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CONTAMINATION ASSESSMENT REMEDIAL ACTIVITIES INVESTIGATION WORK PLAN FOR GROUP Q AT OAK GROVE CAMPGROUND SITE 39 NAS PENSACOLA FL

7/1/1990

ECOLOGY AND ENVIRONMENT, INC.

CONTAMINATION ASSESSMENT/ REMEDIAL ACTIVITIES INVESTIGATION WORK PLAN — GROUP Q NAVAL AIR STATION PENSACOLA PENSACOLA, FLORIDA

Oak Grove Campground (Site 39)

ecology and environment, inc.
International Specialists in the Environment

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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 Oak Grove Campground (Site 39) 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 a preliminary site inspection conducted in April 1991.

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 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 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 II. 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:

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- o 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;

- o 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

- o Early screening of potential remedial alternatives, which, in turn, allows 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 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation (RI)/Feasibility Study (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 an RI report, which will provide all the information necessary for the development and completion of an FS.

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2. SITE DESCRIPTION

Site 39 (Oak Grove Campground) is located in the southwestern portion of the NAS Pensacola facility (see Figure 2-1). The site area is approximately 2,500 feet south of Forrest Sherman Field and 700 feet northwest of the Pensacola Bay shoreline. The site occupies a roughly circular area approximately 300 feet in diameter and is approximately 5 feet above mean sea level (MSL; see Figure 2-2).

The site area lies in a sandy soil clearing approximately 200 feet south of the campground's trailer camp and is entirely unpaved (see Figure 2-2). Debris, consisting of broken pieces of brick, concrete, tile, glass, coal, and iron nails and rods, is scattered about the circular site area. Within the area of debris lies a zone of stained soils approximately 150 feet in diameter. These stained soils extend several inches beneath land surface and emit a hydrocarbon odor. Little surface runoff from the site occurs due to the relatively flat topography and sandy soils.

No groundwater monitoring wells are present in the vicinity of Site 39; however, NAS Pensacola supply well no. 3 is located approximately 1.2 miles northeast of the site. An area of sparse pine trees and shrubs is located south and east of the site, and a more heavily wooded area is located west and north of the site. Sherman Inlet, a small estuary open to Pensacola Bay, lies approximately **[350]** feet west of the site area. A sandy trail leading to the bay shoreline extends past the site to the east, and an unpaved road leads to the site from the campground. Site 3 (Crash Crew Training Area) and Site 19 (Fuel Farm Pipeline Leak Area) are located approximately 2,400 feet and 3,400 feet, respectively, northwest of Site 39.

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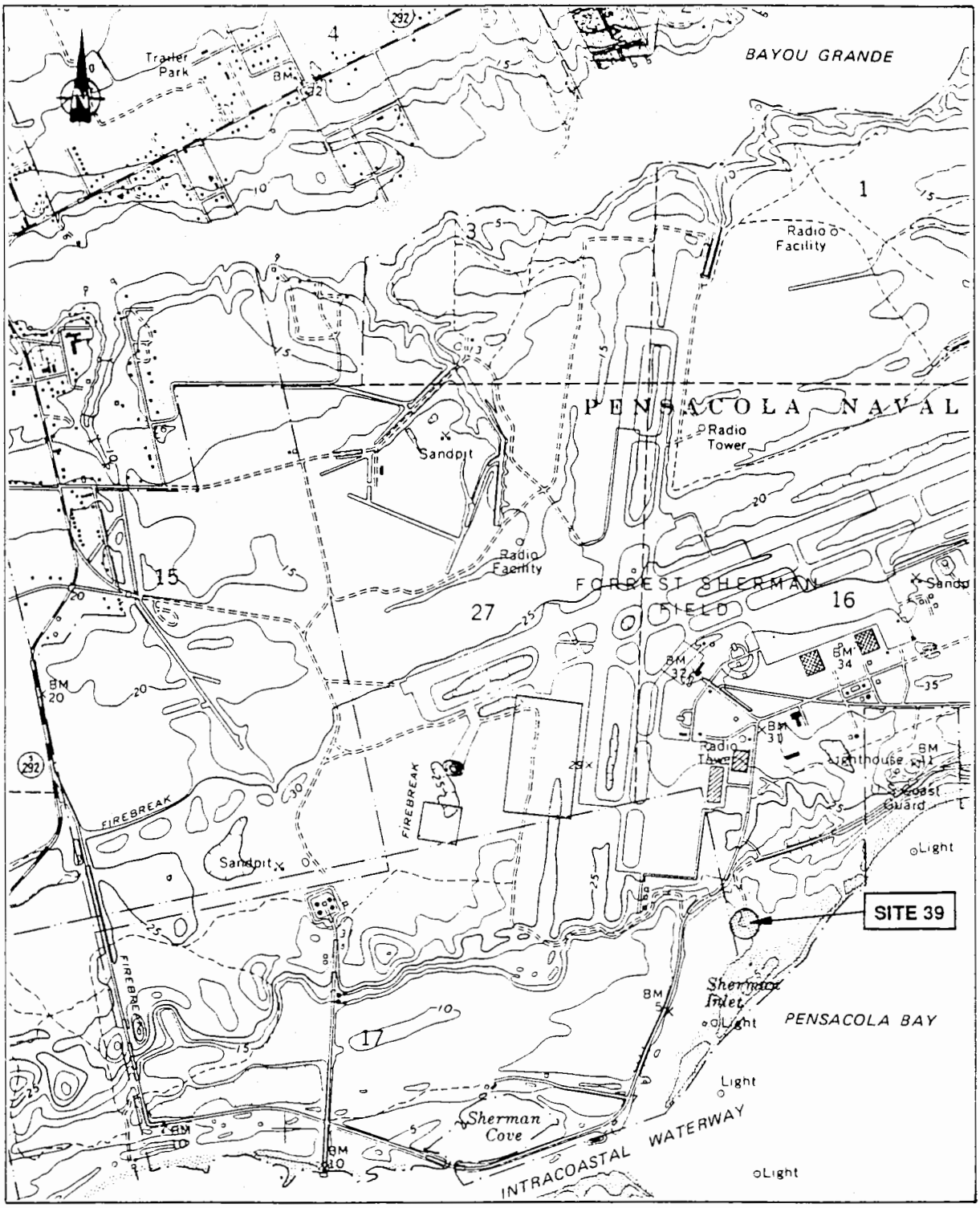


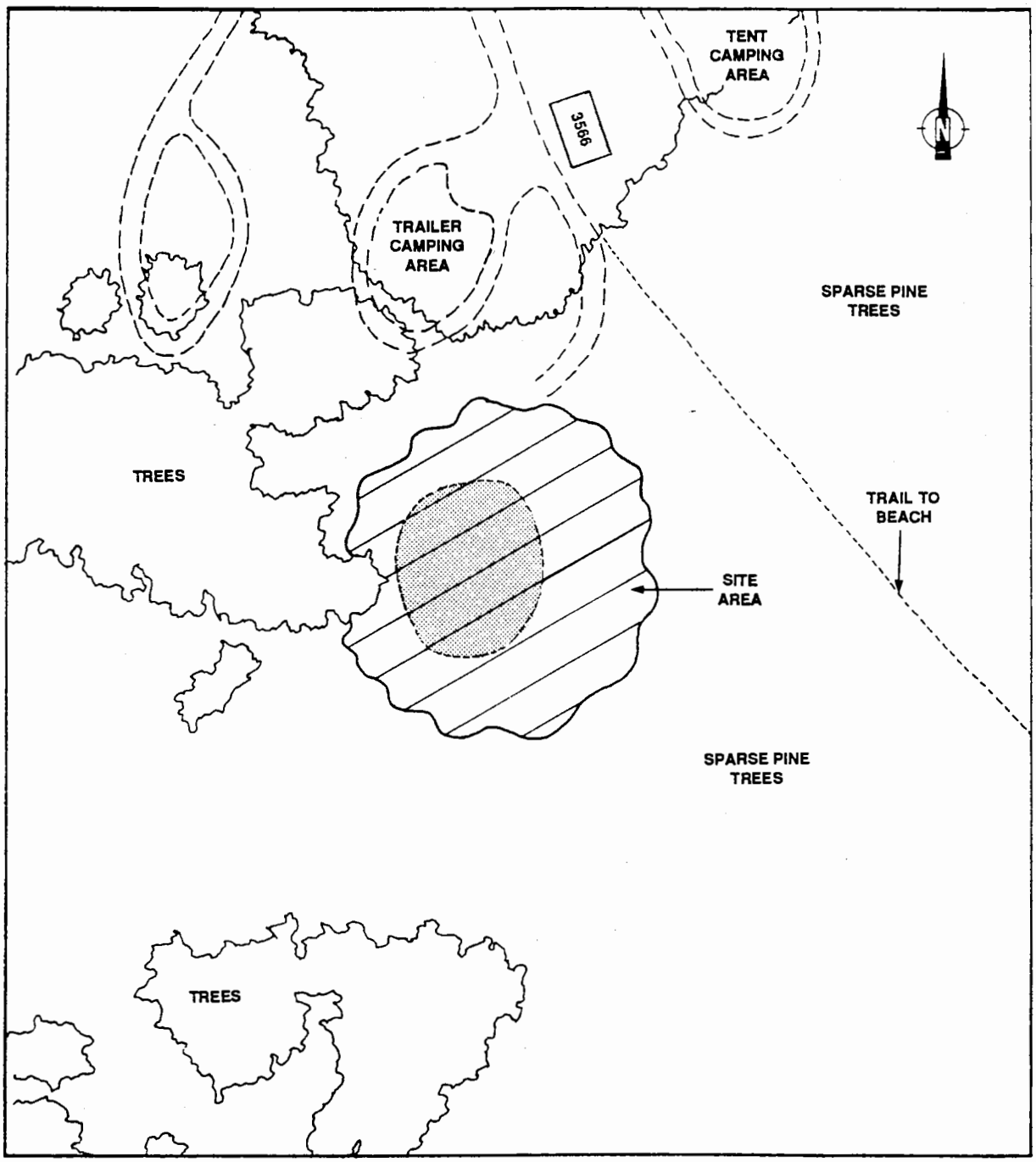
SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangles: Fort Barrancas, Florida. 1970 and West Pensacola, Florida 1970, Photorevised 1987, Ecology and Environment, Inc., 1991

SCALE

0 ½ 1 MILE

0 .5 1 KILOMETER

Figure 2-1 LOCATION MAP — NAS PENSACOLA SITE 39



SOURCE: Ecology and Environment, Inc., 1991

SCALE

0 100 200 FEET

KEY:

- 3566 — Building
- Unpaved Road
- Area of Scattered Debris
- Area of Stained Soils

Figure 2-2 SITE MAP — NAS PENSACOLA SITE 39

3. SITE HISTORY

The origin of the stained soils and debris scattered about Site 39 has not been determined. It has been reported that a boiler-powered sawmill might have been located in the vicinity of Site 39, but this has not been confirmed (Joyner 1991).

A preliminary review of aerial photographs dating from 1951 to 1989 was conducted by E & E. Photographs dated 1961 and 1964 indicate that the development of the Oak Grove Campground occurred during this time period. This development included the formation of unpaved roadways into the area. In a 1968 photograph, the area south and adjacent to the to the campground (currently Site 39) appeared to have been cleared of vegetation and graded. A photograph taken in 1970 shows a zone of disturbed soils occurring in the cleared area south of the campground. This zone appeared to emerge from a roadway and spread to the south toward the bay. The remaining photographs taken since 1970 display various phases of revegetation and a fading of the disturbed area.

In the site area, visibly stained soils emitting a distinct hydrocarbon odor were first reported by campers in the spring of 1990 (Joyner 1991). In April 1990, NAS Facilities Management personnel collected two grab soil samples from the area of stained soils. These soil samples were collected from a depth of 0 to approximately 7 inches below land surface (BLS) and were analyzed for United States Environmental Protection Agency (EPA) solvent numbers F001 through F005, total recoverable petroleum hydrocarbons (TRPHs), and polychlorinated biphenyls (PCBs). The analytical results indicated the presence of 9,834 parts per million (ppm) TRPHs, 9,390 parts per billion (ppb) methanol, 70 ppb tetrachloro-

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ethylene, 40 ppb toluene, and 60 ppb xylene. No PCBs were detected. The complete analytical results for these samples are contained in Appendix A.

To date, no other sampling or investigation has occurred at Site 39.

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4. CLIMATOLOGY

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 the days during the summer months and can cause a 10° to 20° F drop in temperature within 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 1982). High intensity thunderstorms are common, producing as much as 3 to 4 inches of rainfall during a single hour. Evaporation rates are also highest in the summer months; therefore, the potential recharge from heavy summer rains is reduced. 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 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.

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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 seminatural (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 or sand pine scrub communities. The north Florida coastal strand communities are stabilized coastal dunes with a sand substrate, vegetatively characterized by the plants Uniola paniculata (sea oats), Hydrocotyle bonariensis (beach pennywort), Ipomoea 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 three to five 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 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 artificial or biological factor. This community type can have three to five distinct habitats (Wolfe 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). Flatwoods communities also occupy areas of low 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 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 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 (Naval Energy and Environmental Support Activity [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 D). 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 nonmating 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 D). Most 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

Freshwater. Little is known of the flora and fauna inhabiting the streams, swamps, and bogs found on NAS Pensacola. These habitats might 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 Wetlands. 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 saltmarch 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. 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 areal 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 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

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 might have been negatively influenced by the sewage outfall.

Samples collected by the Navy (1986) indicate a low density yet moderate diversity of benthic infaunal organisms when compared to other estuarine systems within and around the turning basin. A complete comparison of the Navy's data with other literature cannot be made at this time because their data are not given in numbers per unit area. However, the Navy's data reveal 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 seven cartilaginous fish species (Cooley 1978). The 13 most abundant species were spot (Leiostomus xanthurus), pinfish (Lagodon rhomboides), Atlantic croaker (Micropogonias 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 blue crab (Callinectes sapidus), shrimp (Penaeus duorarum, P. setiferus, and P. aztecus), and oysters (Crassostrea virginica) have been collected throughout Pensacola Bay (Heil 1989).

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Shrimp are caught in greater abundances near NAS Pensacola 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 the Florida Department of Natural Resources (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 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 to 1985 (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, blue crabs, and squid. These data, as well as the Navy's data, also suggest 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 for the state of Florida are not available 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, grouper, red snapper, flounder, 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 90% of all commercially valuable fish species are estuarine dependent during some phase of their life cycle. Shrimp, blue crab, 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 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 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 (see Appendix D) 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 D). Most 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, the foraging activities of birds in the waters surrounding the

NAS Pensacola facility, and nesting and feeding animals on the facility grounds. Complete biotic surveys may be necessary to determine the presence of threatened or endangered species and potential pathways of contamination to these species.

5.2 Site-Specific Biological Resources

Habitats within Site 39 have been disturbed to varying degrees by base activities (e.g., the campground and the area of scattered debris). The site area has a vegetative community dominated by pioneer-stage understory shrub species and some associations of longleaf-slash pines. Mammals, amphibians, reptiles, and birds associated with coastal vegetated communities, as well as waterfront habitats, could be found in and around this site. Waterfront and wading birds may also utilize this site for resting areas. Areas immediately south of Site 39 are dominated by coastal dune grasses and some shrubs. Because the site is essentially a sand dune area, it is expected that fauna associated with this coastal habitat may utilize this site for feeding, resting, and/or nesting. Site 39 can most likely support large numbers of waterfowl during the migration periods of October through March and wading birds throughout the year.

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 artificial 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 (United States Geological Survey [USGS] 1970a, 1970b).

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.

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

The nearest surface water bodies to Site 39 are Pensacola Bay and the northern portion of Sherman Inlet. Pensacola Bay is located approximately 700 feet **[southeast]** of Site 39. Sherman Inlet and associated marshy areas are located approximately **[350]** feet west of the site.

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7. PHYSIOGRAPHY AND HYDROGEOLOGY

7.1 Physiography and Regional Hydrogeology

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 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, 1970b). 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

Three principal hydrogeologic units of importance underlie 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 approximately 300 feet at NAS Pensacola and is composed of a sequence of

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unconsolidated to poorly indurated clastic deposits (Wagner et al. 1984). In this portion of Florida, the Surficial Aquifer constitutes an important source of water supply and is called the Sand-and-Gravel Aquifer (Southeastern Geological Society [SEGS] 1986). **[Based on the total dissolved solids (TDS) content of groundwater from wells that tap the Sand-and-Gravel Aquifer in southern Escambia County (Clemens et al. 1989), the groundwater is classified as Class G-1 (FDER 1988b).]** The sediments making up this aquifer belong to all or part of the Pliocene to Holocene 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 low permeability zone, and the main producing zone (Wilkins et al. 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 (Geraghty and Miller [G & M] 1984, 1986) indicate that the surficial zone ranges in thickness between 40 and 70 feet and 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 1 foot near surface water bodies to more than 20 feet in areas of higher elevation. In general, the direction of groundwater 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 yielded hydraulic conductivity values ranging from 16 to 56 feet per day (ft/day; G & M 1986). 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.

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 4.2×10^{-5} to 9.9×10^{-2} ft/day. Thus, the low permeability zone probably functions as a confining or semiconfining 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 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 feet BLS 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 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 within the main producing zone occurs under confined or semiconfined 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 flow 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 between the overlying Sand-and-Gravel Aquifer and the underlying Floridan Aquifer System (SEGS 1986). The entire sequence is primarily poor to non-water bearing. However, relatively thin beds of sand which exist within the unit may yield small quantities 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 Lower Member of the Pensacola Clay; all are 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 BLS 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

The soils of Escambia County are derived primarily from marine and stream deposit parent material. The Initial Assessment Study (IAS) soil association map (NEESA 1983) indicates that the surface soils at Site 39 are predominately undifferentiated coastal soils, including dune land and beach-tidal marsh. Lithologic information collected during the drilling of various soil borings on NAS Pensacola indicates that sands, which correspond to the surficial zone of the Sand-and-Gravel Aquifer, extend from land surface to approximately 35 feet below MSL (G & M 1986). This zone primarily consists of fine- to medium-grained, buff to brown to gray quartz sands. An approximately 15-foot-thick marine clay, which corresponds to the low permeability zone of the same aquifer, is found below these sands (G & M 1986).

The immediate Site 39 is currently an undeveloped clearing that borders Pensacola Bay. No monitoring wells are located on site. Considering the site's proximity to Pensacola Bay (approximately 700 feet), the depth to groundwater has been roughly estimated to be 5 feet, and groundwater flow is presumably to the south toward the bay.

An NAS Pensacola water supply well (Well No. 3) is located approximately 1.2 miles northeast of Site 39. This well is infrequently used as a secondary water supply to augment the primary well field located at

Corry Station. The supply well was installed in 1969 to a depth of 240 feet (open to the main producing zone). The well yield, when in use, is about 1,200 gallons per minute (gpm), and depth to the static water level, in 1969, was approximately 45 feet.

[Bold items enclosed in brackets denote changes to last version of document]

8. PROJECT MANAGEMENT PLAN

The Generic Project Management Plan (GPMP) 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).

9. SITE MANAGEMENT PLAN

The Generic Site Management Plan (GSMP) 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 Site 39 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.

[Bold items enclosed in brackets denote changes to last version of document]

10. HEALTH AND SAFETY PLAN

A comprehensive General Health and Safety Plan (GHSP) and individual site-specific safety plan (SSP; **[see Appendix B]**) have been developed to provide readily available emergency information and preventative safety measures. The GHSP outlines health and safety procedures and protocols to be followed during all field investigations at each of the **[39]** sites on NAS Pensacola. The plan includes: standard operating procedures (e.g., site entry and decontamination); hazard communication and training (e.g., safety training, briefings, and documentation); safety equipment and instrumentation (e.g., monitoring and personnel protective equipment); hazard evaluation by contaminant class (e.g., metals and organics); and hazard evaluation for each task (e.g., drilling and sampling). 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 (e.g., 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 Code of Federal Regulations [CFR] Section 1910).

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; **[see Appendix C]**).

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 be 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 to last version of document]

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 might 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 to last version of document]

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 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 to last version of document]

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 II) and subsequent Extent Delineation (phases 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 QA/QC requirements, reflecting the "focusing" objective (as opposed to a formal contaminant quantification objective) of this phase. Each field screening task will utilize all existing information from preceding tasks, including aerial photograph analyses, 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.

[It should be noted that much of the data from the tasks described below will be available to the investigation teams while the fieldwork is still underway. To the greatest extent possible, these data and/or other field observations will be utilized to adjust and/or redirect Phase I efforts in order to maximize the amount of information obtained regarding the horizontal and vertical extents of possible contamination at the site. Adjustments to the Phase I scope of work may include, but may not be limited to: 1) sampling of additional media which are not already included in this work plan; 2) installation of additional and/or deeper (i.e., intermediate depth) temporary monitoring wells; and 3) collection and analysis of additional samples from any given medium. Furthermore, additional data from other site investigations may become available prior to or during the completion of Phase I activities at

this site. This could warrant either an increase or decrease in the scope of work proposed in this work plan.

When the data indicate the need to increase or expand the Phase I scope of work, these data shall also be evaluated to determine whether it is appropriate to collect and analyze any additional samples using DQO Level IV protocol. If the data evaluation clearly indicates that the collection of an additional sample from a specified location and medium will provide final information--information which may be used to determine the nature and extent of contamination, for risk assessment purposes, or to make a final decision on the site--then the additional sample will be collected and analyzed using DQO Level IV protocol. If the data evaluation indicates that the sampling location may be optimized following receipt and evaluation of all Phase I data, then the DQO Level IV sampling event may be postponed until the evaluation of all Phase I data is complete.]

14.1.1 Physical Survey

14.1.1.1 Overall Physical Reconnaissance

A field reconnaissance survey will be conducted on and around Site 39 (Oak Grove Campground). Available aerial photographs and maps will be used as guides in locating surface features. Visual inspections will be made regarding surface conditions, stressed vegetation, surface drainage patterns, and areas of staining.

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 the Phase I field investigation is discussed in the following sections.

The reconnaissance survey team will utilize air monitoring equipment during walkovers of the site, in accordance with Section 6.1.1 of the GQAPP. In the event that any **[areas with readings above background]** are located, the area(s) will be flagged and identified on a site map for future reference. In addition, the field team will record the location and dimensions of any areas characterized by visible staining and/or

exposed waste materials. All findings of the physical reconnaissance will be mapped in detail and recorded in the field logbook.

14.1.1.2 HNu/OVA Surface Emissions Survey and Particulate Air [Screening]

Prior to conducting the survey, a grid will be laid out across the site, using the method described below in Section 14.1.2. In order to identify potential areas where shallow soil volatile organic compound (VOC) contamination exists, a surface emissions survey will be conducted at a minimum of 25-foot grid intervals across Site 39, using an HNu photoionization detector or organic vapor analyzer (OVA). Detailed notes of site activities and weather conditions will be recorded in the site logbook. The survey will be conducted in accordance with Section 6.1.1 of the GQAPP. Measurements will be made at each established grid point, and readings will be recorded in the site logbook.

Preliminary air screening will be conducted with a particulate monitor, such as a Mini-Ram, to determine if the site represents a source of particulates in the air. The air **[screening]** will be conducted in accordance with Section 6.1.**[1]** of the GQAPP.

14.1.1.3 Radiation Survey

A radiation survey is proposed at Site 39 due to the fact that the source of debris on the site is unknown. The survey will be performed using a Micro-R-meter and gamma scintillation detector. The instruments will be passed over the site at ground level, and any areas having above background radioactivity (hot spots) will be recorded. This survey will be conducted on 25-foot grid intervals, in accordance with Section 6.3.2 of the GQAPP.

The instruments will be calibrated as specified in Section 6.3 of the GQAPP in an area away from the influence of the site. All radiation levels will be documented in field logbooks and mapped as detected during the survey.

14.1.1.4 Asbestos Survey

An asbestos survey will be conducted on Site 39 during the physical reconnaissance. This survey will consist of locating and identifying building materials that could potentially contain asbestos. No sampling will be conducted; however, building materials suspected to contain asbestos will be mapped for future reference.

14.1.1.5 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 which may be affected by off-site contaminant migration. 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. **[Using historical aerial photographs and the survey results, a map illustrating the identified habitats will be generated.]** A habitat/biota survey will be conducted for Site 39, as well as an evaluation of the available literature.

14.1.2 Geophysical Survey

At Site 39 and the surrounding areas, an electromagnetic terrain conductivity survey, using an EM-31, and a magnetometer survey will be conducted. 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 establishment 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 25-foot intervals. A transit survey instrument will be used to establish the baselines, and a Brunton compass and a tape measure will be used to complete the grid system for the study area. The grid spacing will be based on 25-foot centers. The EM-31 and magnetometer surveys will be conducted by obtaining measurements at each grid point.

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

14.1.3 Analytical Screening

Phase I sampling activities for Site 39 will require a soil headspace survey, soil sampling, the installation of shallow temporary monitoring wells, and groundwater sampling. Samples will be analyzed in the laboratory for analytical screening parameters. The analytical screening program has been developed for the Phase I effort to efficiently and cost effectively focus subsequent phases of site characterization and contaminant 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.

14.1.3.1 Soil Headspace Survey

Soil samples will be collected for headspace analysis at 50-foot grid intervals across Site 39. Composite soil samples will be collected from each 5-foot depth interval **[(0 to 5 feet BLS, 5 to 10 feet BLS, etc.)]** to the water table. The depth to water is assumed to be 5 feet at Site 39; thus, one depth interval at each sampling location will be analyzed.

The purpose of the soil headspace survey will be to provide preliminary data regarding subsurface VOC contamination and to aid in identifying suitable locations for monitoring well installation and soil borings. In addition, this task meets the requirements of the Florida Administrative Code, Chapter 17-770 for delineating the extent of petroleum-contaminated soils. The collection and processing of soil samples for headspace analysis and the recording of OVA measurements are discussed in detail in Section 6.4 of the GQAPP.

Table 14-1

PHASE I SAMPLING AND ANALYTICAL REQUIREMENTS—GROUP Q

SITE 39

Medium	No. of Samples	Duplicates	Total	Analytical Suite[a,b]
Soil	**[10]**	1	**[11]**	A
Groundwater	6	1	7	A
TOTAL	**[16]**	2	**[18]**	

14[NASP]UH8000:T0291/523/12

[a]Analytical suite designation is as follows:

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

[b]Specific constituents encompassed by the various chemical groups included within analytical suite A are identified in tables 9-1 through 9-[5] of the Generic Quality Assurance Project Pla

Source: Ecology and Environment, Inc., 1992.

[Bold items enclosed in brackets denote changes to last version of document]

14.1.3.2 Laboratory Analyses

Soil and groundwater samples will be collected and laboratory analyzed for screening parameters in order to provide preliminary data regarding the nature and extent of any contamination. The proposed sample locations are focused on the observed area of debris and stained soil.

Soils -- Soil samples will be collected at **[10]** locations across Site 39 (see Figure 14-1). **[These locations may be adjusted based on the results of the preliminary reconnaissance surveys and the soil headspace survey.]** At **[eight boring]** locations, soil samples will be collected and composited over 5-foot intervals **[(0 to 5 feet BLS, 5 to 10 feet BLS, etc.)]** from the surface to the water table. Assuming the depth to water **[across Site 39]** is approximately 5 feet BLS, it is estimated that one soil sample will be collected at each **[boring]** location. **[In addition, two composite surface soil samples will be collected (see Figure 14-1). The purpose of this Phase I surface sampling is to focus the Phase II soil sampling and ultimately to provide the data to evaluate the need for formal air sampling. The data will also be pertinent to Risk Assessment tasks.]** If surface runoff pathways to Sherman Inlet or Pensacola Bay are identified, soil **[boring]** samples will also be collected in the areas of the pathways.

[Soil boring] samples will be collected using a drill rig with 4-inch-diameter solid stem augers. In those areas where it is impractical to use the drill rig, a hand-operated bucket auger will be employed. **[Each surface soil sample will be collected as a composite of five aliquots from within a 50-foot-diameter area. Each aliquot will be collected at a depth interval of surface to 6 inches. For each location, the five aliquots will be homogenized to comprise a single sample.]** All soil sampling and equipment decontamination activities will be conducted in accordance with sections 6.6 and 6.10 of the GQAPP, respectively.

Groundwater -- Six temporary monitoring wells will be installed across Site 39 during Phase I at the locations shown on Figure 14-1. The exact locations of the temporary monitoring wells will be determined after the completion of the physical and geophysical surveys. Each temporary

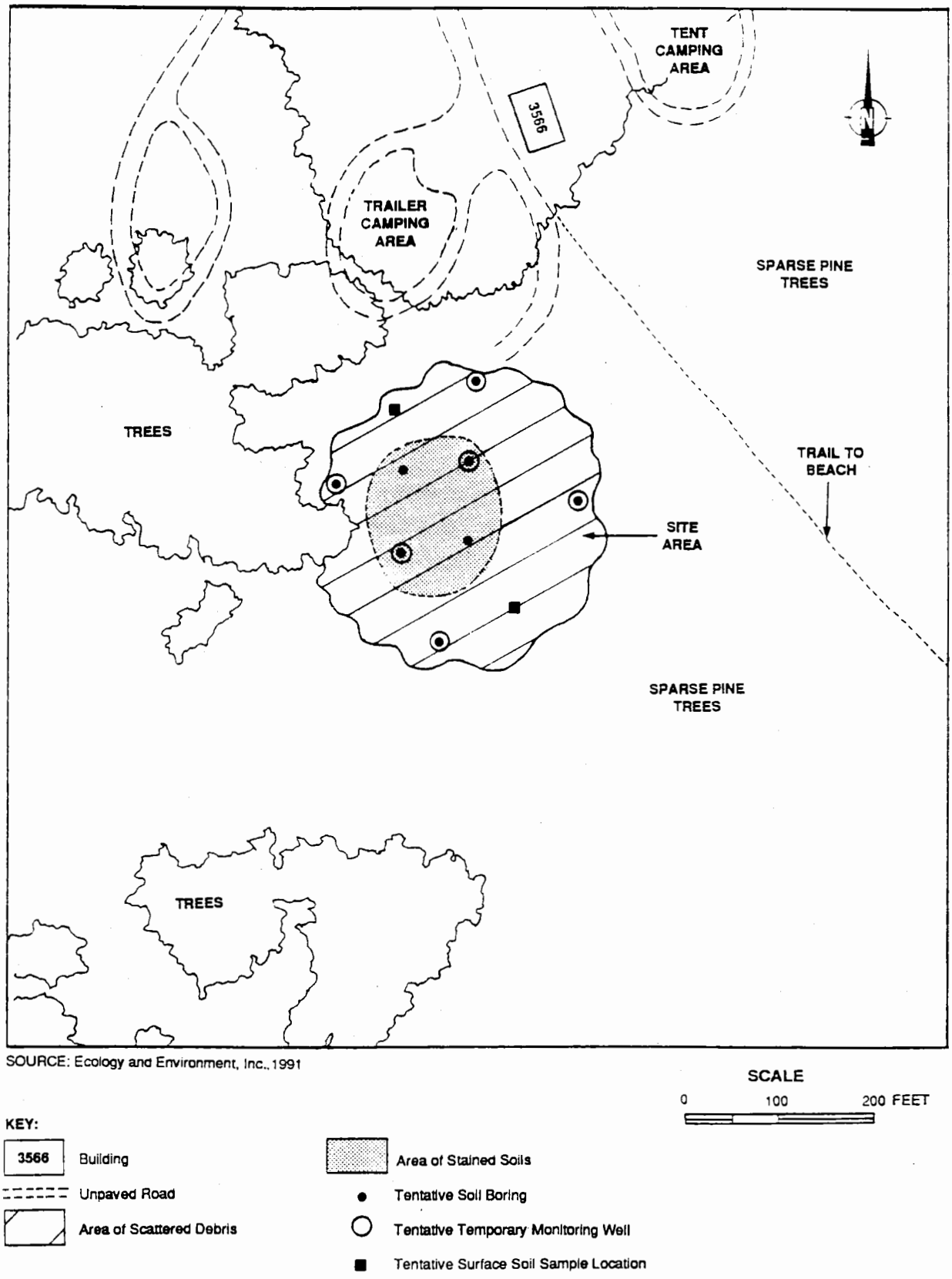


Figure 14-1 TENTATIVE SOIL BORING AND TEMPORARY MONITORING WELL LOCATIONS — NAS PENSACOLA SITE 39 - PHASE I

monitoring well will be constructed of 2-inch-diameter, stainless steel casing, terminating in 5 feet of 0.01-inch slotted, stainless steel screen.

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). Following installation, each well will be developed in accordance with Section 6.7.5 of the GQAPP.

Each of the six temporary monitoring wells will be purged and sampled in accordance with sections 6.7 and 6.8 of the GQAPP. All temporary stainless steel casings and screens and groundwater sampling equipment will be decontaminated in accordance with Section 6.10 of the GQAPP.

14.1.4 Hydrologic Assessment

All temporary and existing monitoring wells will be surveyed to obtain top of casing **[(TOC)]** elevations referenced to a USGS benchmark or to a suitable established elevation reference point located within the vicinity of Site 39. Static water levels will be measured in each well to determine shallow groundwater flow direction and horizontal hydraulic gradient.

14.2 Phase II--Characterization/Extent Delineation

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

The proposed Phase II sampling locations are designed to focus on the areas of contamination associated with the debris and stained soils. This contamination is assumed to be identified during Phase I activities (see Section 14.1.3). 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.

The Phase II investigation of Site 39 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.

[Every effort will be made to complete the investigation of this site during Phase II. To the greatest extent possible, the results of the Phase I investigation, as well as field data and/or observations generated during the Phase II investigation, will be utilized to adjust and/or redirect the Phase II efforts in order to maximize the amount of information obtained regarding the horizontal and vertical extents of possible contamination at the site. Adjustments to the Phase II scope of work may include, but may not be limited to: 1) sampling of additional media which are not already included in this work plan; 2) installation of additional and/or deeper (i.e., intermediate and/or deep) permanent monitoring wells; 3) collection and analysis of additional samples from any given medium; and 4) performance of full-scale aquifer tests or other studies to further characterize the hydraulic properties of the soil or aquifer matrix. Furthermore, additional data from other site investigations may become available prior to or during the completion of Phase II activities at this site. This could warrant an increase or decrease in the scope of work proposed in this work plan.]

Table 14-2

PHASE II SAMPLING AND ANALYTICAL REQUIREMENTS—GROUP Q

SITE 39

Medium	No. of Samples	Duplicates	Trip Blanks[a]	Field Blanks	Rinsate Blanks	Preservative Blanks[b]	Total[c]	Analytical Suite[d,e]
Soil	18	2	1	**[NR]**	1	NR	**[22]** (6)	A C
Groundwater	4	1	1	**[1]**	1	1	**[9]** (2)	A B
TOTAL	22	3	2	1	2	1	31 (8)	

14[NASP]UH8000:T0291/1691/12

[a]Trip blanks will be analyzed for Target Compound List (TCL) Volatile organic compounds (VOCs) only.
[b]Preservative blanks will be analyzed for TCL VOCs, total recoverable petroleum hydrocarbons (TRPHs), total **[Target Analyte List (TAL)]** metals, and cyanide.
[c]The number of samples shown in parentheses will be analyzed for the additional parameters indicated.
[d]Analytical suite designations are as follows:

A = TCL VOCs plus methanol; TCL base-neutral/acid extractable organic compounds; TCL pesticides and polychlorinated biphenyls; TRPHs; **[TAL]** metals (total [i.e., unfiltered] and dissolved [i.e., millipore-filtered, water only]); cyanide; gross alpha, **[gross beta, and gamma scan]** (water only); total organic carbon; hardness (water only); and alkalinity (water only). Rinsate blank metal analyses will be for total metals only.

B = Total suspended solids, total Kjeldahl nitrogen, ammonia nitrogen, orthophosphate phosphorus, dissolved oxygen (in field), 5-day biological oxygen demand (BOD_5), and chemical oxygen demand (COD).

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

[e]Specific constituents encompassed by the various chemical groups included within the above-listed analytical suites are identified in tables 9-**[6]** through 9-**[15]** of the Generic Quality Assurance Project Plan.

NR = Not required.

Source: Ecology and Environment, Inc., 1992.

[Bold items enclosed in brackets denote changes to last version of document]

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, which outlines sample locations, sampling methodologies, analytical parameters, etc., will be prepared.

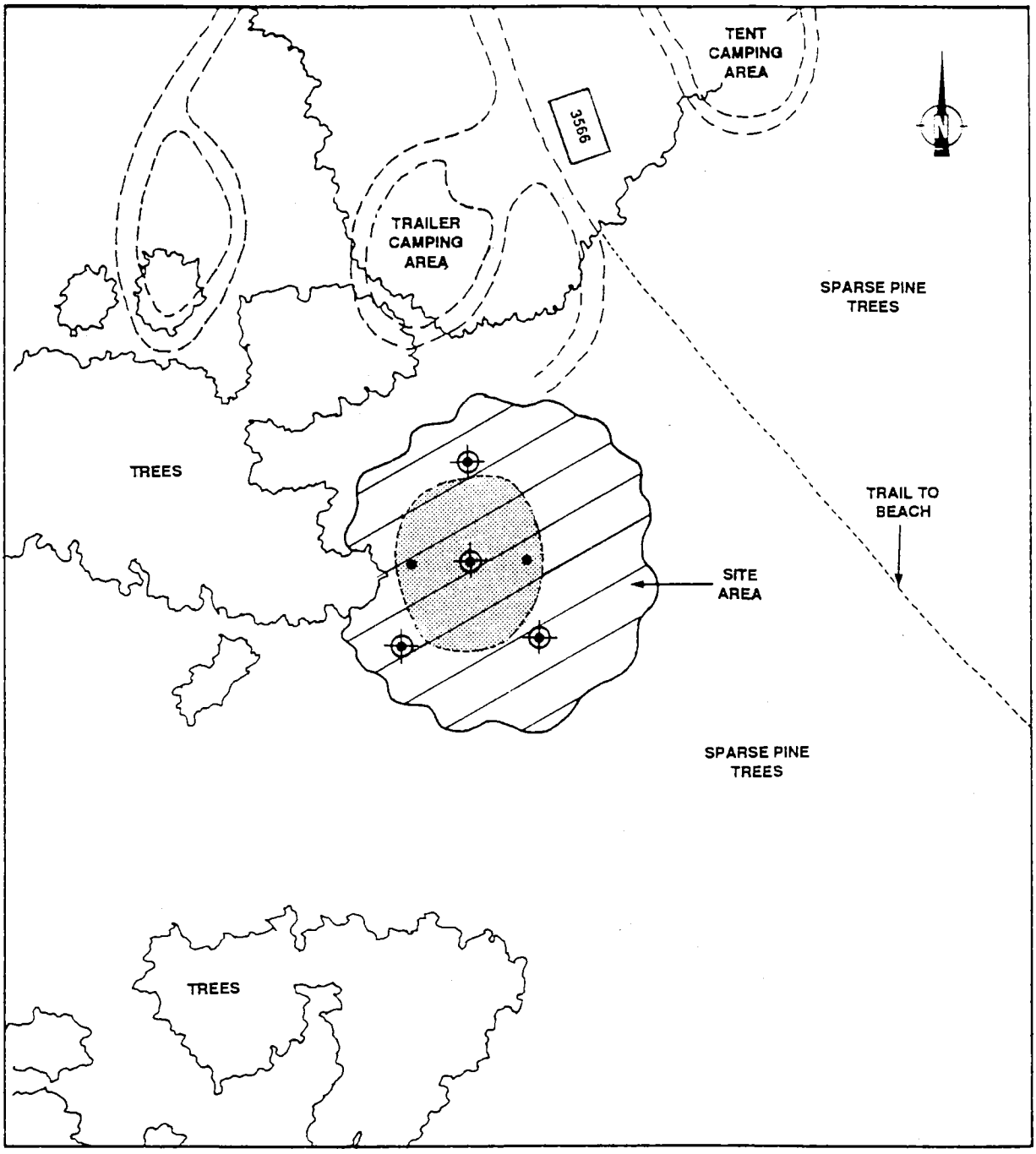
14.2.2 Soil Sampling

The actual number and location of soil samples will be determined based on the results of Phase I. Tentative Phase II soil sample locations are presented on Figure 14-2. For planning purposes, it is estimated that soil samples will be collected at six locations.

Soil samples will be collected in discrete intervals using a hand-operated bucket auger or a split-spoon sampler powered by a drill rig. At each location, a composite soil sample will be collected from the following depth intervals: 0 to **[1.0]** foot BLS, **[1.0]** to 2.5 feet BLS, then every 2.5 feet to the water table. Assuming that the depth to water is approximately 5 feet BLS, it is estimated that three soil samples will be collected at each location for a total of 18 samples. 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 in accordance with Section 6.10 of the GQAPP.

14.2.3 Shallow Monitoring Well Installation and Development

Tentative locations for the Phase II shallow monitoring wells are shown in Figure 14-2. The actual numbers and locations of shallow monitoring wells will be dependent on the results of Phase I. For planning purposes, four new shallow monitoring wells are tentatively proposed for Site 39. 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 constructed of 4-inch-diameter, PVC casing, will bracket the water table with 10 feet of 0.015-inch slotted screen, and will be an estimated 15 feet deep. A detailed discussion of standard monitoring well construction practices is provided in Section



SOURCE: Ecology and Environment, Inc., 1991

SCALE

0 100 200 FEET

KEY:

- 3566 Building
- Unpaved Road
- Area of Scattered Debris
- Area of Stained Soils
- Tentative Soil Boring
- Tentative Shallow Monitoring Well

Figure 14-2 TENTATIVE SOIL BORING AND SHALLOW MONITORING WELL LOCATIONS — NAS PENSACOLA SITE 39 - PHASE II

6.7.3 of the GQAPP. Upon completion, the wells will be developed using the method described in Section 6.7.5 of the GQAPP. All equipment used in monitoring well installation will be decontaminated as discussed in Section 6.10 of the GQAPP.

[Following well development, water levels in all on-site wells will be measured at low and high tides to determine the effect of tidal fluctuations on well water levels. In addition, the elevation of Pensacola Bay, immediately adjacent to the site, will be surveyed concurrently with measuring the water levels in the on-site wells.]

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 wells 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 four newly installed shallow monitoring wells. Each well will be purged and sampled according to the methods provided in Section 6.8 of the GQAPP, and equipment decontamination will be performed in accordance with Section 6.10 of the GQAPP.

14.2.5 Hydrologic Assessment

Wellhead elevations will be surveyed for all newly installed monitoring wells, and water levels will be measured in all wells, following procedures described in Section 14.1.4 of this work plan.

Limited aquifer testing will be conducted on all newly installed and existing monitoring wells. This testing will consist primarily of performing slug tests and/or short-term specific capacity tests **[immediately following]** development of the newly installed monitoring wells **[after the water levels have fully recovered and stabilized]**. However, depending on the results of Phase I (i.e., if significant

groundwater contamination is detected), testing may be scaled up to include multiple well aquifer tests. Specific capacity and slug tests are particularly useful for deriving first estimates of aquifer hydraulic properties (i.e., hydraulic conductivity, transmissivity).

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 II.

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 **[screening]** 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 II**[, if deemed necessary.]** Although the earlier phases are intended to identify and characterize areas and contaminants of primary concern as they extend laterally from Site 39, Phase III activities will be geared toward further delineating the horizontal and vertical extents of contamination, if necessary.

14.3.1 Biota Sampling

If deemed appropriate based on the findings of phases I and II, additional biota sampling may be conducted in Phase III. **[If required,]** a separate biological sampling plan will be prepared. **[However, basewide biota sampling will be conducted as part of the investigation of operable units (OUs) 15, 16, and 17.]**

14.3.2 Soil Sampling

Soil sampling will be conducted in conjunction with the installation of any new shallow, intermediate, or deep monitoring wells.

14.3.3 Shallow Monitoring Well Installation and Development

Additional shallow monitoring wells may be required to further determine the horizontal extent of any shallow groundwater contamination detected in phases I and II.

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 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 the findings of phases I and II.

14.3.5 Groundwater Sampling

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

14.3.6 Hydrologic Assessment

All wells installed during Phase III will require a wellhead survey to obtain TOC elevations. Water level measurements will be made for all site monitoring wells. Horizontal and vertical gradients will be determined. Aquifer testing will be performed, as required, to determine 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 low permeability zone, as well as the degree to which a hydraulic connection exists between the surficial zone and underlying main producing zone at the 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 phases I and II.

14.4 Phase IV--Extent Delineation

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

- o Soil sampling;
- o Shallow monitoring well installation and development;
- o Intermediate and deep monitoring well installation and development;
- o Groundwater sampling; and
- o Hydrologic assessment.

14.5 Topographic Survey and Base Map

Following the completion of phases III and IV, a topographic survey of the Site 39 area 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 aboveground 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 of the GQAPP.

14.6.2 Field Quality Assurance/Quality Control 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 **[11.1]** of the GQAPP. 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 Site 39 will be performed in accordance with Section 6.10 of the GQAPP.

14.7.2 Waste Management Procedures

[All investigation-derived waste handling will be performed in accordance with Section 6.11 of the GQAPP and EPA's guidance for investigation-derived waste.] All water generated during temporary monitoring well purging and development activities on each site will be containerized near each respective well and poured down the well prior to abandonment. All water generated during permanent monitoring well development will be drummed, labeled, and moved to a storage area on NAS Pensacola, as directed by the Navy.

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

Other investigation-derived wastes, such as potentially contaminated clothing and other disposable materials, will be drummed, labeled, and moved to a storage area on NAS Pensacola, as directed by the Navy.

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 GQAPP and GSMP. 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 GSMP.

[Bold items enclosed in brackets denote changes to last version of document]

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. The following two scenarios will be considered to assess the potential for off-site contamination:

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

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 determined from the previous phases of fieldwork.

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 10 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; GWTRANS, a two-dimensional, finite-difference solute transport model; FEMWATER, a finite-element groundwater model; and FEMWASTE, a finite-element solute transport model.

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.

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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 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 risk assessment will be performed in accordance with EPA's 1989 documents, Risk Assessment Guidance for Superfund: Volumes I and II.]**

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, groundwater, and/or 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 and potential future risks if no action is taken. Therefore, as part of this evaluation, a reasonable maximum exposure scenario should be developed to reflect 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 quantitative estimate of the expected exposure levels resulting from the actual or potential release of contaminants from the site.

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. The Integrated Risk Information System (IRIS) will be utilized **[during the toxicity assessment.]**

18.4 Risk Characterization

In the final stages of the baseline risk assessment, a characterization of the potentially 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.

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

- Distance to the closest residence (on or off NAS Pensacola);
- 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, and retirement home);
- o Activities (recreational and/or occupational) which take place near the sites and the estimated number of people involved;
- 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 FS 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 (e.g., hydrogeologists, chemists, and risk assessors), the Navy, and the reviewing regulatory agencies (i.e., FDER and EPA) and that the goal of these tasks is to produce appropriate, sufficient, and high quality data to complete the baseline risk assessment.

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 work plan 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 with the cleanup criteria developed. E & E will prepare a qualitative and quantitative summary of contamination for the scenarios identified during the risk assessment evaluation. The results of this evaluation will serve as a basis for screening applicable remedial technologies for the development and evaluation of remedial action alternatives.

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, 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.

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 any appropriate comments 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 allow 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 considering 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 action 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.

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 Feasibility Study Report

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

20. REPORT

Following the Phase I investigation, E & E will prepare a Phase I Interim Data Report for each site. The purpose of this report is to summarize 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 interim 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 **[RI]** 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 will only 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. **[Once the Phase III work is complete, all results will be synthesized and presented in an RI report.]**

In addition, following any treatability studies and FS work, formal reports will be produced for these efforts. These reports will include detailed narratives associated with the respective tasks.]

For all reports, E & E will prepare a 100% draft report for the Navy and Technical Review Committee (TRC) review. The TRC review comments will be incorporated into draft final reports which will be resubmitted to the TRC for final approval. The draft final report will then become final if no further comments are received from the TRC. 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 conditions at the site(s). Information used in analyses, 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 to last version of document]

21. DOCUMENT REVISION

Periodic updating of all administrative documents (GQAPP, GSMP, GHSP, GPMP, 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, GSMP, 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.

[Bold items enclosed in brackets denote changes to last version of document]

22. PROJECT MANAGEMENT

Project management will be an ongoing process throughout this investigation. This process includes preparation of biweekly 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 and 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.

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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 II, III, 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 (FFA SMP). The schedule in the FFA SMP will be updated yearly.

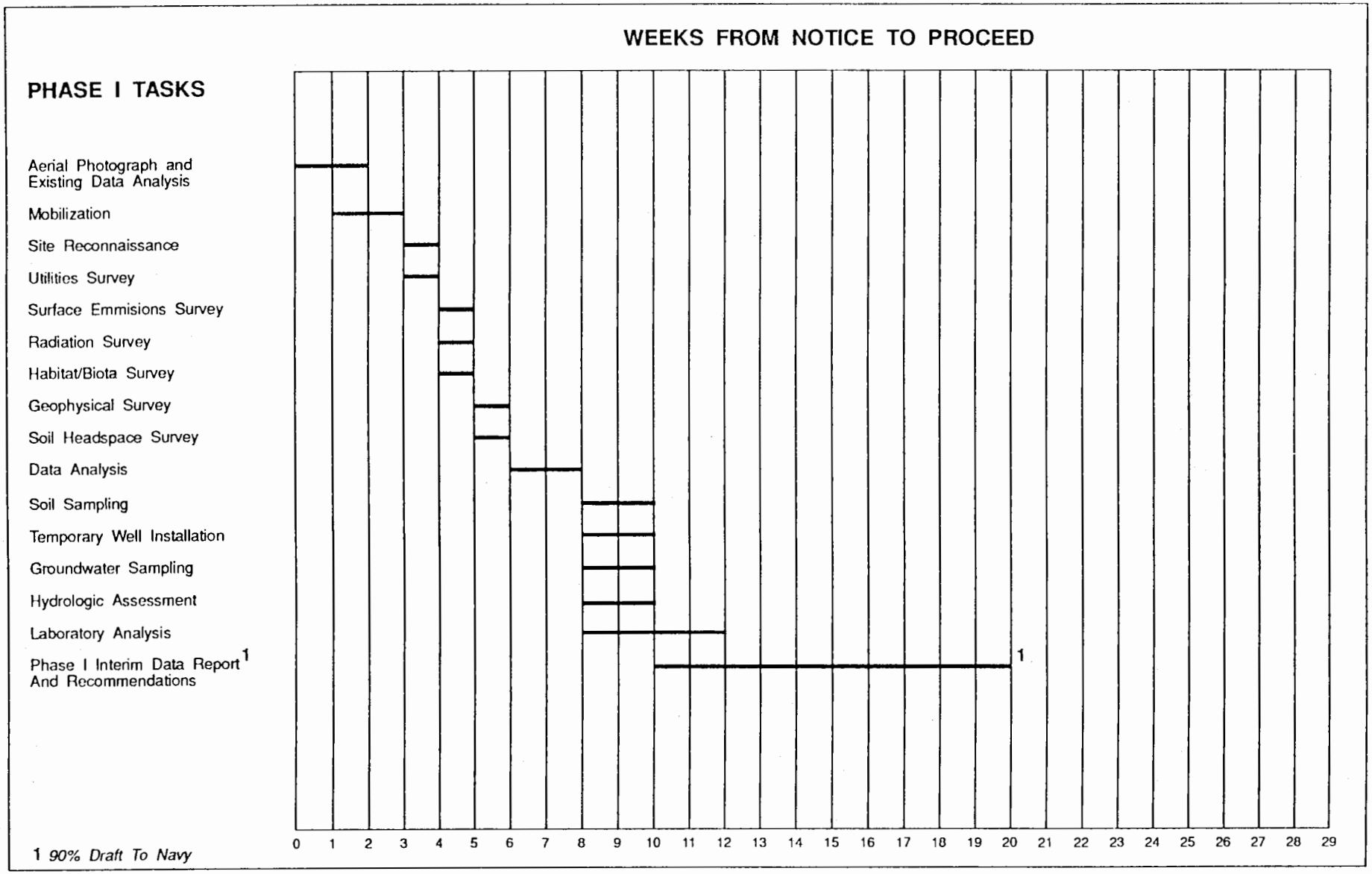


Figure 23-1 PHASE I PROJECT SCHEDULE -- GROUP Q

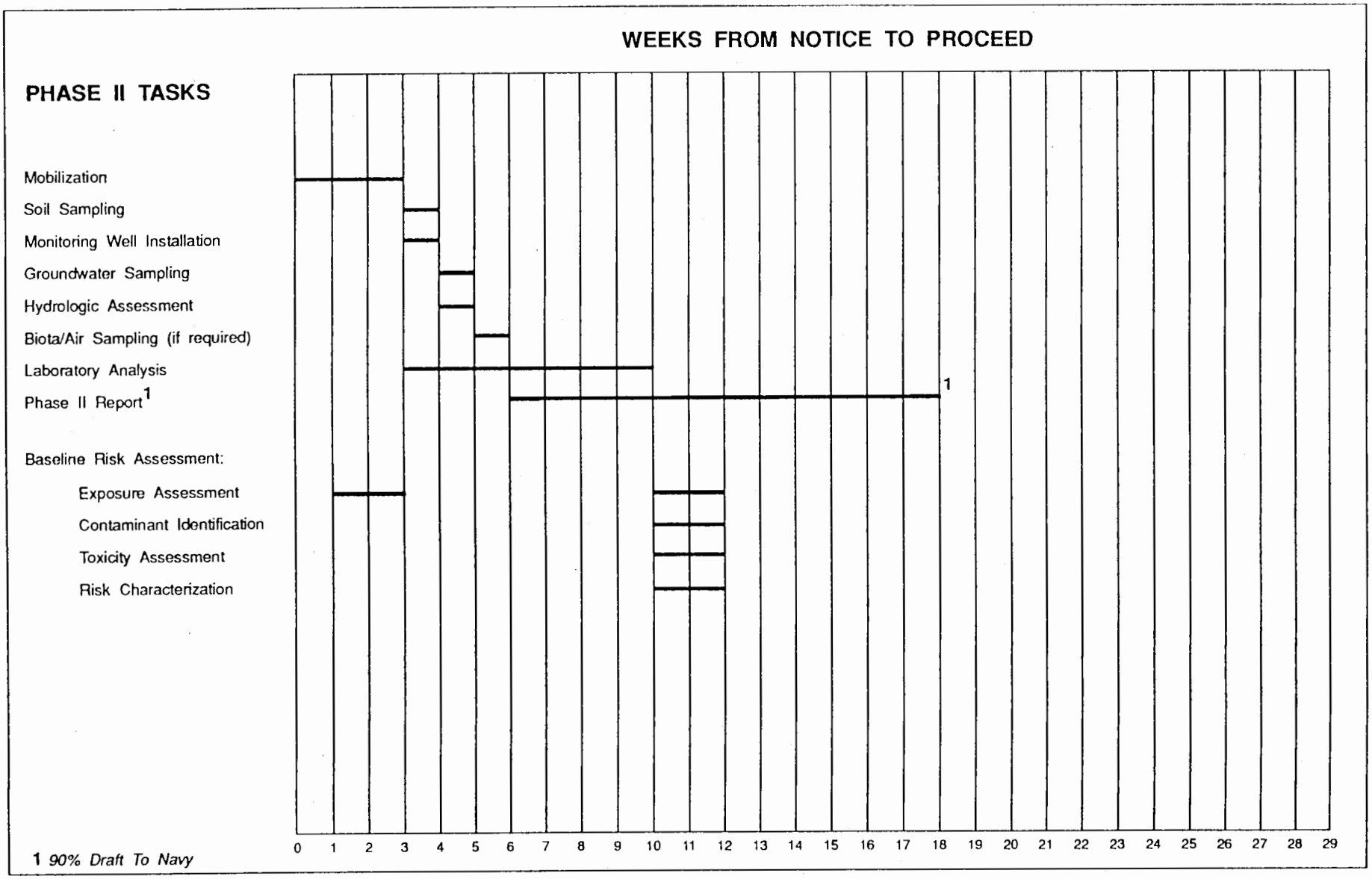


Figure 23-2 PHASE II PROJECT SCHEDULE – GROUP Q

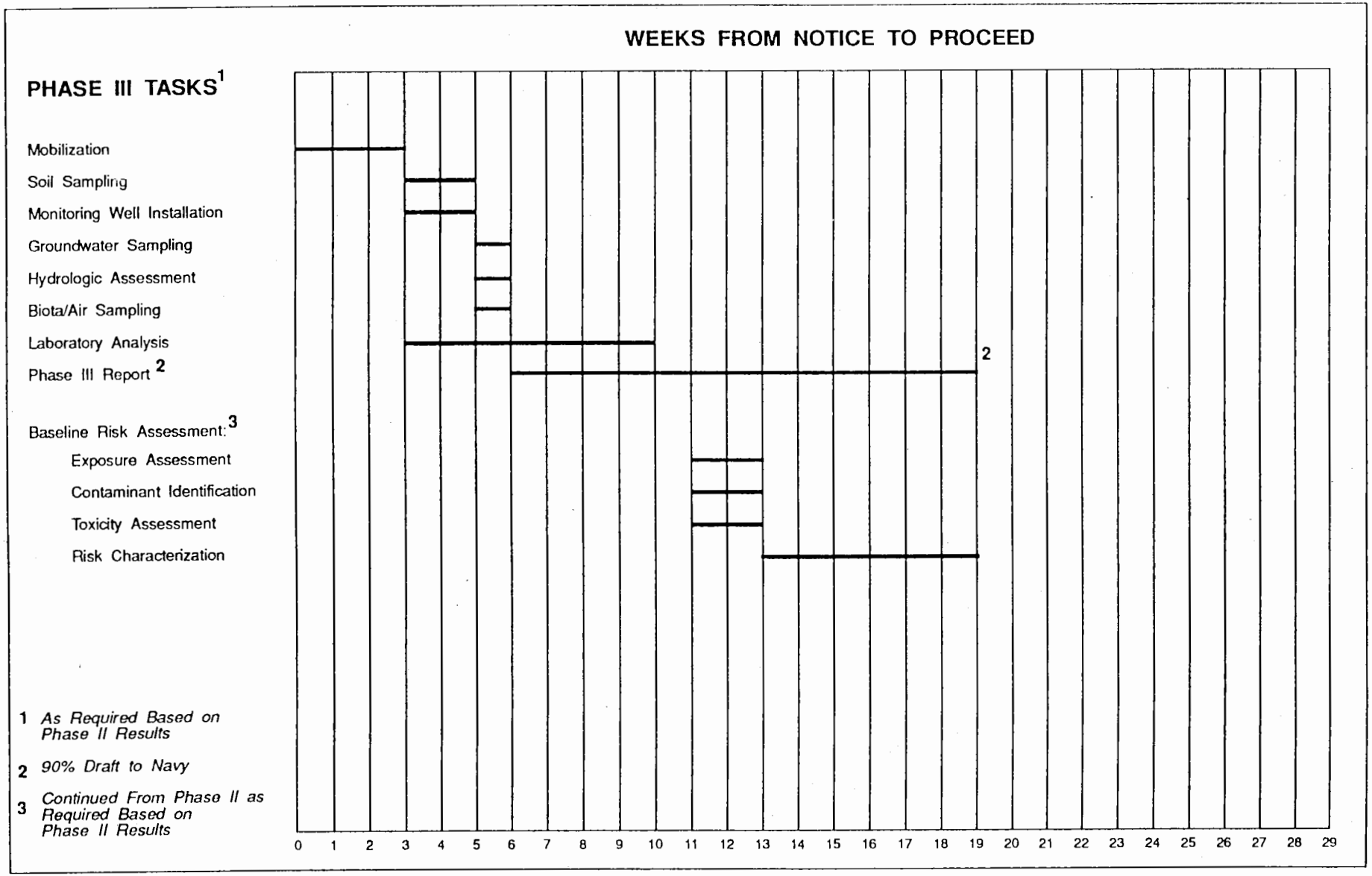


Figure 23-3 PHASE III PROJECT SCHEDULE – GROUP Q

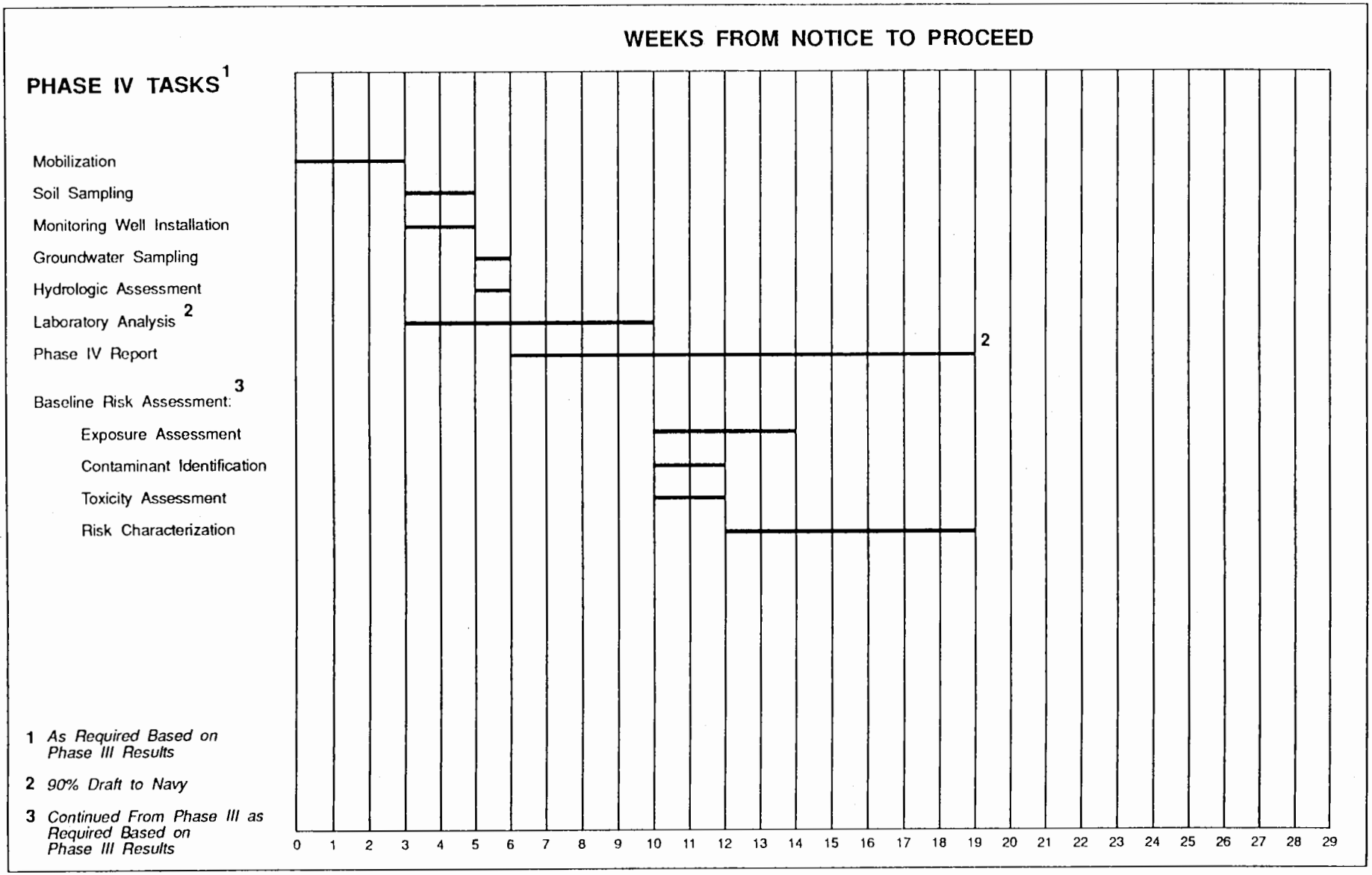


Figure 23-4 PHASE IV PROJECT SCHEDULE -- GROUP Q

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, Washington, D.C.

Coe, C. J., 1979, Geology of the Plio-Pleistocene Sediments 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.

_____, 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., 1990a, General Health and Safety Plan, Contamination Assessments and Remedial Activities, Naval Air Station, Pensacola, Florida.

_____, 1990b, General Project Management Plan, Contamination Assessments and Remedial Activities, Naval Air Station Pensacola, Pensacola, Florida.

[Bold items enclosed in brackets denote changes to last version of document]

_____, 1990c, General Site Management Plan, Contamination Assessments and Remedial Activities, Naval Air Station Pensacola, Pensacola, Florida.

[_____, 1990d, Generic Quality Assurance Project Plan, Contamination Assessments and Remedial Activities, Naval Air Station Pensacola, Pensacola, Florida.

_____, 1991, Contamination Assessment/Remedial Activities Investigation Work Plan--Group A, Naval Air Station Pensacola, Pensacola, Florida.]

_____, 19**[92]**a, General Health and Safety Plan, Contamination Assessments and Remedial Activities, Naval Air Station Pensacola, Pensacola, Florida.

_____, 19**[92]**b, General Project Management Plan, Contamination Assessments and Remedial Activities, Naval Air Station Pensacola, Pensacola, Florida.

_____, 19**[92c]**, General Site Management Plan, Contamination Assessments and Remedial Activities, Naval Air Station Pensacola, Pensacola, Florida.

[_____, 1992d, Generic Quality Assurance Project Plan, Contamination Assessments and Remedial Activities, Naval Air Station Pensacola, Pensacola, Florida.]

ERM-Southeast, Inc. (ERM), 1988, Draft Site Investigation Report NIRP Site 31 at Building 649, Naval Air Station Pensacola, 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 (FDER), 1988**[a]**, Unpublished Marine Sediment Data from Pensacola Bay Sediment Study, 1985-1987, Tallahassee, Florida.

[_____, 1988b, Water Quality Standards, Classification of Groundwater, Usage, Reclassification, Chapter 17-3.403, Florida Administrative Code.]

Florida Natural Areas Inventory (FNAI), 1988a, Special Plants and Animals List, Escambia County, Florida, Tallahassee, Florida.

_____, 1988b, Survey of Pensacola Naval Air Station and Outlying Bronson Field for Rare and Endangered Plants, Tallahassee, Florida.

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

[Bold items enclosed in brackets denote changes to last version of document]

_____, 1986, Characterization Study, Assessment of Potential Ground-water Pollution at Naval Air Station, Pensacola, Florida.

_____, 1987a, Quarterly Report, Corrective Action Program, Wastewater Treatment Plant, NAS Pensacola, Florida.

_____, 1987b, Lithologic Logs, NAS Pensacola Wastewater Treatment Facility, Pensacola, Florida.

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

Green, K. Michael, 1989, personal communication, Navy Engineer in Charge.

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: Water 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.

_____, 1966, Water Resources Records of Escambia and Santa Rosa Counties, Florida: Florida Geological Survey, Information Circular No. 50.

[Bold items enclosed in brackets denote changes to last version of document]

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.

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, Illinois.

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.

Southeastern Geological Society (SEGS), 1986, Florida Hydrogeologic Units: Southeastern Geological Society Ad Hoc Committee on Florida Hydrostratigraphic 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.

_____, 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.

_____, 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.

_____, 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 (EPA), 1984, Standard Operating Safety Guidelines.

_____, 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.

[Bold items enclosed in brackets denote changes to last version of document]

_____, 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.

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

_____, 1987, Compendium of Superfund Field Operations Methods, OSWER Directive 9355.0-14, EPA/540/P-87/00/a.

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

_____, 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.

[_____, 1989a, Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part A), Washington, D.C.

_____, 1989b, Risk Assessment Guidance for Superfund: Volume II - Environmental Evaluation Manual, 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, USFWS Field Office, Panama City, Florida.

U.S. Geological Survey (USGS), 1970a, 7 1/2 Minute Topographic Map, Fort Barrancas, Florida Quadrangle.

_____, 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.

_____, 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.

_____, 1989, Hydrogeologic Framework of the Northwest Florida Water Management District.

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.

[Bold items enclosed in brackets denote changes to last version of document]

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.

Wilkins, K. T., J. R. Wagner, and T. W. Allen, 1985, Hydrogeologic Data for the Sand-and-Gravel Aquifer in Southern Escambia 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 and Wildlife Service Biological Report 88(12); Minerals Management Service OCS Study\MMS 88-0063.

[Bold items enclosed in brackets denote changes to last version of document]

25. FLORIDA PROFESSIONAL GEOLOGIST SEAL

I hereby affix my seal to the Contamination Assessment/Remedial Activities Investigation Work Plan, Group Q, Naval Air Station, Pensacola, Escambia County, Florida, in accordance with Chapter 492 of the Florida Statutes and applicable rules and regulations developed pursuant thereto:

Name:	John D. Barksdale
License Number:	P.G. No. 1150
State:	Florida
Expiration Date:	July 31, 1992

John D. Barksdale

Date

[Bold items enclosed in brackets denote changes to last version of document]

APPENDIX A

SOIL SAMPLE ANALYTICAL RESULTS

(SOURCE: NAS PENSACOLA)

[Bold items enclosed in brackets denote changes to last version of document]

Pioneer LABORATORY INC
Technologies, Inc.
11 EAST OLIVE ROAD • [illegible] FLORIDA 32514 • (904) 474-1001

TO: NAS
Pensacola, Florida 32508

DATE OF ORDER: 13 APRIL 1990

DATE COMPLETED: 26 APRIL 1990

BPA #: N65114-87-A-0182

Call #: 9077

Stub #: 0106-7063

Job Order No.: 178-4095

NASP NO.: 015

PLI [illegible] NO.#: 25273

PLI [illegible] #: 90-1993

Laboratory Analysis:

1 SOIL SAMPLE ANALYZED FOR:

F001 F005, TPH/418.1, PCB

Total Cost $754.00

Signature J. A. Campbell

Pioneer LABORATORY INC
Technologies, Inc.
11 EAST OLIVE ROAD • [illegible] • (904) 474-1001

NAS, CO, PWC
BUILDING 3560

NAS PENSACOLA FL 32508-0000

Lab I.D.#: 90-1993
Order Number: P29108
Order Date: 04/13/90
Client: 14002
Sampled By: R. BELL
Sample Date: 04/13/90
Sample Time: N/S

Project Number: 015
Project Name: OAK GROVE
Sample Site: NASP
Sample Type: SOIL

N/S = Not Submitte

Lab ID	Sample ID	Parameter	Units	Results	Detecti Limit
1993-1	OAK GROVE	PCB/SOIL	PPM	BDL	1
1993-1	OAK GROVE	PETROLEUM HYDROCARBONS	PPM	9834	1

Comments: PPM = Parts Per Million, mg/kg on a dry basis. PPB = Parts Per Billion, ug/kg on a dry basis. Method Refs: SW-846, 3rd Edition, Novem r 1986 and EPA 600/4-79-020, March 1983. BDL = Below Detection Limits.

Approved By : [signature]

Pioneer LABORATORY INC Technologies, Inc.
11 EAST OLIVE ROAD • [illegible] PA 12514 • (804) 474-1001

Client: NAS, CO, PWC
14002

Lab I.D.#: 90-1993-1
Order Date: 04/13/90
Sampled By: R. BELL

Sample Site: NASP
Sample Type: SOIL

Sample ID.: OAK GROVE Sample Date: 04/13/90 Time: N/S

F001F005 EPA SOLVENTS ID. NO.'S F001--F005

Parameter	Units	Result	Detection Limit
METHANOL	PPB	9390	500
M-CRESOL	PPB	BDL	814
NITROBENZENE	PPB	BDL	2056
O-CRESOL	PPB	BDL	2056
P-CHLORO M-CRESOL	PPB	BDL	5140
P-CRESOL	PPB	BDL	2056
PENTACHLOROPHENOL	PPB	BDL	6168
PYRIDINE	PPB	BDL	2056
CHLOROPHENOL	PPB	BDL	3084
2 NITROPHENOL	PPB	BDL	2056
2,4-DINITROPHENOL	PPB	BDL	6168
2,4,6-TRICHLOROPHENOL	PPB	BDL	4112
2,4-DICHLOROPHENOL	PPB	BDL	2056
2,4-DIMETHYLPHENOL	PPB	BDL	1028
4-NITROPHENOL	PPB	BDL	4112
4,6-DINITROCRESOL	PPB	BDL	10280
ACETONE	PPB	BDL	102
BENZENE	PPB	BDL	10
CARBON DISULFIDE	PPB	BDL	51
CARBON TETRACHLORIDE	PPB	BDL	31
CHLOROBENZENE	PPB	BDL	10
CYCLOHEXANONE	PPB	BDL	10
ETHYL ACETATE	PPB	BDL	51
ETHYL BENZENE	PPB	BDL	10
ETHYL ETHER	PPB	BDL	10
ISOBUTANOL	PPB	BDL	10
METHYL ETHYL KETONE	PPB	BDL	51
METHYLENE CHLORIDE	PPB	BDL	51
METHYL ISOBUTYL KETONE	PPB	BDL	51
N-BUTYL ALCOHOL	PPB	BDL	51
1,2 DICHLOROBENZENE	PPB	BDL	51
TETRACHLOROETHYLENE	PPB	70	31
TOLUENE	PPB	40	10
TRICHLOROETHYLENE	PPB	BDL	10
TRICHLOROFLUOROMETHANE	PPB	BDL	51

Sample ID.: OAK GROVE Test Parameters continued on next page

Client: NAS, CO, PWC
14002

Lab I.D.#: 90-1993-1
Order Date: 04/13/90
Sampled By: R. BELL

Sample Site: NASP
Sample Type: SOIL

Sample ID.: OAK GROVE Sample Date: 04/13/90 Time: N/S

F001F005 EPA SOLVENTS ID. NO.'S F001-F005 continued

Parameter	Units	Result	Detection Limit
XYLENE	PPB	60	51
1,1,1-TRICHLOROETHANE	PPB	BDL	51
1,1,2TRICHLORO1,2,2TRIFLUOROETHANE	PPB	BDL	51
2-ETHOXYETHANOL	PPB	BDL	51
2-NITROPROPANE	PPB	BDL	10

APPENDIX B

SITE-SPECIFIC SAFETY PLAN

[Bold items enclosed in brackets denote changes to last version of document]

ecology and environment, inc.

S I T E S A F E T Y P L A N

Version 988

A. GENERAL INFORMATION

Project Title: Site 39 - Oak Grove Campground Project No.: UH8000

TDD/Pan No.: _____

Project Manager: John Barksdale Project Dir.: Gerry Gallagher III

Location(s): South of Shell Road, approximately 0.1 mile east of Radford Boulevard/Shell Road Intersection

Prepared by: Jeff Lunceford Date Prepared: 5-23-91

Approval by: Sybil Newchurch; Mary Miller Date Approved: 5-30-91; 5-30-91

Site Safety Officer Review: _____ Date Reviewed: _____

Scope/Objective of Work: Field screening will include physical survey, radiation survey, geophysical survey, soil headspace, soil sampling, monitoring well installation, groundwater sampling, and hydrologic assessment.

Proposed Date of Field Activities: July 1992 to June 1993

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

Documentation/Summary:

Overall Chemical Hazard:	Serious [ ]	Moderate [ ]
	Low [X]	Unknown [ ]
Overall Physical Hazard	Serious [ ]	Moderate [X]
	Low [ ]	Unknown [ ]

B. SITE/WASTE CHARACTERISTICS

Waste Type(s):

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

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 [X]	Burn [ ]	Cut [X]	Splash [X]
Noise [X]	Other: Snakes, insects, poison ivy, heat/cold stress.		

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

Site History/Description and Unusual Features (see Sampling Plan for detailed description): Site 39 is located approximately 200 feet south of the campground and occupies a roughly circular, sandy-soil clearing, approximately 200 feet in diameter. Debris consisting of broken pieces of brick, concrete, tile, glass, coal, and iron nails and rods is scattered about the site.

Locations of Chemicals/Wastes: Stained soils with hydrocarbon odor are located within the circular clearing.

Estimated Volume of Chemicals/Wastes: Unknown

Site Currently in Operation Yes: [X] (Campground) No: [ ]

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, radiation, and geophysical survey - Site walkovers; trip/fall, puncture, cut;

2) Soil headspace - Trip/fall, puncture, cut;

3) Soil sampling - Using hand auger or drill rig; overhead, noise, trip/fall, puncture, cut;

4) Monitoring well installation - Using drill rig; overhead, noise, trip/fall, puncture, cut;

5) Groundwater sampling - Trip/fall, splash, puncture, cut;

6) Decontamination - Using solvents; splash; and

7) Hydrologic assessment - Splash, personal contamination, automobiles.

Chemical Hazard Evaluation:

Compound	PEL/TWA	Route of Exposure	Acute Symptoms	Odor Threshold	Odor Description
Methanol	200 ppm	Inh, Derm, Ing	Eye irr.,headache, drowsiness, nausea	160.0 ppm	Pungent odor
Tetrachloroethylene	100 ppm	Inh, Derm, Ing	Eye, nose, throat irr.; nausea	47.0 ppm	Ether/chloroform odor
Toluene	200 ppm	Inh, Derm, Ing	Fatigue,dizziness, headache, confus.	40.0 ppm	Aromatic benzene odor
Xylene	100 ppm	Inh, Derm, Ing	Dizziness, drows., nausea, abd. pain	20.0 ppm	Aromatic odor
Isopropanol	440 ppm	Inh, Derm, Ing	Skin irritation	7.5 - 200 ppm	Rubbing alcohol
Nitric Acid	2 ppm	Inh, Derm, Ing	Corrosive	0.3 - 1 ppm	Acrid
Sulfuric Acid	1 mg/m^3	Inh, Derm, Ing	Corrosive	NA	Odorless
Hydrochloric Acid	5 ppm	Inh, Derm, Ing	Corrosive	Unknown	Acrid
Sodium Hydroxide	2 mg/m^3	Inh, Derm, Ing	Corrosive	NA	Odorless

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

D. SITE SAFETY WORK PLAN

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

Perimeter identified? [yes] Site secured? [yes]

Work areas designated? [yes] Zone(s) of contamination identified? [no]

Personnel Protection (TLD badges required for all 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
Task 5				X
Task 6				X
Task 7				X

(Expand if necessary)

Modifications: Modified level D with Tyvek, neoprene gloves and boots, safety glasses, APR available when level C upgrade is necessary based on OVA readings.

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

- Level D: O_2 <19.5% or >25%, explosive atmosphere >10% LEL, organic vapors above background levels, particulates >_____ mg/m^3, other _____.
- Level C: O_2 <19.5% or >25%, explosive atmosphere >25% LEL_3(California-20%), unknown organic vapor (in breathing zone) >1 ppm, particulates >_____ mg/m^3, other _____.
- Level B: O_2 <19.5% or >25%, explosive atmosphere >25% LEL_3(California-20%), unknown organic vapors (in breathing zone) >5 ppm, particulates >_____ mg/m^3, other _____.
- Level A: O_2 <19.5% or >25%, explosive atmosphere >25% LEL (California-20%), unknown organic vapors >500 ppm, particulates >_____ mg/m^3, other _____.

Air Monitoring (daily calibration unless otherwise noted):

Contaminant of Interest	Type of Sample (area, personal)	Monitoring Equipment	Frequency of Sampling
VOCs	Area	OVA	Continuous
Radiation	Area	Mini-Rad Gamma Scintillator Micro-R-meter	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, deionized water rinse, isopropanol rinse (twice), final organic-free water rinse, and allow to air dry as long as possible. Note: Every effort will be made not to generate mixed waste.

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

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

Special Site Equipment, Facilities, or Procedures (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 Procedures and Special Considerations: E & E's "Buddy System" will be employed at all times during fieldwork activities. Personnel will exercise caution in the vicinity of Chevalier Field and along nearby roadways. If above background radiation levels are encountered, team members will evacuate the sampling area and contact the corporate health physics group to reassess the site.

Work Limitations (time of day, weather conditions, etc.) and Heat/Cold Stress Requirements: All fieldwork activities will be performed during daylight hours. Team members will take breaks as necessary to avoid heat stress and replace fluids. Cooling vests may be 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 be double bagged, drummed, labeled, and transported to a designated location for final disposal by the Navy.

Sample Handling Procedures Including Protective Wear: During all handling of samples, all field team members will wear surgical gloves. Goggles will be worn during sample preservation with acids.

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

*All entries into exclusion zone require Buddy System use. All E & E field 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 sheets, 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 Room: NAS Dispensary -- Building 3600: 904-452-2733; Baptist Hospital 904-434-4811 (Life Flight)

Poison Control Center:

Police (include local, county sheriff, state): 911

Fire Department: 911

Airport:

Agency Contact (EPA, State, Local USCG, etc.): Emergency: 904-453-8178; General Information: 904-453-8282

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

UPS/Fed. Express: 1-800-238-5355

Client/EPA Contact: U.S. Navy Southern Division, Engineer-In-Charge, Suzanne O. Sanborn: 1-803-743-0574

Site Contact: NAS Pensacola Environmental Coordinator, Ron Joyner: 904-452-4515

SITE RESOURCES

Site Emergency Evacuation Alarm Method: NA

Water Supply Source: On site

Telephone Location, Number: To be determined on site

Cellular Phone, if available: To be determined on site

Radio:

Other: On-site warehouse number to be determined

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 (home)

3. Regional Safety Coordinator - Sybil Newchurch ..... (904) 877-1978 (office)
   (904) 878-2336 (home)

4. Regional Office Manager - Rick Rudy ..... (904) 877-1978 (office)
   (904) 893-7245 (home)

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 reach 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 the information given to the answering service.

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

   a. **24 hour hotline - (716) 684-8940**
   b. Corporate Safety Director - Paul Jonmaire - home # (716) 655-1260
   c. Assistant Corp. Safety Officer - Steven Sherman - home # (716) 688-0084

EMERGENCY ROUTES

(NOTE: Field Team Must Know Route(s) Prior to Start of Work)

Directions to hospital from Site 39 (include map): **NAS Dispensary** - Turn right onto Shell Road, which joins and becomes Radford Boulevard. Continue east on Radford Boulevard to Ellyson Avenue. Turn left onto Ellyson Ave and continue to its intersection with Turner Street. The NAS Dispensary is located on Turner Street in Building 3600.

Baptist Hospital - Take Duncan Road (Navy Boulevard) north to exit the base. Navy Boulevard becomes Highway 98 and curves to the east. Follow Navy Boulevard/Highway 98 east approximately 3 miles to Pace Boulevard. Turn left (north) onto Pace Boulevard and proceed approximately 1 mile to Cervantes Street (Highway 90). Turn right on Cervantes/Highway 90 and follow this road for about 8 blocks and turn left (north) onto E street. The hospital is about 6 blocks north on the left.

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

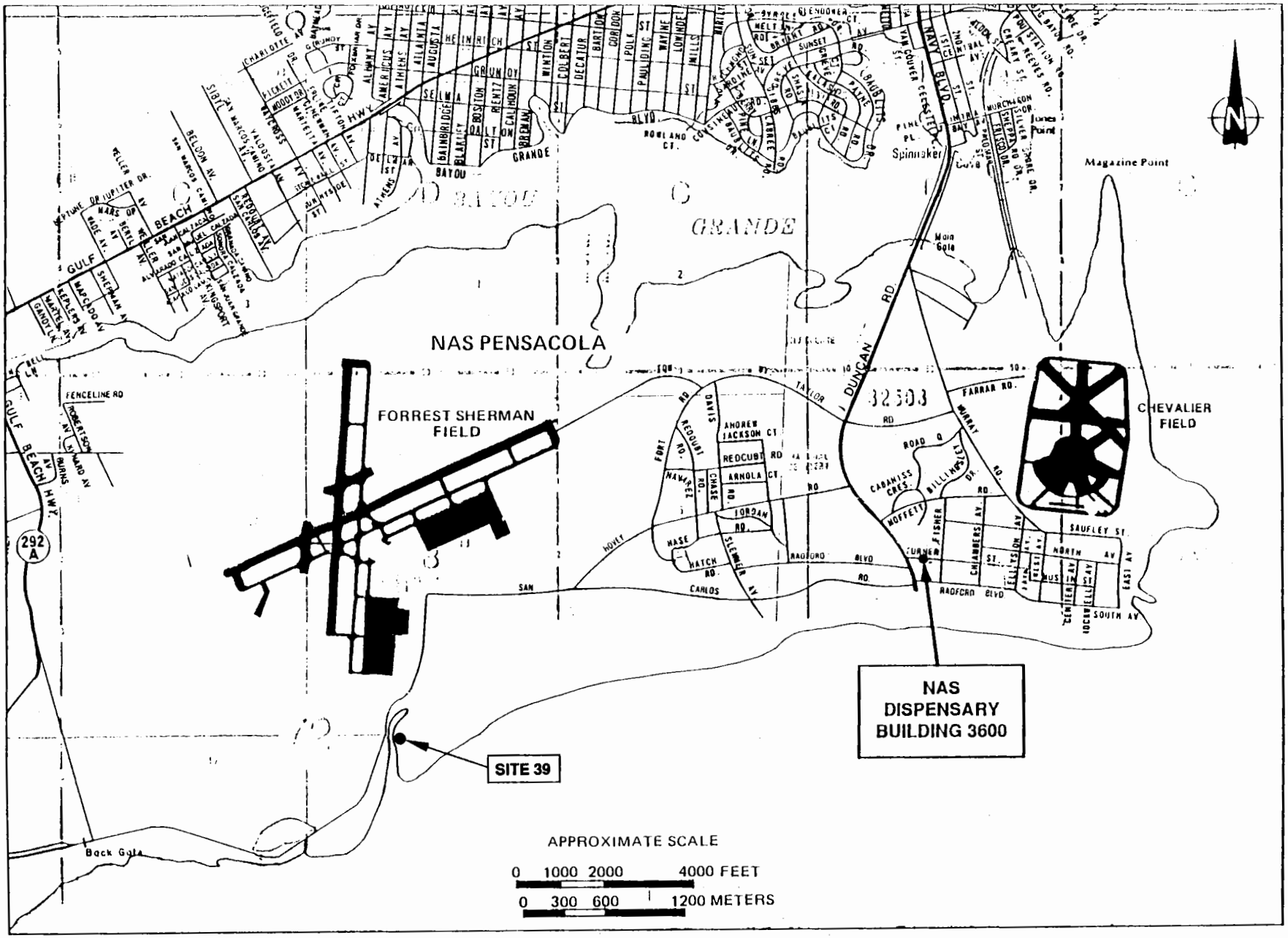
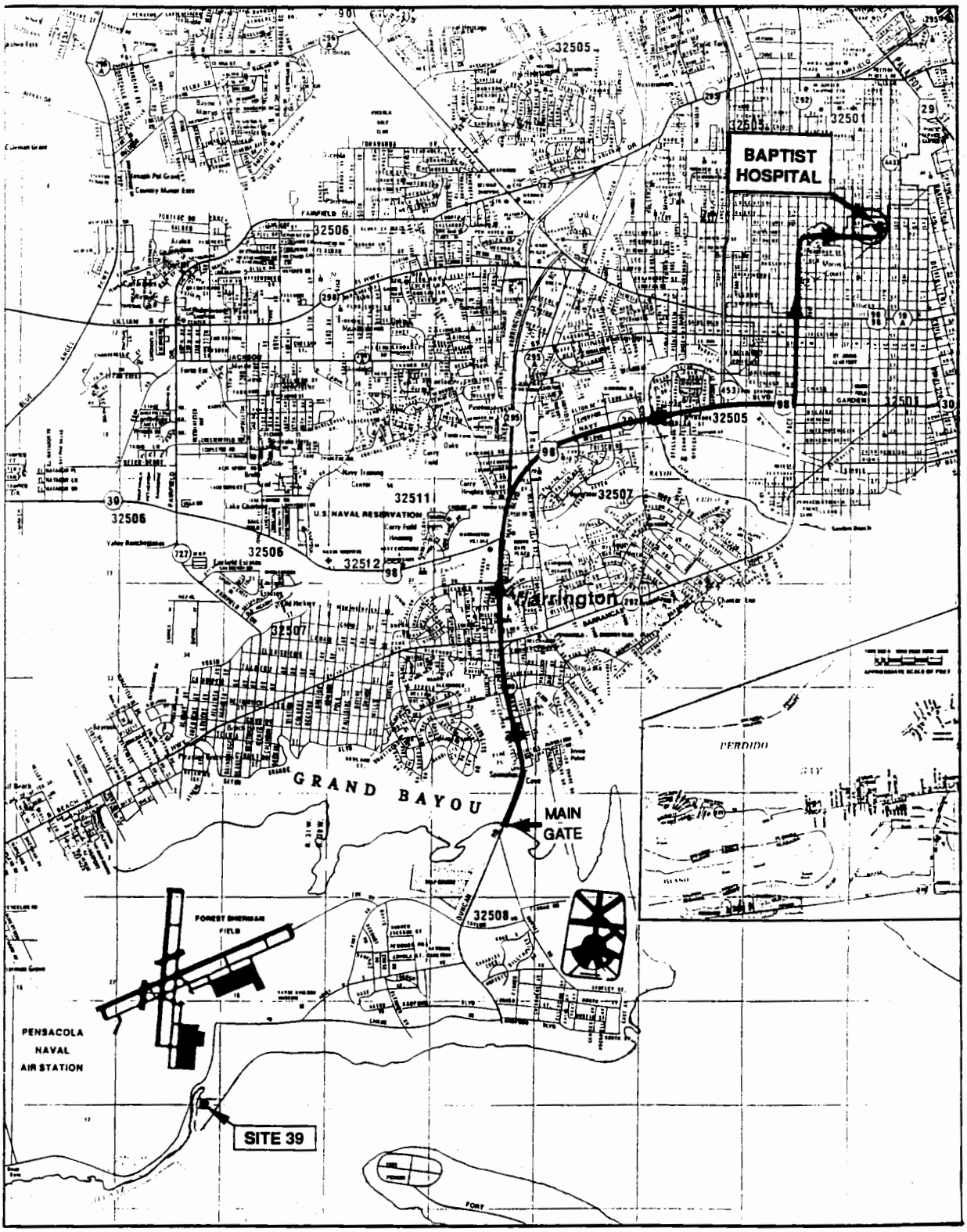


Figure B-1 LOCATION OF NAS DISPENSARY



SOURCE: Ecology and Environment, Inc., 1992

Figure B-2 LOCATION OF BAPTIST HOSPITAL

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.

* Make 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.

STANDARD OPERATING PROCEDURE FOR EMERGENCIES DUE TO HEAT AND HEAT STRESS MONITORING

REVISED JANUARY 1990

Prepared by

Ecology and Environment, Inc.
368 Pleasantview Drive
Lancaster, New York 14086

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CONTENTS

1 INTRODUCTION

Field operations present a variety of hazards to the employee. During hot days or when wearing protective clothing, heat stress can be experienced and, if not remedied, can threaten the health or life of field personnel. Therefore, it is important that all employees are able to recognize the symptoms of heat stress as well as perform first aid without delay.

2 SCOPE

This standard operating procedure (SOP) describes the symptoms and treatment for the three classical types of heat stress presented here in ascending order of severity: heat cramps, heat exhaustion, and heat stroke. Field personnel should take immediate action to prevent a less severe form of heat stress from escalating into one requiring hospital treatment.

In addition, this SOP recommends ways to avoid heat stress, such as frequent rest periods, carefully timed excursions in protective clothing, and monitoring heartrate and body temperature. The Site Safety Officer (SSO) has overall responsibility for seeing that these guidelines are followed in the field. However, each individual must be cautious when working in conditions where heat stress is possible.

3 OBJECTIVES

The prevention of heat stress is of paramount importance for field personnel, particularly when they must wear heavy or confining protective clothing. The SSO must ensure that all personnel monitor themselves for possible heat stress, and know what to do in a heat emergency. For example, a person who recognizes the symptoms of heat stroke can provide lifesaving first-aid to another, while medical assistance is summoned.

4 EFFECTS OF HEAT

Normal oxidation processes within the body produce a predictable amount of heat. If the heat is liberated as it is formed, there is no change in body temperature. If the heat is liberated slightly 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. Such a condition produces a 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 such as 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 (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°F to 100°F, with high humidity and little or no breeze, heat is retained within the body. It is on such a day or, more commonly, after 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.

4.1 HEAT CRAMPS

Heat cramps usually affect people who work in hot environments and perspire a great deal. Loss of salt from the body causes painful cramps of the leg, arm, or abdominal muscles. Heat cramps also may result from drinking iced water or other drinks either too quickly or in too large a quantity. Heat cramps generally occur during work, but may appear hours later in some cases.

4.1.1 Symptoms

The symptoms of heat cramps include the following:

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

4.1.2 Emergency Care

Place the victim in a cool location, observing safety and decontamination considerations (see Section 6) if the victim is coming from the hot zone. Give the person sips of water or an electrolyte liquid such as Gatorade or its equivalent. Apply manual pressure to the cramped muscle. The victim should not require medical treatment but be alert for any indication of a more serious problem.

4.2 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 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.

4.2.1 Symptoms

The symptoms of heat exhaustion are as follows:

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

4.2.2 Emergency Care

Place the victim in a cool location and remove as much clothing as possible while observing proper decontamination procedures. 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 for shock, and take the victim to a medical facility if there is any indication of a more serious problem.

4.3 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-percent mortality rate. Alcoholics are extremely susceptible.

4.3.1 Symptoms

Following are the symptoms of heat stroke (note the absence of perspiration):

- o Dry, hot, and flushed skin;
- o Sudden onset;
- o Full and fast pulse;
- o Dilated pupils;
- o Early loss of consciousness;
- o Body (core) temperature's exceeding 105°F;
- o Muscle twitching, growing into convulsions; and
- o Breathing deeply at first, later shallowly or even almost absent.

4.3.2 Emergency Care

Remember that this is a true emergency, therefore, transportation to a medical facility should not be delayed. In the meantime, place the victim in a cool environment and remove as much clothing as possible. Ensure an open airway. Reduce body temperature promptly, preferably by wrapping the victim in a wet sheet or dousing the body with water. If cold packs are available, place them under the arms, around the neck, on the ankles, or any place where blood vessels located close to the skin can be cooled. Protect the victim from injury during convulsions, especially tongue biting.

5 PREVENTION OF HEAT STRESS

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 body's system. Without these electrolytes, body systems cannot function properly, and the represented health hazard will be increased. Therefore, when personnel are working in situations where the ambient temperatures and humidity are high, and especially in situations where levels A, B, and C of protective apparel are required, the SSO must follow the procedures listed below:

- o Ensure that all employees have sufficient quantities of fluids (Gatorade or its equivalent). Personnel should prepare ahead of time for field work in heat stress environments by consuming extra fluids;

- Ensure that frequent breaks are scheduled so that overheating is less likely to occur;
- 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); and
- Cooling vests should be worn if available.
- NOTE: Taking salt tablets is NOT currently recommended.

5.1 GUIDELINES FOR USE OF PROTECTIVE CLOTHING

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

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

5.2 HEARTRATE MONITORING

One method of measuring the effectiveness of an employee's rest-recovery regime is by monitoring the heartrate. The "Brouha guideline" is one such method:

- During a 3-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.
- 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 period is required, accompanied by an increased intake of fluids.

5.3 MONITORING PERSONNEL BODY TEMPERATURE AND BLOOD PRESSURE

When personnel are in respiratory protective gear for extended periods, or when air temperatures are very high, the monitoring of body temperature and blood pressure is another way of checking for symptoms of heat stress. Careful adherence to existing medical guidelines could identify an individual who may not have fully stabilized and therefore, is not ready to continue working in the hot zone.

5.4 MONITORING THE WORK AREA FOR HEAT STRESS CONDITIONS

Air temperature and relative humidity are the two most important measurements for determining the likelihood that a heat stress situation will occur. The reading can be achieved using both a dry and wet bulb thermometer.

6 DECONTAMINATION

As in other medical emergencies, decontamination should proceed as normally as possible without contributing unduly to the victim's stress or injury. At a minimum, the protective clothing should be removed as he or she is taken from the hazardous zone. The "buddy system" is always in effect and backup personnel should be available at the decontamination station to either suit up and assist in extraction or to help decontaminate and undress the victim. If other serious injuries or more life-threatening conditions exist, and the victim cannot be disrobed or decontaminated completely, the victim (or contaminated portions) should be wrapped in plastic (or other protective material) for his or her own safety as well as the safety of ambulance and hospital personnel. Carefully avoid action that would result in the victim's being further overheated.

STANDARD OPERATING PROCEDURES FOR HEALTH AND SAFETY ON DRILLING RIG OPERATIONS

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CONTENTS

1 INTRODUCTION

This document is meant to be used in conjunction with E & E SOPs for field operations and hazardous waste site operations, and incorporates by reference all the safety precautions required therein. It specifically addresses the functions and responsibilities of personnel working on or around drilling operations.

E & E personnel are frequently required to work in the field with drill rigs, taking soil and rock samples, installing piezometers, and monitoring wells. Two general situations discussed separately are the supervision of Subcontract Drillers by E & E, and the direct operation of E & E's own drill rig by our personnel.

2 OPERATION OF DRILLING EQUIPMENT BY E & E

2.1 RESPONSIBILITIES AND AUTHORITY OF SITE SAFETY OFFICER

The duties of the Site Safety Officer (SSO) on drilling sites are the same as in other types of operations with the exception of the increased emphasis on the hazards unique to drilling work. This section details specific drilling concerns of an SSO.

E & E personnel are restricted from the borehole area during active drilling. When E & E personnel are doing drilling, they will be restricted from the borehole area by means of a "super exclusion zone" delineated by placing a 4- by 8-foot sheet of plywood over the borehole.

2.2 RESPONSIBILITIES AND AUTHORITY OF E & E DRILLER

At the beginning of each work day, the E & E driller must inspect the rig to ensure the following components have been properly inspected, maintained, or replaced, or procedures have been performed:

- Kill switches tripped and operation verified;
- Chain guards in place;
- Belt guards in place;
- Belts set to proper tension (visual);
- Loose belts;
- Presence of any fluid leaks;
- Any damaged hoses, cables, ropes, chains;
- Control panel is clean;
- Control lever functions labeled;
- Pressure relief valves function;
- Cathead free of rust and grease;
- Cathead grooves less than 1/8 inch in depth;
- All tools in proper working order;
- Rig leveled and stabilized;
- Check for weld cracks in mast; and
- Safety hooks operational.

The Driller will report items needing attention to the SSO; however, it is the Driller's responsibility to make sure that these items are corrected prior to drilling.

During the drilling operations, the following safety practices will be in effect:

- All wheels will be blocked.
- Rig will be leveled using jacks or stabilizers.
- Rig engine will be in neutral when not actively turning augers.
- Plywood (or suitable substitute material) "super exclusion zone" pad will be in place over borehole.
- Rig engine key will be properly labeled.
- Rig equipment will be kept in an orderly manner within drilling work zone.
- All equipment will be properly lubricated.
- Tools will be used only for their intended purpose.
- Safety glasses, hearing protection will be worn when hammers are operated.
- Jaws of all wrenches will be clean and free of mud to prevent slippage.
- All lift hooks will have jaw clasps.
- Fire extinguisher will be staged at rear of rig.
- Rig will not be moved when mast is in raised position.
- Cables and ropes will be tied back or secured on stabilizer posts.
- All unattended drill holes will be covered.
- Check for overhead obstructions when raising rig mast, boom will not be raised within 25 feet of overhead utilities.
- No refueling will be permitted while equipment is running.

The Driller has authority to direct personnel within the area while drilling operations are in progress. Access to the hazardous area around the auger and borehole is restricted by the "super exclusion zone" delineated by the 4- by 8-foot sheet of plywood centered over the borehole before drilling. A large hole cut in the plywood allows penetration of the augers. No personnel are allowed in this zone pad at any time while drilling is actively underway.

Housekeeping around the rig is the responsibility of the Driller, but all team members must participate in this effort as well.

2.3 RESPONSIBILITY AND AUTHORITY OF OTHER E & E PERSONNEL

E & E personnel working at a drilling site must act as support to the Drilling Team by providing any necessary support functions; however, it is important that personnel are careful not to interfere with the drilling process. Personnel are restricted from approaching the "super exclusion zone" while drilling is underway. If an E & E crew member recognizes an unsafe condition in the work area or on the rig, he should bring it to the attention of the SSO and Team Leader, if it is not resolved in a timely manner. If conditions are still deemed to be hazardous, team members have the option to contact their Regional Safety Coordinator (RSC) or Corporate Health and Safety in Buffalo.

It is the responsibility of all E & E personnel to carry their issued nondisposable gear, including hard hat, face shield, respirator, steel-toed boots, eyepiece inserts, safety glasses, and appropriate outerwear for the expected climate.

All personnel should be aware of emergency facilities, egress routes, and special medical conditions of their team members. As with all E & E field work, the buddy system is to be enforced.

3 TRAINING REQUIREMENTS FOR SITE PERSONNEL

3.1 E & E SITE SAFETY OFFICER

In addition to Basic Health and Safety Training and other OSHA mandated training, first aid, CPR, and necessary training in field monitoring of personnel, an SSO should have previously worked as a team member on field drilling projects in order to have a working knowledge of the drill rig and its inherently hazardous nature. Where monitoring instrumentation is to be used, the SSO must be properly trained prior to field work. The SSO must have an understanding of the hazards of heat and cold stress, their associated symptoms, and proper work modifications to protect field staff from potential injury.

3.2 E & E DRILLER AND HELPER

The E & E driller and helper shall have taken and passed the basic 40-hour Health and Safety Training as prescribed by E & E and mandated by OSHA. They shall also meet the other minimum requirements for field work including medical approvals and respirator fit test. Based on previous experience and training, the Driller will be critiqued by the E & E Drilling Team upon employment with E & E, by performing various types of drilling. This review will be the basis for determining whether additional training or apprenticeship will be required before allowing this employee to act as Driller. An existing E & E employee shall have a minimum of 1 year experience as a Driller's Helper on an assortment of field projects before he or she can be reviewed for advancement to the position of Driller. If a Driller is uninvolved in drilling efforts for 1 year or more, he or she will be required to act as a Driller's Helper on a project, as well as receive rig-specific training on the equipment, before being permitted to act as a Driller again. The Driller's Helper position requires prior attendance at a drilling training school program. Following successful completion of such a course, the Driller's Helper will be observed on sites for a period of approximately 6 months, during which time he or she will work on several drilling projects performing assorted types of drilling. The E & E Drilling Team will determine, based on these field observations, whether additional training is required for this individual.

3.3 OTHER E & E DRILLING PERSONNEL

All E & E personnel shall have taken the basic 40-hour Health and Safety Training course. Field personnel must meet medical and respiratory fit test requirements established by E & E and OSHA, as well.

3.4 SUBCONTRACT DRILLER AND OTHER SUBCONTRACT DRILLING PERSONNEL

Subcontract Drillers and their support personnel must, at a minimum, have passed basic 40-hour Health and Safety Training as prescribed by OSHA 29 CFR1910.120. They shall be medically approved and trained to use the level(s) of respiratory protection required onsite. Certification of training by the Subcontractor shall be required as a deliverable included in E & E's contractual documentation. This training shall be verbally verified and logged onsite by the SSO or Team Leader before starting work.

4 SUPERVISION OF SUBCONTRACT DRILLERS

4.1 RESPONSIBILITIES AND AUTHORITY OF SITE SAFETY OFFICER

The responsibilities of the SSO at a drilling site where subcontracted drillers are used include the following: rig inspections, personnel monitoring, and personnel protection.

A rig inspection starts with, but is not limited to, verifying each item on the following checklist:

- The mast must be located at least 25 feet from any overhead or underground utility lines.
- The location and operation of operational and unencumbered kill switches must be reiterated to all site personnel.
- Outriggers, stabilizers, or jacks are in place, and the rig is level.
- A geophysical survey (electromagnetic or ground-penetrating radar) or a reliable site history must be obtained to verify absence of buried obstacles, tanks, or drums.
- A first aid kit and filled eyewash must be readily available.
- A fire extinguisher should be charged to the proper pressure and staged at rear of rig during drilling.
- The condition of ropes, chains, and cables must be checked.
- A lifeline or safety belt must be available if mast climbing is necessary.
- The Site Safety Plan (SSP) must be posted with emergency phone list and map of hospital route.
- A "super exclusion zone" must be established around the borehole, using a 4- by 8-foot sheet of plywood. This defined area will be entered during active drilling only by the Driller, except in emergency situations.

If any of these items need replacement or repair, the SSO must make necessary arrangements and later verify that repair or replacement is sufficient before actual drilling begins. Working together, the SSO and the driller should verify that the rig has been checked against the Operator's checklist.

The SSO's monitoring duties include calibration and setup of the appropriate monitoring devices, as specified in the SSP. At a minimum, this generally includes an O_2/explosimeter and realtime organic vapor monitoring capabilities (e.g., HNU, OVA). Noise monitoring, like heat stress monitoring, is employed where appropriate. If the SSO believes additional monitoring devices beyond the directive of the SSP should be employed (e.g., Rad Mini, Mini Ram), it is his or her responsibility to obtain this equipment with the cooperation of the RSC or the Corporate Health and Safety Group, from the nearest E & E office.

It is the responsibility of the SSO to ensure that all safety equipment is in good working order. Day-to-day operations, as well as calibration data, must be recorded in the equipment log or SSO log. Adequate supplies such as breathing air, drinking liquids, and calibration gas must be maintained.

E & E personnel are forbidden from entering the "super exclusion zone" around the borehole while the rig is actively drilling. The SSO must not attempt to take air readings in or around the auger while in use, nor are cutting samples taken while the auger is in motion. An O_2/explosimeter should be set up if possible for unmanned (alarmed) operations at the rig using an extension hose to continuously draw samples from the borehole area during drilling operations.

The SSO has the ultimate authority over the Subcontractor with regard to whether work practices meet the requirements of the SSP. Shutdown of work or restriction of personnel are options available to the SSO. The SSO should hold informal site safety briefings at the start of both field work and daily work shifts throughout the course of the project. Although E & E contractually requires Subcontractors to provide properly trained and outfitted staff, the SSO should verify verbally at the start-up meeting that the field staff has necessary respiratory approval and OSHA-mandated training, especially on hazardous waste sites. Site safety briefing topics, as well as attendees, will be recorded in the site safety log.

If the SSO has reason to believe either E & E or Subcontractor personnel are under the influence of alcohol or drugs, or are otherwise ill before or during work onsite, he or she should consider restricting those team members from site work. Personnel arriving for work requiring level C protection who are not cleanly shaved may also be restricted at the discretion of the SSO.

The following is a list of basic topics to be covered at site safety meetings:

- Personnel responsibilities;
- Planned investigation and presumed potential hazards;
- Levels of protection, monitoring plan, and equipment;
- Emergency scenario plans, including kill switch use;

- o Location and operation of kill switches, fire extinguisher, and first aid kit;
- o Heat and cold stress hazards;
- o "Super exclusion zone" around borehole; and
- o Warnings to Subcontractors about hazards of climbing the mast without safety belt and other equipment.

Because heat stress is a constant threat during warm weather, the SSO is responsible for determining whether conditions are unsuitable for work. Where workers cannot work with the assistance of work modifications, cooling vests, and other cooling means, the SSO may decide that work should not continue. The need for worker monitoring through blood pressure and oral temperature checks will be determined by the SSO with assistance from the RSC and Buffalo Health and Safety staff, if necessary.

The SSO will be responsible for shutdown of the drilling operation if electrical storms are in the site area.

No refueling operations will be performed until rig engines are shut down. Motor fuels should be stored and dispensed from spring-loaded, OSHA/FM-approved gas cans constructed of metal or polyethylene.

The SSO should ensure and document that no boreholes are left open or unfilled after drilling equipment is moved. In instances where a hole must be left open and unattended, suitable barricades, or the equivalent, will be staged around the hole to prevent personnel and equipment from falling in.

4.2 RESPONSIBILITIES AND AUTHORITY OF OTHER E & E PERSONNEL

All E & E personnel on site are required to follow the terms of the SSP and the direction of the SSO. Because the SSO cannot be in all places at all times, the crew should observe the subcontractors and condition of their equipment at all times, and report immediately to the Team Leader and SSO any safety-related issues that are unresolved. Included are such details as dressout, site functions, and decontamination. It is important that the SSO be involved so that proper log entries can be made.

E & E, as policy, does not provide safety equipment or monitoring instrumentation to subcontractors. Some projects, however, may be set up so that E & E personnel and subcontractors share the same expendable supplies.

E & E personnel are forbidden from approaching augers during drilling. Activities at the borehole, such as sampling, require that equipment be stopped.

5 GENERAL DRILLING SITE SAFETY CHECKLISTS

5.1 SAFETY CHECKLISTS FOR SPECIFIC TYPES OF DRILLING ACTIVITIES

5.1.1 General Drilling Site Safety Checklist

- All E & E drilling personnel will have read and understood the terms of the E & E drilling SOP.
- Obvious or questionable safety conditions that arise during daily inspection of the rig and its components will be cause for work interruption.
- Only approved Drillers will remain in proximity to the borehole during drilling, and an approximate 4- by 8-foot "super exclusion area" will be established around the moving auger at all times. No personnel, except the Driller and the Driller's Helper, will enter this zone during drilling. The SSO will issue warnings to those personnel who breach this zone.
- Continuous O_2/explosimeter monitoring at borehole using remote sampling hose will exist at all times.
- All field team members will be briefed on planned drilling operations and possible problems before work begins on day 1. All will be shown the location and operation of "kill switches," which will be operationally checked each morning.
- Fire extinguisher(s) will be staged next to the rig before drilling and refueling operations.
- Welding and cutting activities will only be performed away from ignition sources at a distance approved by the SSO or Team Leader.
- Appropriate personnel protective equipment (based on hazards associated with assumed well contaminants) will be worn as directed by the SSO and the SSP. At a minimum, steel-toed boots, hard hats, and face shields will be worn during any active drilling.
- Outrigger stabilizers must be in place before drilling commences, and the rig must also be leveled.
- The drill rig mast must be horizontal during movement of rig and should not be erected within 25 feet of overhead lines.

- Electrical storms within hearing range of the job site will signal work termination until the SSO and Team Leader notify personnel otherwise.

- The local utilities should be contacted prior to drilling so that their lines can be located and flagged. Situations of close proximity may involve isolating utility lines (i.e., shutdown and inerting of gas lines).

- When buried drums or other material are suspected, a full survey of the drilling zone is required using appropriate instrumentation prior to ground breaking.

- Only trained, experienced staff who have studied proper drilling methods and served as a Helper under an experienced Driller will operate the cathead.

- Only properly licensed staff will drive the drill rig. A daily safety check of the vehicle, following E & E protocol, will be carried out by the driver.

- Climbing on the vertical mast is not permitted by E & E staff. Because the boom is not equipped with a ladder, it should be lowered for repairs.

5.1.2 Rotary and Core Drilling

The following precautionary measures should be taken during rotary and core drilling:

- Rotary drilling tools should be safety checked prior to drilling:

  - Rods and bit should be open and clear.

  - Water swivels and hoisting plugs should be lubricated and checked for "frozen" bearings before use.

  - Drill rod chuck jaws should be checked periodically and replaced when necessary.

  - The capacities of hoists and sheaves should be checked against the anticipated weight of the drill rod string, in addition to other expected hoisting loads.

  - All hoses to and from the pump should be checked for properly installed couplings; couplings should be secured with locking devices on "quick connect" fittings or wire on "Chicago-Style" couplings.

- Hoses should be inspected daily for deterioration and leakage, and replaced if needed.

o Special precautions that should be taken for safe rotary or core drilling involve chucking, joint break, hoisting, and lowering of drill rods:

- Only the Operator of the drill rig should brake or set a manual chuck so that rotation (of the chuck) will not occur before removing the wrench from the chuck.

- Drill rods should not be braked while being lowered into the hole with chuck jaws.

- Drill rods should not be held or lowered into the hole with pipe wrenches.

- If a string of drill rods are accidentally or inadvertently released into the hole, do not attempt to grab the falling rods with hands or a wrench.

- In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction should be relieved or bled down before breaking the first tool joint.

- When drill rods are hoisted from the hole, they should be cleaned for safe handling with rubber or other suitable rod wiper. Do not use your hands to clean drilling fluids from drill rods.

- If work must progress over a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. The mud pit should be equipped with rough-surfaced, fitted, cover panels strong enough to hold drill rig personnel.

- Drill rods should not be lifted and leaned unsecured against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage, or lay the rods down. As previously stated, hardhats, steel-toed boots, safety glasses, and work gloves are to be worn during such work, with impervious gear and respiratory protection added as required by the SSP.

5.1.3 Cathead Usage

o Keep the cathead clean and free of rust, oil, and grease. If it becomes rusty, clean with a wire brush.

- Check the cathead periodically, when the engine is not running, for rope wear grooves. If a rope groove forms to a depth greater than 1/8 inch (3 mm), the cathead should be replaced.

- Always use a clean, dry, sound rope. A wet or oily rope may "grab" the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.

- Should the rope "grab" the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel, including the Operator, to rapidly back away and stay clear. If the rope "grabs" the cathead and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the Operator can turn off the drill rig engine and initiate other appropriate actions to release the tools. The Operator should carefully watch the suspended tools, quickly backing away after turning off the engine.

- Chemicals can cause deterioration of the rope that may not be visibly detectable, thus the rope should always be protected from any chemical contact.

- Never wrap the rope from the cathead (or any other rope, wire rope, or cable on the drill rig) around a hand, wrist, arm, foot, ankle, leg, or any other part of the body.

- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing, or other tools with the cathead and rope method. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.

- Do not use more rope wraps than are required to hoist a load.

- Do not leave a cathead unattended with the rope wrapped on the drum.

- Position all other hoist lines to prevent contact with the operating cathead rope.

- When using the cathead and rope for driving or back-driving, make sure that all threaded connections are tight, while staying as far away as possible from the hammer impact point.

- The cathead Operator must be able to operate the cathead standing on a level surface with sound, firm-footing conditions, without distraction or disturbance.

5.1.4 Continuous-Flight or Hollow-Stem Augers

- Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.
- Apply an adequate amount of down pressure before rotation to seat the auger head below the ground surface.
- Check auger flights for nicks or burrs that could catch clothing during rotation, and file them down.
- Watch the auger head while slowly engaging the clutch or rotation control, and start rotation. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about 1 foot or more below ground surface.
- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control, and repeat the starting process.
- An auger guide should be considered to facilitate the starting of a straight hole through hard ground or pavement.
- The Operator and tool handler should establish a system of responsibility for the various activities required for auger drilling, such as connecting and disconnecting auger sections and inserting and removing the auger fork. The Operator must ensure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.
- Only use the manufacturer's recommended method of securing the auger to the power coupling. Do not touch the coupling or the auger with your hands, a wrench, or any other tool during rotation.
- Whenever possible, use tool hoists to handle auger sections.
- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.
- Never allow feet to get under the auger section that is being hoisted.

- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger.

- Use a long-handled shovel to move auger cuttings away from the auger. Never use your hands or feet to move cuttings away from the auger.

- Do not use hands to clean rotating augers when removing augers from the ground.

- The use of wire line hoists, wire rope, and hoisting hardware should conform to stipulations developed by the American Iron and Steel Institute Wire Rope Users Manual.

5.1.5 Use of Wire Line Hoists, Wire Rope, and Hoisting Equipment

- All wire ropes and fittings should be visually inspected during use and thoroughly inspected at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper weaving, jamming, crushing, bird caging, kinking, core protrusion, and damage to lifting hardware. All related equipment must conform to standards as established by the American Iron and Steel Institute Wire Rope Users Manual. Wire ropes should be replaced when inspection indicates excessive damage according to the Wire Rope Users Manual. All wire ropes which have not been used for a period of 1 month or more should be thoroughly inspected before being returned to service.

- End fittings and connections consist of spliced eyes and various manufactured devices. All manufactured end fittings and connections should be installed according to the manufacturer's instructions and loaded according to the manufacturer's specifications.

- If a ball-bearing type hoisting swivel is used to hoist drill rods, swivel bearings should be inspected and lubricated daily to ensure that the swivel freely rotates under load.

- If a rod slipping device is used to hoist drill rods, do not drill through or rotate drill rods through the slipping device, and do not hoist the drill rod column higher than one-half the mast height above the top of the mast (derrick). Do not hoist a rod column with loose tool joints and do not make up, tighten, or loosen tool joints while the rod column is being supported by a rod slipping device. If drill rods should slip back into the borehole, do not attempt to brake the fall of the rods with hands or by tensioning the slipping device.

- Most sheaves on exploration drill rigs are stationary with a single part line. The number of parts of line should never be increased without first consulting with the manufacturer of the drill rig.

- Wire ropes must be properly matched with each sheave--if the rope is too large, the sheave will pinch the wire rope--if the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger wire ropes.

- Use tool handling hoists only for vertical lifting of tools (except when angle hole drilling). Do not use tool handling hoists to pull objects away from the drill rig; however, drills may be moved using the main hoist if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.

- When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or the feed mechanism of the drill.

- When attempting to free a mired vehicle or drill carrier, use only a winch on the front or rear of the vehicle, and stay as far as possible away from the wire rope. Do not attempt to use tool hoists to pull out a mired vehicle or drill rig carrier.

- Minimize shock loading on a wire rope--apply loads smoothly and steadily.

- Avoid sudden loading in cold weather.

- Never use frozen ropes.

- Protect wire rope from sharp corners or edges.

- Do not operate the rig with damaged or faulty guides, rollers, sheave bearings, or latches on safety hooks.

- Clutches and brakes on hoists should be periodically tested.

- Know and do not exceed the rated capacity of hooks, rings, links, swivels, shackles, and other lifting aids.

- Always wear gloves when handling wire rope.

- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.

- Never carry out hoisting operations when weather conditions are such that hazards to personnel, the public, or property are created.
- Never leave a load suspended in the air when the hoist is unattended.
- Never hoist a load over the head, body, or feet of personnel.
- Never use a hoist line to "ride" up the mast (derrick) of a drill rig.
- Replacement of wire ropes should conform to the drill rig manufacturer's specifications.

6 REFERENCES

Health and safety sections of the following operation manuals are incorporated by reference in this SOP:

Diedrich D-50 Safety Manual.

Drilling Safety Guide, Diamond Core Drill Manufacturers Association and National Drilling Contractors Association.

Wire Rope Users Manual, American Iron and Steel Institute.

Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

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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 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 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 clear 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 [illegible]nability: 3 Reactivity: 0

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:
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.

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 any contaminated clothing. Wash skin with soap or mild detergent and water for at least 15 minutes. 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, 1986)

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), 500 ppm (STEL)

-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 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. Outside or detached storage is preferred. Separate from oxidizing materials. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment.

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Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

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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.

AD

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

Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

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

Addendum to Material Safety Data Sheet

REGULATORY STATUS

This Addendum Must Not Be Detached from the MSDS

Identifies SARA 313 substance(s)

Any copying or redistribution of the MSDS must include a copy of this addendum

(Chem.Key: NITRA)

Hazard Categories for SARA Section 311/312 Reporting

Acute	Chronic	Fire	Pressure	Reactive
X	X			X

Product or Components of Product:	SARA EHS Sect. 302 RQ (lbs.)	SARA EHS Sect. 302 TPQ (lbs.)	SARA Section 313 Chemicals Name List	SARA Section 313 Chemicals Chemical Category	CERCLA Sec.103 RQ (lbs.)	RCRA Sec. 261.33
NITRIC ACID, 70% (7697-37-2)	1000	1,000	Yes	No	1000	No

SARA Section 302 EHS RQ: Reportable Quantity of Extremely Hazardous Substance, listed at 40 CFR 355.
SARA Section 302 EHS TPQ: Threshold Planning Quantity of Extremely Hazardous Substance. An asterisk (*) following a Threshold Planning Quantity signifies that if the material is a solid and has a particle size equal to or larger than 100 micrometers, the Threshold Planning Quantity = 10,000 LBS.
SARA Section 313 Chemicals: Toxic Substances subject to annual release reporting requirements listed at 40 CFR 372.65.
CERCLA Sec. 103: Comprehensive Enviromental Response, Compensation and Liability Act (Superfund). Releases to air, land or water of these hazardous substances which exceed the Reportable Quantity (RQ) must be reported to the National Response Center, (800-424-8802); Listed at 40 CFR 302.4
RCRA: Resource Conservation and Reclamation Act. Commercial chemical product wastes designated as acute hazards and toxic under 40 CFR 261.33

Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

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 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°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 stror g 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

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.

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:
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 Explosure 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 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 is less. 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

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.

Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

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

HYDROCHLORIC ACID, 37%

PRODUCT IDENTIFICATION:

Synonyms: Muriatic acid

Formula CAS No.: 7647-01-0

Molecular Weight: 36.46 (HCl)

Chemical Formula: HCl

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.
Avoid breathing mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
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: Corrosive Material

SECTION 1 Physical Data

Appearance: Clear, colorless fuming liquid.

Odor: Pungent odor of hydrogen chloride.

Solubility: Infinite in water with slight evolution of heat.

Boiling Point: 53°C (127°F); Azeotrope (20.2%) boils at 109°C (228°F)

Melting Point: -74°C (-101°F)

Specific Gravity: 1.18

Vapor Density (Air = 1): No information found.

Vapor Pressure (mm Hg): 190 @ 25°C (77°F)

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

Fire:
Can react with metals to release flammable hydrogen gas.

Explosion:
Not considered to be an explosion hazard.

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

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. Containers may burst when heated.

Hazardous Decomposition Products:
When heated to decomposition, emits toxic hydrogen chloride fumes and will react with water or steam to produce heat and toxic and corrosive fumes.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
A strong mineral acid, concentrated hydrochloric acid is highly reactive with strong bases, metals, metal oxides, hydroxides, amines, carbonates and other alkaline materials. Incompatible with materials such as cyanides, sulfides, sulfites, and formaldehyde.

SECTION 4 Leak/Spill Disposal Information

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

Reportable Quantity (RQ)(CWA/CERCLA) : 5000 lbs.

Ensure compliance with local, state and federal regulations.

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

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Inhalation:
Corrosive! Inhalation of vapors can cause coughing, choking, inflamation of the nose, throat, and upper respiratory tract. Inhalation of higher concentrations may cause lung damage.

Ingestion:
Corrosive! Swallowing hydrochloric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea.

Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and discolor skin.

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)

Oral rat LD50: 900 mg/kg (Hydrochloric acid concentrated) Mutation references cited.

SECTION 6 Occupational Control Measures

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
5 ppm (TWA) Ceiling
-ACGIH Threshold Limit Value (TLV):
5 ppm (TWA) Ceiling

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 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 is less. Alternatively, a supplied air full facepiece respirator or airlined hood may be worn.

Skin Protection:
Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure 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.

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Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

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

SODIUM HYDROXIDE

PRODUCT IDENTIFICATION:

Synonyms: Caustic soda; lye; sodium hydroxide solid; sodium hydrate

Formula CAS No.: 1310-73-2

Molecular Weight: 40.00

Chemical Formula: NaOH

Hazardous Ingredients: None.

PRECAUTIONARY MEASURES

DANGER! MAY BE FATAL IF SWALLOWED. CAUSES SEVERE BURNS.

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

EMERGENCY/FIRST AID

If swallowed, do NOT induce vomiting. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician immediately. 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: Corrosive Material

SECTION 1 Physical Data

Appearance: White, deliquescent pellets.

Odor: Odorless.

Solubility: 111 g/100 g of water.

Boiling Point: 1390°C (2534°F)

Melting Point: 318°C (604°F)

Specific Gravity (water = 1): 2.13

Vapor Density (Air = 1): No information found.

Vapor Pressure (mm Hg): Negligible.

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

Fire:
Not considered to be a fire hazard. Hot or molten material can react violently with water.
Can react with certain metals, such as aluminium, to generate flammable hydrogen gas.

Explosion:
Not considered to be an explosion hazard.

Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.
Adding water to caustic solution generates large amounts of heat.

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. Very hygroscopic. Can slowly pick up moisture from air and react with carbon dioxide from air to form sodium carbonate.

Hazardous Decomposition Products:
Sodium oxide.

Hazardous Polymerization:
This substance does not polymerize.

Incompatibilities:
Contact with water, acids, flammable liquids, and organic halogen compounds, especially trichloroethylene, may cause fire or explosion. Contact with nitromethane and other similar nitro compounds causes formation of shock-sensitive salts. Contact with metals such as aluminum, tin, and zinc causes formation of flammable hydrogen gas.

SECTION 4 Leak/Spill Disposal Information

This is a test line. 1000°C. Clean-up personnel require protective clothing and respiratory protection from dust. Sweep, scoop or pick up spilled material. Avoid dusting. Collected waste may be transferred to a closed, preferably metal, container and sent to a RCRA-approved waste disposal facility. Do not flush to the sewer. Caution! Floor and other surfaces may be slippery. Do not contact with water. Neutralize traces with dilute acid.

Ensure compliance with local, state and federal regulations.

NFPA Ratings: Health Flammability: 0 Reactivity: 1

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Inhalation:
Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Severe pneumonitis may occur.

Ingestion:
Corrosive! Swallowing may cause severe burns of mouth, throat, and stomach. Severe scarring of tissue and death may result.

Skin Contact:
Corrosive! Contact of skin can cause irritation or severe burns and scarring with greater exposures.

Eye Contact:
Corrosive! May cause irritation of eyes, and with greater exposures, severe burns with possibly blindness resulting.

Chronic Exposure:
Prolonged contact with dilute solutions or dust has a destructive effect upon tissue.

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:
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. Call a physician 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)

No LD50/LC50 information found relating to normal routes of occupational exposure. Irritation data: Skin, rabbit: 50 mg/24H Severe Eye, rabbit: 50 mg/24H Severe

SECTION 6 Occupational Control Measures

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

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 dust/mist respirator with chemical goggles may be worn, in general, up to ten times the TLV. Consult respirator supplier for limitations. 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

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Always add the caustic to water while stirring; never the reverse.

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Methanol Date 6/01/92

DOT Name/U.N. No. 1230 Job No.

CAS Number 67-56-1

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other:

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Methyl alcohol, Wood alcohol, Wood spirits, Carbinol)

Chemical Formula CH_3OH Molecular Weight 32.1

Physical State Liquid Solubility (H2O) Miscilble Boiling Point 21°F

Flash Point 54°F Vapor Pressure/Density 92 mm Hg Freezing Point -136°F

Specific Gravity 0.79 Odor Characteristic 160 ppm Flammable Limits

Incompatabilities sulfuric/nitric acid, caustics, aliphatric amines, isocyanates, reducing agents

Biological Properties:

TLV-TWA 200 ppm PEL 200 ppm Odor/Odor Threshold Sweet/sour, pungent

IDLH 25,000 ppm Human Aquatic Rat/Mouse

Route of Exposure Oral, inh, ing, derm

Carcinogen Teratogen Mutagen

Radiological Properties:

N/A

Handling Recommendations: (Personal protective measures)

Tyvek, gloves (PVA, Viton);

Monitoring Recommendations:

OVA or HNu with a 11.7 eV probe. (the ionizing potential is 10.8 eV)

Disposal/Waste Treatment:

Health Hazards and First Aid:

Inh: move to fresh air, APR if necessary; Eye/skin: flush with water for 15 minutes, wash skin with soap/water; Ing: induce vomiting, seek medical attention

Symptoms: Acute: Mental confusion, light-headedness, nausea/vomiting, headache, staggering, unconsciousness, irritation of eyes/resp/skin, skin burns

Chronic: skin, liver, kidney, eye damage

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Toluene Date 3/23/92

DOT Name/U.N. No. 1294 Job No. UH8000

CAS Number 108-88-3

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other:

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Methyl benzene, Toluol, Phenyl methane)

Chemical Formula C_7H_8 Molecular Weight 92

Physical State Colorless Liquid Solubility (H2O) 0.05g/100 H_2O Boiling Point 231°F

Flash Point 40°F Vapor Pressure/Density 22mm Freezing Point -139°F

Specific Gravity 0.8669 Odor Characteristic 0.2ppm Flammable Limits 1.3% - 7.1%

Incompatabilities Strong Oxidizers, HNO_3, H_2SO_4, O_2, Peroxides, Heat

Biological Properties:

TLV-TWA 100 ppm PEL 200 ppm Odor/Odor Threshold Benzene-Like

IDLH 2,000 ppm Human IHL TCLD - 200 ppm Aquatic 96:100-10 ppm Rat/Mouse 4000 ppm

Route of Exposure Inhalation, Ingestion, Dermal Contact, Eye (Ocular)

Carcinogen Experimental Teratogen Experimental Mutagen Experimental

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Impervious clothing, Viton gloves, faceshield respirator w/organic vapor cartridge up to 1000 ppm, >1000 ppm use APR with chemical cartridge; 2000 ppm-SCBA

Monitoring Recommendations:

Disposal/Waste Treatment:

Concentrated: incineration; dilute discharge to municipal sewer after primary treatment, incineration for dilute organic mixture

Health Hazards and First Aid:

Flush area with water and wash with soap; move to fresh air if inhaled; if swallowed, do not induce vomiting. Contact physician immediately.

Symptoms: Acute: Dizziness, fatigue, nausea, headache, vomiting, irritates eyes, dries skin

Chronic: Bone marrow, depression, defatting of skin, dermatitis, kidney and/or liver damage if ingested

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Xylene Date 3/23/92

DOT Name/U.N. No. 1307 Job No. UH8000

CAS Number 1330-73-8

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other:

Rad Health Handbook NCRP 65 10 CFR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Dimethylbenzene, Xylol)

Chemical Formula C_8H_{10} Molecular Weight 106

Physical State Colorless Liquid Solubility (H2O) Boiling Point 292°F

Flash Point 77°F Vapor Pressure/Density 3.7 Freezing Point -12°F

Specific Gravity 0.86 Odor Characteristic 0.5 ppm Flammable Limits 1.0% - 7.0%

Incompatabilities Strong oxidizers, strong acid, heat, peroxide

Biological Properties:

TLV-TWA 100 ppm PEL 100 ppm Odor/Odor Threshold Aromatic

IDLH 1,000 ppm Human IHL TCL 0-200 ppm Aquatic Rat/Mouse IHL LD_{50} - 50% ppm/4HC

Route of Exposure Inhale, skin

Carcinogen Experimental Teratogen Mutagen

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Impervious clothing, PVC gloves, faceshield, avoid prolonged contact. Respirator w/organic vapor cartridge up to 5,000 ppm; >10,000 ppm use SCBA

Monitoring Recommendations:

Disposal/Waste Treatment:

OSHA standard 29 CFR 1910. 106 applies

Health Hazards and First Aid:

Skin - wash w/soap and water; eyes - flush w/water; remove to fresh air if overcome

Symptoms: Acute: Eye and mucous membrane irritant, CNS depressant, ingestion causes gastrointestinal upset

Chronic: More severe than above, hyperplasia of bone marrow

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Tetrachloroethylene Date 3/23/92

DOT Name/U.N. No. _____ Job No. UH8000

CAS Number 127-18-4

References Consulted (circle):

NIOSH/OSHA Pocket Guide | Verschueren | Merck Index | Hazardline | Chris (Vol. II)

Toxic and Hazardous Safety Manual | ACGIH | Other: _____

Rad Health Handbook | NCRP 65 | 10 CFR 20 | Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Perchloroethylene)

Chemical Formula $CL_2C + C Cl_2$ Molecular Weight 165.82

Physical State Liquid Solubility (H2O) 0.015% Boiling Point 121.2°C

Flash Point N/A Vapor Pressure/Density 15.8 mm/5.83 Freezing Point -23.35°C

Specific Gravity 1.631 Odor Characteristic -- Flammable Limits N/A

Incompatabilities Strong oxidizers, chemically active metals (barium, lithium, beryllium)

Biological Properties:

TLV-TWA 25 ppm, 167.5 mg/m^3 PEL 100 ppm Odor/Odor Threshold Ether, chloroform

IDLH 1000 ppm Human TCLO 230 ppm Aquatic -- Rat/Mouse --

Route of Exposure Inhalation, ingestion, direct contact.

Carcinogen _____ Teratogen _____ Mutagen _____

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Impervious clothing, gloves, and boots should be worn; eye protection; respirators with cartridges worn at levels of 50 ppm; SCBAs at levels of 500 ppm.

Monitoring Recommendations:

Disposal/Waste Treatment:

N/A

Health Hazards and First Aid:

Remove form exposure; perform artificial respiration if necessary; wash skin with soap and water; irrigate eyes with water; if swallowed, induce vomiting.

Symptoms: Acute: Irritation of eyes, nose, or throat; nausea; flushed face; vertigo, dizziness; incoherence; headache; skin blisters.

Chronic: Liver damage; impaired memory; numbness of extremities; impaired vision.

APPENDIX C

SITE-SPECIFIC QUALITY ASSURANCE PROJECT PLAN

[Bold items enclosed in brackets denote changes to last version of document]

Section 1.0 -- Title Page

Work Plan Group: Q
Site No.: 39
Site Name: Oak Grove Campground

Prepared by: Jeffrey B. Lunceford
Ecology and Environment, Inc.
316 South Baylen Street
Pensacola, Florida 32501

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 Regional QA/QC Coordinator _____
K. Walker

E & E ASC Director: _____
A. Clifton

E & E QA/QC Project Officer: _____
M. Meredith

Section 2.0 -- Table of Contents

Section 3.0 -- Project Summary

Work Plan Group: Q

Site No.: 39

Site Name: Oak Grove Campground

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
- [X] Radiation Survey
- [X] Habitat/Biota Survey
- [X] Asbestos Survey
- [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 25 (Approximate)
- [ ] 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	8	[X]	Phenols
Groundwater	6	[ ]	Organophosphorus Pesticides
Duplicates	2	[ ]	Chlorinated Herbicides
Trip Blanks	___	[ ]	Carbamates
Field Blanks	___	[X]	Pesticides/Polychlorinated Biphenyls
Rinsate Blanks	___	[X]	Total Recoverable Petroleum 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	18	Flora	___	Field Blanks	1
Groundwater	4	Fauna	___	Rinsate Blanks	2
				Preservation Blanks	1

CATEGORIES OF ANALYSES

___	Purgeable Aromatics	X	Pesticides
___	Purgeable Halocarbons	X	Polychlorinated Biphenyls
X	Base/Neutral Extractables	X	Total Recoverable Petroleum Hydrocarbons
X	Acid Extractables	X	Metals
X	Volatile Organic Compounds		
___	Polynuclear Aromatic Hydrocarbons	X	Cyanide
___	Phenols		
___	Dioxins		
___	Organophosphorus Pesticides		
___	Herbicides		

Additional analytical categories are identified below:

X	Gross Alpha (water only)	X	pH
X	Gross Beta (water only)	X	Percent Moisture
X	Gamma Scan (water only)	X	Grain Size
X	Total Organic Carbon	X	BTU Content
X	Hardness (water only)	X	Ash Content
X	Alkalinity	X	Total Organic Halogens
X	Total Suspended Solids (water only)	X	Sulfur
		X	Ignitability
X	Total Kjeldahl Nitrogen	X	Cation Exchange Capacity

Section 3.0 -- Project Summary (Continued)

_X_ Ammonia Nitrogen
_X_ Orthophosphate Phosphorus
_X_ Dissolved Oxygen (in field)
_X_ 5-day Biological Oxygen Demand
_X_ Chemical Oxygen Demand

Additional analytical parameters are identified below:
Methanol

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 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 Petroleum Hydrocarbons	S/W	EPA 418.1	N/M	N/M	N/M	TBD
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						
Methanol	S/W	Laboratory-Derived	N/M	N/M	N/M	N/M
Gross Alpha	W	EPA 900.0	N/M	N/M	N/M	N/M
Gross Beta	W	EPA 900.0	TBD	TBD	TBD	TBD
Gamma Scan	W	EPA 901.1	TBD	TBD	TBD	TBD
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 & PCBs	S/W	EPA 8080/608	N/M	N/M	N/M	N/M
Total Recoverable Petroleum Hydrocarbons	S/W	EPA 418.1	N/M	N/M	N/M	N/M
TAL Metals:						
Aluminum	S/W	EPA 6010	N/M	N/M	N/M	N/M
Antimony	S/W	EPA 6010	N/M	N/M	N/M	N/M
Arsenic	S/W	EPA 7060	N/M	N/M	N/M	N/M
Barium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Beryllium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Boron	S/W	EPA 6010	N/M	N/M	N/M	N/M
Cadmium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Calcium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Chromium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Cobalt	S/W	EPA 6010	N/M	N/M	N/M	N/M
Copper	S/W	EPA 6010	N/M	N/M	N/M	N/M
Iron	S/W	EPA 6010	N/M	N/M	N/M	N/M
Lead	S/W	EPA 7421	N/M	N/M	N/M	N/M
Magnesium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Manganese	S/W	EPA 6010	N/M	N/M	N/M	N/M
Mercury	S/W	EPA 7471/7470	N/M	N/M	N/M	N/M

Analyte	Media	Method No.	A	P	C	DL
Nickel	S/W	EPA 6010	N/M	N/M	N/M	N/M
Selenium	S/W	EPA 7740	N/M	N/M	N/M	N/M
Silver	S/W	EPA 6010	N/M	N/M	N/M	N/M
Sodium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Thallium	S/W	EPA 7841	N/M	N/M	N/M	N/M
Vanadium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Zinc	S/W	EPA 6010	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 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 5210	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 Organic Halogens	S	SW 9020	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	150.1	N/M	N/M	N/M	N/M
Specific Conductance	W	120.1	N/M	N/M	N/M	N/M
Temperature	W	170.1	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.
TBD = To be determined.

*With the exception of total recoverable petroleum 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. Modifications 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 GQAPP are listed below; biographies for these site personnel are presented on the following pages.

To Be Determined

APPENDIX D

THREATENED AND ENDANGERED FLORA AND FAUNA ASSOCIATED WITH NAS PENSACOLA

[Bold items enclosed in brackets denote changes to last version of document]

APPENDIX D

THREATENED AND ENDANGERED FLORA AND FAUNA OBSERVED OR LIKELY TO OCCUR WITHIN THE NAS PENSACOLA FACILITY OR NEARBY

Scientific Name	Common Name	Base Status[a]	Status[b] FGFWFC (or FDA)	Status[b] USFWS	Habitat
FISHES					
Acipenser oxyrhynchus	Atlantic sturgeon	M	SSC	UR 2	Gulf coast, estuarine
Ammocrypta asprella	Crystal darter	U	T	UR 2	Fresh water
Etheostoma histrio	Harlequin darter	U	SSC		Fresh water
Fundulus jenkinsi	Salt marsh topminnow	P	SSC		Salt, fresh, brackish waters
Lepisosteus spatula	Alligator gar	U	SSC		Brackish, fresh, salt water
Moxostoma carinatum	River redhorse	U	SSC		Fresh water
AMPHIBIANS AND REPTILES					
Alligator mississippiensis	American alligator	R	SSC	T(S/A)	Swamps, marshes, ponds
Caretta caretta caretta	Loggerhead turtle	M?	T	T	Marine, coastal
Chelonia mydas mydas	Green turtle	M?	E	E	Marine, coastal
Dermochelys coriacea	Leatherback turtle	M	E	E	Marine, coastal
Drymarchon corais coupori	Eastern indigo snake	P	T	T	Open areas near water
Eretmochelys imbricata	Hawksbill turtle	M?	E	E	Marine, coastal
Gopherus polyphemus	Gopher tortoise	P	SSC	UR 1	Sandy coastal plains
Graptemys pulchra	Alabama map turtle	U	SSC		Swamps, streams, marshes, ponds
Lepidochelys kempi	Atlantic ridley turtle	M?	E	E	Marine, coastal
Rana areolata aesopus	Florida gopher frog	P	SSC	UR 2	Sand hill communities
Macroclemys temmincki	Alligator snapping turtle	SR	SSC	UR 2	Swamps, marshes, ponds

Key at end of table.

Table Appendix D (Cont.)

Scientific Name	Common Name	Base Status[a]	Status[b] FGFWFC (or FDA)	Status[b] USFWS	Habitat
MAMMALS					
Mustela vison lutensis	Florida mink	U		UR 2	Terrestrial habitats
Peromyscus polionotus trissyllepsis	Perdido Key beach mouse	N/A	T	E	Beach dunes
Trichechus manatus latirostris	West Indian manatee	M	E	E	Atlantic and Gulf coasts
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
Haematopus 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
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

Key at end of table.

Table Appendix D (Cont.)

Scientific Name	Common Name	Base Status[a]	Status[b] FGFWFC (or FDA)	Status[b] USFWS	Habitat
Picoides borealis	Red-cockaded woodpecker	P-U	T	E	Cavity nests/old pine stands
Vermivora bachmanii	Bachmann's warbler	U	E	E	Wooded habitats
Campephilus 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/coastal wetlands
INVERTEBRATES					
Copris gopheri	Scarab beetle	P		UR 2	Associated w/gopher tortoise
Chrysopsis gossypina cruiseana	Cruise's golden-aster	P	E	UR 1	Coastal dunes
Drosera intermedia	Spoon-leaved sundew	R	T		Aquatic habitats
Epigaea repens	Trailing arbutus	U	E		Dry, acid, sandy 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 soils
Pinguicula planifolia	Chapman's butterwort	U	RE	UR 2	
Polygonella macrophylla	Large-leaved jointweed	R	T	UR 1	Sand pine-oak scrub
Rhododendron austrinum	Orange azalea	U	E	UR 5	Moist, woody habitats

Key at end of table.

Table Appendix D (Cont.)

Scientific Name	Common Name	Base Status[a]	Status[b] FGFWFC (or FDA)	Status[b] USFWS	Habitat
Sarracenia leucophylla	White-top pitcherplant	R	E		Open acid bogs
Sarracenia rubra	Sweet pitcherplant	U	E	UR 2	Acid bogs/slash pine woods
Stewartia malacodnedron	Silky camellia	U	E		Slopes of wooded ravines

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Key:

[a]Status of species on the NAS Pensacola facility:
R = Resident.
M = Migrant.
SR = Suspected resident.
P = Possible resident due to available habitat; survey required.
U = Unknown, survey required.
N/A = Not expected to occur on the NAS Pensacola facility.

[b]State and federal status:
E = Endangered.
T = Threatened.
T(S/A) = Threatened due to similarity in appearance.
AC = Agency concern; not currently listed or a candidate for listing.
UR 1 = Under review for federal listing with substantial evidence indicating at least some degree of biological vulnerability and/or threat.
UR 2 = Under review, insufficient biological data available.
UR 5 = Candidate species but taxa has proven to be more widespread than previously believed and/or those species that are not subject to any identifiable threat.
FDA = Florida Department of Agriculture.
FGFWFC = Florida Game and Freshwater Fish Commission.
USFWS = U.S. Fish and Wildlife Service.

Source: Ecology and Environment, Inc., 1992 after Florida Natural Areas Inventory 1988.