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PHASE II

CONTAMINATION ASSESSMENT/ REMEDIAL ACTIVITIES INVESTIGATION WORK PIAN - GROUP M NAVAL AIR STATION PENSACOLA PENSACOLA, FLORIDA

Soil North of Building 648 (Site31)

April 1992

Prepared for:

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NAVAL FACILITIES ENGINEERING COMMAND
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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 Soil North of Building 648 (Site 31) located at the Naval Air Station (NAS) in Pensacola, Escambia County, Florida. This work plan has been prepared by Ecology and Environment, Inc., (E & E) for the Southern Division, U.S. Navy, Naval Facilities Engineering Command, under Contract No. N62467-88-C-0200. The work plan has been developed based on information and file documents provided by the Navy and on information gathered by E & E during preliminary site inspections conducted in January 1989.

E & E has developed a phased approach for performing the NAS Pensacola site investigations. Phase I (Field Screening) is directed toward identifying the principal area(s) and primary contaminants of concern at a site, thereby providing a mechanism for focusing 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 11. Phases III and IV, if required, will be directed not only toward fully identifying the horizontal and vertical extents of contamination, but also toward providing the quantitative data base necessary to support the screening and evaluation of potential remedial alternatives. The main objectives/advantages of this phased approach are as follows:

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

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

- Early screening of potential remedial alternatives, 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.

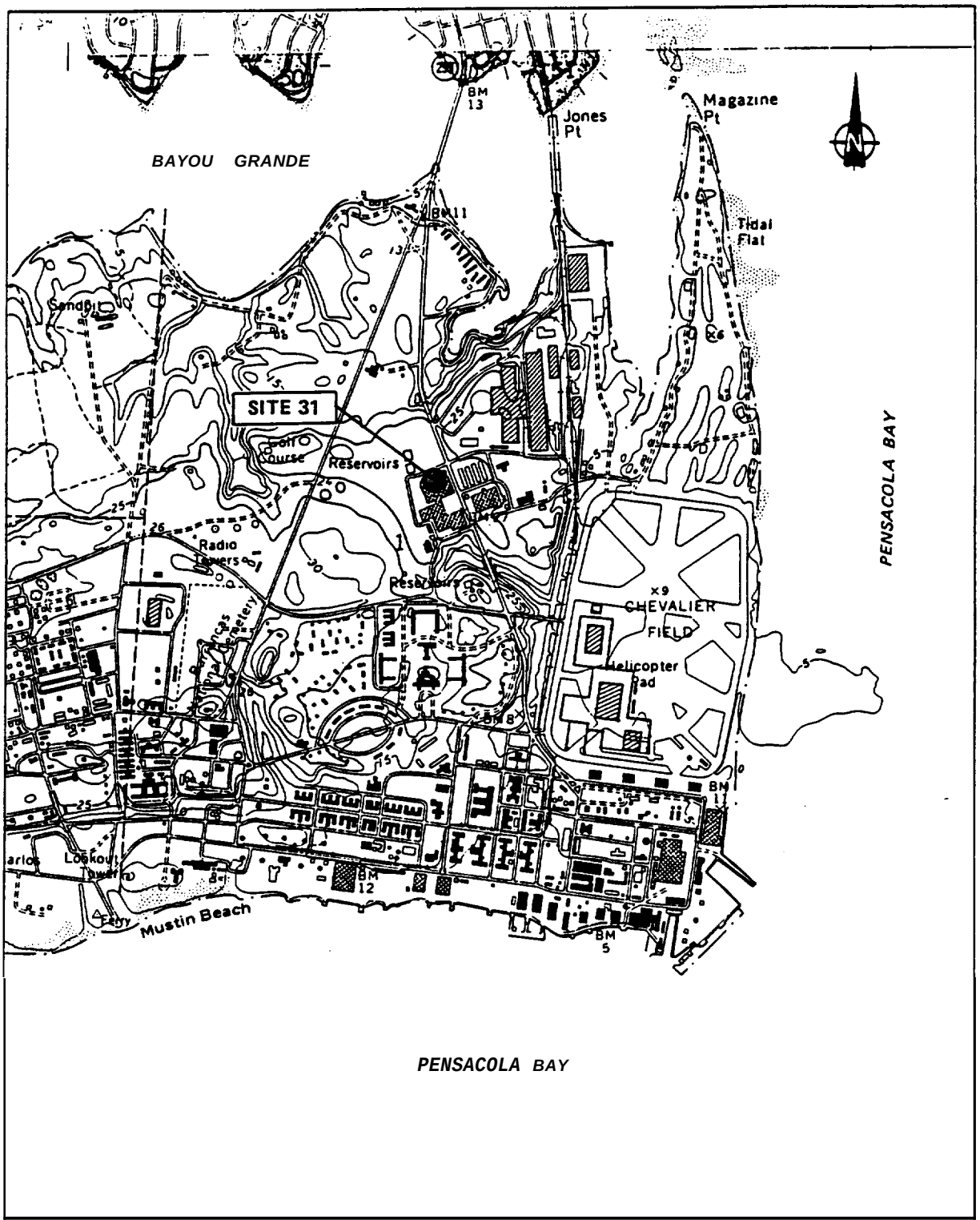
It is anticipated that some of the NAS Pensacola sites may not require investigation beyond Phase II and hence will comprise Contamination Assessment-type investigations. On the other hand, sites which have documented contamination will likely require the additional phases of work, and hence will comprise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

2. SITE DESCRIPTION

Site 31 (Soil North of Building *648)* located north of Building *648*, west of Murray Road, and adjacent to both, is a 100- by 200-foot unpaved area characterized by well-drained sandy soils. As shown on Figure 2-1, Bayou Grande is located approximately 1,300 feet north of the site; however, the nearest surface water body is a small creek *800* feet south of the site (U.S. Geological Society [USGS] 1970a). The topography at the site and immediate vicinity is generally flat with land surface elevations ranging from 25 to 28 feet above mean sea level (MSL; USGS 1970a). North of the site is a large, tree-covered park area (see Figure 2-2). Immediately west of the site is a covered storage area and Building *693*, and approximately *400* feet west of Building *648* and Site *31* is the A.C. Read Golf Course. Site 31 is located approximately 500 feet northwest of NAS Pensacola sites 25 [(Radium Spill Area)] and 27 [(Radium Dial Shop Sever)].

The site area is enclosed by an iron and concrete fence. At the time of the E & E initial site reconnaissance, the following were within this enclosure: a temporary storage trailer, located near the northwest corner of Building *648;* several 55-gallon drums, located near the center of the site; and a monitoring well (GM1), located approximately 20 feet north of the northeast corner of Building *648* (Geraghty and Miller [G & M] *1984).*

Monitoring well GM1, installed by G & M in 1984, is screened from 23.8 feet to 26.3 feet [below land surface (BLS]; see Figure 2-2). Monitoring well GM2, installed at the same time, is located on Site 27 approximately 700 feet east of Site 31 and is screened from *17.7* to 20.2



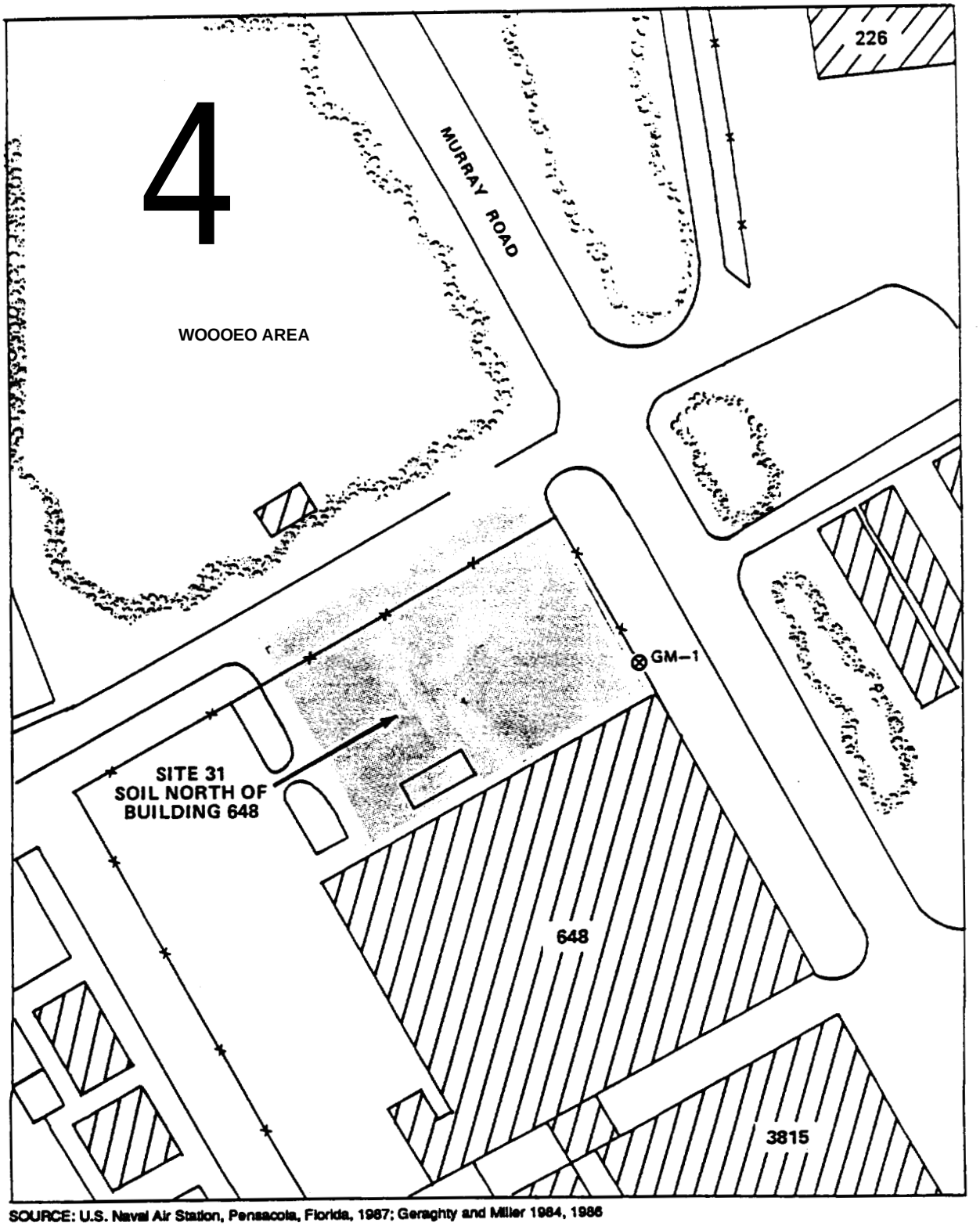
SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangles: Fort Barrancas, Fla. 1970 and Wen Pensacola, Fla. 1970, Photorevised 1987

SCALE

0 ½ 1 MILE

0 .5 1 KILOMETER

Figure 2–1 LOCATION MAP – NAS PENSACOLA SITE 31



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

SCALE

0 50 100 200 300 FEET

KEY:

Building

Existing MonftoringWell

Figure 2–2 SITE MAP - NAS PENSACOLA SITE 31

feet BLS; G & M 1984). NAS Pensacola supply well (Well No. 2), located approximately 1,300 feet southwest of the site, is screened from 110 to 160 feet BLS and the well casing is *24* inches in diameter terminating in a 12-inch diameter screen (Uilkins et al. 1985).

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3. SITE HISTORY

Building 648 has been used for painting operations since 1949 (Naval Energy and Environmental Support Activity [NEESA] 1983). Until 1973, paint waste and spent paint thinner were discarded in the unpaved area north of the building--Site 31. Over the 24-year period, an estimated 20,000 gallons of waste paint thinner and paint, as well as an estimated 8,600 gallons of paint sludges removed from water well paint booths, were poured directly onto the ground adjacent to Building 648. Paints and thinners that were commonly used by the Naval Aviation Depot (NADEP) included: cellulose nitrate lacquer, zinc chromate, nitrate dope, acetate dope, "day-glow," epoxy, enamel, lacquer thinner, toluene, and M-T-6096 (NEESA 1983; G & M 1984).

In June 1983, an Initial Assessment Study (IAS) of 29 potentially contaminated sites was completed by NEESA at NAS Pensacola. Site 31 was not included in this study; however, at a meeting with the Florida Department of Environmental Regulation (FDER) in November 1983, this site, along with three others, was added to the list of sites included in a Verification Study conducted by G & M in 1984.

In July 1984, G & M completed the Verification Study of 18 sites, including Site 31, at NAS Pensacola. During the study, monitoring well GM1 was installed on site and monitoring well GM2 was installed approximately 700 feet east of Site 31 on Site 27. Analyses of the groundwater from well GM1 revealed low levels of five volatile organic compounds (VOCs): methylene chloride at 2.1 µg/L; 1,1-dichloroethene at 0.1 µg/L; chloroform at 4.6 µg/L; 1,1,1-trichloroethane at 1.7 µg/L; and tetrachloroethene at 0.4 µg/L. Analyses of groundwater from well GM2 revealed some of the same contaminants at comparable concentrations:

chloroform at 3.7 µg/L; 1,1,1-trichloroethane at 2.5 µg/L; tetrachloroethene at 0.6 µg/L; and 1,2-dichloroethane at 29 µg/L (see Table 3-1). According to G & M 1984, the direction and rate of shallow groundwater flow suggest that the VOC contamination found at Site 27 may have originated at Site 31. To further define the horizontal and vertical extents of contamination, G & M recommended the installation of three additional shallow monitoring wells east of the two sites near the drainage ditch, and the installation of a deep well next to GM2.

During a subsequent Characterization Study (G & M 1986), two of the recommended shallow monitoring wells (GM55 and GM58) were installed approximately 1,600 feet east of Site 31 near the drainage ditch, and the recommended deep well (GM54) was installed near well GM2 on Site 27. Shallow wells GM55 and GM58 are screened from 23.5 to 26 feet BLS and 23 to 25.5 feet BLS, respectively. The deep well, GM54, is screened from 109.5 to 114.5 feet BLS (G & M 1986). Analyses of the groundwater samples collected from monitoring wells GM54 and GM55 did not reveal any VOC contamination. However, 1,1,1-trichloroethane was detected at a concentration of 8 µg/L in the groundwater sample from monitoring well GM58.

Groundwater samples collected from monitoring wells GM1 and GM2 during the Characterization Study (G & M 1986) exhibited significantly fewer contaminants at lower concentrations than during the previous sampling effort in 1984. During the 1986 study, groundwater from monitoring well GM1 did not exhibit any VOC contamination, and groundwater from monitoring well GM2 was found to contain 3 µg/L of trichloroethene (G & M 1986; see Table 3-1). G & H (1986) stated that water level elevations indicated a north-northeasterly groundwater flow, differing from the easterly flow estimated in the Verification Study (G & M 1984). A more accurate determination of groundwater flow is needed for the site.

An additional study was conducted in the site vicinity in 1988, apparently in an attempt to eliminate the site from consideration as a hazardous waste site, which would allow NAS Pensacola to proceed with

Table 3-1

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS FOR SITE 31 (µg/L [ppb])

Compounds Detected (EPA Methods 601 and 602)	Monitoring Well Number											
	GI¶-1		GM-2		GM-52		GI¶-54		on-55		GM-58	
	VS	CS	VS	CS	VS	CS	VS	CS	VS	CS	VS	CS
Methylene chloride	2.1	--	--	--	NA	--	NA	--	NA	--	NA	--
1,1-Dichloroethene	0.1	--	--	--	NA	--	NA	--	NA	--	NA	--
Chloroform	4.6	--	3.1	—	NA	--	NA	--	NA	--	NA	--
1.2-Dichloroethane	--	--	29	--	NA	--	NA	--	NA	--	NA	--
1,1,1-Trichloroethane	1.7	--	2.5	--	NA	--	NA	--	NA	8	NA	--
Trichloroethene	--	--	5.2	3	NA	--	NA	--	NA	--	NA	210
Tetrachloroethene	0.4	--	0.6	--	NA	--	NA	--	NA	--	NA	--
Trans-1,2-dichloroethene	--	--	--	--	NA	--	NA	--	NA	--	NA	530
Vinyl chloride	--	--	--	—	NA	--	NA	--	NA	--	NA	73

Key:

VS = Verification Study (G & M 1984).
CS = Characterization Study (G C M 1986).

-- = Not present above detection limits.
NA = Not Applicable - wells were not installed at this date.

[Source: Ecology and Environment, Inc., 1992.]

the construction of a proposed building. Under the Naval Installation and Restoration Program (NIRP), ERM-Southeast, Inc., (ERH) was retained by the Southern Division Naval Facilities Engineering Command (SOUTHDIVNAVFACENGCOM) to complete a site investigation for Site 31 at Building 649. There is some confusion regarding the actual location of samples collected during the ERM investigation. Site 31, as designated by this investigation (shown in Figure 2-2) is immediately north of Building 648. However, the ERM report locates the site north of Building 649. According to the Navy, samples taken during the ERM investigation were actually collected in front of Building 648 (Greene 1989). Low levels of semi-volatile organics, PCB-1260, and 4,4-DDE were found in soil samples collected by ERM. ERM concluded that the low levels of contaminants present at the site posed no apparent threat to human health or the environment and that the planned construction activity should proceed.

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 (Uolfe 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 (Uolfe 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, 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.

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, and 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), Eydrocotyle 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

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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 (Uolfe ~~et al~~. 1988).

Two other community types may be found in the western portions of the NAS Pensacola facility. These are flatwoods and sandhill vegetative communities. Flatwoods vegetation occupies areas which were ocean bottoms in recent geologic times. Primary overstory vegetation is dominated by Pinus palustris (longleaf pine), Pinus elliottii (slash pine), and Serenoa repens (saw palmetto). 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 (NEESA 1983).

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

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

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

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

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

Reptiles and Amphibians. During the 1986 survey conducted by the Navy, only four out of a possible 30 species of reptiles and amphibians associated with the area were identified on the NAS Pensacola facility, none of which are endangered. A recent check of the FNAI files confirms that the presence of the gopher tortoise (Gopherus polyphemus) can most likely be found in suitable habitats on the western portions of the facility (see Appendix C). 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 may have been significantly altered for drainage control and base development. Some of the species associated with aquatic habitats are Semotilus atromaculatus (creek chub), Gambusia affinis (mosquitofish), and Etheostoma sp. (darters). Birds, mammals, reptiles, and amphibians that associate with aquatic habitats may also be found in and around those sites with surface waters (Wolfe et. al. 1988).

Coastal 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 Bemiaulus 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 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 (Hicropogonias undulatus), gulf menhaden (Brevoortia patronus), bay anchovy (Anchoa mitchilli), longspine porgy (Stenotus caprinus), silver perch (Bairdiella chrysoura), southern hake (Urophycis floridana), inshore lizardfish (Synodus foetens), gafftopsail catfish (Bagre marinus), sand seatrout (Cynoscion arenarius), and spotted hake (Urophycis regia; Heil 1988).

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

Moderate densities of blue crab (Callinectes sapidus), shrimp (Penaeus duorarum, P. setiferus, and P. aztecus), and oysters (Crassostrea virginica) have been collected throughout Pensacola Bay (Heil 1989). 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 crab, 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, groupers, red snapper, flounders, and sand seatrout. It is likely that the sport fishing catch equals or exceeds commercial landings for species sought by both interests (Navy 1986).

The estuarine system is a very important element in the life history of most of the commercial and sport fishing species sought. Between 65 and 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 the FNAI in October 1988. A goosebeaked whale (Ziphius cavirostris) was reported stranded on Santa Rosa Island, and a pilot whale (Globicephala macrorhynchus) was found stranded on a beach near Pensacola (Navy 1986).

Although no surveys of marine mammals have been conducted, it can be assumed that they are 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 C) have been identified in the vicinity of the NAS Pensacola facility. Many rare, threatened, and endangered species are associated with the wetland or bog habitats found on NAS Pensacola. A total of 57 occurrences for six plant species were recorded in an inventory conducted by FNAI (1988b) of the NAS Pensacola facility (see Appendix C). 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

Site 31 is located within the industrialized portion of NAS Pensacola. A wooded area consisting of an altered sand pine scrub community habitat exists north of the site. The understory in this wooded area was removed during the establishment of a park area. Although the site is unpaved, it is not expected that flora or fauna from nearby habitats utilize this site for feeding or as a migration corridor.

6. SURFACE VATER HYDROLOGY

61 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 (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.

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 Eydrology

No surface water bodies occur on or in the immediate vicinity of Site 31. The nearest body of surface water, an unnamed creek and marshy area, is located approximately 800 feet south of Site 31. A cove of Bayou Grande is located approximately 1,300 feet north of Site 31 and an unnamed drainage ditch, which flows north to Bayou Grande, is located approximately 1,500 feet east of the site. A small pond associated with the golf course is located approximately 2,000 feet to the west.

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

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

7.1.2.1 Surficial/Sand-and-Gravel Aquifer

The Surficial Aquifer occurs from land surface to a depth of approximately 300 feet at NAS Pensacola and is composed of a sequence of unconsolidated to poorly indurated clastic deposits (Wagner ~~et al.~~ 1984). In this portion of Florida, the Surficial Aquifer constitutes an 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 (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 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 (Uilkins et al. 1985). NAS Pensacola has three supply wells which produce water from this zone; however, due to the 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

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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

In the immediate vicinity of Site 31, the surficial zone of the Sand-and Gravel Aquifer occurs from land surface to a depth of approximately 73 feet. The lithologic description of cuttings collected during the installation of monitoring well GM54, located near Site 27, indicates that this zone primarily consists of tan and brown, fine- to medium-grained quartz sand. Only one shallow monitoring well open to the surficial zone exists in the immediate proximity of Site 31 (see Figure 2-2). This well (GM1) has indicated that the water table in this area occurs approximately 14 feet BLS. Another shallow well (GM2) exists approximately 700 feet southeast of GM1 and is associated with Site 27. Based on water-level data collected from both of these wells (G & M 1984), the direction of groundwater flow is generally to the east toward an unnamed creek, and the horizontal hydraulic gradient is approximately 0.005. No aquifer tests have been conducted on wells open to the surficial zone in the immediate vicinity of Site 31. However, according to the reported results from tests on shallow wells located elsewhere at NAS Pensacola, hydraulic conductivities range from 16 to 57 ft/day and average approximately 30 ft/day. Assuming an effective porosity of 0.20, a groundwater flow velocity for the surficial zone in this area is estimated to be approximately 0.75 ft/day or 274 ft/year (G & M 1986).

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Immediately underlying the surficial zone in the vicinity of Site 31 and extending to a depth of approximately 105 feet, is the low permeability zone of the Sand-and-Gravel Aquifer. Based on the cuttings from the installation of well GM54, this zone primarily consists of green to gray, sandy, clayey silt with some shell fragments. No monitoring wells open to the low permeability zone exist in the vicinity of Site 31; however, based on the lithology, this zone would be expected to function as a confining or semiconfining unit restricting the flow of groundwater between the surficial zone and the underlying main producing zone. The direction of groundwater flow within the low permeability zone is unknown.

The top of the main producing zone occurs at approximately 110 feet BLS in the site vicinity and consists of fine-grained quartz sand to a depth of at least 120 feet. Monitoring well GM54 is screened between 109.5 and 114.5 feet BLS and is open to the upper portion of this zone. The water level elevation in well GM54 is approximately 7 feet lower than that in well GM2 (located 30 feet southeast of GM54), indicating a significant downward hydraulic gradient between the surficial zone and the main producing zone in this area (approximately 0.09; G & M 1984). Thus, depending on the vertical hydraulic gradient of the low permeability zone at this site location, a significant potential for downward groundwater flow from the surficial zone into the main producing zone exists.

The direction of groundwater flow within the main producing zone at this site is unknown; however, a generally southward flow is expected. An NAS Pensacola supply well (Well No. 2), located approximately 1,300 feet southwest of Site 31, is screened between 110 and 160 feet BLS, and thus is open to the main producing zone. This well is utilized by NAS Pensacola for back-up water supply only during periods of peak demand. However, during these periods of pumping, the direction of flow in the main producing zone could be affected over a large area. Insufficient data exist for wells open to the main producing zone to allow a determination of hydraulic gradient at NAS Pensacola.

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 31 will follow the GSMP and any updated versions. Data Quality Objectives (DQOs) and all applicable or relevant and appropriate requirements (ARARs) have been considered in developing the initial phases of fieldwork described here and will be updated and revised for any subsequent phases of fieldwork.

10. HEALTH AND SAFETY PLAN

A comprehensive General Health and Safety Plan (GHSP) and individual site-specific safety plans (SSPs) 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 (i.e., 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 Bealth Administration (OSHA) Guidelines for Hazardous Waste Operations (29 Code of Federal Regulations [CFR] Section 1910).

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11. QUALITY ASSURANCE PROJECT PLAN

A Generic Quality Assurance Project Plan (GQAPP) has been prepared and submitted to the Navy. 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 (SQAPs).

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

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.

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.

14. FIELDWORK METHODOLOGY

14.1 Phase I--Field Screening

The primary objective of the Phase I field screening investigation is to effectively and efficiently focus the Site Characterization (Phase 11) and subsequent Extent Delineation (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.

14.1.1 Physical Survey

14.1.1.1 Overall Physical Reconnaissance

A field reconnaissance survey will be conducted on and around Site 31 (Soil North of Building 648). 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.

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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. 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]

In order to identify potential source areas where volatile organic releases (hot spots) are occurring, a surface emissions survey will be performed across all unpaved areas of Site 31, using an HNu photoionization detector or organic vapor analyzer (OVA). Prior to the survey, a sampling grid with 25-foot centers will be established (see Section 14.1.2). In addition, the sampling team will carefully record the location and dimensions of any areas characterized by visible staining and/or exposed waste materials. Detailed notes of site activities and current weather information 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 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. A habitat/biota survey will be conducted for Site 31 as well as an evaluation of the literature sources.

14.1.2 Geophysical Survey

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

The effort will initially require the 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 tape measure will be 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 Mag 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 anomolous 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 monitoring well placement strategies.

14.1.3 Analytical Screening

14.1.3.1 Laboratory Analyses

Phase I activities for Site 31 will include soil sampling, installation of shallow temporary monitoring wells, and groundwater sampling. All 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.

Soil -- Soil samples will be collected at 11 locations across Site 31 (see Figure 14-1). At each location, soil samples will be collected and composited over 5-foot intervals ((0 to 5, 5 to 10 feet, etc.)] to the water table. Assuming the depth to water [across Site 31] is approximately 20 feet BLS (G & M 1986), an estimated total of 44 soil samples will be collected. Samples will be collected using a portable drill rig with 4-inch diameter solid stem augers. In those areas where it is impractical to use the portable drill rig, a hand operated bucket auger will be employed. All soil sampling and equipment decontamination activities will be conducted in accordance with sections 6.6 and 6.10 of the GQAPP, respectively.

Groundwater -- Four temporary monitoring wells will be installed across Site 31 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 monitoring well will be constructed of 2-inch 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 four temporary monitoring wells and existing well GM-1 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.

Table 14-1

PHASE I SAMPLING AND ANALYTICAL REQUIREMENTS—GROUP M

SITE 31

Medium	No. of Samples	Duplicates	Total	Analytical Suite[b]
Soil	44	2	46	A
Groundwater[d]	4	1	5	A
TOTAL	48	3	51	

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

[a]Analytical suite designations are as follows:

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

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

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

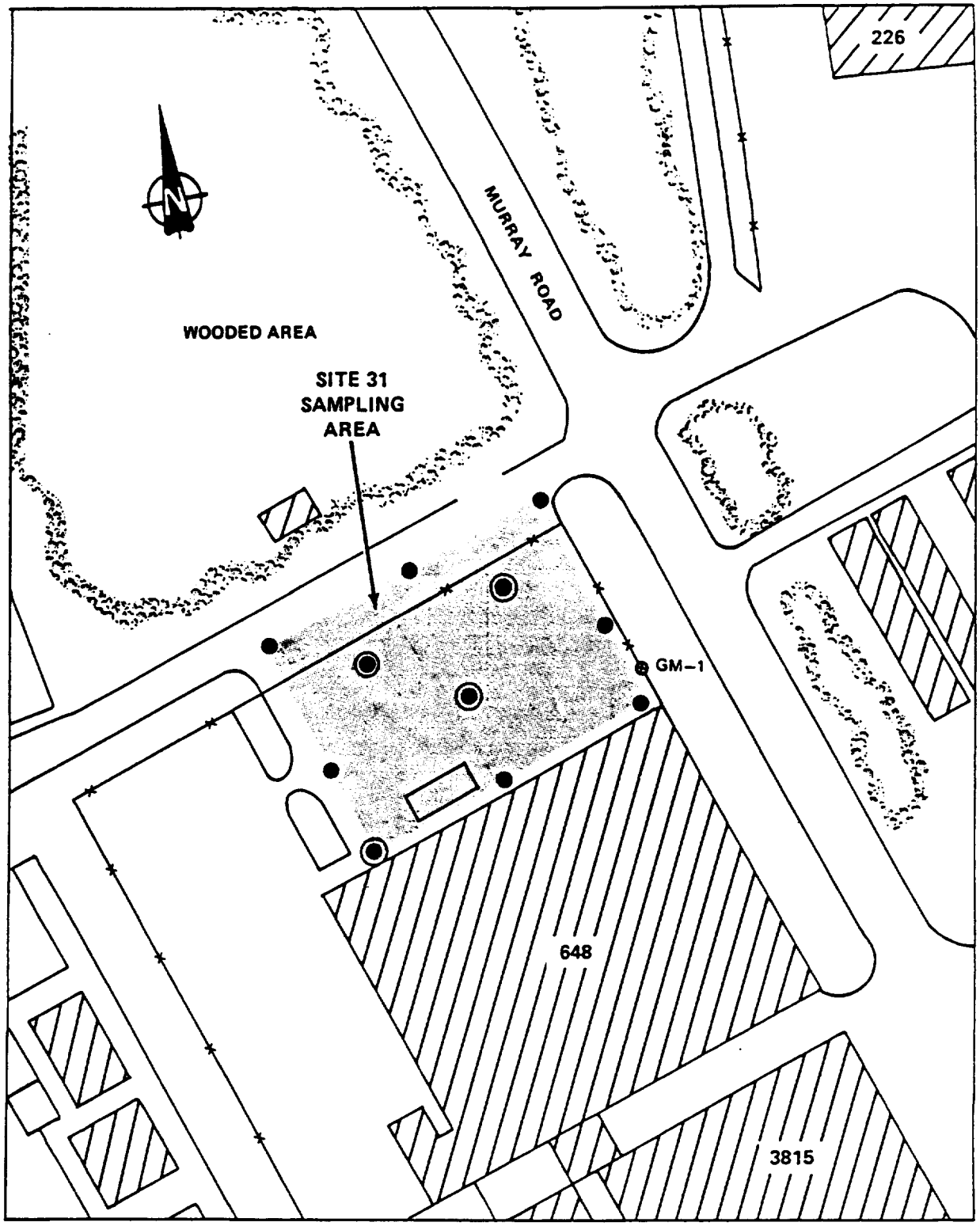
[c]Specific constituents encompassed by tho various chemical groups includod within tho above-listed analytical suite B are identified in Tables 9-5 through 9-13 of tho GQAPP.

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

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

[f]Trip blanks will bo analyzed for TCL volatilo organics only.

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



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

KEY:

Building

Existing Monitoring Well

Tentative Soil Boring

Tentative Temporary Monitoring Well

SCALE

0 50 100 200 300 FEET

Figure 14—1 TENTATIVE SOIL BORING AND TEMPORARY MONITORING WELL LOCATIONS, SITE 31 — PHASE I

14.1.4 Hydrologic Assessment

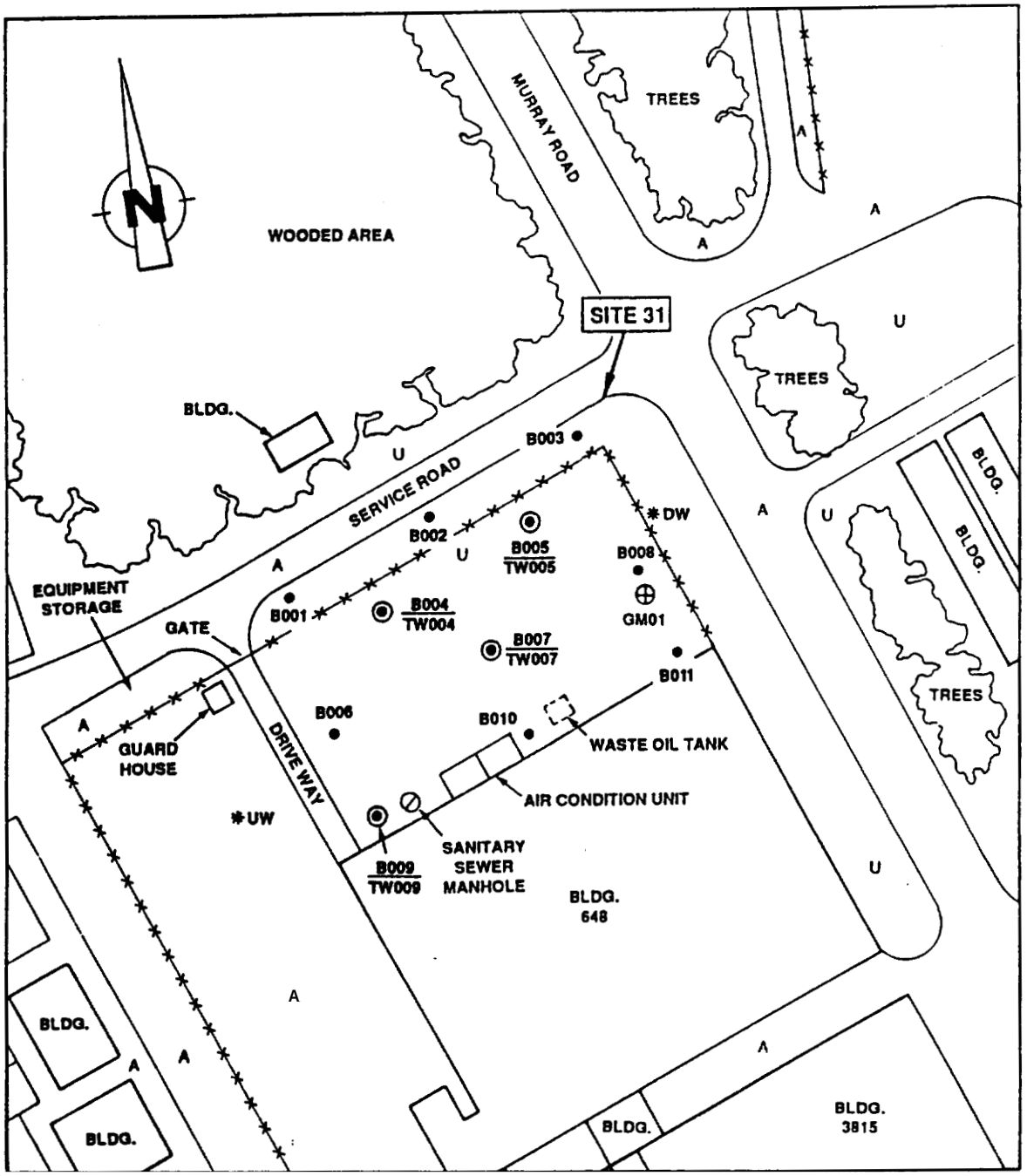
All temporary and existing monitoring wells will be surveyed to obtain top of casing [(TOC)] elevations referenced to USGS datum or to a suitable established benchmark located within the vicinity of Site 31. Static water levels will be measured in each well to determine shallow groundwater flow direction and horizontal hydraulic gradient.

14.2 Phase II--Characterization/Extent Delineation

This section of the Contamination Assessment/Remedial Activities Investigation Work Plan--Group M (Site 31, Soil North of Building 648), Naval Air Station Pensacola, Pensacola, Florida, has been entirely revised to reflect the results of the Phase I activities proposed in the original work plan document (June 1990). The original version (June 1990) of Section 14.2 of this work plan is presented in Appendix D. Figure 14-2 shows the actual Phase I sampling locations and location designations. The results of the Phase I investigation of Site 31 are presented in E & E's Final Draft Interim Data Report, Contamination Assessment/Remedial Activities Investigation, Soil North of Building 648 (Site 31), Naval Air Station Pensacola, Pensacola, Florida, April 1992.

In general, the results of E & E's Phase I investigation of Site 31, reviewed in combination with those of previous investigations of the site (G & M 1984, 1986), indicated the following:

- Significant levels of soil and groundwater contamination are absent across the site area.
- The presence of generally low levels of total recoverable petroleum hydrocarbons (TRPHs), the primary soil contaminants detected, in about half the samples most likely reflects an ambient source. Polynuclear aromatic hydrocarbons (PAHs) were detected at trace levels in only two shallow soil samples, and phenols were detected at a low level in only one shallow soil sample.
- Metals at low concentrations and the VOC chloroform (one sample only) were the primary groundwater contaminants detected; however, detected concentrations did not exceed any applicable primary drinking water standard.



SOURCE: U.S. Naval Air Station, Pensacola, Florida, 1987; Ecology and Environment, Inc., 1991

SCALE

0 100 200 FEET

KEY:

- BLDG. 648 — Building
- Trees
- Fence
- A — Asphalt-Paved Area
- U — Unpaved Area
- Sanitary Sewer Manhole
- Existing Permanent Shallow Monitoring Well
- GM01 — Permanent Monitoring Well Number
- Soil Boring
- Temporary Monitoring Well
- B004 — Soil Boring Number
- TW004 — Temporary Monitoring Well Number
- Particulate Air Screening Location
- DW/UW — Particulate Air Screening Location Designation (downwind/upwind)

Figure 14-2 PARTICULATE AIR SCREENING, SOIL BORING, AND TEMPORARY MONITORING WELL LOCATIONS — NAS PENSACOLA SITE 31 — PHASE I

In light of the Phase I results summarized above, the objective of the Phase II investigation of Site 31 is to confirm the absence of significant levels of on-site soil and groundwater contamination. A full-scale RI/FS will not be warranted at Site 31.

In order to meet the above objective, the Phase II investigation of Site 31 will include the following elements:

- Contaminant source survey;
- Soil sampling;
- Installation of shallow monitoring wells;
- Collection of groundwater samples from existing and newly installed wells;
- Hydrologic assessment; and
- Engineering survey.

The specific scope of work associated with each of the above elements is described in sections 14.2.1 through 14.2.4. In developing the specific scopes of work, the Phase I analytical results and previous analytical results have both been evaluated regarding all requirements of CERCLA and Superfund Amendments and Reauthorization Act (SARA), as well as all other *ARARs*. For Site 31, these *ARARs* include:

- Resource Conservation and Recovery Act (RCRA);
- Clean Water Act (CWA);
- Safe Drinking Water Act (SDWA);
- 40 CRF Parts 264, 265, 270, and 271 (Corrective Action for Solid Waste Management Units at Hazardous Waste Management Facilities; Proposed Rule);
- Chapter 17-3, Florida Administrative Code (FAC; Water Quality Standards);
- Chapter 17-550, FAC (Drinking Water Standards, Monitoring, and Reporting); and
- Chapter 17-770, FAC (State Underground Petroleum Environmental Response).

Formal, quantitative air sampling will not be conducted during Phase II at Site 31 because no evidence that Site 31 represents a potential source of airborne volatile or particulate contaminants was revealed by the Phase I surface emissions survey, particulate air screening, or fieldwork air monitoring activities. Biota sampling also will not be conducted during Phase II because the presence of significant on-site contamination has not been confirmed and, therefore, potential contaminants of concern have not been sufficiently characterized. However, base-wide biota sampling will be conducted in conjunction with the investigation of operable units (OUs) 15, 16, and 17 (Bayou Grande Area, NAS Pensacola Wetlands, and Pensacola Bay Area, respectively).

It is not anticipated that Risk Assessment or Feasibility Study activities will be required at Site 31. However, if required based on the results of the activities identified above, during Phase II E & E will initiate the appropriate Risk Assessment and Feasibility Study activities.

If required, Risk Assessment activities will be directed toward identification of contaminants of concern as well as identification of data gaps that must be eliminated to support the eventual completion of a Baseline Risk Assessment for the site. If no data gaps are identified, the Baseline Risk Assessment will be completed during Phase 11.

If required, Feasibility Study activities will be directed toward identification of data gaps that must be eliminated to support the eventual completion of a comprehensive Feasibility Study for the site. If no data gaps are identified, the Feasibility Study will be completed during Phase 11.

In addition, if warranted, E & E will evaluate the Phase II results to identify whether any interim remedial measures (IRMs) are required and, if so, to develop recommendations for implementing these IRMs (see Section 14.2.5). IRMs will only be implemented following receipt of EPA approval.

All Phase II investigation activities and results will be discussed in an interim data report structured in the required format of a formal draft remedial investigation (RI) report. This Phase II interim data report will provide a complete data synthesis incorporating the results of E & E's Phase I and Phase II investigations, as well as the results of previous investigations. The interim data report will specify whether additional Phase III assessment activities are required, or whether the formal draft RI report for the site can be prepared.

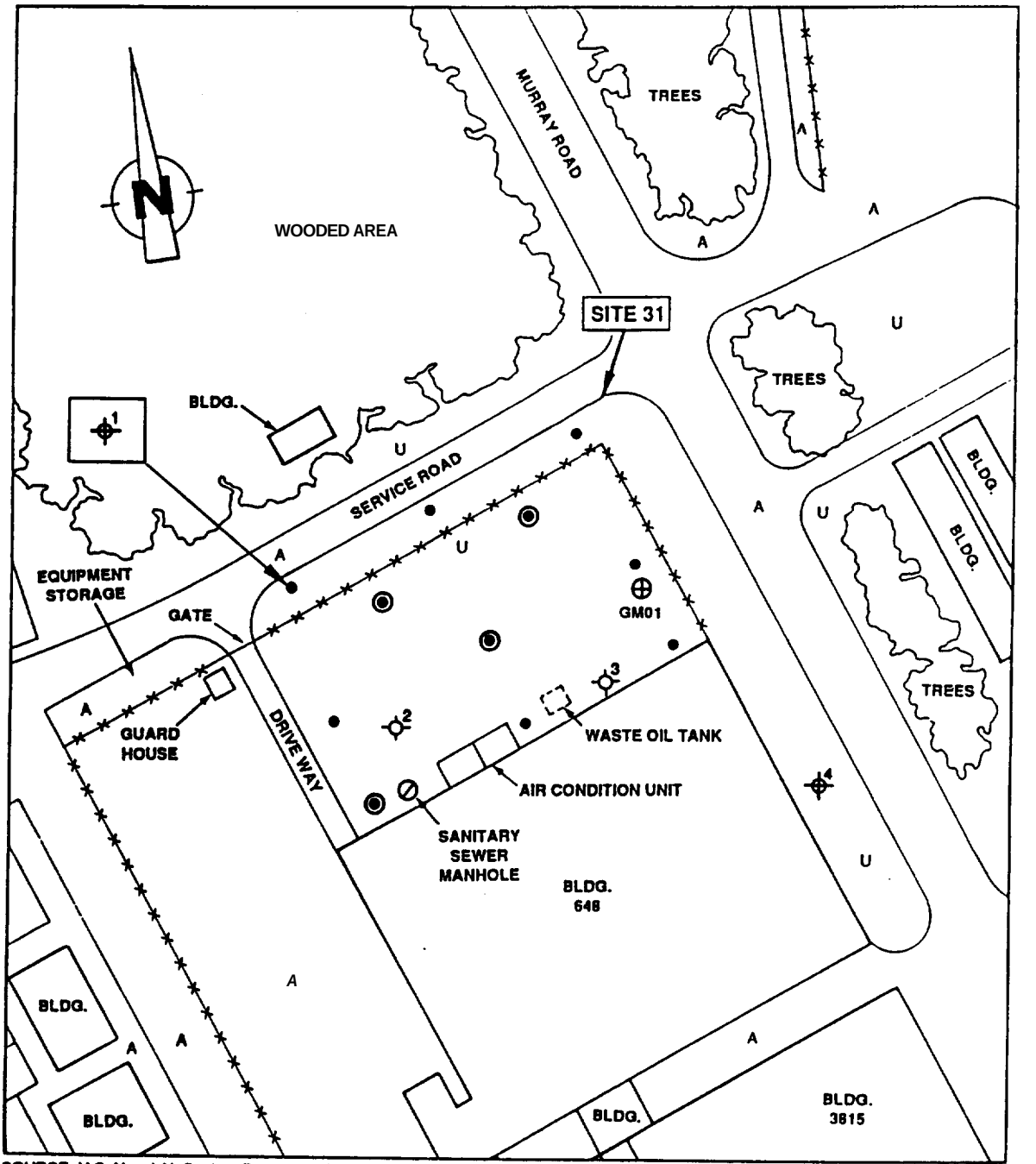
All Phase I investigation activities were completed in accordance with E & E's 1990 GQAPP for Contamination Assessments and Remedial Activities at NAS Pensacola. All Phase II investigation activities will be completed in accordance with the newly revised, updated 1992 version of this document. In this section (14.2), all references apply to the 1992 version of the GQAPP.

14.2.1 Contaminant Source Survey

A supplemental contaminant source survey will be performed at Site 31 to obtain a comprehensive understanding of potential former and/or existing ambient sources of TRPH contamination on site and in the site vicinity. The identification of potential former and existing ambient contaminant sources will involve an evaluation of existing files and literature to determine whether any normal, daily, facility-specific and/or base-wide activities, such as aircraft operations, may have created potential, low-level ambient contaminant source(s). All background source survey work will be conducted in close communication with the facility Installation Restoration (IR) coordinator as the survey may need to access repositories and/or individuals at several locations among the various tenant commands.

14.2.2 Sampling and Analysis

Figure 14-3 shows the proposed Phase II soil boring and monitoring well locations for Site 31. Table *14-2* summarizes the sampling and analytical requirements, including QA/QC samples, for the Phase II investigation of Site 31. Tables *14-3* and *14-4* provide the specific rationale for each proposed Phase II soil boring and monitoring well



SOURCE: U.S. Naval Air Station, Pensacola, Florida, 1987; Ecology and Environment, Inc., 1991

SCALE

0 100 200 FEET

KEY:

BLDG 648	Building	⊕	Existing Permanent Shallow Monitoring Well	⌖	Proposed Phase II Soil Boring
	Trees	GM01	Permanent Monitoring Well Number	⌖	Proposed Phase II Soil Boring and Shallow Monitoring Well
	Fence	●	Phase I Soil Boring	4	Location Reference Number
A	Asphalt-Paved Area	○	Phase I Temporary Monitoring Well		
U	Unpaved Area				
⊘	Sanitary Sewer Manhole				

'Figure 14-3 PROPOSED SOIL BORING AND SHALLOW MONITORING WELL LOCATIONS— NAS PENSACOLA SITE 31 — PHASE II

Table 14-2

PHASE II SAMPLING AND ANALYTICAL REQUIREMENTS
NAS PENSACOLA SITE 31

Medium	lo. of Samples[a]	Dupli-cates	Trip Blanks[b]	Preservative Blanks[b]	Field Blanks	Rinsate Blanks	Total[a]	Analytical Suite[c]
Soil[e]	24 (4)	2 NR	-- NR	NR[f] NR	NR NR	1 NR	21 (4)	A B
Groundwater[g]	3 (1)	1 NR	1 NR	1 NR	1 NR	1 NR	8 (1)	A C
TOTAL	27 (5)	3 NR	1 NR	1 NR	1 NR	2 NR	35 (5)	

14[NASP]UH8000:T0483/1304/10

Key:

[a]The number of samples shown in parentheses will bo analyrod for tho additional parametors indicated.

[b]Trip blanks will bo analyzed for Target Compound List (TCL) volatile organic compounds (VOCs) only. Preservative blanks will bo analyzed for TCL VOCs, total recoverable petroleum hydrocarbons (TRPHs), dissolvod Target Analyte List (TAL) metals, and cyanide.

[c]Analytical suite designations are as follows:

A = TCL VOCs; TCL base-neutral/acid extractable organic conpounds (BNAs); TCL pesticides, and polychlorinated biphenyls (PCBs); TRPHs; TAL metals (total [i.e., unfiltered] and dissolvod [i.e., millipore-filtered], wator only): cyanide: gross alpha, beta, and gamma radioactivity: total organic carbon: hardness (water only): and alkalinity (water only).

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

C = Total suspended solids, total Kjeldahl nitrogon (TKN), ammonia nitrogen, orthophosphate phosphorus, dissolvod oxygon (in field), 5-day biological oxygon domand (BOD_5), and chemical oxygon demand (COD).

[d]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 GQAPP.

[e]4 boring locations X 6 depth intervals = 24 samples.

[f]NR = lot required.

[g]1 existing well + 2 now shallow wells = 3 samples.

Source: Ecology and Environnont, Inc., 1992.

Table 14-3

RATIONALE FOR PROPOSED PHASE II SOIL SAMPLE LOCATIONS AND ANALYSES NAS PENSACOLA SITE 31

Location Reference Number(s)	Sample Type(s)[a]	Location Rationale	Analytical Suite(S)[b]	Analytical Rationale
1	AUT	Phenols and PAHs detected in Phase I soil boring B001.	A	Characterize full spectrum of potential contaminants.
			B	Support potential site remediation planning activities.
2,3	AWT	Confirm absence of soil contamination in those areas.	A	Characterize full spectrum of potential contaminants.
			B	Support potential site remediation planning activities.
4	AUT	Confirm absence of soil contamination in this area (not sampled during Phase I).	A	Characterize full spectrum of potential contaminants.
			B	Support potential site remediation planning activities.

14[NASP]UH8000:T0483/1305/7

Key:

[a]AWT = Soil samples collected above water table at following intervals (BLS): 0-0.5, 0.5-2.5, 2.5-5, 5-10, 10-15, and 15-20 foot.
[b]Specific parameters included within each analytical suite are given in Table 14-2.

Source: Ecology and Environment, Inc., 1992.

Table 14-4

RATIONALE FOR PROPOSED PHASE II MONITORING WELL LOCATIONS AND GROUNDWATER SAMPLE ANALYSES NAS PENSACOLA SITE 31

Location Reference Number(s)	Sample Type(s)[a]	Location Rational.	Analytical Suit. (s)[b]	Analytical Rational.
1, 4	SGW	Confirm absence of groundwater contamination in thoro areas. Location 1 is hydraulically upgradiont and location 4 is hydraulically downgradient.	A	Characterize full spectrum of potential contaminants
			C	Support potential site remediation planning activities.

14[NASP]UH8000:T0483/1305/7

Key :

[a]Existing well GM01 will also bo sampled during Phase II for analytical suite A parameters.
[b]SGW = Groundwater sample from shallow monitoring well.
[c]Specific parameters included within each analytical suite are given in Table 14-2.

Source: Ecology and Environaont, Inc., 1992.

location, respectively, and for the analytical suite associated with each proposed Phase II sampling location. (Groundwater samples to be collected from the existing on-site well and analyzed for suite A, see below, are not included in rationale Table *14-4).*

The sample location reference numbers listed in tables *14-3* and *14-4* correspond to the location numbers on Figure *14-3.* The analytical suite designations used in tables *14-3* and *14-4* correspond to the designations defined in Table *14-2.*

It is proposed to sample the existing well and all newly installed wells for analytical suite A during Phase II to provide a uniform, time-synchronous perspective on Site *31* groundwater conditions. This perspective will be critical to properly evaluate the groundwater migration pathway. In addition, during Phase II field activities at NAS Pensacola site groups A through E, soil borings, shallow monitoring wells, and intermediate monitoring wells will be completed at three background locations across the base and--together with the three existing on-base deep supply wells--sampled for analytical suite A. (Soil samples collected below the water table will be analyzed for Target Analyte List [TAL] metals.) These background locations will help provide a perspective on the on-site occurrences of potential contaminants as well as aid in evaluating the impact of potential, base-wide ambient contaminant sources. The collection of these background soil and groundwater samples is discussed in the work plan for Group A--Site 1 (Sanitary Landfill; E & E *1991).*

Table *14-2* indicates that the samples from each medium will be analyzed for analytical suite A and also notes that trip blanks will not be analyzed for the full suite of parameters but only for Target Compound List (TCL) VOCs.

As noted above, tables *14-3* and *14-4* provide specific rationales for proposed Phase II sampling locations and analyses. Sampling locations were selected based on the Phase I results in accordance with one of the following criteria:

- Area of known contamination,
- Area of potential contamination, or
- Known or suspected area of no contamination.

Sampling locations selected according to the first criterion are required to allow identification of the full spectrum of potential on-site contaminants as well as the maximum levels of occurrence. Locations selected according to the second criterion are required to delineate the distribution of contamination on site and in the site vicinity. Locations selected according to the third criterion are required to confirm that the extent of contamination has been completely delineated. Although significant contamination was not detected in any of the Site 31 Phase I samples, the specific, detailed rationales provided in tables 14-3 and 14-4 for each sampling location meet one or more of the three general criteria defined above.

In order to confirm the absence of contamination on Site 31, the collected samples must be analyzed for all the parameters in analytical suite A. Finally, although not anticipated to be required for Site 31, to support potential remediation planning activities for the site, selected samples from each medium also will be analyzed for those parameters which directly control the viability of various remedial alternatives (see analytical suites B and C, Table 14-2).

14.2.2.1 Soil Sampling

During the Phase II soil boring and monitoring well installation (Section 14.2.2.2), soil samples will be collected at four locations across Site 31 (see Figure 14-3). At soil boring locations where a monitoring well will not be installed, soil borings will be completed using hollow-stem auger methods, and soil samples will be collected using split-spoon samplers in accordance with Section 6.6.2 of the GQAPP.

At each location, composite samples will be collected from each of the following depth intervals: 0 to 0.5 foot BLS, 0.5 foot to 2.5 feet BLS,

2.5 to 5 feet BLS, and then every 5-foot interval to the water table. For the purpose of estimating sample numbers, the depth to the water table is assumed to be 17 feet BLS. The 24 soil samples will be analyzed for the parameters indicated on Table 14-2 (see also Table 14-3).

The number and types of soil field QA/QC samples to be collected during Phase II were determined in accordance with Section 11.1 of the GQAPP.

All soil sampling, compositing, and lithologic logging activities will be performed in accordance with Section 6.6 of the GQAPP. Equipment decontamination will be performed in accordance with Section 6.10 of the GQAPP.

14.2.2.2 Soil Boring Completion and Permanent Monitoring Well Installation and Development

Two shallow permanent monitoring wells, each approximately 20 feet deep, will be installed at Site 31. These wells will be located and designed to supplement the Phase I investigation results.

Figure 14-3 shows the locations of the proposed monitoring wells at Site 31, and Table 14-4 provides the rationale for each of the monitoring well locations and corresponding sampling analytical requirements. In order to detect the presence of any floating product at Site 31, the two shallow wells will be completed into the upper portion of the surficial zone of the Sand-and-Gravel Aquifer so that the well screen brackets the water table. These wells are expected to be approximately 20 feet deep.

The shallow wells will be installed using hollow-stem auger methods, and constructed of 4-inch-diameter, flush-threaded, polyvinyl chloride (PVC) casing terminating in 10 feet of 0.015-inch, factory-slotted screen. All drilling and finished monitoring well construction will be conducted in accordance with sections 6.7.2 and 6.7.3 of the GQAPP. In addition, the Site 31 newly installed wells will be protected above surface grade with a steel surface casing and locking wellhead cover.

In conjunction with the drilling of the well boreholes, continuous split-spoon samples will be collected to the target completion depth of each well in accordance with Section 6.7.2.3 of the GQAPP.

After installation, each of the new monitoring wells will be developed using a submersible pump and/or bailer in accordance with Section 6.7.5 of the GQAPP. Development waste will be contained in 55-gallon drums, labeled, and moved to a storage area on NAS Pensacola, as directed by the Navy (see also Section 14.6.2).

All drilling equipment will be decontaminated prior to use and between the installation of each well in accordance with Section 6.10 of the GQAPP. All borehole cuttings and drilling fluids will be stored in 55-gallon drums, labeled, and moved to a storage area on NAS Pensacola, as directed by the Navy (see also Section 14.6.2).

14.2.2.3 Groundwater Sampling

During Phase II at Site 31, groundwater samples will be collected from the existing on-site monitoring well and the two newly installed shallow on-site monitoring wells (see Figure 14-3). Purging and sampling of each well will be conducted in accordance with sections 6.8.2 and 6.8.3 of the GQAPP, respectively. Equipment decontamination activities will be conducted in accordance with Section 6.10 of the GQAPP. The number and types of groundwater field QA/QC samples to be collected during Phase II were determined in accordance with Section 11.1 of the GQAPP.

The three groundwater samples will be analyzed for the parameters indicated on Table 14-2 (see also Table 14-4).

All shallow monitoring wells will be checked for floating and/or sinking immiscible hydrocarbons with an oil/water interface probe.

14.2.3 Eydrologic Assessment

The main objective of the Phase II hydrologic assessment is to further delineate the hydrogeologic character of the underlying aquifer at Site

31. Slug and short-term specific capacity tests, rather than a long-term pump test, have been proposed for Phase II because it is not anticipated that groundwater remediation will be required at this site.

The hydrologic assessment at Site 31 will include a wellhead elevation survey of both newly installed permanent monitoring wells; static water level measurements in all three on-site wells; and short-term specific capacity (new wells only) and/or slug tests on all three on-site wells.

Both of the newly installed monitoring wells will be surveyed during the engineering survey (Section 14.2.4), and referenced to a USGS benchmark, in accordance with Section 6.7.6 of the GQAPP.

At Site 31, static water levels will be measured in the existing and proposed on-site wells on at least four occasions: once daring the sampling of the newly installed wells; once approximately two to four weeks after sampling to obtain an estimate of the short-term temporal variability in water levels; once during a low tidal phase; and once during a high tidal phase. The measurements taken during opposing tidal phases will be collected on the same day in order to accurately evaluate tidal influences on water level elevations at Site 31.

Limited aquifer testing will be conducted at Site 31 on all three on-site monitoring wells. This testing will consist primarily of performing short-term specific capacity tests on the newly installed wells that are capable of sustaining a measurable yield. The specific capacity testing at Site 31 will be conducted during the development of the newly installed wells. The procedure for specific capacity testing involves measuring the initial static water level in the well and then withdrawing groundwater from the well at a constant rate for a designated period.

The sustained water level during pumping is then noted, and the pump is turned off. The water level recovery in the well is then recorded continuously over time until the water level equilibrates to the initial static level. In addition to measuring drawdown in the developing well

during the specific capacity testing, water levels will be measured in adjacent shallow monitoring wells to determine the extent to which the respective, monitored zones may be hydraulically connected.

Injection or withdrawal-type slug tests will be performed on newly installed wells that are not capable of sustaining a measurable yield and on the existing permanent shallow well. The procedure for slug testing involves measuring the initial static water level in the well and then injecting or withdrawing a known volume from the well, using a solid stainless steel cylinder, to create an instantaneous change in water level. The water level is then recorded continuously over time until the water level equilibrates to the initial static level.

The purposes of the specific capacity and slug testing are to obtain site-specific, first estimate values for hydraulic conductivity (K), transmissivity (T), and groundwater flow velocity (V) for each of the monitored depth zones. During each of these tests, a calibrated tape and/or electronic data logger will be used to monitor and record the water levels in the well(s) being tested or observed.

A rain gauge will be installed at or near the site and monitored regularly during the fieldwork.

14.2.4 Engineering Survey

A comprehensive engineering survey will be conducted to accurately identify all site sampling locations and cultural and topographic features. All sampling and monitoring well locations will be identified both horizontally and vertically. In addition, any utilities, aboveground structures, and improvements (such as pavement) will be located. Any pertinent information found during the contaminant source survey (Section 14.2.1) will be incorporated into this survey. The survey also will delineate topographic variability using contour intervals of 2 feet.

All engineering survey information will be integrated with any existing computer-aided design (CAD) base maps so that all updated, site-related

information can be precisely and efficiently added to the base map. The development of a CAD base map will include the addition of previous data point locations (i.e., coordinates of latitude and longitude). The survey drawing will be produced in mylar and blueline copies; the CAD file for the drawing will be kept on diskette.

14.2.5 Interim Remedial Measures

During the field investigation, circumstances on site may require **IRMs.** **IRMs** will be initiated on a case-by-case basis and only following receipt of EPA approval. Rapid response will be emphasized. **An IRM** could involve the installation of security fences and warning signs; construction of berms, caps, and/or recovery and treatment systems; and removal of soil, sediment, and/or drums. **If** an **IRM** is conducted, a detailed, explanatory report of the IRM will be developed by E & E and provided to the Navy and EPA.

14.2.6 Report

Refer to Section 20 of this work plan (revised April ***1992)*** for a description of the Phase II report.

14.3 Phase 111--Extent Delineation

[As noted in the beginning of **Section 14.2, the objective of the Phase II investigation of Site 31 is to confirm the absence of significant levels** of **on-site soil and groundwater contamination. Consequently, it is not anticipated that Phase III or Phase IV (see Section 14.4) investigation activities will be required at Site 31. However, if contamination is detected in the Phase II samples, then]** Phase III activities will be geared toward further delineating the horizontal and vertical extents of **[the detected]** contamination.

14.3.1 Soil Sampling

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

14.3.2 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 11.

14.3.3 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 11.

14.3.4 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.

14.3.5 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 11, 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 hydraulic connection exists between the surficial zone and underlying main producing zone at the site.

(14.3.6 Engineering Survey

A comprehensive engineering survey will be conducted to accurately identify all new site sampling locations. All sampling and monitoring well locations will be identified both horizontally and vertically. In addition, any improvements (such as pavement) will be located. All engineering survey information will be integrated with the existing Phase II CAD base maps so that all updated, site-related information can be precisely and efficiently added to the base map. The survey drawing will be produced in mylar and blueline copies; the CAD file for the draving will be kept on diskette.]

14.4 Phase IV--Extent Delineation

[Although not anticipated to be needed at Site 31 (see Section 14.3),] 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;
- o Hydrologic assessment; [and
- o Engineering survey.]

14.[5] Field Quality Assurance/Quality Control

14.[5].1 Documentation

Field activities and sample management will entail certain strict documentation requirements as described in Section 7 of the GQAPP.

14.[5].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

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

estimated numbers of required field QA/QC samples for phases I and II are shown in tables 14-1 and 14-2.

14.[6] Decontamination and Waste Management Procedures

14.[6].1 Decontamination Procedures

All equipment decontamination procedures for Site 31 will be performed in accordance with Section 6.10 of the GQAPP.

14.[6].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 monitoring well purging and development activities on Site 31 will be discharged onto the ground surface away from the well or will be contained, labeled, and moved to a storage area on NAS Pensacola, as directed by the Navy.

Any excess soil auger cuttings generated by soil boring or monitoring well installation activities will be disposed of on Site 31 or will be contained, 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 contained, labeled, and moved to a storage area on NAS Pensacola.

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.

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 RANDOHWALK 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 ten years into the future. Additional simulations will include different remedial pumping scenarios for both organic and inorganic contamination. E & E then will use information generated by these computer simulations for remedial alternative development. Other computer models that can be utilized to assess on-site groundwater conditions include: PLASM, a two-dimensional, finite-difference groundwater flow model; GWTRANS, a two-dimensional, finite-difference solute transport model; FEHWATER, a finite-element groundwater model; and FEHWASTE, 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.

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 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, 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 qualitative and/or 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.

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. In addition, the Integrated Risk Information System (IRIS) will be utilized.

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

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

- Records of any environmental and/or health complaints regarding the sites; and
- 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 remedial investigation (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 and summary 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 Bvaluation 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 and 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 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 briefly summarize the Phase II results and provide recommendations for the Phase III investigation. Thus, the Phase II interim report will not be a formal document. Following production of the Phase II interim report, the work plans for the Phase III work will be updated. [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.]

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

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.

21. DOCUMENT REVISION

Periodic updating of all administrative documents (GQAPP, GSMP, GHSP, GPHP, and work plans) will be necessary due to changes in site conditions and/or program conditions or requirements. The schedules shown in the GPMP and GSMP indicate document revisions approximately every two months for the GQAPP, 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.

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.

23. PROJECT SCHEDULE

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

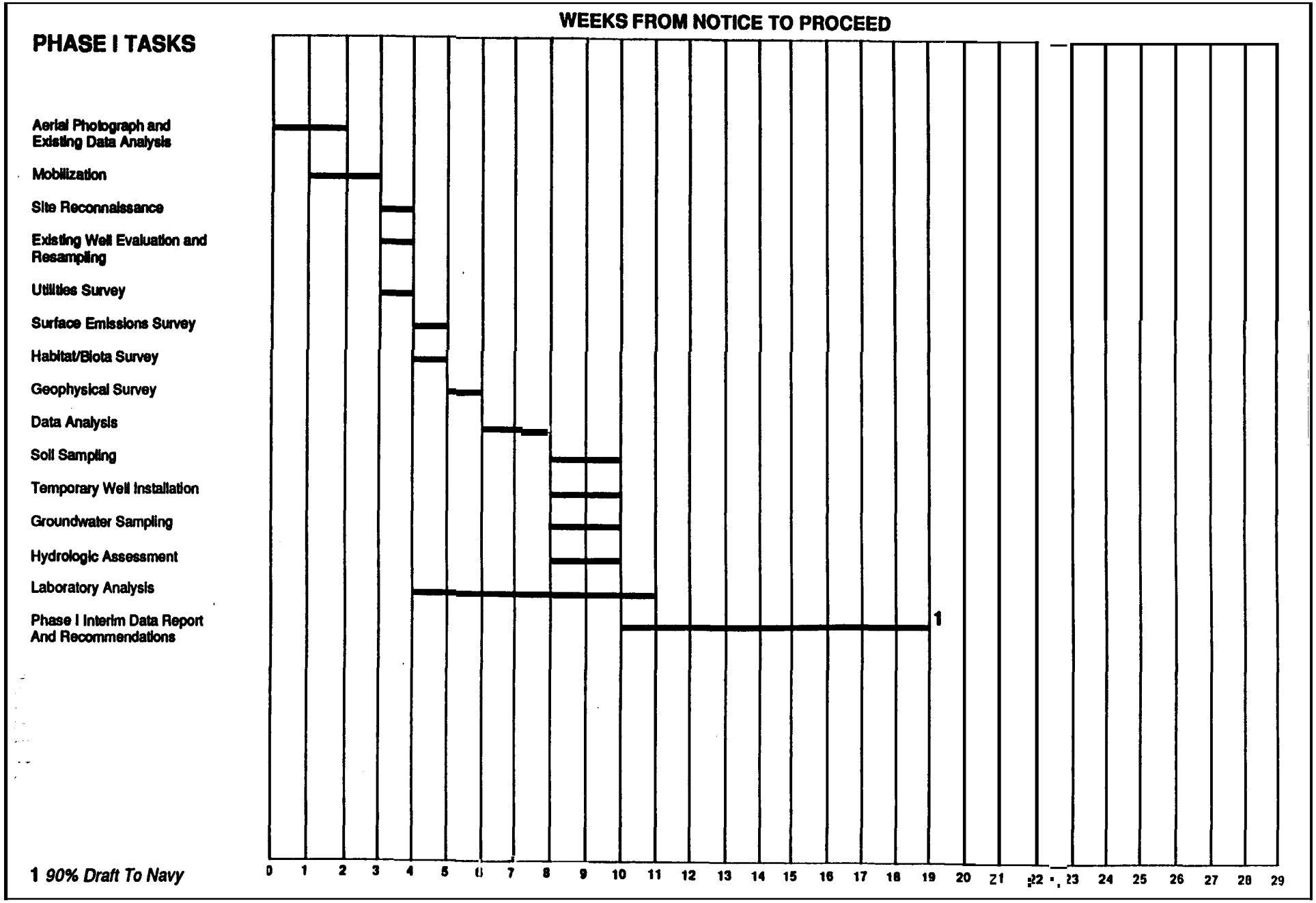


Figure 23-1 PHASE I PROJECT SCHEDULE -- GROUP M (SITE 31)

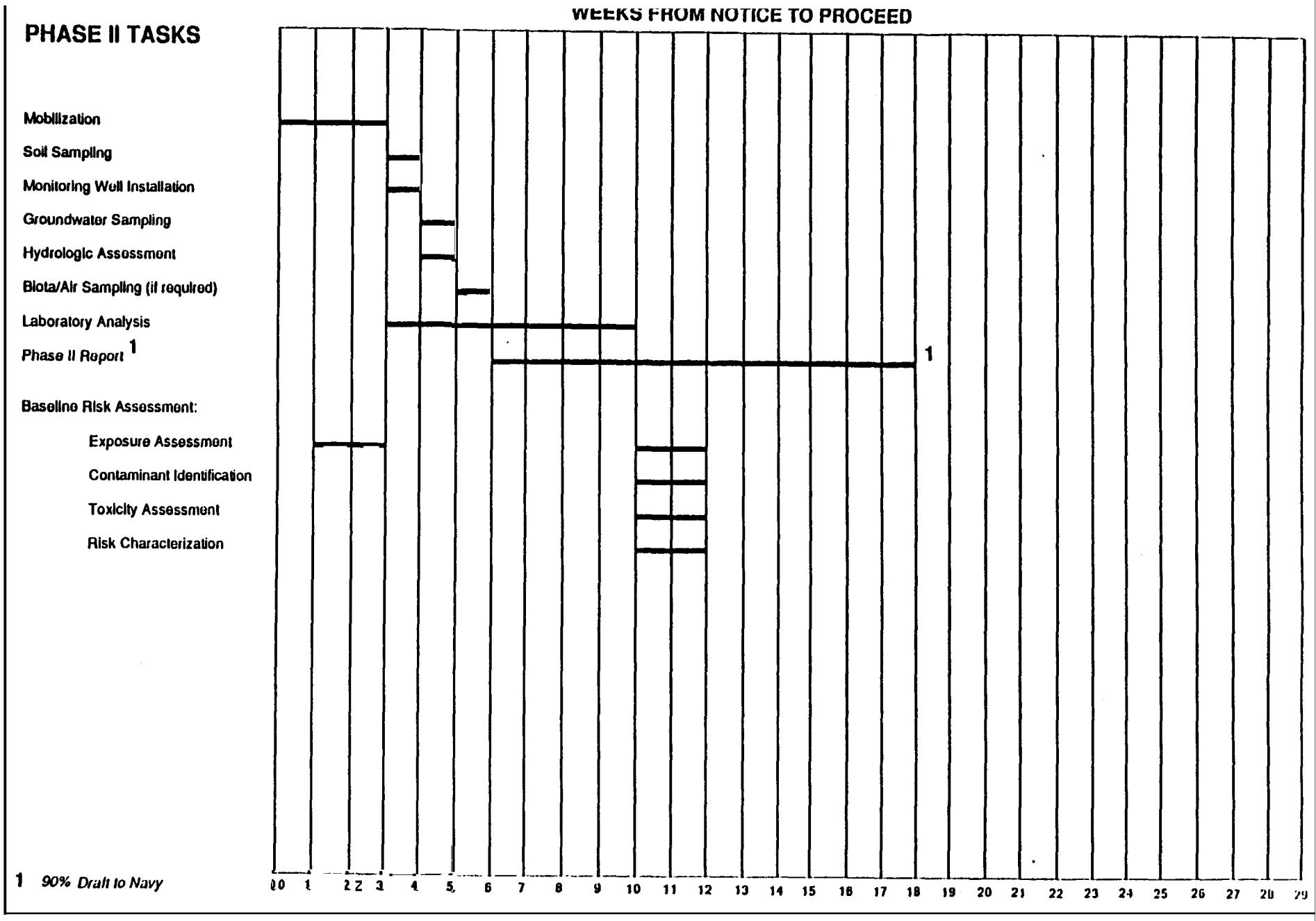


Figure 23-2 PHASE II PROJECT SCHEDULE -- GROUP M (SITE 31)

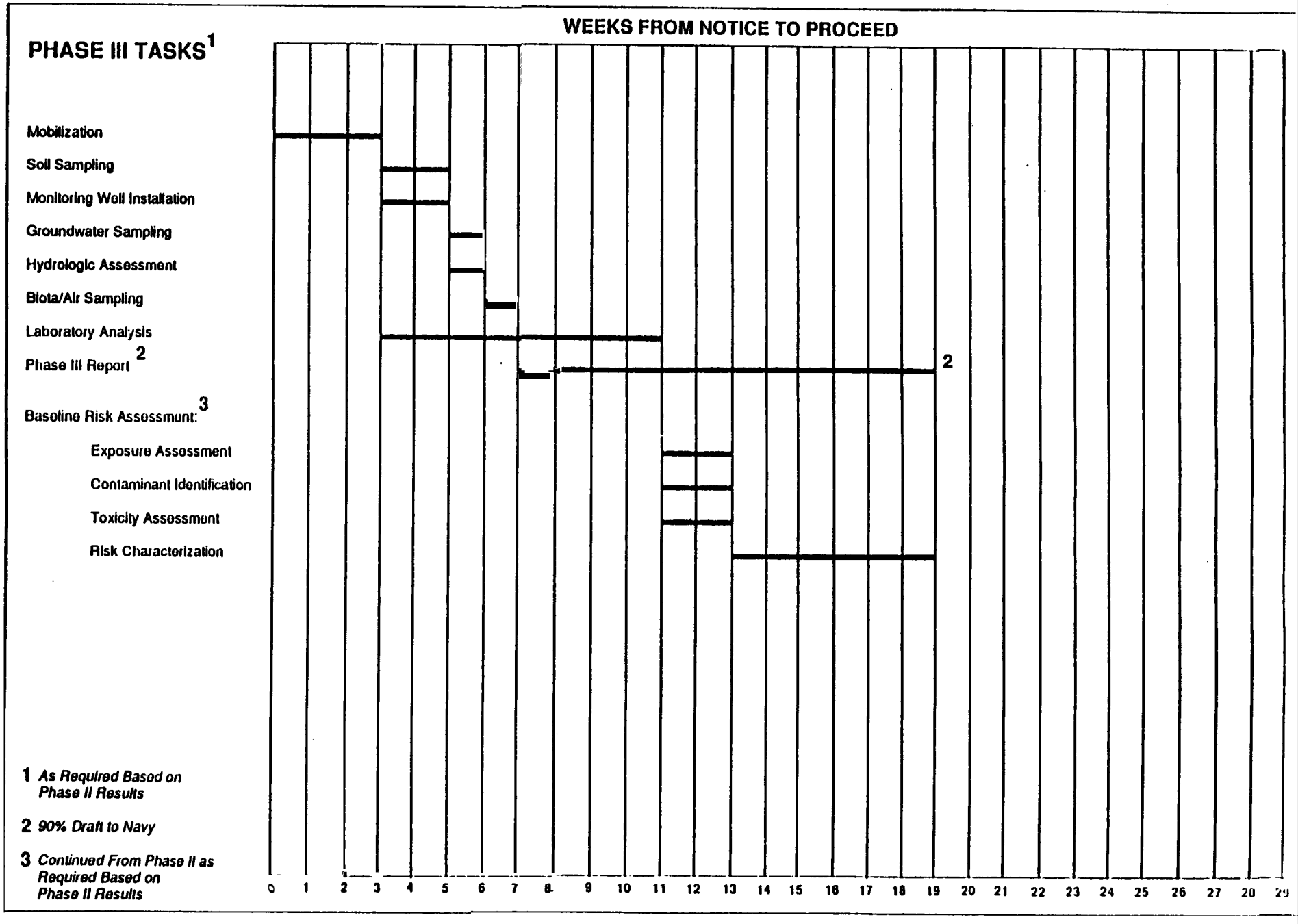


Figure 23-3 PHASE III PROJECT SCHEDULE -- GROUP M (SITE 31)

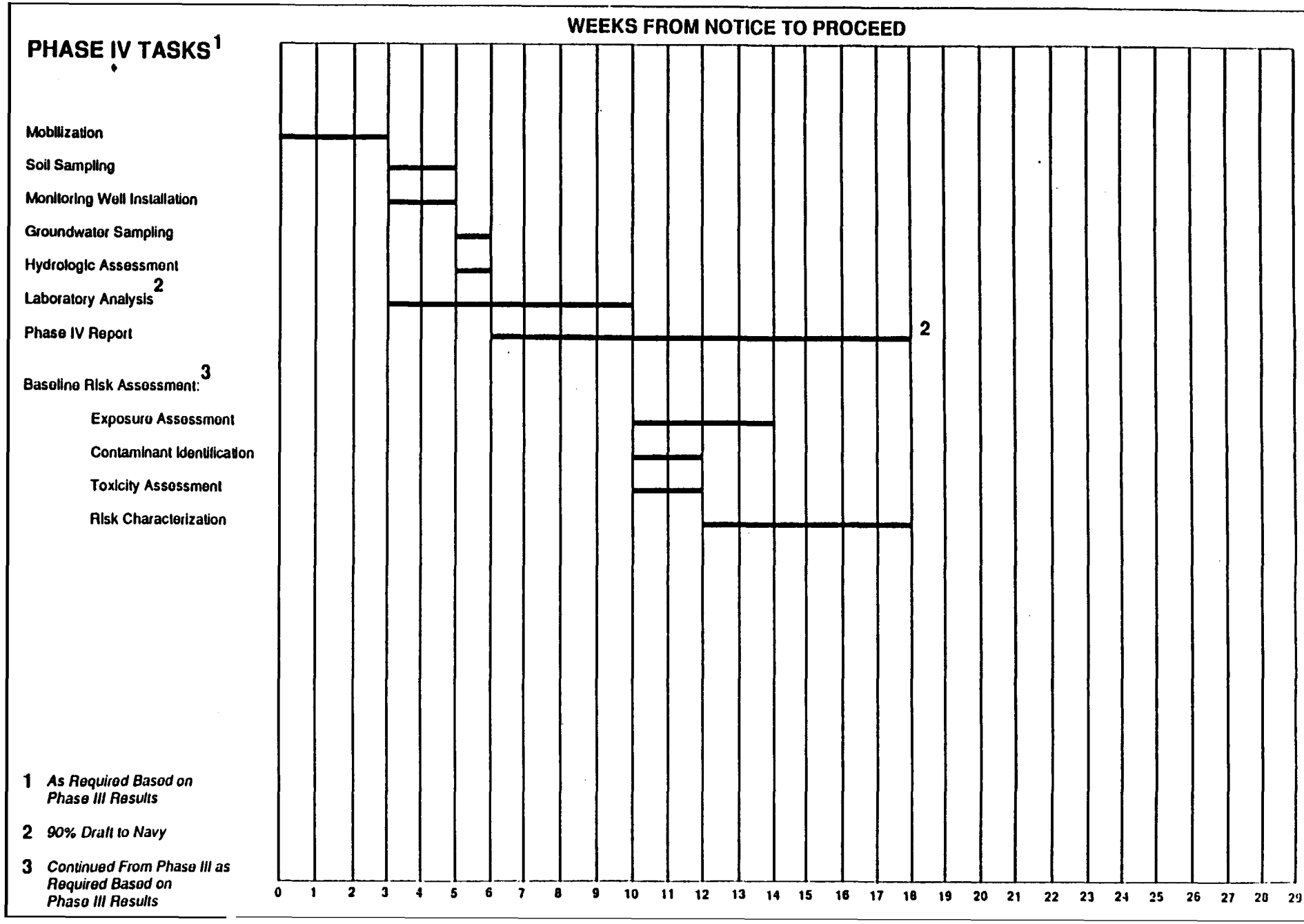


Figure 23-4 PHASE IV PROJECT SCHEDULE -- GROUP M (SITE 31)

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APPENDIX A

SITE-SPECIFIC SAFETY PLAN

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ecology and environment, inc.

SITS SAFETY PLAN

Version 988

A. GENERAL INFORMATION

Project Title: Site 31-Soil North of Building 648 **Project No.:** UH8000

TDD/Pan No.:

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

Location(s):

Prepared by: Joe Fugitt **Date Prepared:** 3-20-92

Approval by: Sybil Newchurch **Date Approved:** 3-24-92

Site Safety Officer Review: **Date Reviewed:**

Scope/Objective of Work: Field activities will include soil sampling, permanent monitoring well installation, groundwater sampling, physical surveys, and hydrologic assessment.

Proposed Date of Field Activities: December 1992

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

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 1	Sludge	[X]	Gas/Vapor	[X]

Characteristic(s):

Flammable/ Ignitable	[X]	Volatile	[X 1	Corrosive	[X]	Acutely Toxic	[ ]
Explosive	[ ]	Reactive	[X]	Carcinogen	[X]	Radioactive*	[ ]

Other:

Physical Hazards:

Overhead	[X 1	Confined* Space	[ ]	Below Grade	[ ]	Trip/Fall	[X]
Puncture	[ ]	Burn	[1	Cut	[ ]	Splash	[X]
Noise	[X]	Other:	Working within fenced area containing drums and small sheds. Vehicular traffic in tho site area. Heat stress. cold stress.				

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

Site History/Description and Unusual Features (see Sampling Plan for detailed description): A 100- by 200- foot area adjacent to north side of Building 648, enclosed by a chain link fonca, is tho site of dumping paints and paint thinners and solvents over a 24 year pariod, from 1949 to 1973. Groundwater from several wells located near tho site has exhibited elevated lovols of solvents. Low levels of metals, TRPHs, PAHs, and phonols were detected in Phase I soil borings. Low lovols of metals and a VOC (chloroform) were detected in Phase I ground-water samples.

Locations of Chemicals/Wastes: Liquid and sludge wastes were dumped directly on tha ground adjacent to Building 648.

Estimated Volume of Chemicals/Wastes: Approximately 20,000 gallons of waste paints and thinners as well as 8,600 gallons of paint sludges were dumped on tho ground over a 24 year pariod.

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

C. ~ ~ I o n

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

Physical Hazard Evaluation:

1) Soil aampling - Personal contamination, ovorhoad, noise, automobiles
2) Monitoring well inatallation - Overhead, noise, automobilos
3) Groundwater sampling - Splash, personal contamination, automobilos
4) Decontamination procedures - Solvents, acid solutions
5) Physical surveys - Slips; trips, falls, automobilos
6) Hydrologic assessment - splash, personal contamination, automobiles

Chemical Hazard Evaluation:

Compound	PEL/TWA	Route of Exposure	Acute Symptoms	Odor Threshold	Odor Description
Hydrochloric Acid	5 ppm	Inh, Ing, Con.	Corrosivo	N/A	Acrid
Nitric Acid	2 ppm	Inh, Ing, Con.	Corrosive	0.3 - 1 ppm	Acrid
Sulfuric Acid	1 mg/m^3	Inh, Ing, Con.	Corrosive	N/A	Odorless
Sodium Hydroxide	2 mg/m^3	Inh, Ing, Con.	Corrosive	N/A	Odorlaas
Isopropyl Alcohol	440 ppm	Inh, Ing, Con.	Drowsiness, Head	7.5 - 200 ppm	Rubbing Alcohol
Lead	0.05 mg/m3	Inh, Ing, Derm	Vomit, Diarr.	N/A	N/A
Tetrachloroethane	5 ppm	Inh, Abs, Dorm	Skin Irritant	--	Chloroform
Chloroform	50 ppm	Inh, Ing, Con	Dizzy, Headache	200 ppn	Ether-like
1,1,1-Trichloroethane	350 ppm	Inh, Ing, Con	Naus, dizzy,vomit	20-100 ppm	Chloroform-lika
1.2-Dichloroathano	1 ppm	Inh, Ing	Naus, dizzy,vomit	6 ppm	Sweetish
Vinyl Chloride	1 ppm	Inh, Abs	Drowsy, cough	260 ppm	Sweet pungont

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

D. SITE SAFETY WORK PLAN

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

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

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

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

Anticipated Lovol of Protoction (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

(Expand if necessary)

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

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

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

Air Monitoring (daily calibration unless otherwise noted):

Contaminant of Interest	Type Of Sample (area, personal)	Monitoring Equipment	Frequency of Sampling
Volatile Organics	Area	OVA	Continuous
Radiation	Area	Mini-rad	Continuous
Explosive Gases	Area	O_2/Explosimeter	Continuous

Alconox + tap wator wash, tap wator rinao, two isopropanol rinses, organic-free wator rinao, and air dry.

Teflon implements used for tho collection of samples for metals analyses will have a 10% nitric acid solution rinse after tho tap wator rinao followed by another tap wator rinao, two isopropanol rinses, and air dry.

Personnel Docon Protocol: Boot and glove wash - Alconox + tap water wash with clean water rinse. Expondablos will bo double-bagged and drummed for disposal. Field personnel will take a hygienic shower off site, following completion of each day's fioldwork.

Decon Solution Monitoring Procoduros, if Applicable: Docontamination activities will bo performed in a well-ventilated area upwind of tho sampling zone.

Special Site Equipment, Facilities, or Procedures (Sanitary Facilities and Lighting Must Moot 29 CFR 1910.120): All drilling safety procoduros 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 a11 times during fioldwork activities. Personnel will exorcise caution in tho vicinity of nearby roadways. If above background radiation levels are encountorod. team members will evacuate tho sampling area and contact the corporate health physics group to reassess tho site.

Work Limitations (time of day, weather conditions, etc.) and Heat/Cold Stress Requirements: All fioldwork activitios will be performed during daylight hours. Team members will break as needed to provont heat stress and replace fluids. Cooling vests may bo used to provont heat stress.

General Spill Control, if applicable: N/A

Investigation-Derived Material Disposal (i.e., expendables, decon waste, cuttings): All fioldwork waste matorials will bo doublo bagged, drummod, labeled, and transported to 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 glovos. Goggles will bo worn during sample preservation with acids.

Team Member*	Responsibility
To bo determined.	Team Leader
	Site Safety Officer/Sampler
	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 M S I 288.2 (1980).

. . . . . .

E. EMERGENCY INFORMATION

(Use supplemental shoots, if necessary)

LOCAL RESOURCES

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

Ambulance: On base: (904) 452-4138: Off base: 911

Hospital Emergency Room: NAS Dispensary - Building 3600: (904) 452-2733: Baptist Hospital: (904) 434-4111 (Life Flight)

Poison Control Center:

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

Fire Department: 911

Airport:

U.S. coast Guard: Emergency: (904) 453-8178: General Information: (904) 453-1282

Laboratory: E & E ASC: (716) 631-0360

Fed. Express: (800) 238-5355

Client Contact: U.S. Navy Southern Division, Enginoor-In-Chargo, Suzanne D. Sanborn: (803) 743-0574

Site Contact: NAS Pensacola Environmental Coordinator. Ron Joyner: (904) 452-4515

SITE RESOURCES

Site Emergency Evacuation Alarm Method: N/A

Water Supply Source: On site

Telephone Location, Number: To bo determined on site

Cellular Phone, if available: To bo 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, 3211
   Alachua, Florida (501) 370-8263 (24 hours)

2. Ecology and Environment, Inc., Safety Director
   Paul Jonmaire ..... (716) 614-8060 (office
   (716) 655-1260 (homo)

3. Regional Safety Coordinator - Sybil Nowchurch..... (904) 877-1978 (office
   (904) 878-2336 (homo)

4. Regional Office Manager - Rick Rudy ..... (904) 177-1978 (office
   (904) 193-7245 (home)

MEDTOX HOTLINE

1. Twenty-four hour answering service: (501) 370-0263

   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 oxposed.
   - Nature of emorqency.
   - Action taken.

2. A toxicologist, (Drs. Raymond Harbison or associate) will contact you. Repeat the information givon to the answoring 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 (include map) from Site 31

NAS Dispensary - Follow Murray Road south. Turn right on Taylor Road west to Duncan Road. Turn left onto Duncan Road and follow it south to the intersection with Turnor Street. Turn left on Turnor Street. The NAS Dispensary is located on Turnor Street in Building 3600.

Baptist Hospital - Take Duncan Road (Navy Blvd.) north to exit the base. Navy Blvd. becomes HWY 98 and curves to the east. Follow Navy Blvd./Hwy. 98 east approx. 3 mi to Pace Blvd. Turn left (north) on Pace Blvd. and proceed approx. 1 mi to Cervantes St. (Hwy. 90). Turn right on Cervantes/Hwy. 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 Got Off-Site Emergency ogress routes will be located if emergency exit routes become blocked by construction, etc.

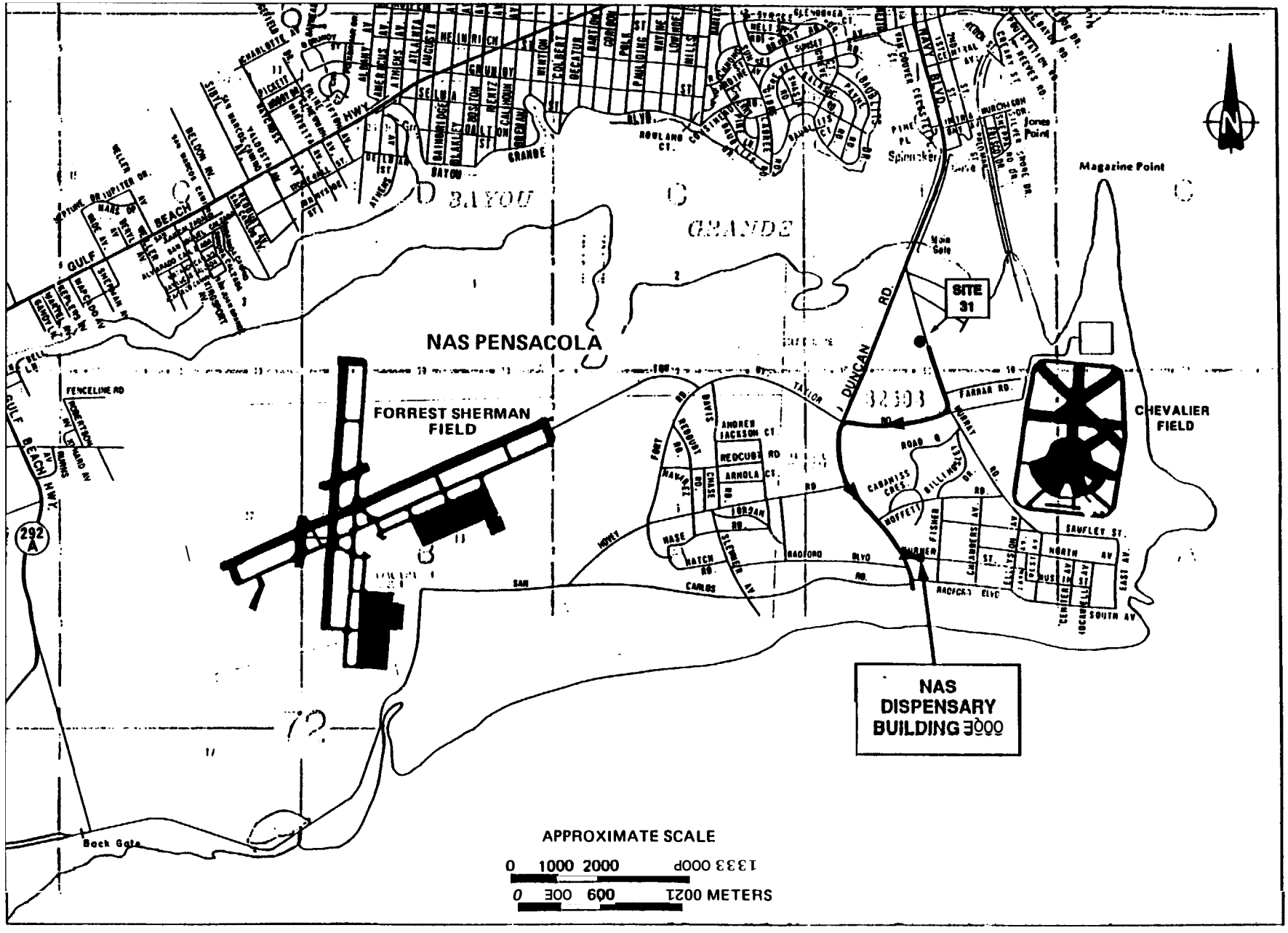
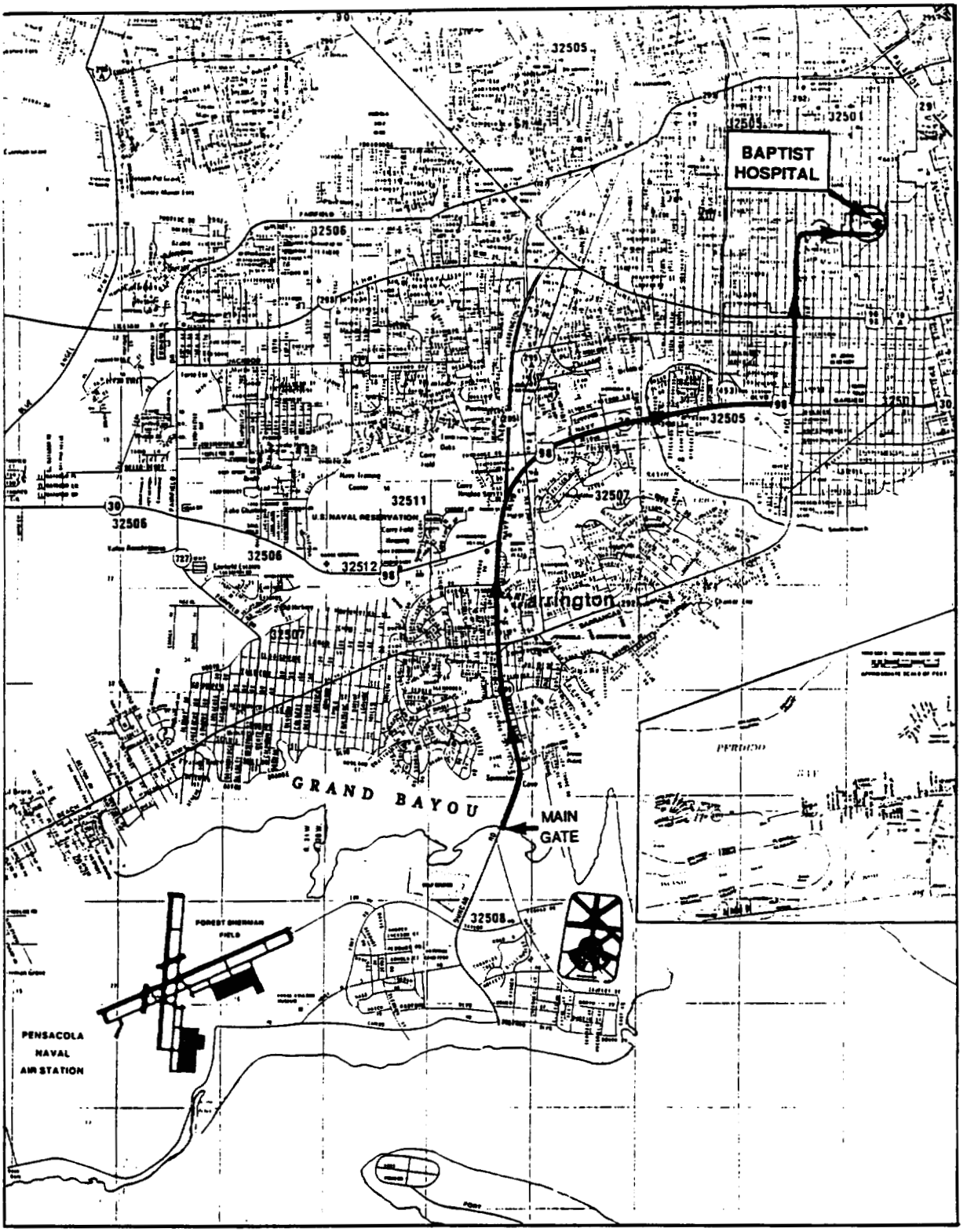


Figure A-1 LOCATION OF NAS DISPENSARY



SOURCE: Ecology and Environment, Inc., 1992

APPROXIMATE SCALE IN FEET

0 2000 4000 6000 8000

Figure A-2 LOCATION OF BAPTIST HOSPITAL

F. EQUIPMENT CHECKLIST

PROTECTIVE GEAR

Level A	No.	Level B	No.
SCBA		SCBA	
SPARE AIR TANKS		SPARE AIR TANKS	
ENCAPSULATING SUIT (Type _____)		PROTECTIVE COVERALL (Type _____)	
SURGICAL GLOVES		RAIN SUIT	
NEOPRENE SAFETY BOOTS		BUTYL APRON	
BOOTIES		SURGICAL GLOVES	
GLOVES (Type _____)		GLOVES (Type _____)	
OUTER WORK GLOVES		OUTER WORK GLOVES	
HARD RAT		NEOPRENE SAFETY BOOTS	
CASCADE SYSTEM		BOOTIES	
5-MINUTE ESCAPE COOLING VEST		HARD HAT WITH FACE SHIELD	
		CASCADE SYSTEM	
		MANIFOLD SYSTEM	
Level C		**Level D**	
ULTRA-TWIN RESPIRATOR		ULTRA-TWIN RESPIRATOR (Available)	X
POWER AIR PURIFYING RESPIRATOR		CARTRIDGES (Type GMC-H _____)	
CARTRIDGES (Type _____)		5-MINUTE ESCAPE MASK (Available)	
5-MINUTE ESCAPE MASK		PROTECTIVE COVERALL (Typo Tyvek _____)	X
PROTECTIVE COVERALL (Type _____)		RAIN SUIT	
RAIN SUIT		NEOPRENE SAFETY BONDS	
BUTYL APRON		BOOTIES	X
SURGICAL GLOVES		WORK GLOVES	
GLOVES (Typo _____)		HARD HAT WITH FACE SHIELD	X
OUTER WORK GLOVES		SAFETY GLASSES	X
NEOPRENE SMETY BOOTS			
HARD HAT WITH FACE SHIELD			
BOOTIES			
HARDHAT			

INSTRUMENTATION	No.	DECON EQUIP —	No.
OVA		WASH TUBS	X
THERMAL DESORBER		BUCKETS	X
O2/EXPLOSIMETER W/CAL. KIT	X	SCRUB BRUSHES	X
PHOTOVAC TIP		PRESSURIZED SPRAYER	X
HNu (Probe 10.2 eV)	X	DETERGENT (Type)	
MAGNETOMETER		SOLVENT (Type)	
PIPE LOCATOR		PLASTIC SHEETING	X
WEATHER STATION		TARPS AND POLES	
DRAEGER PUMP, TUBES		TRASH BAGS	X
BRUNTON COMPASS		TRASH CANS	
MONITOX CYANIDE		MASKING TAPE	X
HEAT STRESS MONITOR		DUCT TAPE	X
NOISE EQUIPMENT		PAPER TOWELS	X
PERSONAL SAMPLING PUMPS		FACE MASK	
		FACE MASK SANITIZER	
		FOLDING CHAIRS	
		STEP LADDERS	
RADIATION EQUIPMENT		DISTILLED WATER	X
DOCUMENTATION FORMS			
PORTABLE RATEMETER			
SCALER/RATEMETER		SAMPLING EQUIPMENT	
NaI Probe		8 OZ. BOTTLES	X
ZnS Probe		HALF-GALLON BOTTLES	X
GM Pancake Probe		VOA BOTTLES	X
GM Side Window Probe		BAILER CORD	X
MICRO R METER		HAND BAILERS	X
ION CHAMBER		THIEVING RODS WITH BULBS	
ALERT DOSIMETER		SPOONS	X
POCKET DOSIMETER		KNIVES	
MINI RAD	X	FILTER PAPER	
FIRST AID EQUIPMENT		PERSONAL SAMPLING PUMP SUPPLIES	
FIRST AID KIT	X		
OXYGEN ADMINISTRATOR			
STRETCHER			
PORTABLE EYE WASH	X		
BLOOD PRESSURE MONITOR			
FIRE EXTINGUISHER	X		

VAN EQUIPMENT	No.	MISCELLANEOUS (coat.)	No.
TOOL KIT	X		
HYDRAULIC JACK			
LUG WRENCH			
TOW CHAIN			
VAN CHECK OUT			
Gas			
Oil			
Antifreeze			
Battery			
Windshield Wash			
Tire Pressure			
		SHIPPING EQUIPMENT	
MISCELLANEOUS		COOLERS	X
PITCHER PUMP		PAINT CANS WITH LIDS. 7 CLIPS EACH	
SURVEYOR'S TAPE		VERMICULITE	X
100 FIBERGLASS TAPE		SHIPPING LABELS	X
300 NYIDN ROPE		DOT LABELS: "DANGER"	
NYLON STRING		"UP"	
SURVEYING FLAGS		"INSIDE CONTAINER COMPLIES ..."	
FILM		"HAZARD GROUP"	
WHEEL BARROW		STRAPPING TAPE	X
BUNG WRENCH		BOTTLE LABELS	X
SOIL AUGER		BAGGIES	X
PICK		CUSTODY SEALS	X
SHOVEL		CHAIN-Or-CUSTODY FORMS	X
CATALYTIC BEATER		FEDERAL EXPRESS FORMS	X
PROPANE GAS		CLEAR PACKING TAPE	X
BANNER TAPE			
SURVEYING METER STICK			
CHAINING PINS L RING			
TABLES			
WEATHER RADIO			
BINOCULARS			
MAGAPHONE			

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0.-SITS SAFETY MEETING

Projoct _____ TDD/Pan _____

Date _____ Time _____ Job No. _____

Address _____

Specific Location _____

Type of Work _____

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment _____

Chemical Hazards _____

Radiation Hazards _____

Physical Hazards _____

Emergency Procedures _____

Hospital/Clinic _____ Telephone _____

Hospital Addross _____

Special Equipaont _____

Other _____

Chocklist

1. Emorgoncy information reviewed? _____ and made familiar to a11 team members? _____
2. Route to nearest hospital driven? _____ and its location known to a11 team members? _____
3. Site safety plan readily available and its location known to a11 team members? _____

Hooting shall bo attended by a11 personnel who will be working within the exclusion area. Daily informal update meetings will bo held when site tasks and/or conditions change.

ATTENDEES

(Expand on back of shoot if necessary)

Name Printed	Signaturs

Mooting Conducted by: _____ (Print) _____ (Signature)

_____ (Site Safety Coordinator) _____ (Team Leader)

[NASP]UH8000:T0483

ecology and environment, inc.	
Title: SOP-HEALTH AND SAFETY ON DRILLING RIG OPERATIONS	
Category: H & S, Training 2.7	Revised: JANUARY 1990
	Approved: H. Van Cleave

STANDARD OPERATING PROCEDURES FOR HEALTH AND SAFETY ON DRILLING RIG OPERATIONS

REVISED: JANUARY 1990

Prepared by

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1 INTRODUCTION

This document is meant to be used in conjunction with E 6 E SOPs for field operations and hazardous vaste 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 vells. 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 6 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.

B & E personnel are restricted from the borehole area during active drilling. When E 6 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 6 E driller must inspect the rig to ensure the folloving 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 veld cracks in mast; and
- Safety hooks operational.

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The Driller will report items needing attention to the SSO: hovever, 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 jav 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.

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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 plyvood 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 6 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" vhile 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 6 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 vorking knovledge 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 vork modifications to protect field staff from potential injury.

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3.2 E & E DRILLER AND HELPER

The E & E driller and helper shall have taken and passed the basic 40-hour Eealth and Safety Training as prescribed by E & E and mandated by OSEA. 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 vhether 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 OSEA, 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 Eealth and Safety Training as prescribed by OSEA 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 & Es contractual documentation. This training shall be verbally verified and logged onsite by the SSO or Team Leader before starting work.

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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 6-foot sheet of plyvood. 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.

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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 6 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 drav 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 OSEA-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 vho 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;

- Location and operation of kill switches, fire extinguisher, and first aid kit:
- Heat and cold stress hazards:
- "Super exclusion zone" around borehole; and
- 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 vork. Where workers cannot vork with the assistance of vork modifications, cooling vests, and other cooling means, the SSO may decide that vork should not continue. The need for worker monitoring through blood pressure and oral temperature checks will be determined by the SSO vith assistance from the RSC and Buffalo Health and Safety staff, if necessary.

The SSO will be responsible for shutdovn 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 crev 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, hovever, 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.

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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 vho 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," vhich 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 avay 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 vorn 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 vithin 25 feet of overhead lines.

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- 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 vith a ladder, it should be lowered for repairs.

S.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.
  - Vater swivels and hoisting plugs should be lubricated and checked for "frozen" bearings before use.
  - Drill rod chuck jaws should be checked periodically and replaced vhen 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.

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- 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 lovering 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 vrench from the chuck.

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

- Drill rods should not be held or lovered into the hole with pipe vrenches.

- 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 vrench.

- In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose betveen the pump and the obstruction should be relieved or bled dom 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 vork 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 vith a vire 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 vet 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.

- Alvays 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 tovard 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 vith 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 vith 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 lov RPH.
- 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 slovly engaging the clutch or rotation control, and start rotation. Stay clear of the auger.
- Slovly 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 estabiish 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 avay 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 vrench, 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 vhen hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.
- Never allov 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, vire 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 Vire Rope Users Manual. Wire ropes should be replaced when inspection indicates excessive damage according to the Wire Rope Users Manual. All wire ropes vhich 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.

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- Host 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 vire 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 avay from the drill rig; however, drills may be moved using the main hoist if the vire 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 vinch 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 aired vehicle or drill rig carrier.

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

- Avoid sudden loading in cold veather.

- 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.

- Alvays 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 folloving operation manuals are incorporated by reference in this SOP:

Di 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.

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

REVISED JANUARY 1990

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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 vhich 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 vhich 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.

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Beat 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 slovs 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 vork in hot environments and perspire a great deal. Loss of salt from the body causes painful cramps of the leg, am, 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 folloving:

- o Muscle cramps in legs, arms, or abdomen;
- o Pain accompanying the cramps;
- o Profuse perspiration; and
- o 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 coning from the hot zone. Give the person sips of water or an electrolyte liquid such as Gatoradc 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 vith heat cramps. Heat exhaustion is caused by the pooling of blood in the vessels of the skin. The heat is

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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 follovs:

- Pale clammy skin,
- Profuse perspiration,
- Generalized weakness,
- Dizziness,
- Weak pulse,
- Rapid and usually shallow breathing,
- Unconsciousness, and
- 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 vater, Gatorade, or its equivalent. If possible, fan the patient continually to remove heat by convection, but do not allov 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.

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4.3.1 Symptoms

Following ate 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 vhere 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;

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- 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 WONITORING

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

- During a 3-rinute 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 vork-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.

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5.3 HONITORING PERSONNEL BODY TEHPERATURE AND BLOOD PRESSURE

When personnel are in respiratory protective gear for extended periods, or vhsn 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 XONXTORING THE WORK AREA FOR HEAT STRESS CONDITIONS

Air temperature and relative humidity are the tvo 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 vould result in the victim's being further overheated.

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Material Safety Data Sheet

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Emergency Telephone Number: 314-982-5000

HYDROCHLORIC ACID, 37%

PRODUCT IDENTIFICATION:

Synonyms: Muriatic acid

Formula CAS No.: 7647414

Molecular Weight: 36.46 (HCl)

Chemical Formula: HCl

Hazardous Ingredients: Hydrogen chloride

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% (-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 fume 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

AD

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 bums of the mouth, throat, esophagus and gastrointestinal tract. May c a w 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 bums and permanent eye damage.

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

Aggreration of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye disease may he 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 ol water for at least IS 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, lilting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS,1986)

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 Ceiling
-ACGIH Threshold Limit Value (TLV):
5 ppm 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 Recomm Practices", most recent edition, lor details.

Personal Respirators: (NIOSH Approved)
If the TLV is exceeded a lull facepiece chemical cartridge respirator may be worn, in general, up to 100 limes the TLV or the maximum use concentration specified by the respirator supplier, whichever is ku. Alternatively, a supplied air lull 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 lull face shield where splashing is possible. Contact lenses should not be worn when working with this material. Maintain eye wash fountain and quick-drench facilities In work area.

SECTION 7 Storage and Special Information

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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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 hut, sparks and flame.
Keep container closed.
Use with adequate ventilation.
Avoid breathing vapor.
Wash thoroughly after handling.
Avoid contact with eyer, 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 lacepiece 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 lo instability.

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

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Heat, flame, strong oxidizers, acetadehyde, chlorine, ethylene oxide, hydrogen-palladium combination, hydrogen peroxide-sulfur 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 pper towels and evaporated in a fume hood. Allow enough time for fumes to clur 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.

Chemical and Physical Sciences

NFPA Ratings: Health 1 Flammability: 3 Reactivity: 0

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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: 2.9 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 chemkrl, 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:
Hut, 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 Flammability: 3 Reactivity: 0

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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 perron. 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.

Explosloa:
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 Are, 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 lull facepiece operated in the pressure demand or other positive pressure mode.

SECTION 3 Reactivity Data

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

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

Hazardous Polymerization:
Will not occur.

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

SECTION 4 Leak/Spill Disposal Information

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

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

Ensure compliance with local, state and federal regulations.

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

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

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

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

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

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

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

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

B. FIRST AID

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

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

Skin Exposure:
In case of contact, immediately flush skin with plenty of water for at k u t 15 minuter while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medial attentkon immediately.

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

C. TOXICITY DATA (RTECS, 1982)

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

SECTION 6 Occupational Control Measures

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

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

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

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

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

SECTION 7 Storage and Special Information

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

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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 lor 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): 213

Vapor Density (Air– 1): **No** information found.

Vapor Pressure (mn **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** witb 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** lull 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** rnd 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 mry **be** transferred to **a** closed, preferably metal, **container** rnd **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: 3 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 b 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.

(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 kee 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. Cons** 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 b **possible. Contact** lenses should not **be** worn **when** working with **this** material. Maintain **eye** wash fountain and qukkdmncb **facilities** in work area.

SECTION 7 Storage and Special Information

Keep in a tightly cloud 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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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 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

DANGLU **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% (77°F)

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

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

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

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

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

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

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 minuter 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.

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Chloroform Date 3/23/92

DOT Name/U.N. No. 1888 Job No. UH8000

CAS Number 67-66-3

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: METHANE TRICHIORIDE, TRICHLOROMETHANE)

Chemical Formula $CHCl_3$ Molecular Weight 119.4

Physical State Liquid Solubility (H2O) 0.5 % Boiling Point 143 -F

Flash Point < 66 -F Vapor Pressure/Density 30 mm Freezing Point -43 -F

Spacific Gravity 1.48 (77°F) Odor Characteristic Pleasant Flammable Limits Non

Incompatabilities strong caustics, chemically-active metals

Biological Properties:

TLV-TWA 2 ppm PEL 2 ppm Odor/Odor Threshold

IDLH 1000 ppm Human Aquatic Rat/Mouse

Route of Exposure Inh, Abs, Inq, Con

Carcinogen Yes Teratogen Mutagen

Handling Recommendations: (Personal protective measures)

Tyvek and safety glasses with full-face respirator available for upgrade.

Monitoring Recommendations:

Continuous HNu/OVA

Disposal/Waste Treatment:

Health Hazards and First Aid:

Eya: wash immediately; skin: wash immediately; ING: immediate medical attantion - irritation from exposure requires immediate medical attention.

Symptoms: Acute: Blurred vision, confusion, delirium, nausea, vomiting

Chronic: Tremors; convulsions: lung, livar, or kidney damage

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HAZARD EVALUATION OF CHEMICALS

Chemical Name 1,2-dichloroethane Date

DOT Name/U.N. No. 1184 Job No. UC3000

CAS Number 107-06-02

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: Ethylene dichloride, Freon 150)

Chemical Formula $Cl_2C_2H_4$ Molecular Weight 98.96

Physical State liquid Solubility (H_2O) 0.8% Boiling Point 182°F

Flash Point 55°F C.C. Vapor Pressure/Density 87 mm at 20°C Freezing Point -32°F

Specific Gravity 1.25 @ 20°C Odor Characteristic sweet Flammable Liaits 6.2% - 15.6%

Incompatabilities Oxidizers, caustics, active metals

Biological Properties:

TLV-TWA 10 ppm PEL 1 ppm Odor/Odor Threshold 100 ppm

IDLH 1000 ppm Human Aquatic Rat/Mouse LD_{50} .5-5 g/kg

Route of Exposure inhalation, ingestion, contact

Carcinogen X Teratogen Mutagen

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Organic vapor/acid gas cartridge or SCM, rubber gloves, goggles, faceshield, rubber boots

Monitoring Recommendations:

organic vapor analyzers - continuous: explosimeter/O_2 analyzer

Disposal/Waste Treatment:

Health Hazards and First Aid:

Inhalation - remove to fresh air; contact - flush with water: got medical attention

symptom.: Acute: Irritation, loss of equilibrium or consciousness, headache, nausea, vomiting, dry skin

Chronic:

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Load Date 3/23/92

DOT Name/U.N. No. 2291 Job No. UH8000

CAS Number 7439-92-1

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 CTR 20 Handbook of Chemistry and Physics

Chemical Properties: (Synonyms: Plumbum)

Chemical Formula Pb Molecular Weight 207.2

Physical State solid solubility (H2O) insoluble Boiling Point 3164 F

Flash Point N/A vapor Pressure/Density 0 mm Freezing Point U/A

Specific Gravity 11.34 Odor Characteristic N/A Flammable Limits N/A

Incompatabilities Strong oxidizers, hydrogen peroxide, acids

Biological Properties:

TLV-TWA .100 mg/m3 PEL .050 mg/m3 Odor/Odor Threshold N/A

IDLH 700 mg/m3 Human ____ Aquatic ____ Rat/Mouse ____

Route of Exposure Inhalation, Ingostion, Dermal

Carcinogen --- Teratogen --- Mutagen ---

Radiological Properties:

Handling Recommendations: (Personal protective measures)

5 mg/m^3 high efficiency particulate respirator; other concentrations- SCBA; avoid skin contact or ingostion.

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

ING: Give water, induce vomiting, medical attention immediately; INH: move to fresh air, medical attontion; DER: wash with soap and water promptly.

Symptoms: Acute: stomach distress, vomiting, diarrhea, black stool, headache, dizziness, metallic taste

Chronic: muscle weakness, joint/muscle pain, insomnia, coma, death

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HAZARD EVALUATION OF CHEMICALS

Chemical Name 1,1,2,2 Tetrachloroethane Date 3/23/92

DOT Name/U.N. No. 1702 Job No. UH8000

CAS Number 79-34-5

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: Acetylene tetrachloride)

Chemical Formula CHCl2CHCl2 Molecular Weight 167.9

Physical State Liquid Solubility (H2O) 0.30 % Boiling Point 296 °F

Flash Point N/A Vapor Pressure/Density 9 mm Freezing Point - 33 °F

Specific Gravity 1.59 Odor Characteristic -- Flammable Limits N/A

Incompatabilities Chemically-active metals, strong caustics, fuming sulfuric acid

Biological Properties:

TLV-TWA 1 ppm PEL 1 ppm Odor/Odor Threshold Pungent, chloroform

IDLH 150 ppm Human 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 high concentrations

Monitoring Recommendations:

Disposal/Waste Treatment:

N/A

Health Hazards and First Aid:

Remove from 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.

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HAZARD EVALUATION OF CHEMICALS

Chorical Name 1,1,1 Trichloroethane Date 3/23/92

DOT Name/U.N. No. 2831 Job No. UH8000

CAS Number 71-55-6

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 Physic6

Chemical Proportios: (Synonyms: Methyl chloroform)

Chemical Formula CH3CCl3 Molecular Weight 133.4

Physical State liquid Solubility (H2O) 0.41 Boiling Point 165 F

Flash Point N/A vapor Pressure/Density 100 mm Freezing Point -23 F

Specific Gravity 1.34 Odor Charactoristic 390 ppm Flammable Limit6

Incompatabilities Strong caustics or oxidizers, water

Biological Properties:

TLV-TWA 350 ppm PEL 350 ppm Odor/Odor Threshold chloroform like

IDLH 1000 ppm Human Aquatic Rat/Mouse

Route of Exposure Ingostion, Inhalation, Dermal

Carcinogen Teratogen Mutagen

Radiological Proportios:

Handling Recommendations: (Personal protective measures)

Monitoring Recommendations:

OVA or HNu with tho 11.7 eV probe.

Disposal/Waste Treatment:

Health Hazards and First Aid:

INH & ING: seek medical attention promptly; DER: wash with soap and water.

Symptoms: Acute: light headed, drowsiness, headache, irritation of eyes and skin

Chronic: CNS depression

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HAZARD EVALUATION OF CHEMICALS

Chomical Name Vinyl Chloride Data April 13, 1989

DOT Name/U.N. No. 1086 Job No. YO 1900

CAS Number

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. 11)

Toxic and Hazardous Safety Manual ACGIH Other:

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

Chomical Proportior: (Synonyms: Chloroethylene, VC, Chloroethene)

Chomical Formula C_2H_3CL Molecular Weight 62.5

Physical State Colorloss gas solubility (H2O) Negligible Boiling Point 7°F

Flash Point -108°F Vapor Pressure/Density 2580 mm Freezing Point -245°F

Specific Gravity 0.9121 Odor Characteristic 4100 ppm Flammable Limits 3.6% - 33%

Incompatabilities Strong oxidizers, strong bases, iron, steel, copper, peroxide

Biological Properties:

TLV-TWA 1 ppm PEL 1 ppm Odor/Odor Threshold Odorless gas, sweet

IDLH 500 ppm Human Aquatic Rat/Mousa

Route of Exposure Inh

Carcinogen Human Teratogen Mutagen Suspect

Radiological Proportios:

Handling Recommendations: (Personal protective measures)

Wash immediately upon contact with skin: impervious clothing, gloves, face shield; 10 ppm app/organic 7 25 ppm 100 ppm - SCBA

Monitoring Recommendations:

PID 10:2, FID

Disposal/Waste Treatment:

N/A

Health Hazards and First hid:

Wash skin, eyes immediately, if contaminated; move to fresh air if largo amounts are breathed in: induce vomiting if swallowed

Symptoms: Acuta: Giddiness, intoxication, nausea, light headedness, CNS depression

Chronic: Liver damage, CNS depression, reproductive affects

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APPENDIX B

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: M
Site No.: 31
Site Name: Soil

Prepared by: Joseph F. Fugitt
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Prepared for: Department of the Navy
Southern Division
Naval Facilities Engineering Command
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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 6 E ASC Director: _____
A. Clifton

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

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Section 3.0 — Project Summary

Vork Plan Group: M

Site No.: 31

Site Name: Soil North of Building 648

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 OVA Surface Emission Survey
- ___ Radiation Survey
- X Habitat/Biota 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
- ___ Soil Headspace Analyses: Planned number of samples ___
- ___ Soil Gas Analyses
- X Laboratory Analyses:

PLANNED NUMBER OF SAMPLES	
Surface Water	___
Sediment	___
Soil	44
Soil Gas	___
Groundwater	5
Duplicates	3
Soil Gas Duplicates	___
Trip Blanks	___
Field Blanks	___
Preservative Blanks	___

Rinsate Blanks ___

CATEGORIES OF ANALYSES

___ Purgeable Aromatics
___ Purgeable Halocarbons
___ Base/Neutral Extractables
___ Acid Extractables
X Volatile Organic Compounds
X Polynuclear Aromatic Hydrocarbons
X Phenols
___ Dioxins
___ Organophosphorus Pesticides
___ Herbicides

X Pesticides
X Polychlorinated Biphenyls
X Total Recoverable Petroleum Hydrocarbons
X Metals
___ Cyanide

Phase II--Characterization

PLANNED NUMBER OF SAMPLES

Surface Water	___
Sediment	___
Soil	24
Soil Gas	___
Groundwater	3
Duplicates	3
Soil Gas Duplicates	___
Trip Blanks	1
Field Blanks	1
Preservative Blanks	1
Rinsate Blanks	2

CATEGORIES OF ANALYSES

___ Purgeable Aromatics
___ Purgeable Ealocarbons
X Base/Neutral Extractables
X Acid Extractables
X Volatile Organic Compounds
___ Polynuclear Aromatic Hydrocarbons
___ Phenols
X Dioxins
X Organophosphorus Pesticides
X Herbicides

X Pesticides
X Polychlorinated Biphenyls
X Total Recoverable Petroleum Hydrocarbons

X Metals
X Cyanide

Additional analytical categories are identified below:

X Gross Alpha
X Gross Beta
X Gamma Scan
X Total Organic Carbon
X Grain Size
X Alkalinity
X Total Suspended Solids (water only)
X Total Kjeldahl Nitrogen
X Ammonia Nitrogen
X Orthophosphate Phosphorus
X Dissolved Oxygen (in field)
X 5-day Biological Oxygen Demand
X Chemical Oxygen Demand

X pH
X Percent Hoisture
X Hardness (water only)
X BTU Content
X Ash Content
X Total Organic Ealogens
X Sulfur
X Ignitability
X Cation Exchange Capacity
___ Sulfide

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.

Section 6.0 — Fieldvork 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

Analyte	Media	Hethod No.	A	P	C	DL
Laboratory Screening *						
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						
Gross Alpha	S/W	EPA 900	N/M	N/M	N/M	N/M
Gross Beta	S/W	EPA 900	TBD	TBD	TBD	TBD
Gamma Scan	S/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
Dioxins	S/W	EPA 8280	TBD	TBD	TBD	TBD
Organophosphorus Pesticides	S/W	EPA 8140	N/M	N/M	N/M	N/M
Herbicides	S/W	EPA 8150 (modified)/509B	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
Total Recoverable Petroleum Eydrocarbons	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/H	N/M	N/M	N/M
Calcium	S/W	EPA 6010	N/H	N/M	N/M	N/M
Chromium	S/W	EPA 6010	N/M	N/M	N/M	N/M

Analyte	Media	Method No.	A	P	C	DL
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/H	N/H	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
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
Tin	S/W	EPA 202.2	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/W	N/M	N/M	N/M
Total Kjeldahl Nitrogen	S/W	EPA 351.3	N/M	N/M	N/M	N/M
Nitrogen-Ammonia	S/W	EPA 350.2	N/M	N/M	N/M	N/M
Orthophosphate Phosphorus	S/W	EPA 365.2	N/M	N/M	N/M	N/M
5-day Biological Oxygen Demand	W	SM 507	N/M	N/M	N/M	N/M
Chemical Oxygen Demand	W	EPA 410.4	N/M	N/M	N/M	N/M
pH	U	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	ASTM D-808-81	TBD	TBD	TBD	TBD
		EPA 325.3	TBD	TBD	TBD	TBD
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	75-125	35	95%	100mg/kg

Analyte	Media	Hethod No.	A	P	C	DL
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/H

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, the laboratory screening analyses do not have EPA method numbers.

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 C

THREATENED AND ENDANGERED FLORA AND FAUNA ASSOCIATED WITH NAS PENSACOLA

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

APPENDIX C

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

Scientific Name	Common Name	Base Statu.	statu. FGFWFC(or FDA)	USFWS	Habitat
FISHES					
Acipenser oxyrhynchus	Atlantic sturgeon	M	SSC	UR 2	Gulf coast, estuarine
Ammocrypta asprella	Crystal darter	U	T	UR 2	Fresh wator
Etheostora histrio	Harelquin 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 wator
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 couperi	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 rap turtle	U	SSC		Swamps, streams, marshes, ponds
Lepidochelys kempi	Atlantic ridley	M ?	E	E	Marine, coastal
Rana areolata aesopus	Florida gopher frog	P	SSC	UR 2	Sand hill cornunities
Macroclemys temmincki	Alligator snapping turtle	SR	SSC	UR 2	Swamps, marshes, ponds
MAMMALS					
Mustela vison lutensis	Florida rink	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
Ursus americanus floridanus	Florida black bear	N/A	T	UR 2	Titi swamps

Appendix C (coot).

Scientific Name	Common Name	Base * Status	status FGFWFC(or FDA)	USFWS	Habitat
BIRDS					
Charadrius melodus	Piping Plover	P	T	T	Open dry, sandy beaches
Charadrius alexandrinus	Snowy plover	P	T	UR 2	Open dry, sandy beaches
Dendroid. dominica stoddardi	Stoddard's yellow-throated warbler	P-u		UR 2	Wooded habitats
Dendroica kirtlandii	Kirtland's warbler	U	E	E	Woodod 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	Southeastorn kestrel	R	T	UR 2	Open pine forests, clearings
Haematopus palliatus	American oystercatcher	P-U	SSC		Open coastal beaches
Haliaeetus leucocephalus	Bald eagle	P-u	T	E	Pine forests/coastal habitat
Pandion haliaetus	Osprey	R	SSC		Near water
Pelecanus occidentalis	Brown pelican	R	SSC	AC	Mangrove trees, coasts
Picoides borealis	Red-cockaded woodpecker	P-u	T	E	Cavity nests/old pine stands
Vermivora bachmanii	Bachmann's warbler	U	E	E	Wooded habitats
Campephilus principalis	Ivory-billed woodpecker	U	E	E	Woodod 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

Appendix C (Cont.)

Scientific Name	Common Name	Base Statu.	status FGFWFC(or FDA)	USFWS	Habitat
PLANTS					
Chrysopsis gossypina cruiseana	Cruise's golden-astor	P	E	UR 1	Coastal dunes
Drosera intermedia	Spoon-leaved sundew	R	T		Aquatic habitats
Epigaea repens	Trailing arbutus	U	E		Dry, acid, sandy roil
Kalmia latifolia	Mountain laurel	U	T		Rich, noist, 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 racrophylla	Large-leaved jointweed	R	T	UR 1	Sand pine-oak scrub
Rhododendron austrinum	Orange azalea	U	E	UR 5	Hoist, woody habitats
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

E = Endangered
T = Threatened
UR 1 = Under review, for Federal listing with substantial evidence in existence 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 was 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.

Appendix C (Cont.)

Base *	=	Status of species on tho NAS Pensacola facility.
R	=	Resident.
M	=	Migrant.
SR	=	Suspected roridont.
P	=	Possible resident duo to available habitat; survey required.
U	=	Unknown, survey required.
N/A	=	Not expected to occur on tho NAS Pensacola facility.

[APPENDIX D

JUNE 1990 SECTION 14.2
PEASE II--CHARACTERIZATION]

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

14.2 Phase II -- Characterization

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

- To characterize the nature and magnitude of the full spectrum of potential site contaminants;
- To confirm and validate the contaminant distributions indicated by the Phase I analytical screening results by collecting and analyzing samples under full-scale, CERCLA-type QA/QC requirements;
- To support the preliminary identification, screening, and evaluation data requirements of potential remedial alternatives.

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

Phase II investigation of Site 31 will involve the collection of soil and groundwater samples. Additional permanent, shallow monitoring wells will be installed. Air sampling will be conducted only if warranted by the results of Phase I efforts. In addition, limited aquifer testing will be performed.

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

During the Phase II investigation of Site 31, which is covered by RCRA requirements, at least one sample per contaminated medium will also be analyzed for Appendix IX parameters (40 CFR, Part *264).* These samples will be collected from the area of highest contamination for each medium as determined during the Phase I investigation. Additional Appendix IX samples may be required depending on the extent of contamination detected.

Table 14-2

PHASE II SAMPLING AND ANALYTICAL REQUIREMENTS—GROUP M

SITE 31

Medium	No. of Samples	Dupli-cates	Trip Blanks[a]	Field Blanks	Rinsate Blanks	Preservative Blanks[b]	Total*	Analytical Suite[c,d]
Soil	25	3	1	1	1	1	32 (10)	A C
Groundwater	3	1	1	NR	1	NR	6 (2)	A B
TOTAL	28	4	2	1	2	1	38(11)	

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

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

[c]Analytical suite designations are as follows:

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

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

*Tho number of samples shown in parentheses will be analyzed for tho additional parameters indicated.

NR = Not required.

14.2.1 Biota Sampling

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

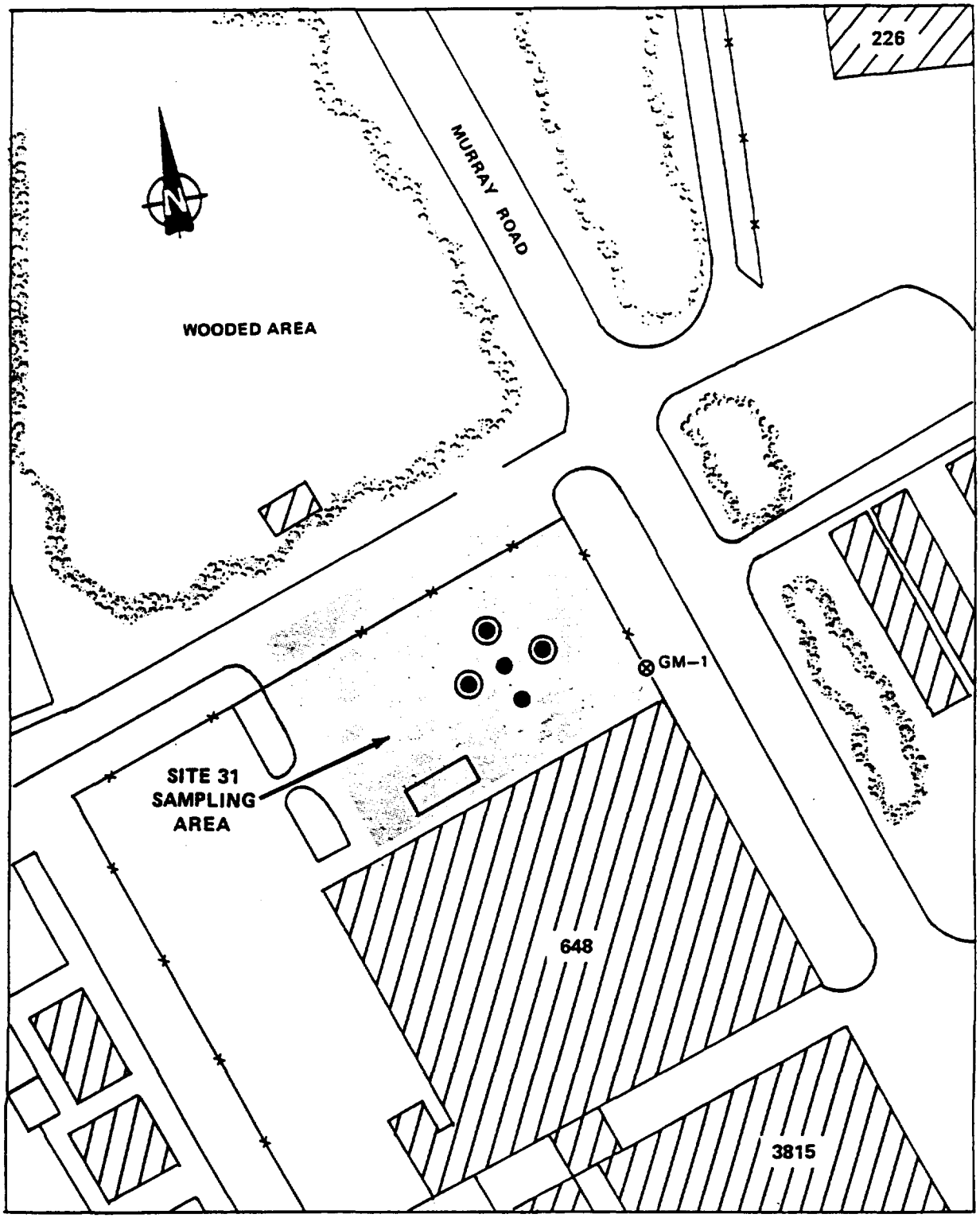
14.2.2 Soil Sampling

The actual number and location of soil samples as well as their appropriate sampling locations will be determined based on the results of Phase I. Tentative locations for collection of soil samples for Phase II are presented in Figure 14-2. For planning purposes, five soil samples are assumed at each boring location.

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 0.5 feet, 0.5 to 2.5 feet, then every 2.5 feet to a maximum of 10 feet or the water table, whichever is shallower. Intervals deeper than 10 feet will be sampled only if contamination was found in the deeper zone during Phase I. 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 GOAPP. A detailed discussion of split-spoon soil sampling procedures is provided in Section 6.7.2.3 of the GQAPP.

14.2.3 Shallov Monitoring Well Installation and Development

Tentative locations for the Phase II shallow monitoring wells are shown in Figure 14-2. The exact monitoring well locations will depend on Phase I results. For planning purposes, three new shallow monitoring wells are tentatively proposed for Site 31. 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 two-inch PVC casing, will bracket the water table with 10 feet of 0.01-inch slotted screen, and will be an estimated 15 feet



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

SCALE

0 50 100 200 300 FEET

KEY:

Building

Existing Monitoring Well

Tentative Soil Boring

Tentative Shallow Monitoring Well

Figure 14–2 TENTATIVE BORING AND SHALLOW MONITORING WELL LOCATIONS SITE 31 - PHASE II

deep. A detailed discussion of standard monitoring well construction practices is provided in Section 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.

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 three newly installed shallow monitoring wells. Each well will be purged and sampled according to the methods provided in Sections 6.8 and 6.10 of the GQAPP.

14.2.5 Eydrologic Assessment

Well head 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 workplan.

Limited aquifer testing will be conducted on all newly installed and existing monitoring wells. This will consist primarily of performing short-duration specific capacity tests during the development of the newly installed monitoring wells and performing slug or specific capacity tests on the existing monitoring wells. Specific capacity and slug tests are particularly useful for deriving first estimates of aquifer hydraulic properties (i.e., hydraulic conductivity, transmissivity). The advantages of conducting specific capacity tests n conjunction with well development is that the test itself does not generate additional potentially contaminated water which requires disposal. Slug testing does not generate potentially contaminated water.

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

14.2.6 Air Sampling

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