. (G & M), 1986, Characterization Study, Assessment of Potential Ground-vater Pollution at Naval Air Station, Pensacola, Florida.

Geraghty and Hiller, Inc. (G & M), 1987a, Quarterly Report, Corrective Action Program, Wastewater Treatment Plant, NAS Pensacola, Florida.

Geraghty and Hiller, Inc. (G b H), 1987b, Lithologic Logs, NAS Pensacola Wastewater Treatment Facility, Pensacola, Florida.

Geraghty and Miller, Inc. 1988, Semi-Annual Report, Corrective-Action and Compliance-Monitoring Programs, Surge Pond Operation Permit, Wastewater Treatment Facility, Naval Air Station, Pensacola, Florida.

Greene, Mike, 1989, Personal Communication. Navy EIC.

[Bold items enclosed in brackets demote changes from original text)

Heil, D.C., 1989, Personal Communication. Florida Department of Natural Resources, Tallahassee, Florida.

Jacob, C. E. and H. H. Cooper Jr., 1940, Report on the Ground-water Resources of the Pensacola Area in Escambia County, Florida: U. S. Geological Survey, Open-file Report 400001.

[Kennedy, L. R., 1982, Rainfall Summary for the Northwest Florida Water Management District: Uater Resources Special Report 82-3.]

Ketchen, H. G. and R. C. Staley, 1979, A Hydrographic Survey in Pensacola Bay. Florida State University, Department of Oceanography, Tallahassee, Florida.

Lohman, S. W., 1972, Ground-Water Hydraulics: U. S. Geological Survey Professional Paper 708, Washington, D.C.

Luckenbach, M. W., R. J. Diay, and L.C. Schaffner, 1988, Scientific Consultation and Analytical Services: Benthic Assessment Procedures. Project 5, Virginia Water Control Board, Gloucester Point, Virginia.

Marsh, O. T., 1966, Geology of Escambia and Santa Rosa counties, Western Florida Panhandle: Florida Geological Survey, Bulletin 46, 140 p.

Musgrove, R. H., J. T. Barraclough, and O. T. Marsh, 1961, Interim Report on the Water Resources of Escambia and Santa Rosa Counties, Florida: Florida Geological Survey, Information Circular No. 30.

Musgrove, R. H., J. T. Barraclough, and R. G. Grantham, 1965, Water Resources of Escambia and Santa Rosa Counties, Florida: Florida Geological Survey, Report of Investigations No. 40.

Musgrove, R. H., J. T. Barraclough, and R. G. Grantham, 1966, Water Resources Records of Escambia and Santa Rosa Counties, Florida: Florida Geological Survey, Information Circular No. 50.

Naval Energy and Environmental Support Activity (NEESA), 1983, Initial Assessment Study of Naval Air Station, Pensacola, Florida. NEESA 13-015.

National Institute for Occupational Safety and Health Association, 1985, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.

Northwest Florida Water Management District, 1981, Public water supply systems in the coastal areas of Escambia, Santa Rosa, Bay, Okaloosa and Walton counties: Northwest Florida Water Management District, Water Resources Special Report 81-3.

Pike, E., 1989, Personal Communication. NAS Pensacola Public Works Department.

[Bold items enclosed in brackets denote changes from original text]

Prickett, T. A., T. G. Naymik, and C.G. Lonnquist, 1981, A Random Walk Solute Transport Model for Selected Groundwater Quality Evaluations, Bulletin 654, Illinois State Water Survey, Champaign, IL.

Schropp, S. J., and H. L. Windom, 1988, A Guide to the Interpretation of Metals Concentrations in Estuarine Sediments. Florida Department of Environmental Regulation, Coastal Zone Management Section, Tallahassee, Florida.

SEGS, 1986, Florida Hydrogeologic Units: Southeastern Geological Society Ad Hoc Committee on Florida Hydrostrategraphic Unit Definition (SEGS), Florida Geologic Survey, Special Publication No. 28.

Trapp, H., Jr., 1972, Availability of Ground Water for Public-Water Supply in the Pensacola Area, Florida - Interim Report, June 1971: U. S. Geological Survey, Open-File Report FL72002.

Trapp, E., Jr., 1973, Availability of Ground Water for Public-Water Supply in Central and Southern Escambia County, Florida - Interim Report, July 1973; U. S. Geological Survey, Open-File Report FL 72029.

Trapp, A., Jr., 1975, Hydrology of the Sand-and-Gravel Aquifer in Central and Southern Escambia County, Florida - Preliminary Report - November 1973: U. S. Geological Survey, Open-File Report FL74027.

Trapp, H., Jr., 1978, Preliminary Hydrologic Budget of the Sand-and-Gravel Aquifer under Unstressed Conditions, with a Section on Water Quality Monitoring, Pensacola, Florida: U. S. Geological Survey, Water-Resources Investigations 77-96.

U.S. Environmental Protection Agency, 1984, Standard Operating Safety Guidelines.

U.S. Environmental Protection Agency, 1985, Guidance on Remedial Investigations under CERCLA. EPA, OSWER, HWERL; EPA report #540/6-85/002; NTIS ref #PB-85-268616; OSWER Directive 9355.0-06B. U.S. EPA, Cincinnati, Ohio.

U.S. Environmental Protection Agency, 1985, Guidance on Feasibility Studies under CERCLA. EPA, OSWER, OWPE, EPA report #540/G-85/003; NTIS ref #PB-85-238-590; OSWER Directive 9355.0-05c. U.S. EPA, Washington, D.C.

U.S. Environmental Protection Agency, 1987, Data Quality Objectives for Remedial Response Activities. OSWER Directive 9335.0-7B. U.S. EPA, Washington D.C.

[Bold items enclosed in brackets denote changes from original text]

U.S. Environmental Protection' Agency, 1987. Compendium of Superfind Field Operations Methods. OSWER Directive 9355.0-14, EPA/540/P-87/00/a.

U.S. Environmental Protection Agency, 1988. CERCLA Compliance with Other Laws Manual. Draft. OSWER Directive 9234.1-01. U.S. EPA, Washington, D.C.

U. S. Environmental Protection Agency, 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA Draft. OSWER Directive 9355.3-01 OERR # 68-01-7090 and 68-W8-0098. U.S. EPA, Washington, D.C.

U.S. Fish and Wildlife Service, 1987, Long Range Fish and Wildlife Section, Naval Air Station Pensacola and Outlying Field Bronson, Pensacola, Florida. U.S.F.W.S. Field Office, Panama City, Florida.

U.S. Geological Survey, 1970a, 7 1/2 Minute Topographic Map, Fort Barrancas, Florida quadrangle.

U.S. Geological Survey, 1970b, 7 1/2 Minute Topographic Map, West Pensacola, Florida Quadrangle, Photorevised 1987.

U. S. Navy, 1986, U.S. Navy Gulf Coast Strategic Homeporting Environmental Impact Statement, Appendix IV, Pensacola, Florida. Southern Division, Naval Facilities Engineering Command, Charleston, South Carolina.

U.S. Navy, 1987, General Development Map Nos. 1276829 to 1276839. U.S. Naval Air Station, Pensacola, Florida. Southern Division Naval Facilities Engineering Command, Charleston, South Carolina.

Wagner, J. R., 1982, Hydrogeology of the Northwest Florida Water Management District: in; Ground Water in Florida - Proceedings of the first Annual Symposium on Florida Hydrogeology: Northwest Florida Water Management District, Public Information Bulletin 82-2.

Wagner, J. R., T. W. Allen, L. A. Clemens, and J. B. Dalton, 1984, Ambient Ground Water Monitoring Program - Phase 1: Northwest Florida Water Management District, DER Contract Number WM65.

Wagner, J. R., (in preparation) 1989, Hydrogeologic Framework of the Northwest Florida Water Management District.

Walton, W.C., 1970, Ground Water Resource Evaluation: McGraw-Hill Book Co., New York.

Water and Air Research, Inc. (WAR), 1986, Report of Collection and Analyses of Sediment, Water, and Elutriate Samples for Navy Gulf Coast Strategic Homeporting Project, Pensacola, Florida.

[Bold items enclosed in brackets denote changes from original text]

Wilkins, K. T., J. R. Wagner, and T. W. Allen, 1985, Hydrogeologic Data for the Sand-and-Gravel Aquifer in Southern Escarbia County, Florida: Northwest Florida Water Management District, Technical File Report *85-2.*

Wolfe, S.H., J. A. Reidenauer, and D. B. Means, 1988, *An* Ecological Characterization of the Florida Panhandle. U.S. Fish Wildl. Serv. Biol. 'Rep. 88(12); Minerals Manage. Serv. *OCS* Study\MMS *88-0063.*

[Bold items enclosed in brackets demote changes from original text]

APPENDIX A

SITE-SPECIFIC SAFETY PLAN

[Bold items enclosed in brackets denote changes from original text)

ecology and environnont. inc.

SITE SAFETY PLAN

Version 988

A. GENERAL INFORMATION

Projoct Title: Site 3-Tho Crash Crow Training Area Projoct No.: UH1203

TDD/Pan No.:

Projoct Manager: John Barksdale Projoct Dir.: John Dumeyer

Location(s): Crash Crow Training Area-Open area of land along tho southwoetorn border of Forrest Sherman Fiold

Prepared by: Hal Davis Date Prepared: 4-25-89

Approval by: Mary Hiller MW Dato Approvod: 5-5-89

Site Safety Officer Review: Dato Reviewed:

Scope/Objective of Work: Fiold Screening will include physical surveys, soil sampling, temporary well installation and groundwater sampling.

Proposed Dato of Field Activities: August 1989

Background Info: Complete: [X] Preliminary (No analytical data available) [ ]

Documentation/Summary:

Overall Chemical Hazard:	Serious [ ]	Moderate [ ]
	LOW [X]	Unknown [ ]
Overall Physical Hazard	Serious [ ]	Moderato [ ]
	LOW [X]	Unknown [ ]

B. SITE/WASTE CHARACTERISTICS

Waste Type(s):

Liquid [X]	Solid [ ]	Sludge [ ]	Gas/Vapor [X]

Characteristic(s):

Flammable/ Ignitable [X]	Volatil. [X]	Corrosive [ ]	Acutely Toxic [ ]
txplosive [X]	Reactive [ ]	Carcinogen [X]	Radioactive* [ ]

Other:

Physical Hazards:

Overhead [X]	Confined. Space [ ]	Below Grade [ ]	Trip/Fall [X]
Puncture [ ]	Burn [ ]	Cut [ ]	Splash [X]
Noise [X]	Other: Aircraft and vehicular traffic using Forrest Sherman Field.		

*Requires completion of additional form and special approval from tho Corporato Health/Safety group. Contact RSC or HQ.

Site History/Description and Unusual Features (see Sampling Plan for detailed description): Since 1955 Site 3 was used to train firefighters. During training approximately 30-50 gallons of JP-4, JP-5, AVGAS or lube oil was poured into unlined pita and ignited to simulate aircraft crash conditions. An additional 200 gallons of fuel per week were disposed of on-aft.. Soil borings did not reveal any free product contamination. Groundwater samples collected from three monitoring wells contained low levels of VOCs.

Locations of Chemicals/Wastes: Contamination is located below land surface.

Estimated Volume of Chemicals/Wastes: unknown

Site Currently in Operation **Yes:** [ ] **No:** [X]

C. HAZARD EVALUATION

List Hazards by Task (i.e., drum sampling, drilling, etc.) and number them. (Task numbers are cross-referenced in Section D)

Physical Hazard Evaluation:

1) Physical Surveys - Aircraft, Automobile hazards;

2) Temporary Monitoring Well Installation - Aircraft, Automobile Hazards, Uaing portable drill rig:

3) Soil Sampling - Uaing portable drill rig:

4) Decontamination Procedures - Using solvents.

Chemical Hazard Evaluation:

Compound	PEL/TWA	Route of Exposure	Acute Symptoms	Odor Threshold	Odor Description
Methylene chloride	500 ppm	Inh, Ing, Con	vertigo, chest pain	214 ppm	sweetish
chloroform	50 ppm	Inh, Ing, Con	head, vertigo	200 ppm	ether-like
Isopropyl Alcohol	400 ppm	" "	drowsiness, head.	7.5-200 ppm	rubbing alcohol
Nitric Acid	2 ppm	" "	corrosive	0.3-1 ppm	acrid
1,2-dichloroethane	50 ppm	Inh, Ing, Con	head, nau, vomit	6 ppm	sweetish
1,1-trichloroethane	350 ppm	Inh, Ing, Con	vomit, nausea	20-100 ppm	ether-like
1,1-dichloroethane	100 ppm	Inh, Ing, Con	CNS dep, drowsy	--	ether-like

Note: Complete and attach a Hazard Evaluation Shoot for major known contaminant.

D. SITE SAFETY WORK PLAN

Site Control: Attach map, use back of this pagm, or skmtch of site showing hot zone, contamination reduction, zone, etc.

Perimeter identified? [yes] Site secured? [no]

Work Areas Designated? [yes] Zone(s) of Contamination Identified? [no]

Personnel Protection (TLD badges required for all field personnel):

Anticipated Lovol of Protection (Cross-reference task numbers to Section C):

	A	B	C	D
Task 1				X
Task 2				X
Task 3				X
Task 4				X

(Expand if necessary)

Modifications: Modified level D with tyvock, neoprene gloves and boots, safety glasses, APR available when level C upgrade is necessary

Action Levels for Evacuation of Work Zone Pending Reassessment of Conditions:

- o Lovol D: O_2 <19.5% or >25%, explosive atmosphere >10% LEL, organic vapors above background levels, particulates > _____ mg/m^3, othor _____
- o Lovol C: O_2 <19.5% or >25%, explosive atmosphere ,252 LEL$_3$(California-20%), unknown organic vapor (in breathing zone) >5 ppm, particulates > _____ mg/m^3, other _____
- o Level B: O_2 <19.5% or >25%, explosive atmosphere >25% LEL (California-20%), unknown organic vapors (in breathing zone) >500 ppm, particulates > _____ mg/m^3, othor _____
- o Lovol A: O_2 <19.5% or >25%, explosive atmosphere >25% LEL (California-2021, unknown organic Vapors >500 ppm, particulates > _____ mg/m^3, othor _____

Air Monitoring (daily calibration unless otherwise noted):

contaminant of Interest	Typo of Samplm (area, personal)	Monitoring Equipment	Frequency of Sanpling
VOC's	Area	OVA	Continuous
Radiation	Area	Mini-Rad	Continuous
Explosive Gases	Area	O_2/Explosimeter	Continuous

(Expand if necessary)

Decontamination Solutions and Procedures for Equipment, Sampling Gear, mtc.:
Trisodium phosphate wash, tap wator rinse, isopropanol rinsm, distillmd wator rinse, isopropanol rinse, and final distillmd wator rinse.

Personnel Decon Protocol: Boot and glove wash - trisodium phosphate wash with clean water rinse. Expendables will bo double bagged and drummed for disposal. Field personnel vill take a hygienic shower, off-sit., following each day's fiold vork.

Decon Solution Monitoring Procoduros, if Applicable: Decontamination will be performed in a well-ventilated area upvind of tho sampling zone.

Special Site Equipment, Facilities, or Procoduros (Sanitary Facilities and Lighting Must Meet 29 CFR 1910.120):

All drilling safety procedures will be strictly adhered to as outlined in Attachment A.

Site Entry Procoduros and Special Considerations: E & E's "Buddy System" will bo employed at all times during fieldwork activities. Personnel will exercise caution in tho vicinity of Forrest Sherman Field and along nearby roadways. If above background radiation levels are encountered team members will evacuate tho sampling area, and contact tho corporate health physics group to reassess tho site.

Work Limitations (time of day, weather conditions, etc.) and Heat/Cold Stress Requirements:

All fieldwork activities vill bo performed during daylight hours. Team members vill take breaks as necessary to avoid heat stress and replace fluids. Cooling vests may bo used to prevent heat stress.

General Spill Control, if applicable: N/A

Investigation-Derived Material Disposal (i.e., expendables, decon vasto, cuttings):

All fieldwork waste materials will bo double bagged, drummed, labeled and transported to a designated location for final disposal by tho Navy.

Sample Handling Procoduros Including Protective Wear:

During a11 handling of samples, all fiold team members will wear surgical gloves. Goggles vill bo worn during sample preservation with acids.

Team Member*	Responsibility
Team members to bo determined	Team Leader
	Site Safety Officer/Sampler
	Geologist/Sampler

*All entries into exclusion zone require Buddy System use. All E & E fiold staff participate in medical monitoring program and have completed applicable training per 29 CFR 1910.120. Respiratory protoction program moots requirements of 29 CFR 1910.134, and ANSI Z88.2 (1980).

E. EMERGENCY INFORMATION

(Use supplemental shoots, if necessary)

LOCAL RESOURCES

(Obtain a local telephone book from your hotel, if possible.)

Ambulance On Base -- 904-452-4138, Off Base -- 911

Hospital Emergency Rooa NAS Dispensary - 904-452-2733, Baptist Hospital 904-434-4811 (Life Plight)

Poison Control Center

Police (include local, county sheriff, state) 911

Fire Department 911

Airpott

U.S. Coart Guard Eaorgoncy - 904-453-8178, General Information 904-453-8282

Laboratory E & E ASC 1-716-631-0360

Fed. Express 1-800-238-5355

Client Contact U.S. Navy Southern Division, Engineer-In-Charge, Mike Green — 1-803-743-0574

Site Contact NAS Pensacola Enviromental Coordinator, W. Dewayne Ray — 904-452-4515

SITE RESOURCES

Site Emergency Evacuation Alarm Method N/A

ıter Supply Source On-sit.

Telephone Location, Number To bo determined on-site

Cellular Hon, if available N/A

Radio

Other On-sit. warehouse number to bo determined

EMERGENCY CONTACTS

1. Dr. Rayaond Harbison (Univ. of Florida) ..... (501) 221-0465 or (9041 462-3277, 3281
   Alachua, Florida (501) 370-8263 (24 hours)

2. Ecology and Environment, Inc., Safety Director
   Paul Jonmaire ..... (716) 684-8060 (office)
   (716) 655-1260 (home)

3. Regional Office Contact ..... M.Miller.... 656-2854 homo)
   877-1978 office)

4. Office Manager .....R.Rudy..... 893-7245 homo)

MEDTOX HOTLINE

1. Twenty-four hour answering service: (501) 370-8263

   What to report:

   - State: "this is an emergency."
   - Your name, region, and site.
   - Telephone number to roach you.
   - Your location.
   - Name of person injured or exposed.
   - Nature of emergency.
   - Action taken.

2. A toxicologist, (Drs. Raymond Harbison or associate) will contact you. Repeat tho information given to tho answering service.

3. If e toxicologist door not return your call within 15 minutes, call tho following persons in order until contact is made:

   a. 24 hour hotline - (716) 614-0940
   b. Corporate Safety Director - Paul Jonmaire - home # (716) 655-1260
   c. Assistant Corp. Safety Officer - Steven Sherman - how # (716) 688-0084

EMERGENCY ROUTES

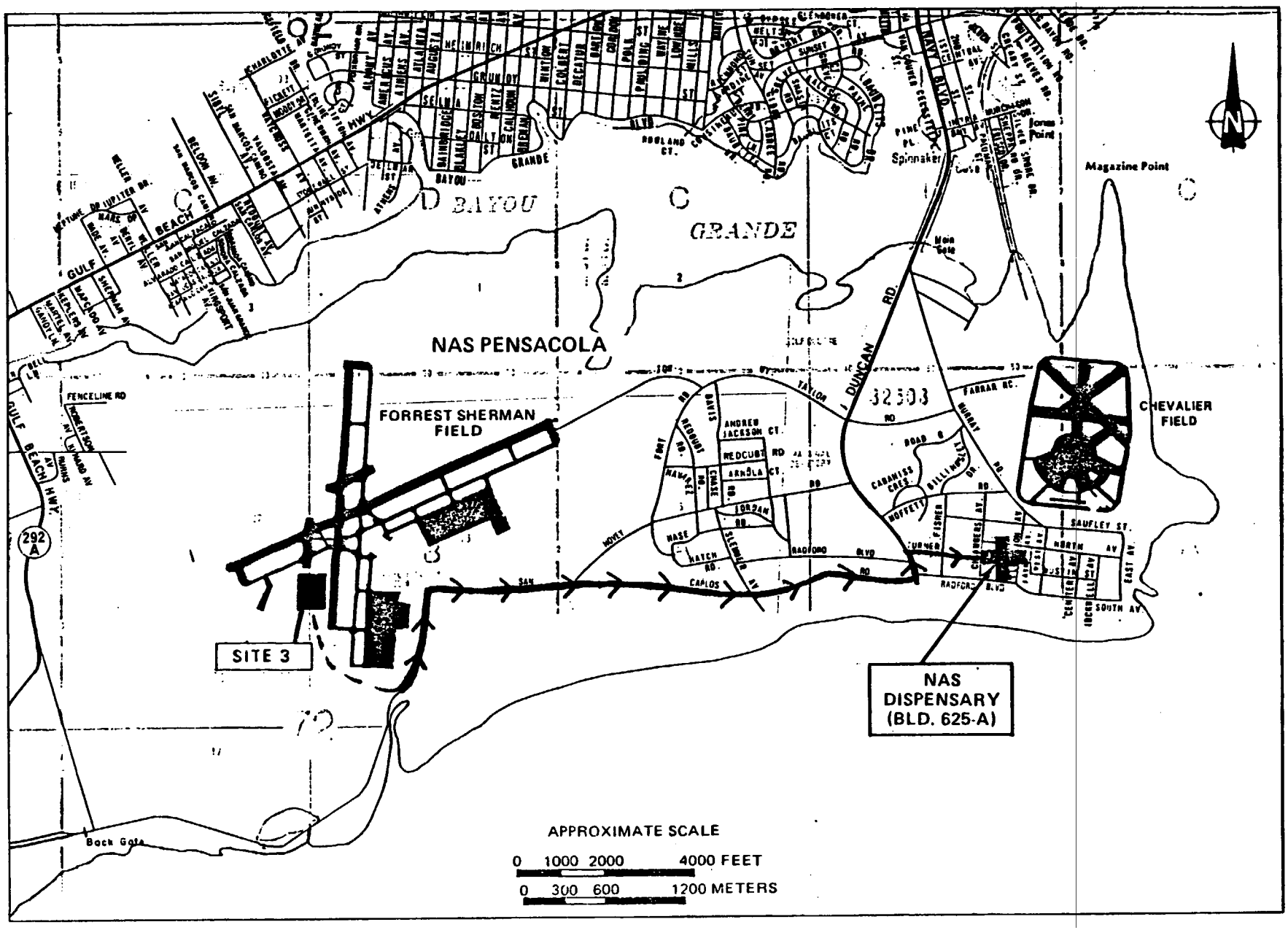
(NOTE: Field Teas rust Know Route(s) Prior to Start of Work)

Directions to hospital (include map)

MAS Dispensary - Take San Carlos Road east approximately two milos to Duncan Road. Turn loft (north) and follow Duncan Road approximately 1000 foot to Turner Stroot. turn right (east) on Turner Street and continuo to it's intersection with Ellyson Avonuo. The MAS Dispensary is located on tho northwest corner of tho intersection of Ellyson Avenue and Turner Stroot, in Building 625-A.

ital - Take Duncan Road (Navy Blvd.) north to exit tho base. Navy Blvd. becomes HWY 98 and curves to the east. Follow Navy Blvd./Hwy. 98 east approx. 3mi to Pace Blvd. Turn loft (north) on Pace Blvd. and proceed approx. 1mi to Cervantes St. (Hwy. 90). Turn right on Cervantes/Hwy. 90 and follow this road for about 8 blocks and turn loft (north) onto E street. Tho hospital is about 6 blocks north on tho loft.

Emergency Egress Routes to Got Off-Sit. Emergency egress routes will bo located if emergency exit routes become blocked by construction, otc.


NAS PENSACOLA
FORREST SHERMAN FIELD
CHEVALIER FIELD
SITE 3
NAS DISPENSARY (BLD. 625-A)
GRANDE BAYOU
Magazine Point
Spinnaker
Jones Point
Main Gate
Back Gate
GULF BEACH HWY.
DUNCAN RD.
TAYLOR RD.
FARRAR RD.
MOVEY
SAN CARLOS
BADFORD BLVD
SAUFLEY ST.
NORTH AV
SOUTH AV
EAST AV
FENCELINE RD
32503
APPROXIMATE SCALE
0 1000 2000 4000 FEET
0 300 600 1200 METERS

DRILL RIG SAFETY

- Hard hats must be worn.
- All team members must be know the procedure to shut the rig off and the location of the "kill" switch.
- When moving a rig off the road, pay attention to obstacles in route of travel. Walk the intended route first.
- Have someone guide the rig driver when clearance is at a minimum or when hazards are in close proximity.
- Set rig brakes and block the wheels when rig is set up at the desired drilling location.
- The mast must be lowered when the rig is moved.
- Always consider overhead wires to be live, watch for sagging lines and do not operate rig within 15 feet of overhead lines.
- Hake sure the site, platforms and walkways are free of obstructions.
- Make sure proper housekeeping is practiced around and on the rig at all times. Tools should be stored in a manner that permits convenient access and provides for adequate safety.
- Store gasoline in approved containers that have a spark arrestor and keep them clear of the drilling work area.
- Check rig equipment prior to starting work. Repair or replace faulty and worn items.
- Handle augers with care. Use proper lifting techniques when picking up samplers and augers. Use a tool hoist if possible and stay clear of rotating augers. Keep cables and ropes secured when not in use.
- Level and stabilize the drill rig prior to raising the mast.
- Watch for slippery ground when working in the area of the rig.
- All unattended boreholes must be properly covered.
- Do not drill during an electrical storm.
- Maintain a safe distance from the rig mechanisms during drive sampling and auger removal operations.

ECOLOGY AND ENVIRONMENT, INC.,
STANDARD OPERATING PROCEDURES FOR
EMERGENCIES DUE TO HEAT AND HEAT STRESS MONITORING

Field operations during the summer months can create a variety of hazards to the employee. Heat cramps, heat exhaustion. and heat stroke can be experienced and, If not remedied, can threaten life or health. Therefore, It Is important that all employees be able to recognize symptoms of these conditions and be capable of arresting the problem as quickly as possible.

THE EFFECTS OF HEAT

As the result of normal oxidation processes within the body, a predictable amount of heat is generated. If the heat Is liberated as It Is formed, there Is no change in body temperature. If the heat Is liberated more rapidly, the body cools to a point at which the production of heat Is accelerated and the excess is available to bring the body temperature back to normal.

Interference with the elimination of heat leads to its accumulation and thus to the elevation of body temperature. As a result, the person Is said to have a fever. When such a condition exists, it produces a vicious cycle In which certain body processes speed up and generate additional heat. Then the body must eliminate not only the normal but also the additional quantities of heat.

Heat produced within the body is brought to the surface largely by the bloodstream and escapes to the cooler surroundings by conduction and radiation. If air movement or a breeze strikes the body, additional heat Is lost by convection. However, when the temperature of the surrounding air becomes equal to or rises above that of the body, all of the heat must be lost by vaporization of the moisture or sweat from the skin surface. As the air becomes more humid (contains more moisture), vaporiration from the skin slows down. Thus, on a day when the temperature Is 95 to 100°F, with high humidity and little or no breeze, conditions are ideal for the retention of heat within the body. It is on such a day or, more commonly, a succession of such days (a heat wave) that medical emergencies due to heat are likely to occur. Such emergencies are classified in three categories: heat cramps, heat exhaustion, and heat stroke.

HEAT CRAMPS

Heat cramps usually affect people who work in hot environments and perspire a great deal. Loss of salt from the body causes very painful cramps of the leg and abdominal muscles. Heat cramps also may result from drinking iced water or other drinks either too quickly or in too large a quantity.

<u>Heat Cramp Symptoms.</u> The symptoms of heat cramp are:

- Muscle cramps in legs and abdomen,
- Pain accompanying the cramps,
- Faintness, and
- Profuse perspiration.

Heat Cramp Emergency Care. Remove the patient to a cool place. Give him sips of liquids such as "Gatorade" or its equivalent. Apply manual pressure to the cramped muscle. Remove the patient to a hospital if there is any indication of a more serious problem.

HEAT EXHAUSTION

Heat exhaustion occurs in individuals working in hot environments, and may be associated with heat cramps. Heat exhaustion is caused by the pooling of blood in the vessels of the skin. The heat is transported from the interior of the body to the surface by the blood. The blood vessels in the skin become dilated and a large mount of blood is pooled in the skin. This condition, plus the blood pooled in the lower extremities when an individual is in an upright position, may lead to an inadequate return of blood to the heart and eventually to physical collapse.

Heat Exhaustion Symptoms. The symptoms of heat exhaustion are:

- Weak pulse:
- Rapid and usually shallow breathing:
- Generalized weakness;
- Pale, clammy skin;
- Profuse perspiration;
- Dizziness;
- Unconsciousness; and
- Appearance of having fainted (the patient responds to the same treatment administered in cases of fainting).

Heat Exhaustion Emergency Care. Remove the patient to a cool place and remove as much clothing as possible. Administer cool water, "Gatorade," or its equivalent, If possible, fan the patient continually to remove heat by convection. but do not allow chilling or overcooling. Treat the patient for shock, and remove him to a medical facility if there is any indication of a more serious problem.

HEAT STROKE

Heat stroke is a profound disturbance of the heat-regulating mechanism, associated. with high fever and collapse. Sometimes this condition results in convulsions, unconsciousness, and even death. Direct

exposure to sun, poor air circulation, poor physical condition,. and advanced age (over 40) bear directly on the tendency to heat stroke. It is a serious threat to life and carries a 200 mortality rate. Alcoholics are extremely susceptible.

Heat Stroke Symptoms. The symptoms of heat stroke are:

- Sudden onset;
- Dry, hot, and flushed skin:
- Dilated pupils;
- Early loss of consciousness;
- Full and fast pulse;
- Breathing deep at first, later shallow and even almost absent;
- Muscle twitching. growing into convulsions; and
- Body temperature reaching 105 to 106°F or higher.

Heat Stroke Emergency Care. Remember that this is a true emergency. Transportation to a medical facility should not be delayed. Remove the patient to a cool environment if possible, and remove as much clothing as possible. Assure an open airway. Reduce body temperature promptly--preferably by wrapping in a wet sheet or else by dousing the body with water. If cold packs are available, place them under the arms. around the neck, at the ankles, or at any place where blood vessels that lie close to the skin can be cooled. Protect the patient from injury during convulsions, especially from tongue biting.

AVOIDANCE OF HEAT-RELATED EMERGENCIES

Please note that, in the case of heat cramps or heat exhaustion, "Gatorade" or its equivalent is suggested as part of the treatment regime. The reason for this type of liquid refreshment is that such beverages will return much-needed electrolytes to the system. Without these electrolytes, body systems cannot function properly, thereby increasing the represented health hazard. Therefore, when personnel are working in situations where the ambient temperatures and humidity are high--and especially in situations where protection Levels A B, and C are required--the site safety officer must:

- Assure that all employees drink plenty of fluids ("Gatorade" or its equivalent):
- Assure that frequent breaks are scheduled so overheating does not occur; and
- Revise work schedules, when necessary, to take advantage of the cooler parts of the day (i.e., 5:00 a.m. to 1:00 p.m., and 6:00 p.m. to nightfall).

If protective clothing must be worn, especially Levels A and 8, the suggested guidelines for ambient temperature arid maximum wearing time per excursion are:

Ambient Temperature (°F)	Maximum Wearing Time per Excursion (Minutes)
Above 90	15
85 to 90	30
80 to 85	60
70 to 80	90
60 to 70	120
50 to 60	180

One method of measuring the effectiveness of employees' rest-recovery regime is by monitoring the heart rate. The "Brouha guideline" is one such method:

- During a three-minute period, count the pulse rate for the last 30 seconds of the first minute, the last 30 seconds of the second minute, and the last 30 seconds of the third minute.

- a Double the count.

If the recovery pulse rate during the last 30 seconds of the last minute is at 110 beats/minute or less and the deceleration between the first, second, and third minutes is at least 10 beats/minute, the work-recovery regime is acceptable. If the employee's rate is above that specified, a longer rest period is required, accompanied by an increased intake of fluids.

0000129

Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

Mallinckrodt provider the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. Individuals receiving this information must exercise their independent judgment in determining its appropriatenessfor a particularpurpose.

Mallinckrodt makes no representations, or warranties, either express or implied, of merchantability, fitness lor a particular purpose with respect to the information set forth herein or to the product to whkh the information refers. Accordingly, Mallinckrodt will not be responsible for damages resulting from use of or reliance upon this information.

Mallinckrodt, Inc., Science Products Division. P.O.Box M, Paris, KY 43061.

ISOPROPYL ALCOHOL

PRODUCT IDENTIFICATION;

Synonyms: 2-propanol; sec-propyl alcohol; isopropanol

Formula CAS No.: 67-63-0

Molecular Weight: 60.10

Chemical Formula: $(CH_3)_2$ CHOH

Hazardous Ingredients: Not applicable.

PRECAUTIONARY MEASURES

WARNING! FLAMMABLE LIQUID. HARMFUL IF SWALLOWED OR INHALED. AFFECTS CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION.

Keep away from heat, sparks and flame.
Keep container closed.
Use with adequate ventilation.
Avoid breathing vapor.
Wash thoroughly after handling.
Avoid contact with eyes, skin and clothing.

EMERGENCY/FIRST AID

If swallowed, give water to drink. Induce vomiting if medical help is not immediately available. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. In all cases call a physician.

SEE SECTION 5.

DOT Hazard Class: Flammable Liquid

SECTION 1 Physical Data

Appearance: Clear. colorless liquid.

Odor: Rubbing alcohol.

Solubility. Infinite in water.

Boiling Point: 82°C (180°F).

Melting Point: -89°C (-128°F).

Specific gravity: 0.79

Vapor Density (Air = 1): 2.1

Vapor Pressure (mm Hg): 33 @ 20°C (68°F)

Evaporation Rate: (n-BUAC = 1) 2.83

SECTION 2 Fire and Explosion Information

Fire:
Flammable Liquid
Flashpoint: 12°C (53°F). (closed cup).
Autoignition temperature: 399°C (750°F).
Flammable limits in air, % by volume:
lel: 2.0; uel: 12.0.

Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with strong oxidizers may cause fire or explosion.

Fire Extinguishing Media:
Water spray, dry chemical, alcohol foam, or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

Special Information:
In the event of a fire, wear full protective clothing and MOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Water may be used to flush spills away from exposures and to dilute spills to non-flammable mixtures. Vapors can flow along surfaces to distant ignition source and flash back.

SECTION 3 Reactivity Data

Stability:
Stable under ordinary conditions of use and storage. Heat and sunlight can contribute to instability.

Hazardous Decomposition Products:
Toxic gases and vapors such as carbon monoxide may be released in a fire involving isopropyl alcohol.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Heat, flame. strong oxidizers, acetadehyde, chlorine, ethylene oxide, hydrogen-palladium combination, hydrogen peroxide-sulfuric acid combination. potassium tert-butoxide, hypochlorous acid, isocyanates, nitroform, phosgene, oleum and perchloric acid.

SECTION 4 Leak/Spill Disposal Information

Remove all sources of ignition. Ventilate area of leak or spill. Clean-up personnel require protective clothing and respiratory protection from vapors. Small spills may be absorbed on paper towels and evaporated in a fume hood. Allow enough time for fumes to dear hood. then ignite paper in a suitable location away from combustible materials. Contain and recover liquid for reclamation when possible. Larger spills. and lot sizes can be collected as hazardous waste and atomized in a suitable RCRA approved combustion chamber, or absorbed with vermiculite, dry sand, earth or similar material for disposal as hazardous waste in a RCRA approved facility.

Ensure compliance with local, state and federal regulations.

NFPA Ratings: Health: 1 Flammability: 3 Reactivity: 0

0010130

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Inhalation:
May cause irritation of the nose and throat. Exposure to high concentrations has a narcotic effect, producing symptoms of drowsiness, headache, staggering, unconsciousness and possibly death.

Ingestion:
May cause drowsiness, unconsciousness, and death. Gastrointestinal pain, cramps, nausea, vomiting, and diarrhea may also result. The single lethal dose for a human adult = about 250 mls (SAX Sixth Edition).

Skin Contact:
H u a defatting action of the skin that can causa irritation. May cause irritation with a stinging effect and burning sensation.

Eye Contact:
Vapors may irritate the eyes. Splashes may cause severe irritation. possible corneal burns a d eye damage.

Chronic Exposure:
Prolonged contact with skin may cause mild irritation, drying, cracking, or contact dermatitis may develop.

Aggrevation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

B. FIRST AID

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:
Give water to drink. Induce vomiting if medical help not is immediately available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Exposure:
Remove m y contaminated clothing. Wash skin with soap or mild detergent and water for at least 15 minuter Get medical attention if irritation develops or persists.

Eye Exposure:
Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS, 1982)

Oral rat LD50: 5840 mg/kg. Skin rabbit LD50: 13 gm/kg. Inhalation rat LC50: 16000 ppm/8H. Mutation references cited Aquatic Toxicity rating TLm96: 1000-10 ppm.

SECTION 6 Occupational Control Measures

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
400 ppm (TWA).
-ACGIH Threshold Limit Value (TLV):
400 ppm (TWA); 500 ppm (STEL).

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation b generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

Personal Respirators: (NIOSH Approved)
If the TLV is exceeded a full facepiece chemical cartridge respirator may be worn, in general, up to the maximum use concentration specified by the respirator supplier. Alternatively, a supplied air full facepiece respirator or airlined hood may be worn.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Contact lenses should *not* be worn when working with this material Maintain eye wash fountain and quick-drench facilities in work area.

SECTION 7 Storage and Special Information

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outride or detached storage is preferred. Separate from oxidizing materials. Containers should be bonded a d grounded for transfers to avoid static sparks. Storage and use areas should be NO Smoking areas. Use non-sparking type tools and equipment.

Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

Mallinckrodt provides the information [illegible]ined herein in good faith but makes no representation as to its com[illegible]aiveness or accuracy. Individuals receiving this information [illegible] exercise their independent judgment in determining its appropriat[illegible], for a particular purpose.

Mallinckrodt makes no representations, or warranties, eit[illegible]ress or implied, of merchantability, fitness for a particular purpo[illegible]espect to the information set forth herein or to the product to which the [illegible]mation refers. Accordingly, Mallinckrodt will not be responsible for [illegible]ges resulting from use of or reliance upon this information.

Mallinckrodt, Inc., Science Products Division, P.O. Box M, Paris, KY 43061.

NITRIC ACID, 70%

PRODUCT IDENTIFICATION:

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 70%

Formula **CAS No.: 7697-37-2**

Molecular Weight: 63.00

Chemical Formula: **HNO_3**

Hazardous Ingredients: **Not** Applicable

PRECAUTIONARY MEASURES

DANGER! STRONG OXIDIZER CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

Do not get in eyes, on skin, or **on** clothing,
Avoid breathing mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep from contact with clothing and other combustible materials.
Do not store near combustible materials.
Store in a tightly closed container.
Remove and wash contaminated clothing promptly.
This substance **is** classified **as** a **POISON** under the Federal Caustic Poison Act.

EMERGENCY/FIRST AID

In **case of** contact, immediately flush **skin** or **eyes with** plenty **of water** for at least **15 minutes. If** swallowed, **DO NOT** INDUCE VOMITING! Give large quantities of water or milk if available. Sever give **anything** by mouth to an unconscious person. If inhaled, remove to fresh air. **If not** breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases tall a physician.
JEE **SECTION 5.**

DOT Hazard **Class:** Oxidizer

SECTION 1 Physical Data

Appearance: Clear, colorless to slightly yellow liquid.

Odor: Suffocating acrid.

Solubility: Infinite in water.

Boiling Point: 122°C (252°F)

Melting **Point:** -34°C (-29°F)

Specific **Gravity:** 141

Vapor Density (Air = 1): 2-3 approximately

Vapor **Pressure** (mm Hg): 62 **@ 20°C (68°F)**

Evaporation Rate: **NO** information found.

SECTION 2 Fire sod Explosion Information

Fire:
Not combustible, but substance **is** a strong oxidizer and **its** h u t of reaction with **reducing** agents or combustibles may **cause** ignition. Can react with metals to release flammable hydrogen **gas.**

Explosion:
Reacts explosively with combustible organic or readily oxidizable materials such **as:** alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc.

Fire Extinguishing Media:
If involved in a **fire,** use water spray.

Special Information:
Increases the flammability of combustible, organic and readily oxidizable materials. **In** the event of fire, **wear** full **protective** clothing and NIOSH-approved self-contained breathing apparatus with **full** facepiece operated io the pressure demand or other positive pressure **mode.**

SECTION 3 Reactivity Data

Stability:
Stable under ordinary conditions of use and storage Containers may burst when heated

Hazardous Decomposition Products:
When **heated** to decomposition, emits **toxic** nitrogen **oxides** fumes and hydrogen nitrate. Will react **with** water or steam to produce b u t and toxic **and corrosive** fumes.

Hazardous Polymerization:
Will not occur.

Incompatibilities
A dangerously **powerful** oxidizing **agent,** concentrated nitric acid **is** incompatible with most substances, **especially** strong bases, metallic **powders,** carbides, **hydrogen** sulfide, turpentine, and combustible organics.

SECTION 4 Leak/Spill Disposal Information

Isolate or enclose the area of the leak or **spill.** Clean-up personnel should wear protective clothing and respiratory equipment suitable for toxic or corrosive fluids or vapors.
Small Spills: flush **with** water and neutralize with **alkaline material** (*soda* ash, lime, etc.). Sewer with **excess** water.
Larger spills **and lot sizes:** Neutralize with **alkaline** material, pick up with **absorbent** material (sand, earth, vermiculite) **and dispose in** RCRA-approved waste facility or sewer **the neutralized slurry** with **excess** water if local ordinances allow.
Provide foxed ventilation to dissipate fumes.

Reportable Quantity (RQ) (CWA/CERCLA) : 1000 **lbs.**

Ensure compliance with local, state and federal regulations.

NFPA Ratings: Health 3 flammability 0 Reactivity 0 Other: Oxidizer

0001131

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Inhalation:
Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.

Ingestion:
Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.

Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.

Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Splashes may cause severe burns and permanent eye damage.

Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.

Aggrevation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

B. FIRST AID

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Exposure:
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 reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye Exposure:
Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS, 1982)

Inhalation (Rat) LC50: 244 ppm
(NO_2)/30M

SECTION 6 Occupational Control Measures

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
2 ppm (TWA)
-ACGIH Threshold Limit Value (TLV):
2 ppm (TWA); 4ppm (STEL)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it a n control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

Personal Respirators: (NIOSH Approved)
If the TLV is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and canisters that contain oxidizable materials, such as activated charcoal.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or / full face shield where splashing b possible. Contact lenses should not be worn when working with this material. Maintain eye wash fountain and quick-drench facilities in work area.

SECTION 7 Storage and Special Information

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect from physical damage and direct sunlight. Isolate from incompatible substances. Protect from moisture.

Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

Mallinckrodt provides the information contained herein in good faith but makes no representations as to its comprehensiveness or accuracy. Individuals receiving this information must exercise their independent judgment in determining its appropriateness for a particular purpose.

Mallinckrodt makes no representations, or warranties, either express or implied, of merchantability, fitness for a particular purpose with respect to the information set forth herein or to the product to which the information refers. Accordingly, Mallinckrodt will not be responsible for damages resulting from use of or reliance upon this information.

Mallinckrodt, Inc., Science Products Division. P.O. Box M, Paris, KY 43061.

SULFURIC ACID 96%

PRODUCT IDENTIFICATION:

Synonyms: Oil of Vitriol

Formula CAS No.: 7664-93-9

Molecular Weight: 98.07

Chemical Formula: H_2SO_4

Hazardous Ingredients: Not applicable.

PRECAUTIONARY MEASURES

DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

Do not get in eyes, on skin, or on clothing.
Do not breathe mist.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
This substance is classified as a POISON under the Federal Caustic Poison Act.

EMERGENCY/FIRST AID

In all cases call a physician. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. If swallowed, DO NOT INDUCE VOMITING! Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
SEE SECTION 5.

DOT Hazard Class: Corrosive Material

SECTION 1 Physical Data

Appearance: Colorless, oily liquid.

Odor: Odorless.

Solubility: Infinite @ 20°C.

Boiling Point: ca. 310°C (590°F)

Melting Point: ca. -14% (6°F).

Specific Gravity: 1.84

Vapor Density (Air = 1): < 0.3 @ 25°C (77°F)

Vapor Pressure (mm Hg): 1 @ 146°C (250°F).

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

Fire:
Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Reacts with most metals releasing flammable, potentially explosive hydrogen gas.

Explosion:
Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition.

Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

SECTION 3 Reactivity Data

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:
Toxic fumes of oxides of sulfur. Will react with water or steam to produce toxic and corrosive fumes. Reacts with carbonates to generate carbon dioxide gas, and with cyanides and sulfides to form poisonous hydrogen cyanide and hydrogen sulfide respectively.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Water, bases, organic material, halogens, metal acetylides, oxides and hydrides, strong oxidizing and reducing agents and many other reactive substances.

SECTION 4 Leak/Spill Disposal Information

Dike and cover leaking or spilled liquid with dirt, vermiculite, kitty-litter or other inert absorbent. Cover spill with sodium bicarbonate or soda ash and mix. Clean-up personnel require protective clothing and respiratory protection from vapors and mists. Neutralized waste may be containerized and disposed in a RCRA approved waste disposal facility. Flush area of spill with dilute soda ash solution and discard to sewer.

Reportable Quantity (RQ)(CWA/CERCLA): 1000 lbs.

Ensure compliance with local, state and federal regulations.

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 2 Other: Water reactive

0000132

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Inhalation:
Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. May cause lung edema. Symptoms may include irritation of the nose and throat, and labored breathing.

Ingestion:
Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach, leading to death. Can cause sore throat, vomiting, diarrhea.

Skin Contact:
Corrosive. Symptoms of redness, pain, and severe burn can occur.

Eye Contact:
Corrosive. Splashes can cause blurred vision, redness, pain and severe tissue burns.

Chronic Exposure:
Long-term exposure to mist or vapors may cause damage to teeth.

Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

B. FIRST AID

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:
If swallowed, DO NOT induce vomiting. Give large quantities of water or milk if available. Call a physician immediately. Never give anything by mouth to an unconscious person.

Skin Exposure:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician.

Eye Exposure:
Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS, 1982)

Oral rat LD50: 2140 mg/kg. Inhalation Guinea Pig LC50: 18 mg/m^3.

SECTION 6 Occupational Control Measures

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
1 mg/m^3 (TWA).
-ACGIH Threshold Limit Value (TLV):
1 mg/m^3 (TWA).

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, 'Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

Personal Respirators: (NIOSH Approved)
If the TLV is exceeded a full faceplece chemical cartridge respirator may be worn, in general, up to 100 times the TLV or the maximum use concentration specified by the respirator supplier, whichever is less. Alternatively, a supplied air full faceplece respirator or airlined hood may be worn.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material. Maintain eye wash fountain and quick-drench facilities in work area.

SECTION 7 Storage and Special Information

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, always add the acid to water; never add water to the acid.

recycled paper

1,1,2-TRICHLOROETHANE

ecology and environment

The information in this sheet applies to workplace exposure resulting from processing, manufacturing, storing or handling and is not designed for the population at large. Any generalization beyond occupational exposures should not be made. The best industrial hygiene practice is to maintain concentrations of all chemicals at levels as low as is practical.

Chemical Names: Ethane trichloride; beta-trichloroethane: 1,2,2-trichloroethane; vinyl trichloride; NCI-C04579; CAS 79-00-5.

Trade Names: Beta-T.

Uses: As an intermediate in the production of vinylidine chloride: as a solvent for fats, waxes, and natural resins: and as a component of adhesives.

PHYSICAL INFORMATION

Appearance: Colorless liquid.

Odor: Chloroform-like, sweet.

Evaporation: Moderate. Vapors are heavier than air and tend to sink.

Behavior In Water: Only slightly soluble: sinks.

HEALTH HAZARD INFORMATION

OSHA Standard: Average 8 hour exposure -- 10 ppm.

NIOSH Recommended Limit: Average 10 hour day/40 hour week -- 10 ppm.

ACGIH Recommended Limit: Average 8 hour exposure -- 10 ppm.

Short Term Exposure:

Inhalation: Inhalation may produce headache, lassitude, dizziness, incoordination, low blood pressure, irregular heart beat, coma and death from respiratory arrest. Exposure to vapor concentrations near 2000 ppm for 5 minutes causes central nervous system depression and anesthetic effects. Symptoms are nasal irritation, drowsiness and equilibrium disturbances. Death may result from 13,600 ppm for 2 hours.

Skin: May Cause irritation and chemical burns if allowed to remain on the skin for a prolonged period. May be absorbed through the skin to cause or increase the severity of symptoms listed above.

Eyes: May cause irritation.

Ingestion: May cause effects similar to those listed under inhalation. Liver and kidney damage have occurred in animals. Laboratory studies with animals suggests that the probable lethal dose for humans is about 12 ounces.

Long Term Exposure:

Inhalation may cause liver and kidney damage. Has caused cancer in laboratory animals. Whether it does so in humans is unknown.

*Prepared by the Bureau of Toxic Substance Assessment, New York State Department of Health. For an explanation of the terms and abbreviations used, see "Toxic Substances: How Toxic Is Toxic", available from the New York State Department of Health.

EMERGENCY AND FIRST AID INSTRUCTIONS

Inhalation: Move to fresh air and perform artificial respiration if necessary. Keep warm and at rest. Get medical attention.

Skin: Remove contaminated clothing. Wash skin with soap or mild detergent and plenty of water for at least 15 minutes. Seek medical attention if necessary.

Eyes: Wash vith water for 15 minutes. Seek medical attention.

Ingestion: Do not induce vomiting. Seek medical attention immediately.

FIRE AND EXPLOSION INFORMATION

General: Not flammable under normal conditions.

Explosive Limits: Upper -- 15.5%, lower -- 6.0%. (High energy ignition source required.)

Extinguisher: water fog, foam, carbon dioxide, dry chemical.

REACTIVITY

Materials to Avoid: Fire and explosion may result from reaction vitb strong oxidizers such as peroxides and permanganates; strong caustics such as potassium hydroxide and sodium hydroxide and chemically active metals such as aluminum, magnesium powders, and potassium. Liquid will attack some forms of plastic, rubber and coatings.

Conditions to Avoid: When decomposed by hot metals, ultraviolet radiation, acids or acid fumes, highly toxic hydrogen chloride gas and small amounts of phosgene and carbon monoxide fumes are evolved. Open flames, welding arcs or other high temperature sources which induce thermal decomposition should be avoided.

PROTECTIVE MEASURES

Storage and Handling: Store in a cool, dry and dark place. Do not store in aluminum containers. Contaminated clothing should be placed in closed containers until it can be discarded or 'cleaned.

Engineering Controls: Provide proper ventilation. Sinks, showers and eyewash stations should be easily available.

Protective Clothing (Shou d not be substituted for proper handling and engineering controls) Splash-proof goggles, impervious clothing, gloves (not leather), and face shield. Wash clothing before reuse; it may not be possible to clean contaminated leather.

Protective Equipment: For any detectable levels use a self-contained breathing apparatus with a full facepiece and operated in a positive pressure mode or a combination Type C supplied-air respirator vith an auxiliary self-contained breathing apparatus, both with a full facepiece and operated in a positive pressure mode. For fire fighting use a self-contained breathing apparatus with a full facepiece operated in a positive pressure mode. For escape use a gas mask providing protection against organic vapors or an escape self-contained breathing apparatus.

PROCEDURES FOR SPILLS AND LEAKS

Warn other workers of spill. Put on proper protective clothing and equipment. Ventilate the area. Mop, wipe or soak up immediately in absorbent material such as vermiculite or dry sand and move to safe place out-of-doors. Contain liquid, transfer to closed metal containers. For final disposal, contact your regional office of the New York State Department of Environmental Conservation.

For more information:
Contact the Industrial Hygienist or Safety Officer at your worksite or the New Yotk State Department of Health, Bureau of Toxic Substance Assessment, 2 University Place, Albany, New York 12203.

1,2-DICHLOROETHANE

The information in this sheet applies to workplace exposure resulting from processing, manufacturing, storing or handling and is not designed for the population at large. Any generalization beyond occupational exposures should not be made. The best industrial hygiene practice is to maintain concentrations of all chemicals at levels as low as is practical.

Chemical Names: Ethylene dichloride; 1,2-ethylene dichloride; 1,2-bichloroethane; alpha, beta-dichloroethane; symdichloroethane; dichloroethylene; CAS 107-06-2.

Trade Names: Freon 150, EDC.

Uses: As a lead scavenger in gasoline: in anti-knock mixtures; fumigant for grain, upholstery and carpets; ar a degreaser, as a solvent for fats. oils, waxes, gums, and resins; in the manufacture of acetyl cellulose: present in paint removers, vetting and penetrating agents, soaps and scouring compounds; in tobacco extract; as plastic cement and others.

PHYSICAL INFORMATION

Appearance: Clear, colorless,. oily liquid.

Odor: Sweetish. **Minimum Detectable By Odor:** 6 ppm.

Evaporation: Rapid.

Behavior In Water: Slightly soluble, sinks.

HEALTH HAZARD INFORMATION

OSHA Standard: Average 8 hour expoaure -- 50 ppm.

NIOSH Recommended Limit: Average 10 hour day/40 hour week -- 1 ppm.

ACGIH Recommended Limit: Average 8 hour exposure -- 10 ppm.

Short Term Exposure:

Inhalation: Levels of 10 to 30 ppm may cause dizziness, nausea, and vomiting. Levels up to SO ppm may cause weakness, trembling, headaches, abdominal cramps, liver and kidney damage, and fluid build up in lungs. nay causa coma and death at high levels.

Skin: Prolonged contact may cause irritation and skin rashes.

Eyes: May cause redness, pain, and blurred vision. Vapor can damage the cornea.

Ingestion: Ingestion of 2 ounces has resulted in nausea, vomiting, faintness, drowsiness, difficulty breathing, pale skin, internal bleeding, kidney damage, and death due to respiratory failure. Other possible symptoms nay include abdominal spasms, severe headache, lethargy, lowered blood pressure, diarrhea, shock, physical collapse. and coma.

Long Term Exposure:

May cause eye, nose and throat irritation, nausea, vooiting, loss of appetite, nerve damage, liver and kidney damage. This substance has been determined to cause cancer in laboratory animals. Whether it does so in humans is not known.

*Prepared by the Bureau of Toxic Substance Assessment, New York State Department of Health. For an explanation of the terms and abbreviations used, see "Toxic Substances: How Toxic Is Toxic", available from the New York State Department of Health.

EMERGENCY AND FIRST AID INSTRUCTIONS

Inhalation: Move to fresh air. Give oxygen or artificial respiration as necessary. Seek medical attention-

Skin: Remove contaminated clothing, Wash affected areas with soap and water. See medical attention.

Eyes: Wash with plenty of water lifting eyelids occasionally. Seek medical attention,

Ingestion: If conscious, give plenty of water and induce vomiting. Seek medical attention,

FIRE AND EXPLOSION INFORMATION

General: Highly flammable- Flashbacks can occur along vapor trail.

Explosive Limits: Upper -- 15.9%, lower -- 6.21.

Extinguisher: Dry chemical, foam, carbon dioxide. Water can be used to cool fir exposed containers.

REACTIVITY

Materials to Avoid: Reacts violently witb strong caustics such as lye or potassi hydroxide and oxidizers such as potassium permanganate; may react with alumin to form compounds sensitive to mechanical shock. Explosions have occurred on contact with dimethylaminopropylamine or with mixtures of liquid ammonia.

Conditions to Avoid: Heat, sources of ignition. May produce highly toxic fumes phosgene when heated,

PROTECTIVE MEASURES

Storage and Handling: Dry, explosion-proof room, separated from oxidizers.

Engineering Controls: Use in closed system, if possible. Provide adequate ventilation. Use spark-proof tools and electrical equipment. Sinks, showers and eyewash stations should be readily available.

Protective Clothing (Should not be substituted for proper handling and engineerir controls): Paceshield, Viton gloves and protective clothing.

Protective Equipment: For any detectable levels use salf-contained breathing apparatus with a full facepiece operated in a positive pressure mode or a combination Type C suppLed-air respirator and an auxiliary self-contained breathing apparatus, both with a full facepiece and oprated in a positive pressure mode. For escape from a contaminated area use a gas mask with an organic vapor canister or an escape self-contained breathing apparatus.

PROCEDURES FOR SPILLS AND LEAKS

Warn other workers of spill. Put on proper protective clothing and equipment. Eliminate all sources of ignition, Ventilate area, absorb on vermiculite or othe suitable material. Collect liquid into sealable containers. Small amounts can be allowed to evaporate out of doors or in a laboratory hood. For disposal of large amounts, contact your regional office of the New York State Department of Environmental Conservation.

For more information:
Contact the Industrial Hygienist or Safety Officer at your worksite or the N York State Department of Health, Bureau of Toxic Substance Assessment, 2 University Place, Albany, New York 12203.

ecology and environment

recycled paper

Chemical Fact Sheet*

Version 3

CHLOROFORM

The information in this sheet applies to workplace exposure resulting from processing, manufacturing, storing or handling and is not designed for the population at large. Any generalization beyond occupational exposures should not be made. The best industrial hygiene practice is to maintain concentrations of all chemicals at levels as low as is practical.

Chemical Names: Trichloromethane, methyl trichloride, trichloroform methane, trichloroform, ; CAS 67-66-3.

Trade Names: Freon 20, R20 and others.

Uses: Refrigerant, extracting agent for penicillin and pharmaceuticals, in the manufacture of plastics and synthetic fibers, solvent, anesthetic.

PHYSICAL INFORMATION

Appearance: Clear, colorless liquid.

Odor: Ether-like. **Minimum Detectable by Odor**: 200 ppm.

Evaporation: Rapid, fumes generally heavier than air.

Behavior in Water: Only very slightly soluble; sinks.

HEALTH HAZARD INFORMATION

OSHA Standard: 50 ppm.

NIOSH Recommended Limit: 2 ppm.

ACGIH Recommended Limit: Average 8 hout exposure -- 10 ppm.

Short Term Exposure:

Inhalation: Symptoms are generally not observed at exposures below 90 ppm for minutes.. Effects may include headaches, pounding heart, dizziness, slowed reactions, unconsciousness, coma and death. Delayed effects of exposure which may not occur for up to 24 hours can include cramps, muscle tremors, jaundice, profuse sweating, liver damage, coma and death.

Skin: Can cause reddening of the skin, followed by blistering and chemical burns on prolonged contact.

Eyes: Vapors may cause stinging sensation. Splashes may cause pain, burninq, redness and damage to tissues.

Ingestion: May cause nausea, vomiting and other symptoms as listed under inhalation. For an adult, death may result from 30 ml (1 liquid ounce).

Long Term Exposure:

The following symptoms have been observed in people exposed to levels up to 20C ppm over periods of weeks, months or years: depression, hallucination, sluggishness, loss of appetite, fatigue and liver and kidney damage. Chlorofoc is a cancer suspect agent because high levels cause kidney and liver cancer in rats and mice.

*Prepared by the Bureau of Toxic Substance Assessment, New Yotk State Department of Health. For an explanation of the terms and abbreviations used, see "Toxic Substances: How Toxic is Toxic" available from the New York State Department of Health.

EMERGENCY AND FIRST AID INSTRUCTIONS

Inhalation: Move person to fresh air. Give artificial respiration or oxygen as rquired. Seek medical attention.

Skin: Remove soaked clothing. Wash affected areas with soap and water for at least 5 minuter. Seek medical attention if necessary.

Eyes: Wash eyes with large amounts of water for at least 15 minutes. Seek medical attention.

Ingestion: Seek medical attention immediately.

Note to Physician: Expired air and blood levels may be useful in estimating levels of acute exposure.

FIRE AND EXPLOSION INFORMATION

General: Chloroform is non-flammable and non-explosive.

REACTIVITY

Materials to Avoid: Strong alkalies like lye and potassium hydroxide decompose chloroform to chloride salts and formates.

Conditions to Avoid: Sunlight will decompose chloroform to highly toxic fumes.

PROTECTIVE MEASURES

Storage and Handling: Store in dark bottles or cans in a cool place.

Engineering Controls: Provide adequate ventilation, eyewash stations and showers.

Protective Clothing (Should not be substituted for proper handling and engineering controls): Impervious gloves, splash-proof goggles and apron should be worn if contact is likely.

Protective Equipment: **For any detectable levels** use a self-contained breathing apparatus with a full facepiece operated in a positive pressure mode or a combination Type C supplied-air respirator with an auxiliary self-contained breathing apparatus, both with a full facepiece and operated in a positive pressure mode. **For escape from a contaminated area** use a gas mask with an organic vapor canister or an escape self-contained breathing apparatus.

PROCEDURES FOR SPILLS AND LEAKS

Gat all workers out of spill area. Use respirator and protective clothing when spreading absorbent material on spill. Shovel into buckets and take to safe place in open air. Allow to evaporate. Wash spill area with soap and water. For final disposal contact your regional office of the New York State Department of Environmental Conservation.

For more information:
Contact the Industrial Hygienist or Safety Officer at your worksite or the New York State Department of Health, Bureau of Toxic Substance Assessment, University Place, Albany, New York 12203.

ecology and environment recycled paper

Chemical Fact Sheet*

Version 2

METHYLENE CHLORIDE

he information in this sheet applies to workplace exposure resulting from processing, manufacturing, storing or handling and io not daoiqned €or the population at large. Any generalization beyond occupational exposures should not be made. The best industrial hygiene practice is to maintain concentrations of all chemicals at levels as low as is practical.

Dichloromethane, Methylene dichloride; CAS 75-09-2.

Trade Names: Solaestine, Aerothene MM, Norkotel, Somethine, R30 and others.

The liquid is used as a solvent, degreasing and cleaning fluid, aerosol propellant, anesthetic and teftiqerant. *Also* used in paint removers, blowing aqents in foams, in the process of decaffeinating coffee and extraction of spices.

PHYSICAL INFORMATION

Appearance: Clear, colorless liquid.

Odor: Sweetish (like chloroform or ether). **Minimum Detectable by Odor:** 214 ppm.

Behavior in Water: Slightly soluble (1.32 g/100 g water), remainder will sink.

Evaporation: Liquid evaporates rapidly.

HEALTH HAZARD INFORMATION

OSHA Standard: Average 8 hour exposure limit -- 500 ppm.

NIOSH Recommended Limit: Reduce exposure to the lowest feasible level.

ACGIH Recommended Limit: Average 8 hour exposure -- 100 ppm.
(Proposed for chanqe in 1988: 50 ppm).

Short Term Exposure:

Note: Methylene chloride is changed to carbon monoxide in the human body. This is a particularly hazardous condition for those who have a history of heart trouble or chose Wno are also exposed to carbon monoxide. See carbon monoxide fact sheet. These perscns should take extra precautions.

Inhalation: Levels of 300-700 ppm for 3-5 hours has caused slight loss of muscle control and coordination. effects of higher concentrations include stupor, dizziness, chest pain, arm and leq pains, loss of feeling, loss of appetite, hoc Clashes and death.

Skin: May be irritating if confined on the skin by gloves or clothinq. May be absorbed slowly through the skin to cause symptoms listed under inhalation.

Eyes: May cause pain, irritation and burns.

Ingestion: Accidental ingestion of paint removers containinq methylene chloride as the main inqredient have reportedly caused headache, nausea, vomiting, visual disturbance, presence of blood in the urine, and unconsciousness.

Long Term Exposure:

Same symptoms as above. Prolonged exposure can cause chanqet in blood, hallucinations ana decreased response to visual and auditory stimulation. Some long term exposures have also resulted in damage to the liver. lost of the effects will disappear after exposure stops. Methylene chloride caused genetic effects in certain bacteria and caused birth defects in chickens. In laboratory studies, methylene chloride has also been shown to Cause tumors in mice and cats. Whether methylene chloride cuses birth defects or tumors in humans is not known.

*Prepared by the Bureau of Toxic Substance Assessment, New York State Department of Health. For an explanation of the terms and abbreviations used, see "Toxic Sutstances: How Toxic is Toxic" available from the New York State Department of Health.

EMERGENCY AND FIRST AID INSTRUCTIONS

Inhalation: Remove person to fresh air. Give artificial respiration or oxygen if breathing has stopped. Seek medical attention immediately.

Skin: Wash with large amounts of soap and water for at least 5 minutes. Seek medical attention it necessary.

Eyes: Wash with water for at least 15 minutes. Seek medical attention.

Ingestion: Do not induce vomiting. Seek medical attention.

Note to Physician: Gastric lavage with 3-5% sodium bicarbonate. Prompt hemodialysis if blood methanol level is above 50 mg/dl or if there is evidence of acidosis. Provide routine supportive measures and 100% oxygen until the carboxyhemoglobin level is satisfactory (less than 10% in an otherwise healthy patient).

FIRE AND EXPLOSION INFORMATION

General: Considered non-flammable, but will burn in high concentrations such as near spills or in cloud spaces. Ignites at 624°C (1224°F).

Explosion Limits: Upper — 64.6%; lower — 15.5% in oxygen.

REACTIVITY

Conditions to Avoid: Avoid hut; decomposes to highly poisonous gases (phosgene).

Materials to Avoid: Avoid contact with alkali metals (example: sodium or potassium); such contact may cause an explosion. Methylene chloride will corrode iron, stainless steel and copper, especially at high temperatures and if the metals are vet. Can is impervious and resistant to methylene chloride. Improper gloves or clothing can prevent evaporation and promote skin contact. Check with manufacturer's specification or your supervisor.

Protective Equipment: For any detectable levels use a self-contained breathing apparatus vith a Lull facepiece operated in a positive pressure mode or a combination type C supplied-air respirator vith an auxiliary self-contained breathing apparatus, both with a full facepiece and operated in a positive pre is impervious and resistant to methylene chloride. Improper gloves or clothinq can prevent evaporation and promote skin contact. Check with manufacturer's specification or your supervisor.

Protective Equipment: For any detectable levels use a self-contained breathing apparatus vitn a full facepiece operated in a positive pressure mode or a combination type C supplied-air respirator vith an auxiliary self-contained breathing apparatus, both with a full facepiece and operated in a positive pressure mode. For escape use a gar mask vith an organic vapor canister or an escape self-contained breathing apparatus. For firefighting use a self-contained breathing apparatus vith a full facepiece operated in a positive pressure node.

PROCEDURES FOR SPILLS AND LEAKS

Get all workers out of the spill area. Remove a11 sources of combustion. Ventilate the area. If you must enter the area, wear protective clothing and equipment. Since methylene chloride is extremely volatile, most will evaporate. Cor final disposal contact your regional office of the New Yock State Department of Environmental Conservation.

For more information:
Contact the Industrial Hygienist or Safety Officer at your worksite or the New York State Department of Health, Bureau of Toxic Substance Assessment, 2 University Place, Albany, New York 12203.

ecology and environment, inc.

SITE SAFETY PLAN

Version 988

A. GENERAL INFORMATION

Project Title: Site 19-Fuel Farm Pipeline Leak

Project No.: UH1203

TDD/Pan No.:

Project Manager: John Barksdale

Project Dir.: John Dumeyer

Location(s): Fuel Farm Pipeline Leak - Southwest of Forrest Sherman Field and Site 3

Prepared by: Hal Davis

Date Proparod: 4-25-89

Approval by: Wry Miller MM

Date Approvod: 5-5-89

Site Safety Officer Review:

Date Reviewed:

Scope/Objective of Work: Fiold Screening will include physical surveys, soil sampling, temporary woll installation and groundwator sampling.

Proposed Date of Fiold Activities: Auguat 1989

Background Info: Complete: [X] Preliminary (No analytical data available) [ ]

Documentation/Summary:

Overall Chemical Hazard:	Serious [ ]	Modorato [X]
	LOW [ ]	Unknown [ ]
Overall Physical Hazard	Serious [ ]	Modorato [ ]
	Low [X]	Unknown [ ]

B. SITE/WASTE CHARACTERISTICS

Waste Type(s):

Liquid [X]	Solid [ ]	Sludge [ ]	Gas/Vapor [X]

Characteristic(s):

Flammable/ Ignitable [X]	Volatile [X]	Corrosive [ ]	Acutely Toxic [ ]
Explosive [X]	Reactive [ ]	Carcinogen [X]	Radioactive* [ ]

Other:

Physical Hazards:

Overhead [X]	Confined* Space [ ]	Below Grade [ ]	Trip/Fall [X]
Puncture [ ]	Burn [ ]	Cut [ ]	Splash [X]
Noise [X]	Other: Aircraft and vehicular traffic using Forrest Sherman Field.		

* Requires conplotion of additional form and special approval from the Corporate Health/Safety group. Contact SC or HQ.

Site History/Description and Unusual Features (see Sampling Plan for detailed description): The Fuel Farm Pipeline Leak occurred in 1958. More than 360,000 gallons of JP-4 fuol oil was discharged onto tho ground surface in tho site vicinity. Monitoring wells showed no free product on tho water table, however a fuol odor was detected in soil samples. Monitoring wells contained extremely high concentrations of benzene (422 ug/l) and xylene (818 ug/l)

Locations of Chemicals/Wastes: Contamination is known to be present in subsurface rmdia, and ray bo present in surface soils.

Estimated Volume of Chemicals/Wastes: Estimated to be a minimum of 360,000 gallons of JP-4 fuol oil.

Site Currently in Operation Yes: [X] No: [ ]????????????

C. HAZARD EVALUATION

List Hazards *by* Task (i.e., drum sampling, drilling, etc.) and number them. (Task numbers arm cross-referenced in Section D)

Physical Hazard Evaluation:

1) Physical Surveys - Aircraft, Automobile hazards;

2) Temporary Monitoring Well Installation - Aircraft, Automobile Hazards, Using portable drill rig;

3) Soil Sampling - using portable drill rig;

4) Decontamination Procedures - Using solvents.

Chemical Hazard Evaluation:

Compound	PEL/TWA	Route of Exposure	Acute symptoms	Odor Threshold	Odor Description
Benzene	1 ppm	Inh,Ing,Con,Abs	head,vomit,euphori	4.68 ppm	aromatic
Xylene	100 ppm	Inh,Ing,Con,Abs	head,naus,cough	0.05 ppm	
Isopropyl Alcohol	400 ppm	"	drowsiness,head.	7.5-200 ppm	rubbing alcohol
Nitric Acid	2 ppm		corrosive	0.3-1 ppm	acrid

Note: Complete and attach a Hazard Evaluation Shoot for major known contaminant.

D. SITE SAFETY WORK PLAN

Site Control: Attach map, use back of this page, or sketch of site showing hot zone, contaninat on reduction, zone, etc.

Perimeter identified? [yes] Site secured? [no]

Work Areas Designated? [yes] Zone(s) of Contamination Identified? [no]

Personnel Protection (TLD badge8 required for a11 field personnel):

Anticipated Level of Protection (Cross-reference task numbers to Section C):

	A	B	C	D
Task 1			X	
Task 2			X	
Task 3			X	
Task 4			X	

(Expand if necessary)

Modifications: Modified level D with tyveck, neoprene gloves and boots, safety glasses, APR available when level D is deemed appropriate.

Action Levels for Evacuation of Work Zone Pending Reassessment of Conditions:

- o kvel D: O_2 <19.5% or >25%, explosive atmosphere >10% LEL, organic vapors above background levels, particulates >_____ mg/m^3, other _____
- o kvel C: O_2 <19.5% or ,252, oxplosivo atmosphoro ,252 LEL (California-20%), unknown organic vapor (in breathing zone) >5 ppm, particulates >_____ mg/m^3, other _____
- o Level B: O_2 <19.5% or >25%, oxplosivo atmosphoro >25% LEL (California-20%), unknown organic vapors (in breathing zone) >500 ppn, particulates >_____ mg/m^3, other _____
- o Level A: O_2 <19.5% or >25%, oxplosivo atmosphero ,252 LEL (California-20%), unknown organic vapors >500 ppm, particulates >_____ mg/m^3, other _____

Air Monitoring (daily calibration unless otherwise noted):

Contaminant of Interest	Typo of Sample (area, personal)	Monitoring Equipment	Frequency of Sampling
VOC's	Area	OVA	Continuous
Radiation	Area	Mini-Rad	Continuous
Explosive Gases	Area	O_2/Explosimeter	Continuous

(Expand if necessary)

Decontamination Solutions and Procedures for Equipment, Sampling Gear, etc.:
Trisodium phosphate wash, tap water rinse, isopropanol rinso, distilled water rinse, isopropanol rinse, and final distilled water rinso.

Personnel Decon Protocol: Boot and glove wash - trisodium phosphate wash vith clean water rinse. Expendables will bo double bagged and drummed for disposal. Field personnel will take a hygienic shower, off-site, following each day's field work.

Decon Solution Monitoring Procoduroa, if Applicable: Decontamination will be performed in a well-ventilated area upwind of tho sampling zone.

Special Site Equipment, Facilities, or Procoduroa (Sanitary Facilities and Lighting Must Meet 29 CFR 1910.120):

All drilling safety procedures will bo strictly adhered to as outlined in Attachwnt A.

Site Entry Procedures and Special Considerations: E & E's "Buddy System" will bo employed at a11 times during fieldwork activities. Personnel will exercise caution in tho vicinity of Forrest Sherman Field and along nearby roadways. It above background radiation levels are encountered team members will evacuate tho sampling area, and contact tho corporato health physics group to reassess tho site.

Work Limitations (time of day, weather conditions, etc.) and Heat/Cold Stress Requirements:

All fieldwork activities will bo performed during daylight hours. Team members will take breaks as necessary to avoid heat stress and replace fluids. Cooling vests may bo used to prevent heat stress.

General Spill Control, if applicable: N/A

Investigation-Derived Material Disposal (i.e., expendables, decon waste, cuttings):

All fieldwork waste materials will bo double bagged, drummed, labeled and transported to a designated location for final disposal by tho Navy.

Sample Handling Procoduroa Including Protective mar:

During all handling of samples, all fiold team members will wear surgical gloves. Goggles will bo worn during sample preservation with acids.

Team Member*	Responsibility
Team members to bo determined	Team Leader
	Site Safety Officer/Sampler
	Geologist/Sampler

*All entries into exclusion zone require Buddy System uno. All E & E fiold staff participate in medical monitoring program and have completed applicable training per 29 CFR 1910.120. Respiratory protection program meets requirements of 29 CFR 1910.134, and ANSI Z88.2 (1980).

E. EMERGENCY INFORMATION

(Use supplemental shoots, if necessary)

LOCAL RESOURCES

(Obtain a local telephone book from your hotel, if possible.)

Ambulance On Base -- 904-452-4138, Off Base -- 911

Hospital Emergency Rood NAS Dispensary - 904-452-2733, Baptist Hospital 904-434-4811 (Life Flight)

Poison Control Center

Police (include local, county sheriff, state) 911

Fire Department 911

Airport

U.S. Coast Guard Emergency - 904-453-8178, General Information 904-453-8282

Laboratory E & E ASC 1-716-631-0360

Fed. Express 1-800-238-5355

Client Contact U.S. Navy Southern Division, Engineer-In-Charge, Mike Green -- 1-803-743-0574

Site Contact NAS Pensacola Enviromental Coordinator, W. Dewayne Ray -- 904-452-4515

SITE RESOURCES

Site Emergency Evacuation Alarm Method N/A

ater Supply Source On-sit.

Telephone Location, Number To bo dotorminod on-site

Cellular Phone, if available N/A

Radio

Other On-site warehouse number to bo dotorminod

EMERGENCY CONTACTS

1. Dr. Raymond Harbison (Univ. of Florida) ..... (501) 221-0465 or (904) 462-3277, 3281
   Alachua, Florida (501) 370-8263 (24 hours)

2. Ecology and Environment, Inc.. Safety Director
   Paul Jonmaire ..... (716) 684-8060 (office)
   (716) 655-1260 (homo)

3. Regional Office Contact .....M.Miller.... 656-2854 (home)
   877-1978 (office)

4. Office Manager ..... R.Rudy..... 893-7245 (home)

MEDTOX HOTLINE

1. Twenty-four hour answering service: (501) 370-6263

   What to report:

   - State: "this is an omorgoncy."
   - Your name, region, and site.
   - Telephone number to roach you.
   - Your location.
   - Name of person injured or exposed.
   - Nature of emergency.
   - Action taken.

2. A toxicologist, (Drs. Raymond Harbison or associate) will contact you. Repeat tho information given to tho answering service.

3. If a toxicologist does not return your call within 15 minutes, call tho following persons in order until contact is made:

   a. 24 hour hotline - (716) 684-8940
   b. Corporato Safety Director - Paul Jonmaire - homo # (716) 655-1260
   c. Assistant Corp. Safety Officer - Steven Sherman - homo # (716) 666-0084

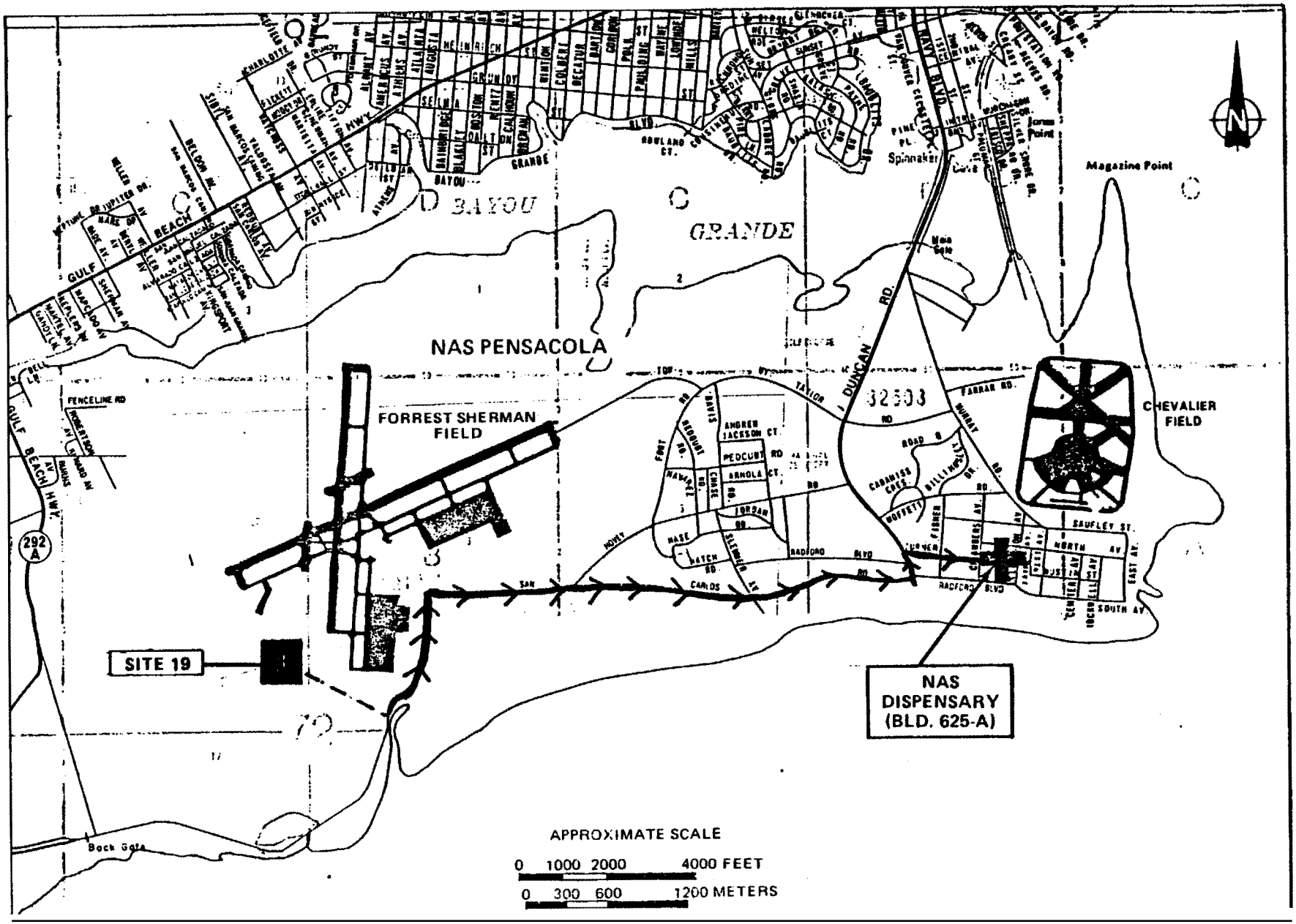
(NOTE: Field ham must Know Route(s) Prior to Start of Work)

Directions to hospital (include map)

NAS Dispensary - Take San Carlos Road east approximately tvo milos to Duncan Road. Turn left (north) and follow Duncan Road approximately 1000 foot to Turner Stroot. Turn right (east) on Turner Stroot and continue to it's intersection with Ellyson Avenue. Tho NAS Dispensary is located on the northwest corner of tho intersection of Ellyson Avenue and Turner Stroot, in Building 625-A.

Baptist Hospital - Take Duncan Road (Navy Blvd.) north to exit tho base. Navy Blod. becomes HWY 96 and curves to tho oast. Follow Navy Blvd./Hwy. 98 oast approx. 3mi to Paco Blvd. Turn left (north) on Paco Blvd. and proceed approx. 1mi to Cervantes St. (Hwy. 90). Turn right on Cervantes/Hwy. 90 and follow this road for about 8 blocks and turn loft (north) onto E street. Tho hospital is about 6 blocks north on tho loft.

Emergency Egress Routes to Got Off-Site Emergency egress routes will bo located if emergency exit routes become blocked by construction, etc.


NAS PENSACOLA
FORREST SHERMAN FIELD
CHEVALIER FIELD
SITE 19
NAS DISPENSARY (BLD. 625-A)
BAYOU GRANDE
Magazine Point
Spinnaker
GULF BEACH HWY.
DUNCAN RD.
FENCELINE RD
SAN CARLOS
HOVEY
TAYLOR
FARRAR RD.
MURRAY
RADFORD BLVD
SAUFLEY ST.
NORTH AV
SOUTH AV
EAST AV
ANDREW JACKSON CT.
PEDCUBT RD
ARNOLA CT.
JORDAN RD
HASE
WATCH RD
SEEMER AV
CABANISS CREEK
BILLINGSLEY DR.
BUFFETT
FISHER
CHAMBERS AV
ROAD 6
32503
292 A
Back Gate
APPROXIMATE SCALE
0 1000 2000 4000 FEET
0 300 600 1200 METERS

DRILL RIG SAFETY

* Hard hats must be worn.
* All team members must be know the procedure to shut the rig off and the location of the "kill" switch.
* When moving a rig off the road, pay attention to obstacles in route of travel. Walk the intended route first.
* Have someone guide the rig driver when clearance is at a minimum or when hazards are in close proximity.
* Set rig brakes and block the wheels when rig is set up at the desired drilling location.
* The mast must be lowered when the rig is moved.
* Always consider overhead wires to be live, watch for sagging lines and do not operate rig within 15 feet of overhead lines.
* Hake sure the site, platforms and walkways are free of obstructions.
* Make sure proper housekeeping is practiced around and on the rig at all times. Tools should be stored in a manner that permits convenient access and provides 'for adequate safety.
* Store gasoline in approved containers that have a spark arrestor and keep them clear of the drilling work area.
* Check rig equipment prior to starting work. Repair or replace faulty and worn items.
* Handle augers with care. Use proper lifting techniques when picking up samplers and augers. Use a tool hoist if possible and stay clear of rotating augers. Keep cables and ropes secured when not in use.
* Level and stabilize the drill rig prior to raising the mast.
* Watch for slippery ground when working in the area of the rig.
* All.unattended boreholes must be properly covered.
* Do not drill during an electrical storm.
* Maintain a safe distance from the rig mechanisms during drive sampling and auger removal operations.

ECOLOGY AND ENVIRONMENT, INC.,
STANDARD OPERATING PROCEDURES FOR
EMERGENCIES DUE TO HEAT AND HEAT STRESS MONITORING

Field operations during the summer months can create a variety of hazards to the employee. Heat cramps, heat exhaustion, and heat stroke can be experienced and, if not remedied, can threaten life or health. Therefore, it is important that all employees be able to recognize symptoms of these conditions and be capable of arresting the problem as quickly as possible,

THE EFFECTS OF HEAT

As the result of normal oxidation processes within the body, a predictable amount of heat is generated. If the heat is liberated as it is formed, there is no change in body temperature, If the heat is liberated more rapidly, the body cools to a point at which the production of heat is accelerated and the excess is available to bring the body temperature back to normal.

Interference with the elimination of heat leads to its accumulation and thus to the elevation of body temperature. As a result, the person is said to have a fever. When such a condition exists, it produces a vicious cycle in which certain body processes speed up and generate additional heat. Then the body must eliminate not only the normal but also the additional quantities of heat.

Heat produced within the body is brought to the surface largely by the bloodstream and escapes to the cooler surroundings by conduction and radiation. If air movement or a breeze strikes the body, additional heat is lost by convection. However, when the temperature of the surrounding air becomes equal to or rises above that of the body, all of the heat must be lost by vaporization of the moisture or sweat from the skin surface. As the air becomes more humid (contains more moisture), vaporization from the skin slows down. Thus, on a day when the temperature is 95 to 100°F, with high humidity and little or no breeze, conditions are ideal for the retention of heat within the body. It is on such a day or, more commonly, a succession of such days (a heat wave) that medical emergencies due to heat are likely to occur. Such emergencies are classified in three categories: heat cramps, heat exhaustion, and heat stroke.

HEAT CRAMPS

Heat cramps usually affect people who work in hot environments and perspire a great deal. Loss of salt from the body causes very painful cramps of the leg and abdominal muscles. Heat cramps also may result from drinking iced water or other drinks either too quickly or in too large a quantity.

<u>Heat Cramp Symptoms,</u> The symptoms of heat cramp are:

- Muscle cramps in legs and abdomen,
- Pain accompanying the cramps,
- Faintness, and
- Profuse perspiration-

Heat Cramp Emergency Care. Remove the patient to a cool place. Give him sips of liquids such as "Gatorade" or its equivalent. Apply manual pressure to the cramped muscle. Remove the patient to a hospital if there is any indication of a more serious problem.

HEAT EXHAUSTION

Heat exhaustion occurs in individuals working in hot environments, and may be associated with heat cramps. Heat exhaustion is caused by the pooling of blood in the vessels of the skin. The heat is transported from the interior of the body to the surface by the blood. The blood vessels in the skin become dilated and a large amount of blood is pooled in the skin. This condition, plus the blood pooled in the lower extremities when an individual is in an upright position, may lead to an inadequate return of blood to the heart and eventually to physical collapse.

Heat Exhaustion Symptoms. The symptoms of heat exhaustion are:

- Weak pulse:
- Rapid and usually shallow breathing;
- Generalized weakness;
- Pale, clammy skin;
- Profuse perspiration;
- Dizziness;
- Unconsciousness; and
- Appearance of having fainted (the patient responds to the same treatment administered in cases of fainting).

Heat Exhaustion Emergency Care. Remove the patient to a cool place and remove as much clothing as possible. Administer cool water, "Gatorade," or its equivalent. If possible, fan the patient continually to remove heat by convection, but do not allow chilling or overcooling. Treat the patient for shock, and remove him to a medical facility if there is any indication of a more serious problem.

HEAT STROKE

Heat stroke is a profound disturbance of the heat-regulating mechanism, associated with high fever and collapse. Sometimes this condition results in convulsions, unconsciousness, and even death, Direct

exposure to sun, poor air circulation, poor physical condition, and advanced age (over 40) bear directly on the tendency to heat stroke. It is a serious threat to life and carries a 20% mortality rate. Alcoholics are extremely susceptible.

Heat Stroke Symptoms. The symptoms of heat stroke are:

- Sudden onset;
- Dry, hot, and flushed skin;
- Dilated pupils;
- Early loss of consciousness;
- Full and fast pulse;
- Breathing deep at first, later shallow and even almost absent;
- Muscle twitching, growing into convulsions; and
- Body temperature reaching 105 to 106°F or higher.

Heat Stroke Emergency Care. Remember that this is a true emergency. Transportation to a medical facility should not be delayed. Remove the patient to a cool environment if possible, and remove as much clothing as possible. Assure an open airway. Reduce body temperature promptly--preferably by wrapping in a wet sheet or else by dousing the body with water. If cold packs are available, place them under the arms, around the neck, at the ankles, or at any place where blood vessels that lie close to the skin can be cooled. Protect the patient from injury during convulsions, especially from tongue biting.

AVOIDANCE OF HEAT-RELATED EMERGENCIES

Please note that, in the case of heat cramps or heat exhaustion, "Gatorade" or its equivalent is suggested as part of the treatment regime. The reason for this type of liquid refreshment is that such beverages will return much-needed electrolytes to the system. Without these electrolytes, body systems cannot function properly, thereby increasing the represented health hazard. Therefore. when personnel arb working in situations where the ambient temperatures arid humidity are high--and especially in situations where protection Levels A B, and C are required--the site safety officer must:

- Assure that all employees drink plenty of fluids ("Gatorade" or its equivalent):
- Assure that frequent breaks are scheduled so overheating does not occur; and
- Revise work schedules, when necessary, to take advantage of the cooler parts of the day (i.e., 5:00 a.m. to 1:00 p.m., and 6:00 p.m. to nightfall).

If protective clothing must be worn, especially Levels A and B, the suggested guidelines for ambient temperature and maximum wearing time per excursion are:

Ambient Temperature (°F)	Maximum Wearing Time per Excursion (Minutes.)
Above 90	15
aS to 90	30
80 to 85	60
70 to 80	90
SO to 70	120
SO to 60	180

One method of measuring the effectiveness of employees' rest-recovery regime Is by monitoring the heart rate. The "Brouha guideline" Is one such method:

- During a three-minute period, count the pulse rate for the last 30 seconds of the first minute, the last 30 seconds of the second minute, and the last 30 seconds of the third mlnutc.
- Double the count.

If the recovery pulse rate during the last 30 seconds of the first minute Is at 110 beats/minute or less and the deceleration between the first, second, and third minutes Is at least 10 beats/minute, the work-recovery regime Is acceptable. If the employee's rate Is above that specified, a longer rest perlod Is required, accompanied by an Increased Intake of fluids.

0000142

Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

Mallinckrodt provides the information contained herein in good faithbut makes no representation as to its comprehensiveness or accuracy. Individuals receiving this information must exercise their independent judgment in determiningita appropriateness for a particular purpose.

Mallinckrodt makes no representations, or warranties, either express or implied, of merchantability, fitness for a particular purpose with respect to the information set forth herein or to the product to which the Informallon refers. Accordingly, Mallinckrodt will not be responsible for damages resulting from use of or reliance upon this Informallon.

Mallinckrodt, Inc., Science Products Division. P. O Box M, Puis. KY 43061.

ISOPROPYL ALCOHOL

PRODUCT IDENTIFICATION:

Synonyms 2-propanol; sec-propyl alcohol; isopropanol

Formula CAS *No.:* **67-63-0**

Molecular Weight: **60.10**

Chemical Formula: $(CH_3)_2$ CHOH

Hazardous Ingredients: **Not** applicable.

PRECAUTIONARY **MEASURES**

WARNING! FLAMMABLE LIQUID. HARMFUL IF SWALLOWED OR INHALED. AFFECTS CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION.

Keep away from heat, sparks and flame.
Keep container closed.
Use with adequate ventilation.
Avoid breathing vapor.
Wash thoroughly after handling.
Avoid contact with eyes, **skin** and clothing.

/FIR AID

If swallowed, give water **to** drink. Induce vomiting if medical help **is** not immediately available. Never give anything by mouth **to** an unconscious person. If inhaled, **remove** to fresh air. If not breathing give artificial respiration. **If** breathing is difficult, **give** oxygen. In case of contact, immediately flush skin **or** eyes with plenty of water for at least **15** minutes. In all c a w call a physician.
SEE SECTION **5.**

DOT Hazard Class: Flammable Liquid

SECTION 1 Physical Data

Appearance: Clear, colorless liquid.

Odor: Rubbing alcohol.

Solubility. Infinite in water.

Boiling Point: 82°C **(180°F).**

Melting Point: -89°C (-128°F).

Specific **gravity.** 0.79

Vapor Density (Air=**1): 2.1**

Vapor Pressure (mm Hg): 33 @ 20°C **(68°F)** •

Evaporation Rae: (n-BUAC = **1) 2.83**

SECTION 2 Fire and Explosion Information

Fire:
Flammable Liquid
Flashpoint: 12°C (53°F). (closed cup).
Autoignition temperature: 399°C (750°F).
Flammable limits in air, % **by** volume:
lel: **2.0;** uel: 12.0.

Explosion:
Above flash point. vapor-air mixtures are explosive within flammable limits noted above. Contact with **strong** oxidizers may cause fire **or** explosion.

Fire Extinguishing Media:
Water spray, **dry** chemical, alcohol form, or carbon dioxide. Water spray may be **used to** keep **fire** exposed containers cool.

Special Information:
In the event of a **fire,** wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand **or** other positive pressure mode. Water may be used **to** flush spills away from exposures and **to** dilute spills **to** non-flammable mixtures. Vapors can flow along surfaces **to** distant ignition source and flash back.

SECTION 3 Reactivity Data

Stability:
Stable under ordinary conditions of **use** and storage. Heat and sunlight **can** contribute to instability.

Hazardous Decomposition Products:
Toxic gases and vapors such as carbon monoxide may be released in a **fire** involving isopropyl alcohol.

Hazardous Polymerization:
Will **not** occur.

Incompatibilities:
Heat, flame, strong oxidizers, acetadehyde, chlorine, ethylene oxide, hydrogen-palladium combination, hydrogen peroxide-sulfuric acid combination, potassium tert-butoxide, hypochlorous acid, isocyanates, nitroform, phosgene, oleum and perchloric acid.

SECTION 4 Leak/Spill Disposal Information

Remove all sources of ignition. Ventilate area of **luk or** spill. Clean-up personnel require protective clothing and respiratory protection from vapors. Small spills may **be** absorbed **on** paper towels and evaporated in a fume hood. Allow enough time for fumes **to** dear hood, then ignite paper in a suitable location away from combustible materials. Contain and recover liquid for reclamation when possible. **Larger spills** and lot sues can **be** collected as hazardous waste and atomized in a suitable RCRA approved combustion chamber, **or** absorbed with vermiculite, dry sand, earth **or** similar material for disposal as hazardous waste in a RCRA approved facility.

Ensure compliance with local, state and federal regulation+

NFPA Ratings: Health **1** Flammability 3 Reactivity ***0***

00001143

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Inhalation:
May cause irritation of the nose and throat. Exposure to high concentrations has a narcotic effect, producing symptoms of drowsiness, headache, staggering, unconsciousness and possibly death.

Ingestion:
May cause drowsiness, unconsciousness, and death. Gastrointestinal pin, cramps, nausea, vomiting, and diarrhea may also result. The single lethal dose for a human adult = about 250 mls (SAX Sixth Edition).

Skin Contact:
Has a defatting action of the skin that can cause irritation. May cause irritation with a stinging effect and burning sensation.

Eye Contact:
Vapors may irritate the eyes. Splashes may cause severe irritation. possible corneal burns and eye damage.

Chronic Exposure:
Prolonged contact with skin may cause mild irritation, drying, cracking, or contact dermatitis may develop.

Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

B. FIRST AID

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give **oxygen. Call a** physician.

Ingestion:
Give water to drink. Induce vomiting if medical help not is immediately available. Never give anything by mouth to an unconscious person. Get medial attention immediately.

Skin Exposure:
Remove any contaminated clothing. Wash skin with soap or mild detergent and water for at least 15 minuter Get medical attention if irritation develops or persists.

Eye Exposure:
Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS, 1982)

Oral rat LD50: 5840 mg/kg. Skin rabbit **LD50: 13** gm/kg. Inhalation rat LC50: 16000 **ppm/8H.** Mutation references cited Aquatic Toxicity rating TLm96: 1000-10 ppm.

SECTION 6 Occupational Control Measures

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
400 ppm (TWA).
-ACGIH Threshold Limit Value (TLV):
400 ppm **(TWA); 500 ppm (STEL).**

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it an control the emissions of the contaminant at its source, preventing dispersion dit into the general work am. Please refer to the ACGIH document, 'Industrial Ventilation, A Manual of Recommended Practices', most recent edition, for details.

Personal Respirators: (NIOSH Approved)
If the TLV is exceeded a full facepiece chemical cartridge respintor may be worn, in general, up to the maximum use concentration specified by the respirator supplier. Alternatively, a supplied air full facepiece respirator or airlined hood may be worn.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material. Maintain eye wash fountain and quick-drench facilities in work area.

SECTION 7 Storage and Special Information

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any a m where the fire hazard may be acute. Outside or detached storage is preferred. Separate from oxidizing materials. Containers should be bonded and grounded for transfer to avoid static sparks. Storage and use areas should be NO Smoking areas. Use non-sparking type tools and equipment.

Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

Mallinckrodt provides the information contained herein in good faith but makes no representation as to its completeness or accuracy. Individuals receiving this information exercise their independent judgment in determining its appropriateness for a particular purpose.

Mallinckrodt makes no representations, or warranties, express or implied, of merchantability, fitness for a particular purpose with respect to the information set forth herein or to the product to which the information refers. Accordingly, Mallinckrodt will not be responsible for damages resulting from use of or reliance upon this information.

Mallinckrodt, Inc., Science Products Division, P.O. Box M, Paris, KY 43061.

NITRIC ACID, 70%

PRODUCT IDENTIFICATION:

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 70%

Formula CAS No.: 7697-37-2

Molecular Weight: 63.00

Chemical Formula: HNO_3

Hazardous Ingredients: Not Applicable

PRECAUTIONARY MEASURES

DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE.
CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

Do not get in eyes, on skin, or on clothing.
Avoid breathing mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep from contact with clothing and other combustible materials.
Do not store near combustible materials.
Store in a tightly closed container.
Remove and wash contaminated clothing promptly.
This substance is classified as a POISON under the Federal Caustic Poison Act.

EMERGENCY/FIRST AID

In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. If swallowed, DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases call a physician.
SEE SECTION 5.

DOT Hazard Class: Oxidizer

SECTION 1 Physical Data

Appearance: Clear, colorless to slightly yellow liquid.

Odor: Suffocating acrid.

Solubility: Infinite in water.

Boiling Point: 122°C (252°F)

Melting Point: -34°C (-29°F)

Specific Gravity: 1.41

Vapor Density (Air=1): 2-3 approximately

Vapor Pressure (mm Hg): 62 @ 20°C (68°F)

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

Fire:
Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.

Explosion:
Reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc.

Fire Extinguishing Media:
If involved in a fire, use water spray.

Special Information:
Increases the flammability of combustible, organic and readily oxidizable materials. In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

SECTION 3 Reactivity Data

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.

Hazardous Decomposition Products:
When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate. Will react with water or steam to produce heat and toxic and corrosive fumes.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

SECTION 4 Leak/Spill Disposal Information

Isolate or enclose the area of the leak or spill. Clean-up personnel should wear protective clothing and respiratory equipment suitable for toxic or corrosive fluids or vapors.
Small Spills: Flush with water and neutralize with alkaline material (soda ash, lime, etc.). Sewer with excess water.
Larger spills and lot sizes: Neutralize with alkaline material, pick up with absorbent material (sand, earth, vermiculite) and dispose in a RCRA-approved waste facility or sewer the neutralized slurry with excess water if local ordinances allow. Provide forced ventilation to dissipate fumes.

Reportable Quantity (RQ)(CWA/CERCLA): 1000 lbs.

Ensure compliance with local, state and federal regulations.

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 0 Other: Oxidizer

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Inhalation:
Corrosive! Inhalation of vapors can cause breathing difficulties **and lead** to pneumonia and **pulmonary** edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat. and respiratory tract.

Ingestion:
Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.

Skin Contact:
Corrosive! **Can** c a w redness, pain, and **severe** skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.

€ye Contact:
Corrosive! Vapors arc irritating and may c a w damage to the eyes. Splashes may aw severe bums and permanent eye damage.

Chronic Exposure:
Long-term exposure to concentrated npon may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.

Aggrevation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

B. FIRST AID

Inhalatloo:
Remove to fresh air. If not bruthing, give artificial respiration. If bruthing b difficult, give oxygen. Call a physician.

Ingestion:
DO NOT **INDUCE VOMITING!** G i large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Exposure:
Io case of contact, immediately flush skin with plenty of water for 8t least 15 minuter while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye **Exposure:**
Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS, 1982)

Inhalation (Rat) LC50: 244 ppm (NO_2)/30M

SECTION 6 Occupational Control Measures

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
2 ppm (TWA)
-ACGIH Threshold Limit Value (TLV):
2 ppm (TWA); 4ppm (STEL)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document. "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

Personal Respirators: (NIOSH Approved)
If the TLV is exceeded. wear a supplied air. full-facepiece respirator, airlined hood, or self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and cannisters that contain oxidizable materials, such as activated charcoal.

Skin Protection:
Wear Impervious protective clothing, including boots, gloves, lab coat. apron or coveralls to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material. Maintain eye wash fountain and quick drench facilities in work area.

SECTION 7 Storage and Special Information

Keep in a tightly closed container. stored in a cool, dry, ventilated area. Protect from physical damage and direct sunlight. Isolate from incompatible substances. Protect from moisture.

Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

Mallinckrodt provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. Individuals receiving this information must exercise their independent judgment in determining its appropriateness for a particular purpose.

Mallinckrodt makes no representations, or warranties, either express or implied, of merchantability, fitness for a particular purpose with respect to the information set forth herein or to the product to which the information refers. Accordingly, Mallinckrodt will not be responsible for damages resulting from use of or reliance upon this information.

Mallinckrodt, Inc., Science Products Division, P.O. Box M, Paris, KY 40361

SULFURIC ACID 96%

PRODUCT IDENTIFICATION;

Synonyms Oil of Vitriol

Formula CAS No.: 7664-93-9

Molecular Weight: 98.07

Chemical Formula: H_2SO_4

Hazardous Ingredients: Not applicable.

PRECAUTIONARY MEASURES

DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

Do not get in eyes, on skin, or on clothing.
Do not breathe mist.
Keep container cloud.
Use only with adequate ventilation.
Wash thoroughly after handling.
This substance is classified as a POISON under the Federal Caustic Poison Act.

EMERGENCY/FIRST AID

In all cases call a physician. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. If swallowed, DO NOT INDUCE VOMITING! Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
SEE SECTION 5.

DOT Hazard Class: *Corrosive* Material

SECTION 1 Physical Data

Appearance: Colorless, oily liquid.

Odor: Odorless.

Solubility: Infinite @ 20°C.

Boiling Point: ca. 310°C (590°F)

Melting Point ca. -14°C (6°F).

Specific Gravity: 1.84

Vapor Density (Air=1): < 0.3 @ 25°C (77°F)

Vapor Pressure (mm Hg): 1 @ 146°C (250°F).

Evaporation **Rate:** No information found.

SECTION 2 Fire and Explosion Information

Fire:
Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Reacts with most metals releasing flammable, potentially explosive hydrogen gas.

Explosion:
Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition.

Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

Special Information:
In the event of fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

SECTION 3 Reactivity Data

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products
Toxic fumes of oxides of sulfur. Will react with water or steam to produce toxic and corrosive fumes. Reacts with carbonates to generate carbon dioxide gas, and with cyanides and sulfides to form poisonous hydrogen cyanide and hydrogen sulfide respectively.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Water, organic material, halogens, metal acetylides, oxides and hydrides, strong oxidizing and reducing agents and many other reactive substances.

SECTION 4 Leak/Spill Disposal Information

Dike and cover leaking or spilled liquid with dirt, vermiculite, kitty-litter or other inert absorbent. Cover spill with sodium bicarbonate or soda ash and mix. Clean-up personnel require protective clothing and respiratory protection from vapors and mists. Neutralized waste may be containerized and disposed in a RCRA approved waste disposal facility. Flush area of spill with dilute soda ash solution and discard to sewer.

Reportable Quantity (RQ)(CWA/CERCLA): 1000 lbs.

Ensure compliance with local, state and federal regulations.

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 2 Other: Water reactive

0000145

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Inhalation:
Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. May cause lung edema. Symptoms may include irritation of the nose and throat, and labored breathing.

Ingestion:
Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach, leading to death. Can cause sore throat, vomiting, diarrhea.

Skin Contact:
Corrosive. Symptoms of redness, pain, and severe burn can occur.

Eye Contact:
Corrosive. Splashes can cause blurred vision, redness, pain and severe tissue burns.

Chronic Exposure:
Long-term exposure to mist or vapors may cause damage to teeth.

Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

B. FIRST AID

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:
If swallowed, DO NOT induct vomiting. Give large quantities of water or milk if available. Call a physician immediately. Never give anything by mouth to an unconscious person.

Skin Exposure:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician.

Eye Exposure:
Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medial attention immediately.

C. TOXICITY DATA (RTECS, 1982)

Oral rat LD50: 2140 mg/kg. Inhalation Guinea Pig LC50: 18 mg/m^3.

SECTION 6 Occupational Control Measures

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
1 mg/m^3 (TWA).
-ACGIH Threshold Limit Value (TLV):
1 mg/m^3 (TWA).

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", mart recent edition, lor details.

Personal Respirators: (NIOSH Approved)
If the TLV is exceeded a full facepiece chemical cartridge respirator may be worn, in general, up to 100 times the TLV or the maximum use concentration specified by the respirator supplier, whichever b less. Alternatively, a supplied air lull faceplece respirator or airlined hood may be worn.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls to prevent skin contact.

Lye Protection:
Use chemical safety goggles and/or a lull face shield where splashing is possible. Contact lenses should not be worn when working with this material. Maintain eye wash fountain and quick-drench facilities in work area.

SECTION 7 Storage and Special Information

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash oul container and use it for other purposes. When diluting, always add tho acid to water; never add water to the acid.

recycled paper

energy and environment

Chemical Pact Sheet* Version 3

XYLENES

The information in this sheet applies to workplace exposure resulting from processing, manufacturing, storing or handling and is not designed for the population at large. Any generalization beyond occupational exposures should not be made. The best industrial hygiene practice io to maintain concentrations of all chemicals at levels as low as is practical.

Chemical Names: Xylene, CAS 1330-20-7; 1,3-Dimethylbenzene, meta-xylene, CAS 108-38-3; 1,2-Dimethylbenzene, ortho-xylene, CAS 95-47-6; 1,4-Dimethylbenzene, para-xylene, CAS 104-42-3.

Trade Names: Mixed aromatic hydrocarbons, p-Xylol, o-Xylol, m-Xylol and others.

Uses: Used a8 an intermediate in the manufacture *of dyes;* found in solvent mixtures, certain insecticides and aviation fuel; degreasing and cleaninq agent; raw material for terephthalic acid. Used in pharmaceutical synthesis and raw material for phthalic anhytides.

PHYSICAL INFORMATION

Appearance: Clear, colorless liquid vhich may form crystals at temperatures below 57°F (14°C).

Odor: Strong; pleasant. **Minimum Detectable by Odor:** 20 ppm.

Behavior in Water: Xylene is not soluble in water, it will float.

HEALTH HAZARD INFORMATION

OSHA Standard: Average 8 hour exposure -- 100 ppm.

NIOSH Recommended Limit: Average 10 hour day/40 hour week -- 100 ppm.

ACGIH Recommended Limit: Average 8 hour exposure -- 100 ppm.

Note: The health effects and standards for all the xylenes are similar.

Short Term Exposure:

Inhalation: Exposure to vapor can be irritatinq to the nose and throat. Inhalaticn of vapor at concentrations above 200 ppm or 3-5 minutes can lead to xylene intoxication. Symptoms include headache, dizziness and nausea. If exposure should Continue, central nervous system depression characterized by shallow breathing and weak pulse can occur. Levels of 230 ppm for 15 minutes may cause lightheadedness without loss of equilibrium. Reversible liver and kidney damaqe in man has followed exposure to sudden high concentrations of vapor. Such high levels may also give rise to lunq conqcstion. Exposure to extremely high concentrations (10,000 ppm) of xylene vapors can lead to a rtronq narcotic effect with symptoms of slurred speech, stupor and coma.

Skin: Contact vith vapor or liquid can cause dryinq and defattinq vhich may lead to irritation,

Eyes: Vapor and liquid may be irritatinq to the eye and eyelids at levels of 100 ppm for 15 minutes.

Ingestion: Swallowing liquid xylene will bring about an immediate burning sensation in the mouth and throat. Irritation of the stomach and intestine can give rise to sharp stomach pains. Symptoms are the same as inhalation, except that lunq conqestion will not usually develop.

Inhalation *of* xylene vapor and skin contact with liquid are the two most probable routes of long term exposure. Symptoms *of* inhalation are dizziness, headache and nausea. Long term exposure has been associated with liver and kidney damaqe, intestinal tract disturbances and central nervous system depression. These effects are reversible and disappear once the chemical has been removed. Prolonged contact with skin can lead to irritation.

*Prepared by the Bureau of Toxic Substance Assessment, New York State Department of Health. For an explanation of the terms and abbreviations used, see 'Toxic Substances: Bow Toxic is Toxic' available from the New York State Department of Health.

EMERGENCY AND FIRST AID INSTRUCTIONS

Inhalation: Move person to fresh air and give artificial respiration if breathing has stopped. Seek medical attention if necessary.

Skin: Wash with soap and water for at least 5 minutes. Seek medical attention if necessary.

Eyes: Wash with water for at least 15 minutes. Seek medical attention.

Ingestion: Do not try to induce vomiting. Seek medical attention immediately.

Note to Physician: May require supportive measures for pulmonary edema.

FIRE AND EXPLOSION INFORMATION

General: Liquid and vapor are both flammable. Vapor can spread to a source of ignition and flash back. Ignites at 84°F (30°C).

Explosive Limits: Upper -- 7%, Lower -- 1.1%.

Extinguisher: Foam, *dry* chemical or carbon dioxide.

REACTIVITY

Materials to Avoid: Oxidizing agents such as permanganate and chlorine.

Conditions to Avoid: *Any* source of ignition.

PROTECTIVE MEASURES

Storage and Handling: Protect containers against physical damage. Store, if possible, outdoors or in a detached building. If indoors, a standard flammable liquid storage room should be used.

Engineering Controls: Proper ventilation of storage area and work area. Sink, showers, eyewash stations should *be* available.

Protective Clothing (Should not be substituted for proper handling and engineering controls): If contact vitb xylene is likely, wear rubber gloves, chemical goggles and impervious protective clothing.

Protective Equipment: For levels up to 1.000 ppm use a supplied-air respirator, a self-contained breathing apparatus, a chemical cartridge respirator with organic vapor cartridges or a powered air-purifying respirator with organic vapor cartridges. For levels up to 2500 ppm use a supplied-air respirator operated in continuous flow mode. For levels up to 5000 ppm use a gas mask with an organic vapor canister, a self-contained breathing apparatus vith a full facepiece or a supplied-air respirator vith a full facepiece. For levels up to 10,000 ppm use a Type C supplied-air respirator with full facepiece operated in a positive pressure rode. par levels above 10.000 ppm or use in areas of unknown concentrations use a self-contained breathing apparatus with full facepiece operated in a positive pressure mode or a Type C supplied-air respirator vith an auxiliary self-contained breathing apparatus, both with a full facepiece and operated in a positive pressure rod.. For escape from a contaminated area use a gas mask with an organic vapor canister or an escape self-contained breathing apparatus.

PROCEDURES FOR SPILLS AND LEAKS

Get all workers out of spill area. After putting on protective clothing and equipment, spread absorbent material on spill area. Sweep and place absorbent into fiber carton container. For final disposal contact your regional office of the New York State Department of Environmental Conservation.

For wre information:
Contact the Industrial Hygienist or Safety Officer at your worksite or the New York State Department of Health, Bureau of Toxic Substance Assessment, 2 University Place, Albany, New York 12203.

BENZENE

The information in this sheet applies to workplace exposure resulting from processing, manufacturing, storing or handling and is not designed for the population at large. Any generalization beyond occupational exposures should not be made. The best industrial hygiene practice is to maintain concentrations of all chemicals at levels as low as is practical.

Chemical Names: Benzol, phenyl hydride, cyclohexatriene; CAS 71-43-2.

Trade Names: Benzole, Benzolene, Carbon Oil, Carbon Naphtha, Mineral Naphtha, Motor Benzol, Nitration Benzene, Phene, Pyrobenzol and others.

Uses: In the manufacture of styrene, phenol, detergents, organic chemicals, pesticides, plastics and resins, synthetic rubber, aviation fuel, pharmaceuticals, dyes, explosives, gasoline, flavors and perfumes, paints and coatings. Used in the industrial processing of nylon, certain food products and photographic chemicals.

PHYSICAL INFORMATION

Appearance: Colorless liquid.

Odor: Strong, pleasant. **Minimum Detectable by Odor:** 5 ppm.

Behavior in Water: Slightly soluble, floats.

Evaporation: Rapid.

HEALTH HAZARD INFORMATION

OSHA Standard: Average 8 hour exposure limit -- 10 ppm.

NIOSH Recommended Limit: 1 ppm.

ACGIH Recommended Limit: Average 8 hour exposure limit -- 10 ppm.

Short Term Exposure:

Inhalation: Benzene may produce both nerve and blood effects. Irritation of the nose, throat and lungs may occur (3,000 ppm may be tolerated for only 30 to 60 minutes). Lung congestion may occur. Nerve effects may include an exaggerated feeling of well-being, excitement, headache, dizziness and slurred speech. At high levels, slowed breathing and death may result. Death has occurred at 70,000 ppm for 5 to 10 minutes, or 7,500 ppm for 30 minutes.

Skin: Irritation may occur, with redness and blistering if not promptly removed. Benzene is poorly absorbed. Whole body exposure for 30 minutes has been reported with no health effects.

Eyes: May cause severe irritation.

Ingestion: May cause irritation of mouth, throat and stomach. Symptoms are similar to those listed under inhalation. One tablespoon may cause collapse, bronchitis, pneumonia and death.

Long Term Exposure:

May cause loss of appetite, nausea, weight loss, fatigue, muscle weakness, headache, dizziness, nervousness and irritability. Mild anemia has been reported from exposures of 25 ppm for several years and 100 ppm for 3 months. At levels between 100 and 200 ppm for periods of 6 months, or more, severe irreversible blood changes and damage to liver and heart may occur. Temporary partial paralysis has been reported.

Benzene is a known human carcinogen. Exposure has been linked to increased risk of several forms of leukemia. Periodic blood tests of occupationally exposed individuals should be conducted.

*Prepared by the Bureau of Toxic Substance Assessment, New York State Department of Health. For an explanation of the terms and abbreviations used, see "Toxic Substances: How Toxic is Toxic" available from the New York State Department of Health.

EMERGENCY AND FIRST AID INSTRUCTIONS

Inhalation: Remove to fresh air. Give artificial respiration or oxygen if necessary. Seek medical attention.

Skin: Remove roiled clothing immediately. Wash thoroughly with soap and water for at least 5 minutes, Seek medical attention. if necessary.

Eyes: Irrigate eyes with water Lor at least 15 minutes. Seek medical attention.

Ingestion: Do not try to induce vomiting. Seek medical attention immediately.

Note to Physician: Severe exposure may require supportive measures for pulmonary edema.

FIRE AND EXPLOSION INFORMATION

General: Flammable, vapor may spread considerable distance to a source of ignition a d flub back. Ignites at -11°C (12°F).

Explosive Limit: Upper — 7.19, Lower — 1.3%.

Extinguisher: Carbon dioxide. dry chemical or foam.

REACTIVITY

Materials to Avoid: Contact with strong oxidizers. or iron in the presence of chlorine or bromine.

Conditions to Avoid: Exposure to sources of ignition.

PROTECTIVE MEASURES

Storage and Handling: Protect containers against physical damage. Storage preferred in an outdoor or detached building. If storage is indoor, use a standard flammable liquid storage room.

Engineering Controls: 0 r only with efficient ventilation,

Protective Clothing (Should not be substituted for proper handling and engineering controls): If direct contact is likely, w u protective rubber clothing, gloves and eye goggles.

Protective Equipment: For any detectable levels use a self-contained breathing apparatus with a full facepiece and operated a positive pressure mode or a combination Type C supplied-air respirator with an auxiliary self-contained breathing apparatus, both with full facepiece and operated in a positive pressure mode. For escape from a contaminated area use a 9.8 mask with organic vapor canister or an escape self-contained breathing apparatus.

PROCEDURES FOR SPILLS AND LEAKS

Get all workers out of spill area. Put on protective clothing and equipment when entering spill area for clean-up. Spread absorbent material on spill, sweep up and keep contained in fiber carton tightly sealed. For final disposal, contact your regional office of the New fork State Department of Environmental Conservation.

For more information:
Contact the Industrial Hygienist or Safety Officer at your worksite or tho New York state Department of Health, Bureau of Toxic Substance Assessment, 2 University Place, Albany, New York 12203.

0000147

APPENDIX B

SITE-SPECIFIC QUALITY ASSURANCE PROJECT PLAN

[Bold items enclosed in brackets denote changes from original text]

Section 10 -- Title Page

Vork Plan Group: J
Site No. : 3
Site Name: Crash Crev Training Area

Prepared by: Mary L. Hiller
Ecology and Environment, Inc.
1203 Governor's Square Boulevard, Suite 401
Tallahassee, Florida 32301

Prepared for: Department of the Navy
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive, P.O. Box 10068
Charleston, South Carolina 29411-0068
Contract Number N62467-88-C-0200

Signature Approvals:

E & E Project Manager: J. Barksdale

E 6 E QA/QC Director or
Assistant QA/QC Director: T. Yeates/R. Short

E & E ASC Director: A. Clifton

E & E QA/QC Project Officer: A. Schuessler

0000143

Section 2.0 — Table of Contents

		Page	Date
Section 1.0	Title Page	1	4-24-89
Section 2.0	Table of Contents	2	4-24-89
Section 3.0	Project Summary	3	4-24-89
Section 4.0	Project Organization and Responsibility	5	4-24-89
Section 5.0	QA/QC Objectives for Measurement Data	5	4-24-89
Section 6.0	Fieldwork and Sampling Procedures	8	4-24-89
Section 7.0	Sample Custody	8	4-24-89
Section 8.0	Calibration Procedures and Frequency	8	4-24-89
Section 9.0	Analytical Procedures	8	4-24-89
Section 10.0	Data Reduction, Validation, and Reporting	9	4-24-89
Section 11.0	Internal Quality Control Checks	9	4-24-89
Section 12.0	Performance and Systems Audits	9	4-24-89
Section 13.0	Preventive Maintenance	10	4-24-89
Section 14.0	Procedures Used to Assess Accuracy, Precision, and Completeness of Data	10	4-24-89
Section 15.0	Corrective Action	10	4-24-89
Section 16.0	Quality Assurance Reports to Management	10	4-24-89
Appendix A	Additional Personnel Biographies	11	4-24-89

Section 3.0 — Project Summary

Work Plan Group: J

Site,No. : 3

Site Name: Crash Crew Training Area

Site Description: A complete site description and history are presented in Sections 2.0 and 3.0 of the attached work plan.

Phase I — Field Screening
Physical Survey (check all that apply):

- X Overall Physical Reconnaissance
- X HNu/OVA Surface Emission Survey
- ___ Radiation Survey
- X Habitat/Biota Survey
- ___ Asbestos Survey (in Rubble)
- X Eydrologic Assessment

Geophysical Survey (check all that apply):

- X Electromagnetic Conductivity:
  - X EM-31 ___ En-34
- X Magnetometry
- ___ Very Low Frequency
- ___ Ground Penetrating Radar
- ___ Seismic Refraction
- ___ Seismic Reflection

Analytical Screening (check all that apply):

- ___ Field Analyses:
- X Soil Eeadspace Analyses: Planned Number of Samples 160
- ___ Soil Gas Analyses : Planned Number of Samples ___
- X Laboratory Analyses:

PLANNED NUMBER OF SAMPLES		CATEGORIES OF ANALYSBS
Surface Water	___	X Volatile Organic Compounds
Sediment	___	X Polynuclear Aromatic Hydrocarbons
Soil	33	X Phenols
Groundwater	12	___ Organophosphorus Pesticides
Duplicates	3	___ Chlorinated Herbicides
Trip Blanks	___	___ Carbamates
Field Blanks	___	X Pesticides/Polychlorinated Biphenyls
Rinsate Blanks	___	X Total Recoverable Hydrocarbons
Other	___	X Metals
		___ Gross Alpha

Section 3.0 -- Project Summary (Continued)

Phase II -- Characterization

PLANNED NUMBER OF SAMPLES

Surface Water	___	Air	___	Duplicates	4
Sediment	___	Biota:		Trip Blanks	3
Soil	27	Flora	___	Field Blanks	3
Groundwater	11	Fauna	___	Rinsate Blanks	3

CATEGORIES OF ANALYSES

X Purgeable Aromatics
X Purgeable Halocarbons
X Base/Neutral Extractables
X Acid Extractables
___ Polynuclear Aromatic Hydrocarbons
X Pesticides
X Polychlorinated Biphenyls
X Total Recoverable Hydrocarbons
X Metals
X Cyanide

Additional analytical categories are identified below:

___ Gross Alpha
X Total Organic Carbon
X Hardness (water only)
X Alkalinity
X Total Suspended Solids (water only)
X Total Kjeldahl Nitrogen
X Ammonia Nitrogen
X Orthophosphate Phosphorus
X Dissolved Oxygen (in field)
X 5-day Biological Oxygen Demand
X Chemical Oxygen Demand
X pH
X Percent Moisture
X Grain Size
X BTU Content
X Ash Content
X Total Halogens
X Sulfur
X Ignitability
X Cation Exchange Capacity

Section 4.0 — Project Organization and Responsibility

The overall organizational structure for this site is discussed in Section 4.0 of the GQAPP. Site-specific designated personnel and their responsibilities are listed below:

Site Manager:
Team/Task Leader(s): To Be Determined
Field Support Personnel:

Biographies for those personnel listed above which are not included in the GQAPP are included in Appendix A of this document.

Section 5.0 -- QA/QC Objectives for Measurement Data

Criteria for reporting the accuracy, precision, and completeness of data are presented in Section 5.0 of the GQAPP. Detection limits for screening and quantitative analyses are presented in Section 9.0 of the GQAPP. Procedures used to assess data accuracy, precision, and completeness are presented in Section 14.0 of the GQAPP. All analytes (including field parameters), sample media, and method numbers relevant to the investigation of this site are listed in the following table, which also identifies any modifications to the accuracy (A), precision (P), completeness (C), and detection limit (DL) criteria specified in the above-referenced GQAPP sections.

Analyte	Media	Method No.	A	P	C	DL
*						
Laboratory Screening Analyses						
Volatile Organic Compounds	S/W	--	N/M	N/M	N/#	N/M
Polynuclear Aromatic Hydrocarbons	S/W	--	N/M	N/M	N/M	N/M
Pesticides	S/W	--	N/M	N/M	N/M	N/M
Polychlorinated Biphenyls	S/W	--	N/M	N/M	N/M	N/M
Total Recoverable Hydrocarbons	S/W	EPA 418.1				
Phenols	S/W	--	N/M	N/M	N/M	N/M
Arsenic	S/W	--	N/M	N/M	N/M	N/M
Cadmium	S/W	--	N/M	N/M	N/M	N/M
Chromium	S/W	--	N/M	N/M	N/M	N/M
Copper	S/W	--	N/M	N/M	N/M	N/M
Lead	S/W	--	N/M	N/M	N/M	N/M
Nickel	S/W	--	N/M	N/M	N/M	N/M
Silver	S/W	--	N/M	N/M	N/M	N/M
Zinc	S/W	--	N/M	N/M	N/M	N/M
Laboratory Analyses						
Volatile Halogenated Hydrocarbons	S/W	EPA 8010/601	N/M	N/M	N/M	N/M
Volatile Aromatic Hydrocarbons	S/W	EPA 8020/602	N/M	N/M	N/M	N/M
TCL Purgeables + xylene	S/W	EPA 8240/624	N/M	N/M	N/M	N/M
TCL BNAs	S/W	EPA 8270/625	N/M	N/M	N/M	N/M
TCL Pesticides 6 PCBs	S/W	EPA 8080/608	N/M	N/M	N/M	N/M
Total Recoverable Hydrocarbons	S/W	EPA 418.1	N/M	N/M	N/M	N/M
TCL Metals:						
Aluminum	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Antimony	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Arsenic	S/W	EPA 7060/206.2	N/M	N/M	N/M	N/M
Barium	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Beryllium	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Boron	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Cadmium	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Calcium	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Chromium	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Cobalt	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Copper	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Iron	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Lead	S/W	EPA 7421/239.2	N/M	N/M	N/M	N/M
Magnesium	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Manganese	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Mercury	S/W	EPA 7471/245.1	N/M	N/M	N/M	N/M

Analyte	Media	Method No.	A	P	C	DL
Nickel	S/W	EPA 6010/200.7	N/H	N/M	N/H	N/M
Selenium	S/W	EPA 7740/270.2	N/H	N/H	N/H	N/M
Silver	S/W	EPA 6010/200.7	N/M	N/M	N/H	N/M
Sodium	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/H
Thallium	S/W	EPA 78411279.2	N/M	N/M	N/H	N/H
Vanadium	S/W	EPA 6010/200.7	N/H	N/H	N/H	N/M
Zinc	S/W	EPA 6010/200.7	N/M	N/M	N/H	N/M
Cyanide	S/W	EPA 9010/335.2	N/H	N/M	N/M	N/M
TOC	S/W	EPA 9060/415.1	N/H	N/M	N/M	N/M
Hardness	V	EPA 130.2	N/H	N/M	N/H	N/M
Alkalinity	V	EPA 310.1	N/H	N/H	N/M	N/M
Total Suspended Solids	V	EPA 160.2	N/H	N/M	N/M	N/M
Total Kjeldahl Nitrogen	S/W	EPA 351.3	N/M	N/H	N/H	N/H
Nitrogen-Ammonia	S/W	EPA 350.2	N/M	N/H	N/H	N/M
Orthophosphate Phosphorus	S/W	EPA 365.2	N/H	N/H	N/H	N/H
5-day Biological Oxygen Demand	V	SM 507	N/H	N/M	N/M	N/H
Chemical Oxygen Demand	V	EPA 410.4	N/H	N/H	N/H	N/M
pH	V	EPA 150.1	N/H	N/M	N/M	N/M
Percent Moisture	S	ASTH D-2216-80	N/H	N/H	N/M	N/
Grain Size	S	ASTH D-422-63	N/M	N/M	N/M	N/M
BTU Content	S	ASIH D-2015-77	N/M	N/M	N/M	N/H
Ash Content	S	ASTH D-482	N/H	N/M	N/H	N/M
Total Ealogens	S	ASIH D-808-81	N/M	N/H	N/M	N/M
		EPA 325.3	N/M	N/H	N/H	N/M
Sulfur	S	ASIH D-129-64	N/H	N/H	N/H	N/M
Ignitability	S/W	EPA 1010	N/M	N/M	N/M	N/H
Cation Exchange Capacity	S	EPA 9081	N/H	N/H	N/H	N/M
Field Parameters						
pH	V	Field	N/M	N/M	N/M	N/M
Specific Conductance	V	Field	N/H	N/H	N/H	N/H
Temperature	V	Field	N/H	N/M	N/M	N/M
Dissolved Oxygen	V	EPA 360.1	N/H	N/M	N/M	N/M

Notes: S = Soil and/or sediment
V = Groundwater and/or surface water
N/M = No Hodifications from GQAPP

*Vith the exception of Total Recoverable Hydrocarbons and Gross Alpha, the laboratory screening analyses do not have EPA method numbers.

Section 6.0 -- Fieldwork and Sampling Procedures

Fieldwork and sampling procedures are presented in Section 6.0 of the GQAPP. Modifications to these procedures are described below:

No Modifications

Section 7.0 -- Sample Custody

Sample custody procedures are presented in Section 7.0 of the GQAPP. Modifications to these procedures are described below:

No Modifications

Section 8.0 -- Calibration Procedures and Frequency

Calibration procedures and frequency are presented in Section 8.0 of the GQAPP. Modifications to these procedures are described below:

No Modifications

Section 9.0 -- Analytical Procedures

Screening and quantitative analytical procedures are presented in Section 9.0 of the GQAPP. Site-specific accuracy, precision, completeness, and detection limit criteria are presented in Section 5.0 of this SQAPP. Modifications to any other of the analytical procedures are described below:

No Modifications

Section 10.0 -- Data Reduction, Validation, and Reporting

Data reduction, validation, and reporting procedures are presented in Section 10.0 of the GQAPP. Modifications to these procedures are described below:

No Modifications

Section 11.0 -- Internal Quality Control Checks

Internal quality control check procedures are presented in Section 11.0 of the GQAPP. Modifications to these procedures are described below:

No Modifications

Section 12.0 — Performance and System Audits

Performance and system audit procedures are presented in Section 12.0 of the GQAPP. Specific audits planned for this site investigation are listed below:

Audit Type	Frequency/Date	Description
	To Be Determined	

Section 13.0 -- Preventive Maintenance

Preventive maintenance procedures are presented in Section 13.0 of the GQAPP. Modifications to these procedures are described below:

No Modifications

Section 14.0 -- Procedures Used to Assess Accuracy, Precision, and Completeness of Data

Procedures used to assess the accuracy, precision, and completeness of data are presented in Section 14.0 of the GQAPP. Modifications to these procedures are described below:

No Modifications

Section 15.0 -- Corrective Action

Corrective action procedures are presented in Section 15.0 of the GQAPP. Hodifications to these procedures are described below:

No Modifications

Section 16.0 -- Quality Assurance Reports to Management

Quality assurance report procedures are presented in Section 16.0 of the GQAPP. Modifications to these procedures are described below:

No Modifications

Appendix A -- Additional Personnel Biographies

Personnel assigned to this site investigation whose biographies do not appear in the GOAPP are listed below; biographies for these site personnel are presented on the following pages.

To Be Determined

Section 1.0 -- Title Page

Work Plan Group: J
Site No. : 19
Site Name: Fuel Farm Pipeline Leak Area

Prepared by: Mary L. Miller
Ecology and Environment, Inc.
1203 Governor's Square Boulevard, Suite 401
Tallahassee, Florida 32301

Prepared for: Department of the Navy
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive, P.O. Box 10068
Charleston, South Carolina 29411-0068
Contract Number N62467-88-C-0200

Signature Approvals:

E & E Project Manager: J. Barksdale

E & E QA/QC Director or Assistant QA/QC Director: T. Yeates/R. Short

E & E ASC Director: A. Clifton

E & E QA/QC Project Officer: A. Schuessler

Section 2.0 __Table of Contents

		Page	Date
Section 1.0	__Title Page	1	4-24-89
Section 2.0	__Table of Contents	2	4-24-89
Section 3.0	__Project Summary	3	4-24-89
Section 4.0	__Project Organization and Responsibility	5	4-24-89
Section 5.0	__QA/QC Objectives for Measurement Data	5	4-24-89
Section 6.0	__Fieldvork and Sampling Procedures	8	4-24-89
Section 7.0	__Sample Custody	8	4-24-89
Section 8.0	__Calibration Procedures and Frequency	8	4-24-89
Section 9.0	__Analytical Procedures	8	4-24-89
Section 10.0	__Data Reduction, Validation, and Reporting	9	4-24-89
Section 11.0	__Internal Quality Control Checks	9	4-24-89
Section 12.0	__Performance and Systems Audits	9	4-24-89
Section 13.0	__Preventive Maintenance	10	4-24-89
Section 14.0	__Procedures Used to Assess Accuracy, Precision, and Completeness of Data	10	4-24-89
Section 15.0	__Corrective Action	10	4-24-89
Section 16.0	__Quality Assurance Reports to Management	10	4-24-89
Appendix A	__Additional Personnel Biographies	11	4-24-89

Section 3.0 -- Project Summary

Work Plan Group: J

Site No.: 19

Site Name: Fuel Farm Pipeline Leak Area

Site Description: A complete site description and history are presented in Sections 2.0 and 3.0 of the attached work plan.

Phase I -- Field Screening
Physical Survey (check all that apply):

- X Overall Physical Reconnaissance
- X HNu/OVA Surface Emission Survey
- ___ Radiation Survey
- X Habitat/Biota Survey
- ___ Asbestos Survey (in Rubble)
- X Hydrologic Assessment

Geophysical Survey (check all that apply):

- X Electromagnetic Conductivity:
  - X EM-31 ___ EM-34
- X Magnetometry
- ___ Very Low Frequency
- ___ Ground Penetrating Radar
- ___ Seismic Refraction
- ___ Seismic Reflection

Analytical Screening (check all that apply):

- ___ Field Analyses:
- X Soil Headspace Analyses: Planned Number of Samples 80
- ___ Soil Gas Analyses : Planned Number of Samples ___
- X Laboratory Analyses:

PLANNED NUMBER OF SAMPLES		CATEGORIES OF ANALYSES
Surface Water	___	X Volatile Organic Compounds
Sediment	___	X Polynuclear Aromatic Hydrocarbons
Soil	18	X Phenols
Groundwater	7	___ Organophosphorus Pesticides
Duplicates	2	___ Chlorinated Herbicides
Trip Blanks	___	___ Carbamates
Field Blanks	___	X Pesticides/Polychlorinated Biphenyls
Rinsate Blanks	___	X Total Recoverable Hydrocarbons
Other	___	X Metals
		___ Gross Alpha

Section 3.0 -- Project Summary (Continued)

Phase II -- Characterization

PLANNED NUMBER OF SAMPLES

Surface Water	___	Air	___	Duplicates	3
Sediment	___	Biota:		Trip Blanks	2
Soil	15	Flora	___	Field Blanks	2
Groundwater	7	Fauna	___	Rinsate Blanks	2

CATEGORIES OF ANALYSES

- X Purgeable Aromatics
- X Purgeable Ealocarbons
- X Base/Neutral Extractables
- X Acid Extractables
- ___ Polynuclear Aromatic Hydrocarbons
- X Pesticides
- X Polychlorinated Biphenyls
- X Total Recoverable Hydrocarbons
- X Metals
- X Cyanide

Additional analytical categories are identified below:

- ___ Gross Alpha
- X Total Organic Carbon
- X Hardness (water only)
- X Alkalinity
- X Total Suspended Solids (water only)
- X Total Kjeldahl Nitrogen
- X Ammonia Nitrogen
- X Orthophosphate Phosphorus
- X Dissolved Oxygen (in field)
- X 5-day Biological Oxygen Demand
- X Chemical Oxygen Demand
- X pH
- X Percent Moisture
- X Grain Size
- X BTU Content
- X Ash Content
- X Total Ealogens
- X Sulfur
- X Ignitability
- X Cation Exchange Capacity

Section 4.0 -- Project Organization and Responsibility

The overall organizational structure for this site is discussed in Section 4.0 of the GQAPP. Site-specific designated personnel and their responsibilities are listed below:

Site Manager:
Team/Task Leader(s): To Be Determined
Field Support Personnel:

Biographies for those personnel listed above which are not included in the GQAPP are included in Appendix A of this document.

Section 5.0 — QA/QC Objectives for Measurement Data

Criteria for reporting the accuracy, precision, and completeness of data are presented in Section 5.0 of the GQAPP. Detection limits for screening and quantitative analyses are presented in Section 9.0 of the GQAPP. Procedures used to assess data accuracy, precision, and completeness are presented in Section 14.0 of the GQAPP. All analytes (including field parameters), sample media, and method numbers relevant to the investigation of this site are listed in the following table, which also identifies any modifications to the accuracy (A), precision (P), completeness (C), and detection limit (DL) criteria specified in the above-referenced GQAPP sections.

Analyte	Media	Method No.	A	P	C	DL
Laboratory Screening Analyses*						
Volatile Organic Compounds	S/W	--	N/M	N/M	N/M	N/M
Polynuclear Aromatic Eydrocarbons	S/W	--	N/M	N/M	N/M	N/M
Pesticides	S/W	--	N/M	N/M	N/H	N/H
Polychlorinated Biphenyls	S/W	--	N/M	N/M	N/H	N/M
Total Recoverable Eydrocarbons	S/W	EPA 418.1				
Pheno1s	S/W	--	N/M	N/M	N/M	N/M
Arsenic	S/W	--	N/M	N/M	N/M	N/M
Cadmium	S/W	--	N/M	N/M	N/M	N/M
Chromium	S/W	--	N/H	N/M	N/M	N/M
Copper	S/W	--	N/M	N/M	N/H	N/M
Lead	S/W	--	N/H	N/M	N/M	N/H
Nickel	S/W	--	N/M	N/M	N/M	N/M
Silver	S/W	--	N/M	N/M	N/M	N/M
Zinc	S/W	--	N/M	N/M	N/M	N/M
Laboratory Analyses						
Volatile Balogenated Eydrocarbons	S/W	EPA 8010/601	N/H	N/M	N/M	N/M
Volatile Aromatic Eydrocarbons	S/W	EPA 8020/602	N/M	N/M	N/M	N/H
TCL Purgeables + xylene	S/W	EPA 8240/624	N/M	N/M	N/H	N/M
TCL BNAs	S/W	EPA 8270/625	N/M	N/M	N/M	N/H
TCL Pesticides & PCBs	S/W	EPA 8080/608	N/M	N/M	N/M	N/M
Total Recoverable Eydrocarbons	S/W	EPA 418.1	N/H	N/M	N/M	N/M
TCL Metals:						
Aluminum	S/W	EPA 6010/200.7	N/H	N/M	N/M	N/M
Antimony	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Arsenic	S/W	EPA 70601206.2	N/H	N/M	N/M	N/M
Barium	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Beryllium	S/W	EPA 6010/200.7	N/M	N/M	N/H	N/H
Boron	S/W	EPA 6010/200.7	N/H	N/M	N/M	N/M
Cadmium	S/W	EPA 6010/200.7	N/H	N/M	N/M	N/M
Calcium	S/W	EPA 6010/200.7	N/M	N/H	N/M	N/M
Chromium	S/W	EPA 6010/200.7	N/M	N/M	N/H	N/H
Cobalt	S/W	EPA 6010/200.7	N/M	N/M	N/H	N/M
Copper	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/H
Iron	S/W	EPA 6010/200.7	N/M	N/M	N/H	N/H
Lead	S/W	EPA 7421/239.2	N/H	N/M	N/M	N/M
Magnesium	S/W	EPA 6010/200.7	N/H	N/M	N/M	N/M
Manganese	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/
Hercury	S/W	EPA 7471/245.1	N/M	N/M	N/M	N/M

Analyte	Media	Method No.	A	P	C	DL
Nickel	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Selenium	S/W	EPA 7740/270.2	N/M	N/M	N/M	N/M
Silver	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Sodium	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Thallium	S/W	EPA 7841/279.2	N/M	N/M	N/M	N/M
Vanadium	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Zinc	S/W	EPA 6010/200.7	N/M	N/M	N/M	N/M
Cyanide	S/W	EPA 9010/335.2	N/M	N/M	N/M	N/M
TOC	S/W	EPA 9060/415.1	N/M	N/M	N/M	N/M
Hardness	W	EPA 130.2	N/M	N/M	N/M	N/M
Alkalinity	W	EPA 310.1	N/M	N/M	N/M	N/M
Total Suspended Solids	W	EPA 160.2	N/M	N/M	N/M	N/M
Total Kjeldahl Nitrogen	S/W	EPA 351.3	N/M	N/M	N/M	N/M
Nitrogen-Ammonia	S/W	EPA 350.2	N/M	N/M	N/M	N/M
Orthophosphate Phosphorus	S/W	EPA 365.2	N/M	N/M	N/M	N/M
5-day Biological Oxygen Demand	W	SM 507	N/M	N/M	N/M	N/M
Chemical Oxygen Demand	W	EPA 410.4	N/M	N/M	N/M	N/M
pH	W	EPA 150.1	N/M	N/M	N/M	N/M
Percent Moisture	S	ASTM D-2216-80	N/M	N/M	N/M	N/M
Grain Size	S	ASTM D-422-63	N/M	N/M	N/M	N/M
BTU Content	S	ASTM D-2015-77	N/M	N/M	N/M	N/M
Ash Content	S	ASTM D-482	N/M	N/M	N/M	N/M
Total Halogens	S	ASTM D-808-81	N/M	N/M	N/M	N/M
		EPA 325.3	N/M	N/M	N/M	N/M
Sulfur	S	ASTM D-129-64	N/M	N/M	N/M	N/M
Ignitability	S/W	EPA 1010	N/M	N/M	N/M	N/M
Cation Exchange Capacity	S	EPA 9081	N/M	N/M	N/M	N/M
Field Parameters						
pH	W	Field	N/M	N/M	N/M	N/M
Specific Conductance	W	Field	N/M	N/M	N/M	N/M
Temperature	W	Field	N/M	N/M	N/M	N/M
Dissolved Oxygen	W	EPA 360.1	N/M	N/M	N/M	N/M

Notes: S = Soil and/or sediment
W = Groundwater and/or surface water
N/M = No Modifications from GQAPP

*
With the exception of Total Recoverable Hydrocarbons and Gross Alpha, the laboratory screening analyses do not have EPA method numbers.

Section 6.0 — Fieldwork and Sampling Procedures

Fieldwork and sampling procedures are presented in Section 6.0 of the GQAPP. Hodifications to these procedures are described belov:

No Modifications

Section 7.0 — Sample Custody

Sample custody procedures are presented in Section 7.0 of the GQAPP. Modifications to these procedures are described belov:

No Hodifications

Section 8.0 -- Calibration Procedures and Frequency

Calibration procedures and frequency are presented in Section 8.0 of the GQAPP. Modifications to these procedures are described below:

No Modifications

Section 9.0 -- Analytical Procedures

Screening and quantitative analytical procedures are presented in Section 9.0 of the GQAPP. Site-specific accuracy, precision, completeness, and detection limit criteria are presented in Section 5.0 of this SQAPP. Modifications to any other of the analytical procedures are described belov:

No Hodifications

Section 10.0 -- Data Reduction, Validation, and Reporting

Data reduction, validation, and reporting procedures are presented in Section 10.0 of the GQAPP. Modifications to these procedures are described below:

No Modifications

Section 11.0 -- Internal Quality Control Checks

Internal quality control check procedures are presented in Section 11.0 of the GQAPP. Modifications to these procedures are described below:

No Modifications

Section 12.0 -- Performance and System Audits

Performance and system audit procedures are presented in Section 12.0 of the GOAPP. Specific audits planned for this site investigation are listed below:

Audit Type	Frequency/Date	Description
	To Be Determined	

Section 13.0 — Preventive Maintenance

Preventive maintenance procedures are presented in Section 13.0 of the GQAPP. Modifications to these procedures are described below:

No Hodifications

Section 14.0 — Procedures Used to Assess Accuracy, Precision, and Completeness of Data

Procedures used to assess the accuracy, precision, and completeness of data are presented in Section 14.0 of the GQAPP. Modifications to these procedures are described below:

No Hodifications

Section 15.0 — Corrective Action

Corrective action procedures are presented in Section 15.0 of the GQAPP. Hodifications to these procedures are described belov:

No Modifications

Section 16.0 — Quality Assurance Reports to Management

Quality assurance report procedures are presented in Section 16.0 of the GQAPP. Hodifications to these procedures are described below:

No Hodifications

Appendix A — Additional Personnel Biographies

Personnel assigned to this site investigation whose biographies do not appear in the GQAPP are listed below; biographies for these site personnel are presented on the following pages.

To Be Determined

APPENDIX C

THREATENED AND ENDANGERED FLORA AND FAUNA ASSOCIATED WITH NAS PENSACOLA

I

[Bold items enclosed in brackets denote changes from original text]

0000160

APPENDIX C
THREATENED AND ENDANGERED FLORA AND FAUNA OBSERVED OR LIKELY TO OCCUR WITHIN THE NAS PENSACOLA FACILITY OR NEARBY

Scientific Name	Common Name	Base * Status	Status FGFWFC(or FDA)	Status USFWS	Habitat
FISHES					
Acipenser oxyrhynchur	Atlantic sturgeon	M	SSC	UR 2	Gult coart, estuarine
Ammocrypta asprella	Crystal darter	U	T	UR 2	Fresh wator
Etheostoma histrio	Harelquin darter	U	SSC		Fresh wator
Fundulus jenkinsi	Salt marsh topminnow	P	SSC		Salt, fresh, brackish waters
Lepisosteus spatula	Alligator gar	U	SSC		Brackish, fresh, salt wator
Moxostoma carinatum	River redhorse	U	SSC		Fresh wator
AMPHIBIANS AND REPTILES					
Alligator mississippiensis	American Alligator	R	SSC	T(S/A)	Swamps, marshes, pondr
Caretta carotta carotta	Loggerhead turtle	M ?	T	T	Marine, coastal
Chelonia mydas mydas	Green turtlo	M ?	E	E	Marine, coastal
Dermochelys coriacea	Loathorback turtlo		E	L	Marine, coastal
Drymarchon corais coupori	Eastern indigo snake	P	T	T	Open areas near wator
Eretmochelys imbricata	Hawksbill turtlo	M ?	E	E	Marina, coastal
Gopherus polyphemus	Gopher tortoise	P	SSC	UR 1	Sandy coastal plains
Graptemys pulchra	Alabama map turtlo	U	SSC		Swamps, streams, marshes, pondr
Lepidochelys kempi	Atlantic ridley	M ?	E	E	Marine, coastal
Rana areolata aesopus	Florida gopher frog	P	SSC	UR 2	Sand hill communities
Macroclemys temmincki	Alligator snapping turtlo	Sa	SSC	UR 2	Swamps, marshes, pondr
MAMMALS					
Mustela vison lutensis	Florida mink	U		UR 2	Terrestrial habitats
Peromyscus polionotus trissyllepsis	Perdido Koy beach mouse		T	E	Beach dunes
Trichechus manatus latirostris	West Indian manatee	M	E	E	Atlantic and Gult coasts
Ursus americanus floridanus	Clorida black bear	N/A	T	Ua 2	Titi swamps

Appendix C (Cont).

Scientific Name	Common Name	Base * Status	Status FGFWFC(or FDA)	Status USFWS	Habitat
BIRDS					
Charadrius melodus	Piping Plover	P	T	T	Open dry, sandy beaches
Charadrius alexandrinus	Snowy plover	P	T	UR 2	Open dry, sandy beaches
Dendroida dominica stoddardi	Stoddard's yellow-throated warbler	P-U		UR 2	Wooded habitats
Dendroica kirtlandii	Kirtland's warbler	U	E	E	Wooded habitats
Haeratopus palliatus	American oystercatcher	U	SSC		Coastal habitats
Egretta rufescens	Reddish egret	P-U	SSC	UR 2	Freshwater/coastal wetlands
Egretta caerulea	Little blue heron	P-U	SSC		Freshwater/coastal wetlands
Egretta thula	Snowy egret	P-u	SSC		Freshwater/coastal wetlands
Grus canadensis pratensis	Florida sandhill crane	U	T		Freshwater wetlands
Falco peregrinus tundrius	Arctic peregrine 'falcon	M	E	T	Winters on coasts
Falco sparverius paulus	Southeastern kestrel	R	T	UR 2	Open pine forests, clearings
Haeratopus palliatus	American oystercatcher	P-U	SSC		Open coastal beaches
Haliaeetus leucocephalus	Bald eagle	P-U	T	E	Pine forests/coastal habitat
Pandion haliaetus	osprey	R	SSC		Near water
Pelecanus occidentalis	Brown pelican	R	SSC	AC	Mangrove trees, coasts
Picoides borealis	Red-cockaded woodpecker	P-U	T	E	Cavity nests/old pine stands
Vermivora bachmanii	Bachmann's warbler	U	E	E	Wooded habitats
Canpephilus principalis	Ivory-billed woodpecker	U	E	E	Wooded habitats
Sterna antillarum	Least tern	U	T		Coastal habitats
Mycteria americana	Wood stork	U	E	E	Freshwater/coastal wetlands
Rostrhamus sociabilis	Snail kite	U	E	E	Freshwater/coasta1 wetlands
INVERTEBRATES					
Copris gopheri	Scarab beetle	P		UR 2	Associated w/Gopher Tortoise

0000161

Appendix C (Cont.)

Scientific Name	Common Name	Base * Status	Status FGFWFC(or FDA)	Status USFWS	Habitat
PLANTS					
Chrysopsis gossypina cruiseana	Cruise's golden-aster	P	E	UR 1	Coastal dunes
Drosera intermedia	Spoon-leaved sundew	R	T		Aquatic habitat.
Epigaea repens	Trailing arbutus	U	E		Dry, acid, randy soil
Kalmia latifolia	Mountain laurel	U	T		Rich, moist, shady woods
Lilaeopsis carolinensis	Carolina lilaeopsis	R		UR 2	
Lilium iridollae	Panhandle lily	U	E	UR 2	Black, mucky roils
Pinguicula planifolia	Chapman's buttorwort	U	RE	UR 2	
Polygonella macrophylla	Large-leaved jointweed	R	T	UR 1	Sand pino-oak scrub
Rhododendron austrinum	Orange azalea	U	E	UR 5	Moist, woody habitat.
Sarracenia leucophylla	White-top pitcherplant	R	E		Open acid bogs
Sarracenia rubra	Sweet pitchorplant .	U	E	UR 2	Acid bogs/slash pine woods
Stewartia malacodnedron	Silky camellia	U	E		Slopes of wooded ravines

E = Endangerod
T = Threatened
UR 1 = Under review, for Federal listing with substantial evidence in existence indicating at least some degree of biological vulnerability and/or throat.
UR 2 = Under review, insufficient biological data available.
UR 5 = Candidate apocior, but taxa has proven to bo more widespread than was previously believed and/or thoro species that are not subject to any identifiable throat.
FDA = Florida Department of Agriculture.
FGFWFC = Florida Game and Freshwater Fish Commission.
USFWS = U.S. Fish and Wildlife Service.

Bas. • = Status of species on tho HAS Pensacola facility.
R = Resident.
M = Migrant.
SR = Suspected resident.
P = Possible resident duo to available habitat; survey required.
U = unknown, survey roquirod.
N/A = lot expected to occur on the NAS Pensacola facility.