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PHASE II

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

Sanitary Landfill (Site 1)

July 1992

Prepared for:

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SOUTHERN DIVISION
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 Sanitary Landfill (Site 1) located at the Naval Air Station (NAS) in Pensacola, Escambia County, Florida. This work plan has been prepared by Ecology and Environment, Inc., (E & E) for the Southern Division, U.S. Navy, Naval Facilities Engineering Command, under Contract No. N62467-88-C-0200. The work plan has been developed based on information and file documents provided by the Navy, and on information gathered by E & E during preliminary site inspections conducted during January of 1989.

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

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- 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 vork 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.

The Sanitary Landfill (Site 1) is known to contain potentially hazardous materials and contamination in the site vicinity has been documented. Consequently, it is probable that the scope-of-vork at Site 1 will encompass a full-scale RI/FS effort.

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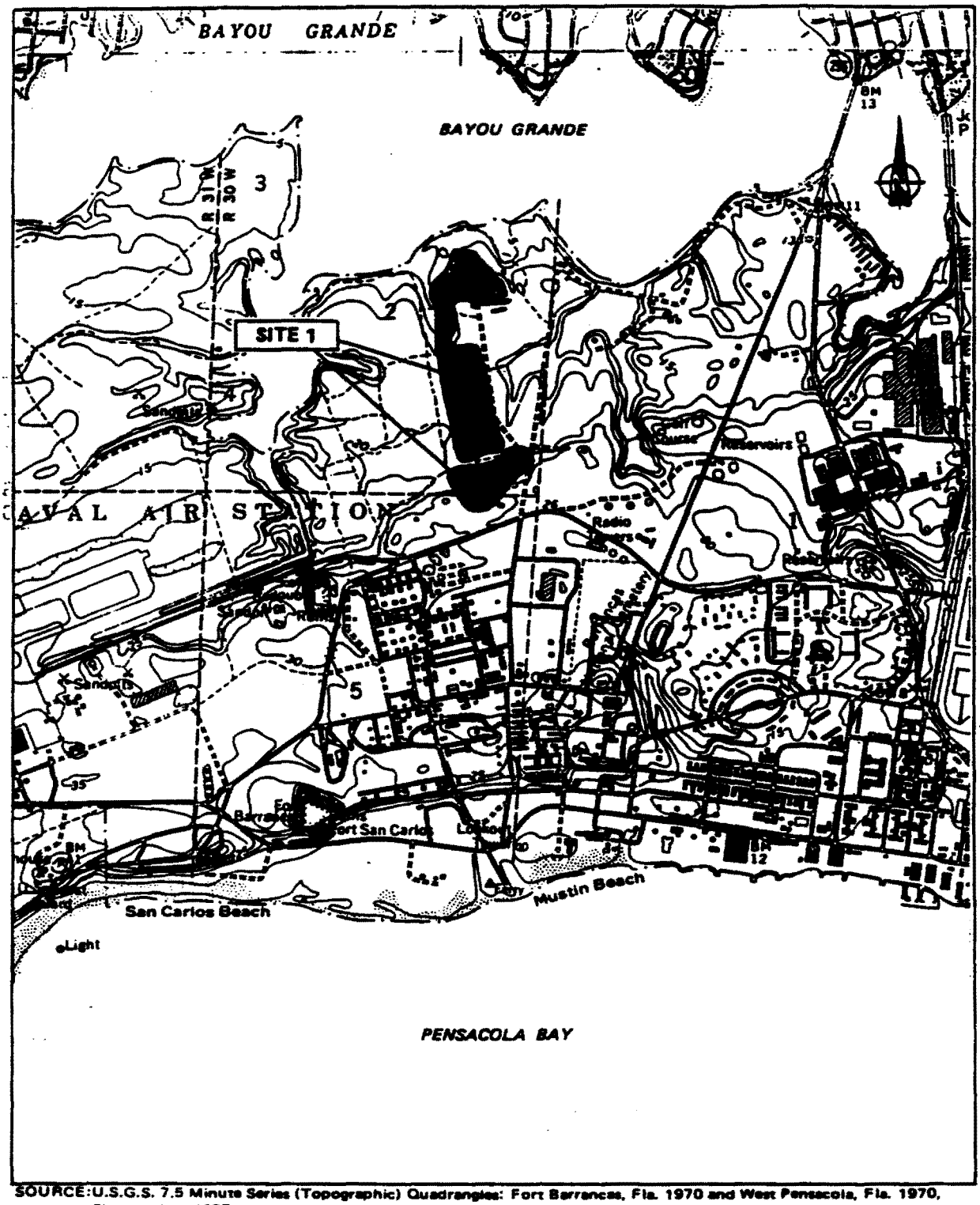
2. SITE DESCRIPTION

The Sanitary Landfill (Site 1) is located approximately 1/2 mile northeast of Sherman Field (see Figure 2-1). The site occupies approximately *80* acres and is situated 10 to 20 feet above mean sea level (MSL; see Figure 2-2). The landfill is inactive, and currently has a dense vegetative cover of planted 15-foot pine trees and naturally occurring scrub vegetation. To the north of the site are a Boy Scout Camp, two ponds, a picnic area which includes buildings *3554* and *3487*, and Bayou Grande. To the east of the site is the A.C. Read Golf Course. West of Site 1 is a wooded area and a former brush disposal and burning area (Site 16). To the south of the site is Taylor Road and naturally occurring scrub vegetation. The nearest residential area is located approximately 1,000 feet south of Site 1.

Construction details for existing monitoring wells associated with Site 1 are shown in Table 2-1.



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

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Figure 2–1 LOCATION MAP – NAS PENSACOLA SITE 1

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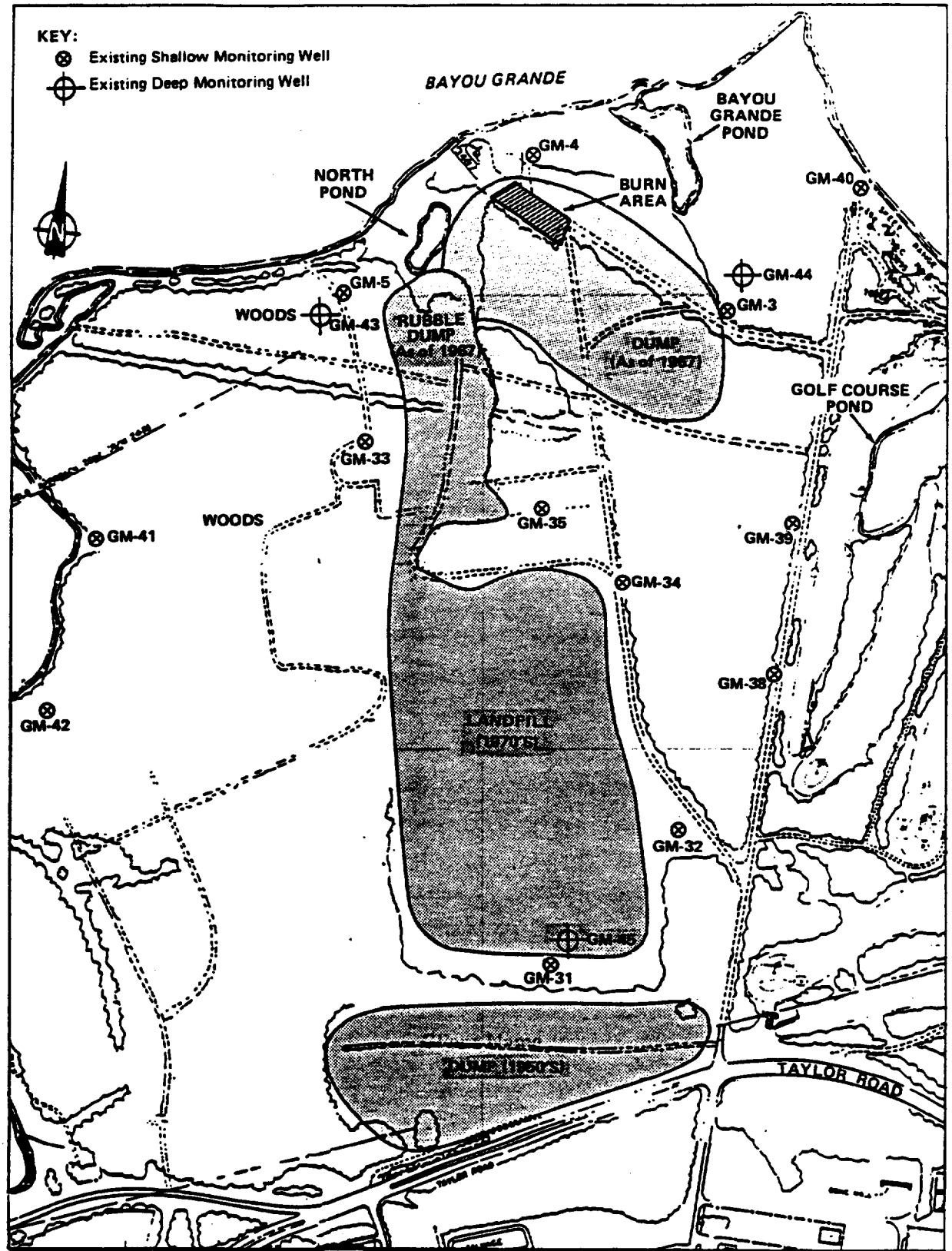

SOURCE: U.S. Naval Air Station, Pensacola, Florida, 1986, 1987, and 1988; and Geraughty & Miller, 1986

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Figure 2–2 SITE MAP – NAS PENSACOLA – SITE 1

TABLE 2-1

CONSTRUCTION DETAILS OF MONITORING WELLS AND PIEZOMETERS INSTALLED BY G & M AT NAS PENSACOLA SITE 1

Well Designation	Surface Elevation (ft msl)	TOC Elevation (ft msl)	Total Depth Drilled (ft)	Screened Interval (ft)	Depth to Filter Pack (ft)
GM-3	18.7	20.08	18.0	15.5 - 18.0	11.5
GM-4	10.2	11.36	17.0	14.5 - 17.0	10.5
GM-5	7.4	8.25	12.0	9.3 - 11.8	5.5
GM-31	19.1	20.49	11.5	8.8 - 11.3	4.9
GM-32	18.3	19.36	11.5	9.1 - 11.6	5.1
Gn-33	14.0	15.25	11.5	9.0 - 11.5	5.0
GM-34	15.2	16.15	11.5	9.1 - 11.6	5.0
Gn-35	15.0	16.15	11.5	9.0 - 11.5	5.0
81-38	18.1	20.83	15.0	12.5 - 15.0	11.0
GM-39	5.8	8.24	15.0	12.5 - 15.0	10.0
GM-40	11.8	14.34	15.0	12.5 - 15.0	9.0
GM-41	1.5	3.96	15.0	12.5 - 15.0	10.0
81-42	13.5	14.48	16.5	14.0 - 16.5	10.0
GM-43	6.7	9.13	68.0	63.0 - 68.0	52.0
GM-44	18.5	21.04	58.0	53.0 - 58.0	47.0
GM-45	19.0	20.51	107.0	102.0 - 107.0	97.0

SOURCE: Geraghty and Hiller (G & M) 1984, 1986

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3. SITE HISTORY

The Sanitary Landfill was used by NAS Pensacola from the early 1950s until 1976. During this time, nearly all solid waste generated on the station, as well as waste from outlying Navy installations, was disposed in this area. A partial list of wastes and quantities disposed of at Site 1 includes (Naval Energy and Environmental Support Activity [NEESA] 1983):

- Ketone soaked rags;
- Polychlorinated biphenyls (PCBs) and transformer oil-soaked rags (6,500 ft.^{3}), Paint chips;
- Paint sludge from water well paint booth (170,000 lbs.);
- Paint sludge (5,200 gallons);
- Dry air filter pads from paint booth;
- Compressed gas cylinders (200);
- Asbestos from building demolition;
- Wood soaked with plating solutions (1,667 ft.^{3});
- Pesticide rinseate;
- Garbage (64,000 tons);
- Hercury; and
- Containers from paints, pesticides, oils, strippers, solvents, thinners, plating, chemicals, etc.

During the early years of operation, wastes were burned and the resulting ashes were landfilled. Due to citizens expressed concerns over air pollution, the practice was discontinued in the 1970s. The

area of active landfilling at the site shifted over the years, as shown in Figure 2-2. The specific methods of disposal at the landfill are unknown.

In 1974, an abandoned drain field began discharging leachate from the landfill into a pond on the golf course. A drain tile outlet vas temporarily plugged, causing the local water table to rise, and eventually resulted in leachate seepages at the surface. Following the incident, the landfill vas closed and 11 galvanized steel monitoring wells vere installed. Groundwater samples were collected in October 1974 and November 1975. Neither the party responsible for the installation nor the locations of all the wells are known. The sampling results indicated the presence of phenol (0.02–14.4 mg/L), cyanide (0.02–4.56 mg/L), chromium (0.11 mg/L), copper (0.01-0.03 mg/L), iron (0.02–166 mg/L), magnesium (0.77–25 mg/L), manganese (0.02–3.58 mg/L), mercury (0.002–0.0052 mg/L), potassium (0.24–63 mg/L), and zinc (0.04–25.1 mg/L). Some of the wells have since deteriorated and are no longer usable for leachate monitoring (Geraghty and Hiller, Inc. [G & M] 1986).

Navy Assessment and Control of Installation Pollutant team, during a 1982 site survey, sampled the leachate discharging at the eastern edge of the landfill and sediment from ponds north and east of the landfill. The analytical results showed mercury (0.016–0.2 mg/L), cadmium (0–2.3 mg/L), chromium (0–19 mg/L), nickel (0.7-4.0 mg/L), and lead (26-51 mg/L) contamination (NEESA 1983).

In 1984, G & M installed and sampled eight 2-inch polyvinyl chloride (PVC), shallov monitor wells as part of a Verification Study of Site 1. These wells were analyzed for acid and base/neutral extractable organic compounds (BNAs), volatile organic compounds (VOCs), pesticides, PCBs, metals, and cyanide. Organic and inorganic contaminants in groundwater are summarized in Table 3-1. The analytical results for the Verification Study groundwater samples indicated the presence of one or more volatile organic contaminants in each of the wells, and significantly high concentrations of methylene chloride in wells GH-3, 631-33, and

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TABLE 3-1

SUMMARY OF ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES COLLECTED AT SITE 1 (1984)
(All results in ug/L unless noted)

Contaminants	Well Numbers							
	3	4	5	31	32	33	34	35
Chloromethane	-	-	-	-	-	-	-	5.4
Chlorothano	0.9	27.	-	-	-		165.	1.2
Methylene Chloride	11,000.	1.	0.6	5.5	2.3	2.400.	-	430.0
1,1-dichloroethene	-	-	-	0.2	-	-	-	0.9
1,1-dichloroethane	-	-	1.	-	-	-	-	3.2
Trans-1,2-dichloroethene	-	-	55.	-	-	-	-	1.7
1,1,1-Trichloroethane	-	59.0	-	2.1	-	-	44	-
Trichloroenthene	-	-	0.7	-	-	-	-	
Chlorobenzene	-	-	-		-	-	-	20.0
2,4-dimethylphenol	-	-	-	-	-	-	-	8.0
1,2-dichlorobenzene	-	-	-	-	-	-	3.0	5.0
1,4-dichlorobenzene	-	5.	-	-	-	15.0	9.0	10.0
Napthalene	-	2.	-	-	-	8.0	8.0	41.0
Diethylphthalate	-	-	-	-	-	2.0	-	3.0
2 ethyl naphthalene	NA	NA	NA	NA	NA	NA	14.0	11.0
2,4-Dimethylphenol	-	-	-	-	-	-	-	8.0
Cadmium (mg/L)	0.002	0.001	-	-	-	0.001	0.002	0.01
Chromium(mg/L)	0.003	0.004	0.002	0.002	0.001	0.005	0.003	0.003
Load (mg/L)	0.01	0.02	-	0.02	-	-	0.02	0.02
Silver(mg/L)	-	0.001	-	-	0.002	0.002	0.031	0.00
Nickel(mg/L)	0.004	0.009	0.001	0.002	0.005	0.008	0.009	0.00
Zinc (mg/L)	0.023	0.008	0.013	0.028	0.035	0.009	0.365	0.012

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NOTE: Hyphen (-) denotes corpound not detected; SOURCE: G & M 1984 (NA) indicates analysis not conducted.

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GM-35 (present at 11,000 ug/L, 2,400 ug/L, and 430 ug/L, respectively). Hethylene chloride vas not detected in well GH-34; however, chloroethane was detected at 165 ug/L. Concentrations of metals were belov Florida Department of Environmental Regulation (FDER) Primary and Secondary Drinking Water Standards. The investigation also determined that shallow groundvater moves north and northvestvard toward Bayou Grande, and northeastward toward the Golf Course Pond, where it discharges to surface waters (G & M 1984).

During a 1986 Confirmation Study of Site 1, G & M installed five additional shallov monitoring wells and three deep wells (GM-43, GM-44, and GU-45) to further assess the presence of groundvater contaaination. The locations of all existing wells are shown on Figure 2-2. Wells GM-3, GM-4, GM-5, and GU-31 through GM-35 vere analyzed for VOCs only, and wells GH-38 through GM-45 were analyzed for VOCs, BNAs, pesticides, and PCBs. Organic and inorganic compounds detected in the groundvatcr samples are summarized in Table 3-2. The analytical results indicated that VOCs vere the only contaminants present within the suite of parameters analyzed. As few as one, and as many as six VOCs vere detected in 12 of the 16 wells; however, the presence of these compounds in the samples vas often not consistent. For example, the highest benzene concentrations detected in the groundvater samples occurred in water collected from deep vells GM-44 and Gn-45 (76 µg/L and 67 ug/L, respectively). Vinyl chloride was not detected in groundwater samples collected during the Verification Study (G & M 1984); however, it vas present in nine samples collected in the second phase (G & M 1986), often at high concentrations. Methylene chloride vas detected at very high concentrations in several samples during the Verification Study, but was not detected in any of the Confirmation Study samples. Water levels in the deep wells during the 1986 Confirmation Study indicated a slight gradient to the south (G & M 1986).

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TABLE 3-2
SUMMARY OF ANALYTICAL RESULTS FOR
GROUNDWATER SAMPLES COLLECTED AT SITE 1
(April - June, 1985)
(All results in ug/L unless noted)

	Well Numbers															
Contaminants	3	4	5	31	32	33	34	35	38	39	40	41	42	43	44	45
Benzene	-	7	-	-	-	3	4 3	1 0	4 1	-	-	-	6	-	76	67
Chloroothano	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroaothano	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methlyene Chloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-dichloroethene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-dichloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-1,2-dichloroethene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1-trichloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	-	5	-	-	1	10	3	7	-	8	-	-	-	-	-	-
Ethyl benzene	-	6	-	-	-	20	14	7	-	-	-	-	-	-	8	-
Methyl Chloride	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
Vinyl Chloride	-	3	56	1	2	2	250	3	-	30	-	-	7	-	-	-
Toluene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA	-	-	-	-	-	-	-	-
2-aothylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	-	-	-	-	-	-	-	-
1,4-dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	-	-	-	-	-	-	-	-
Diethylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	-	-	-	-	-	-	-	-
2.4-dimothylphenol	NA	NA	NA	NA	NA	NA	NA	M	-	-	-	-	-	-	-	-
PCBs	NA	NA	NA	NA	NA	NA	NA	M	-	-	-	-	-	-	-	-
Pesticides	NA	NA	NA	NA	NA	NA	NA	NA	-	-	-	-	-	-		

NOTE: Hyphen (-) denotes coapound not detected;
(NA) indicates analysis not conducted

SOURCE: G & M 1986

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4. CLIMATOLOGY

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

Precipitation rates in the NAS Pensacola vicinity are relatively high with an average annual rainfall of approximately 60 inches. Rainfall amounts are highest in July and August during almost daily thunderstorms (averaging seven inches per month) and lowest during spring and fall (averaging four inches per month; Kennedy 1982). High intensity thunderstorms are common, producing as much as 3 to 4 inches of rainfall during a single hour. Evaporation rates are also highest in the summer months; therefore, the potential recharge resulting from heavy summer rains is reduced. Spring and fall rains are generally less intense, but longer in duration, producing less surface runoff and higher rates of infiltration and net recharge.

Wind velocities are generally moderate except during thunderstorms (Carlisle 1960). Prevailing winds are northerly during the winter and southerly during the summer. An ocean-land temperature differential produces a daily clockwise rotation of the surface wind direction near

the coast, commonly known as the sea-breeze effect (Flood and Associates 1978). Hurricanes and tornadoes are infrequent but can cause substantial damage to the nearshore environment. Six hurricanes have passed within 50 miles of Pensacola since 1980.

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5. BIOLOGICAL RESOURCES

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

5.1 Regional Biological Resources

5.1.1 Terrestrial

Vegetation. The primary vegetated communities of the NAS Pensacola facility can be considered one of two types: north Florida coastal strand communities, 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), Hydrocotyle bonariensis (beach pennywort), Ipomoea stolonifera (beach morning-glory), Coccoloba uvifera (sea grape), Quercus geminata (twin live oak), and'the stunted shrubs species Yucca aloifolia (yucca), Opuntia, and Cereus. This community type has been ranked by the Florida Natural Areas Inventory (FNAI) as locally restricted and vulnerable to extinction due to developmental activities. This community type can have three to five distinct habitat types (Wolfe et al. 1988).

The sand pine scrub community is a more upland coastal community characterized by coastal dune formations from an older geologic age with deep, fine, white sand substrate and the plants Pinus clausa (sand

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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 statevide 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 (Volfe et al. 1988).

Two other community types may be found in the vestcrn portions of the NAS Pensacola facility. These arc flatvoods and sandhill vegetative communities. Flatwoods vegetation occupies areas which vere 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 vithin flatvoods are dominated by the herbaceous plants Pinguicula spp. (buttervort), 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 flatvoods soils. The overstory of this community type is dominated by Pinus palustris (longleaf pine), Quercus lacvis (turkey *oak)*, Q. marilandica (bluejack *oak)*, Q. stcllata (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 (vire grass). These habitats vere verified vith 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

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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 nonmating season, it is likely that there are more species of birds using the facility and surrounding waters as feeding and nesting sites than have been found.

Reptiles and Amphibians. During the 1986 survey conducted by the Navy, only four out of a possible 30 species of reptiles and amphibians associated with the area were identified on the NAS Pensacola facility, none of which are endangered. A recent check of the FNAI files confirms that the presence of the gopher tortoise (Gopherus polyphemus) can most likely be found in suitable habitats on the western portions of the facility (see Appendix C). Host of the reptiles and amphibians that may be found on the facility can be expected to use the surface vater bodies in sore 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 vith surface waters (Volfe et al. 1988).

—tal 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 saltmarsh cordgrass (Spartina alterniflora) or black needlerush (Juncus roemarianus). A biota survey of these and other potential habitat areas will be conducted to determine the extent of estuarine flora and fauna.

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

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

Benthos. Marine soft-sediment communities are found adjacent to the northern, eastern, and southern areas of the NAS Pensacola facility in Pensacola Bay. Although no intensive benthic surveys were conducted along the perimeter of the facility, surveys at nearby sites by 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 vastevater treatment plant outfall shov 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 vithin 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 at. 1988).

Pi& and Shellfish. Early studies of Pensacola Bay have identified 180 bony fish species and seven cartilaginous fish species (Cooley 1978). The 13 most abundant species were spot (Leiostomus xanthurus), pinfish (Lagodon rhomboides), Atlantic croaker (Micropogonias undulatus), g 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 vas highest in the more saline vaters near the NAS Pensacola facility during spring and summer. In the less saline waters of Bast Bay, diversity was lowest in summer and highest during the winter months. Fish population density was the highest in the more saline vaters, 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 (Eeil 1989). Shrimp are caught in greater abundances near NAS Pensacola because of the higher salinities. Blue crabs and oysters are more readily caught

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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 the Big Lagoon along the southwest portion of the facility.

Sport and Commercial Fishing. A moderate amount of commercial fishing occurs in Escambia County, accounting for 2% of the total Florida landings for 1980 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

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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. Pew mammals have been sighted within the area of the IUS Pensacola facility; most of the 13 species of mammals reported for tbc 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, vith one recent sighting in the area recorded by the Florida Natural Areas Inventory (FNAI) in October 1988. A goosebeaked whale (Ziphius cavirostris) vas reported stranded on Santa Rosa Island, and a pilot whale (Globicephala macrorhynchus) vas 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 vithin the vaters surrounding the NAS Pensacola facility.

Threatened and Endangered Species. A number of threatened and endangered species have been identified in the vicinity of the NAS Pwacola facility (see Appendix C). Hany rare, threatened, and endangered species are associated with the wetland or bog habitats found on NAS Pensacola. A total of 57 occurrences for six plant species were recorded in an inventory conducted by FNAI (1988b) of the NAS Pensacola facility (see Appendix C). Host of these plants were found in the area around Sherman Field and habitats to the vest. 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 IUS Pensacola facility, and nesting and feeding animals on the facility

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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 1 and the immediate surrounding area contain several of the major community types that are found on the NAS Pensacola facility. Vegetated community types found in the vicinity of Site 1 include: sand pine scrub forests, semi-natural pine plantations, semi-natural grassy savannahs and freshwater and estuarine marsh areas. On the actual landfill site, there is a relatively new (5 to 8 years old) stand of pines. This pine plantation, as it is sometimes called, is usually maintained by fire which reduces accumulations of understory growth, thereby inducing faster growth of planted species.

Outside of the landfill boundaries (see Figure 2-1) the sand pine scrub and marsh communities, found primarily on the north, east, an south sides of the site, are in a relatively undisturbed natural state. Interdispersed within these habitats will utilize this site to a large degree for feeding, nesting, and as a migration corridor. An extensive survey of the flora and fauna using this site must be conducted to determine potential contaminant pathways for each of the communities found in the vicinity of Site 1.

6. SURFACE WATER 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 (U.S. Geological Survey [USGS] 1970a, 1970b).

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

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 vater or groundwater, into vetland areas found on site could also have a significant impact on the biotic communities that are dependent on those habitats.

62 Site-Specific Surface Vater Hydrology

A number of surface water bodies *are* located in the vicinity of Site 1. These include Bayou Grande, Bayou Grande Pond, North Pond, the Golf Course Pond, and a large volume drainage ditch originating from the Forrest Sherman Field complex.

The landfill is situated on an area of land that juts somewhat north into Bayou Grande, hence the surface vater body surrounds the site from west to northeast. The northern extent of the landfill is within 250 feet of the Bayou.

Bayou Grande Pond is northeast of the landfill. This coastal backwater feature is connected to the Bayou by a small tidal inlet. The natural origin of the pond, and its subsequent artificial alterations are not known, nor is its water quality status. The pond will be investigated and sampled as described in Section 14.

North Pond is located north of and adjacent to the landfill and rubble disposal area. Its natural origins and/or artificial alterations are not known. North Pond will be inspected and sampled as discussed in Section 14.

The Golf Course Pond is located east of the landfill, and about 750 feet from the nearest known disposal area at the landfill. Connected by tidal inlet from Bayou Grande, the pond is surrounded by golf course fairways and wooded plots. Natural origins of the pond and subsequent

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artificial modifications are not known. As discussed in Section 2, a leachate drain was discovered to be discharging into the pond in 1974. Although the pipe was plugged, the current status of the leachate situation in this area of the Golf Course Pond is not known.

Twelve hundred feet southwest of the landfill is a large volume drainage ditch that drains the eastern section of Forrest Sherman Field to Bayou Grande.

Overland flow of runoff in the Site 1 area is discouraged by the sandy and highly permeable nature of surficial soils and sediments and the nearly level topography. Precipitation infiltrates rapidly to the shallow surficial aquifer.

All of the ponds are downgradient from the landfill area, based on shallow well water table data (G & M 1984, 1986). The degree to which the landfill has affected any of the nearby surface water bodies is not known.

An objective of the multi-phased investigation for Site 1 is to gain understanding of the hydrological nature of these surface water bodies to aid in evaluating the degree to which they have been impacted by the site.

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 mean sea level (HSL). 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 tbe 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 Eolocene Series which, in this area, consist mainly of the Citronelle Formation overlain by a thin cover of marine terrace deposits. Given that the Sand-and-Gravel Aquifer is contiguous vith land surface and recharge occurs principally by the direct infiltration of precipitation, the aquifer is particularly susceptible to contamination from surface sources. In the NAS Pensacola vicinity, the Sand-and-Gravel Aquifer is made up of three zones based on contrasting permeabilities. These zones are referred to as the surficial zone, the lov permeability zone, and the main producing zone (Wilkins et al. 1985).

Surficial Zone. The surficial zone is contiguous with land surface and contains groundvater under water table or perched vater 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 vithin 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 groundvater flow is controlled by the topography and by discharge to surface water bodies. Consequently, 'shallow groundwater in the surficial zone moves toward areas of lover 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

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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 below land surface (BLS) at NAS Pensacola. This zone generally has the highest permeability characteristics due to thicker and more persistent sand and gravel beds, and is tapped by most of the major wells in the Pensacola area (Wilkins et al. 1985). NAS Pensacola has three supply wells which produce water from this zone; however, due to high iron content in the water, the wells are

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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 tovard the wells.

As a result of the overlying lov permeability zone, groundvater within the main producing zone occurs under confined or semiconfined conditions. At one nested well location on NAS Pensacola (east of Building 648), the vater level elevation in a well open to the main producing zone is approximately 7 feet lover than that in an adjacent well open to the surficial zone (G & H 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 lover 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 (Vilkins et al. 1985). In general, the Intermediate System consists of fine-grained sediments and functions as an effective confining unit vhich retards the exchange of water between the overlying Sand-and-Gravel Aquifer and the underlying Floridan Aquifer System (SEGS 1986). For the most part, the entire sequence is poor to nonwater bearing. However, relatively thin beds of sand which exist within the unit may yield small quantities of water. In the NAS Pensacola area the Interaediate System is

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approximately 1,100 feet thick and is composed of the lower portion of the Hiocene 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 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 Hiddle to Lower Hiocene 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 1, the surficial zone of the Sand-and-Gravel Aquifer occurs from land surface to depths of approximately 40 to 60 feet. The lithologic descriptions of cuttings collected during the installation of the 16 existing monitoring wells (shown on Figure 2-2) indicate that the zone primarily consists of tan to brown, fine- to medium-grained sand. Water table conditions occur at approximately 5 to 10 feet BLS. Based on water level data collected from shallow wells (G & M 1984, 1986), groundwater flow is generally radial from the landfilled area, and toward the coastal areas of Bayou Grande to the west, north, and northeast. Aquifer tests were performed on shallow wells as part of Verification Study (1984) and Characterization Study (1986) efforts. Hydraulic conductivity was determined from a slug test at GH-5 to be 17.3 ft/day. Assuming a hydraulic gradient of 0.008 and an effective porosity of 0.35 for the surficial sands, the horizontal seepage velocity for the shallow groundwater at the site was calculated to be approximately 140 feet per year (ft/year; G & H 1984). At an unnamed shallow well, hydraulic conductivity was determined to be 19 ft/day. Assuming a hydraulic gradient range of 0.0048 to 0.007 and an effective porosity of 0.20, the horizontal groundwater flow velocity was calculated to be from 190 to 275 ft/year (G & M 1986).

Immediately underlying the surficial zone in the vicinity of Site 1, and extending to depths of 48 to 100 feet, is the low permeability zone of the Sand-and-Gravel Aquifer. Based on the cuttings from the installation of deep wells 43, 44, and 45, this zone primarily consists of gray to dark gray clay with very thin beds of fine to coarse quartz sand and shell fragments. Clay samples, collected from this zone during the installation of the three deep wells, were tested in the laboratory, and hydraulic conductivities were determined to range from 5.7 x 10^{-8} to 3.5 x 10^{-5} cm/sec (1.6 x 10^{-4} to 1.0 x 10^{-1} ft/day).

Although water level elevation data collected from the deep wells during the 1986 Characterization Study are not provided in the final report, it is stated that an upward vertical gradient was observed in well clusters at the north end of the site, and a downward gradient in a well cluster to the south. Based on these qualitative descriptions, it can be expected that the low permeability zone functions as a confining or semi-confining 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 (G & 1 1986).

The top of the main producing zone occurs at depths between 48 and 100 feet, based on deep well data in the vicinity of Site 1. The three deep wells GM-43, GM-44, and GM-45, are open to the upper portion of this zone and screened at 63 to 68, 53 to 58, and 102 to 107 feet respectively, BLS. As mentioned above, water level data for the deep wells is not provided; however, it is reported that both downward and upward gradients were observed between the surficial and main producing zones, and a slight horizontal gradient is oriented to the south in the main producing zone (G & M 1986).

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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).

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9. SITE MANAGEMENT PLAN

The Generic Site Management Plan (GSHP) 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 1 will follow the GSMP and any updated versions. Data Quality Objectives (DQOs) and all applicable or relevant and appropriate requirements (ARARs) have been considered in developing the initial phases of fieldwork described here and will be updated and revised for any subsequent phases of fieldwork.

10. HEALTH AND SAFETY PLAN

A comprehensive General Health and Safety Plan (GHSP) and individual site-specific safety plans (SSP[; see Appendix A]) 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 (site entry, decontamination, etc.); hazard communication and training (safety training, briefings, documentation, etc.); safety equipment and instrumentation (monitoring, personnel protective equipment, etc.); hazard evaluation by contaminant class (metals, organics, etc.); and hazard evaluation for each task (drilling, sampling, etc.). The GHSP will be periodically updated, as required, during the course of this program.

In addition, the GHSP and the individual SSPs will define the toxicological properties and health hazards associated with each site. The SSP will include emergency action information pertinent to the safety of the field personnel and of the public (hospitals, ambulatory units, poison control centers, fire departments, and police/sheriff departments). The SSP will also identify first-aid and personal safety equipment and will provide recommended site security precautions. The GHSP and the SSP will comply with the Occupational Safety and Health Administration (OSHA) Guidelines for Eiazardous 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 (GOAPP) has been prepared and submitted to the Navy. This comprehensive document will be referenced for all field and laboratory procedures for this program used to develop the Site-Specific Quality Assurance Plans (SQAP[; see Appendix B]).

The *SOAP* will provide site-specific quality assurance/quality control (QA/QC) measures used to obtain accurate and precise data for all site investigation activities. The SOAP 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 GOAPP and SQAP will be in accordance with applicable professional technical standards, U.S. Environmental Protection Agency (EPA) requirements, and specific Navy goals and requirements for this project. All samples will be collected, handled, packaged, preserved, and transported in accordance with the GQAPP and SQAP and with U.S. Navy and EPA procedures.

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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 (Phase III and IV) studies. The field screening phase will employ a variety of field investigation techniques, including the collection of samples for laboratory analysis. However, the analysis of these samples will be subject to less rigorous QA/QC requirements, which reflect the "focusing" objective--rather than a formal contaminant quantification objective--of this phase. Each field screening task will utilize all existing information from preceding tasks, including aerial photograph 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 the landfill areas. 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, areas of exposed landfill debris, and leachate seeps.

During the reconnaissance survey, the field team wiil identify areas which present the most suitable conditions for the establishment of grid

survey baselines. The use of a grid system as part of the Phase I field investigation is discussed in the following sections.

The reconnaissance survey team will utilize radiation and air monitoring equipotent during walkovers of landfilled areas, 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 reconnaissancce will be mapped in detail and recorded in the field logbook.

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

During the establishment of the geophysical survey grid network (discussed in Section 14.1.2), an emissions survey will be conducted using HNu and/or organic vapor analyzer (OVA) air monitoring equipment. 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 field logbook.

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

14.1.1.3 Radiation *Survey*

During the establishment of the geophysical survey grid network, a radiation survey will be conducted using a micro-R-meter and gamma scintillation detector. The survey will be conducted in accordance with Section 6.3.2 of the GQAPP. Measurements will be made at each established grid point, and readings will be recorded in the field logbook.

14.1.1.4 Habitat/Biota Survey

During the physical reconnaissance, an E 6 E biologist/ecologist will determine the on-site terrestrial and aquatic habitats, and the

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surrounding habitats which may be affected by off-site contaminant migrations. During the walkover survey, rare, threatened, and endangered species and their potential habitats will be identified, and an evaluation will be made of general site conditions to support viable populations of plants and animals. [Using historical aerial photographs and the survey results, a map illustrating the identified habitats will be generated.] A habitat/biota survey, as well as an evaluation of the literature, will be conducted for Site 1.

14.1.1.5 Asbestos Survey

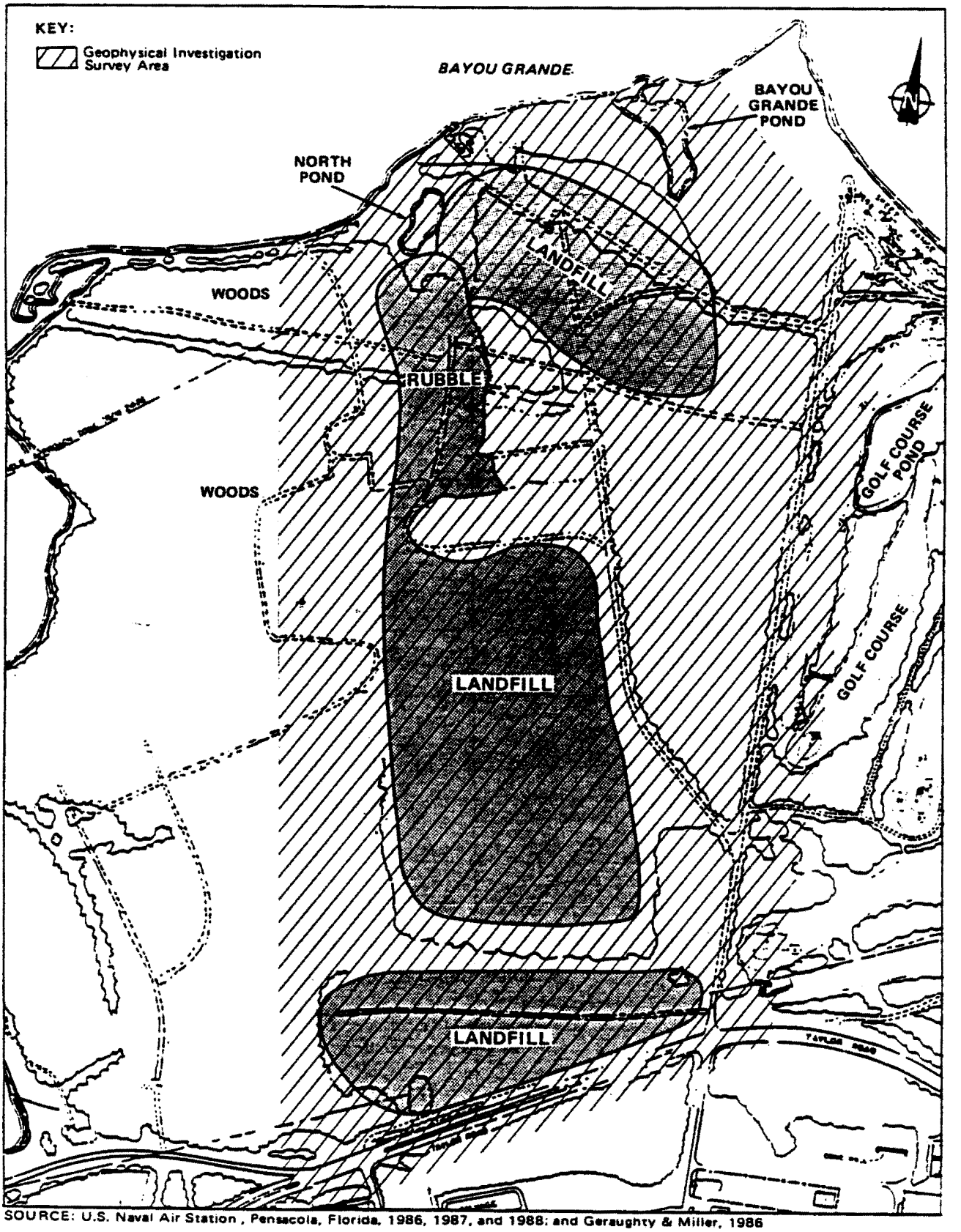
An asbestos survey will be conducted on Site 1 during the physical reconnaissance. This survey will consist of locating and identifying suspect building materials that could potentially contain asbestos. No sampling will be conducted, and suspect building materials will be mapped for future reference.

14.1.2 Geophysical Survey

The landfill areas, landfill fringes, and surrounding local areas will require an electromagnetic terrain conductivity survey (EM-31 and EM-34XL), and magnetometer survey. The geophysical survey area is shown on Figure 14-1. The survey 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 100-foot intervals. A transit survey instrument will be used to establish the baselines, and a Brunton compass and tape measure used to complete the grid system for the study area. The grid spacing will be based on 100-foot centers.

The EM-31 and magnetometer surveys will be conducted by obtaining measurements at each 100-foot interval grid point. EM-34XL readings will be obtained at alternating grid point locations with a spacing of 200 feet.



SOURCE: U.S. Naval Air Station, Pensacola, Florida, 1986, 1987, and 1988; and Geraughty & Miller, 1986

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Figure 14—1 GEOPHYSICAL INVESTIGATION SURVEY AREA, SITE 1 – PHASE I

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The geophysical data, in conjunction with other background data, will be used to identify: anomalous conditions in the landfilled areas, the horizontal extent of landfilled debris, water table conditions, the location of potential subsurface contaminant plumes and leachate streams, and to ascertain 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 II monitoring well'placement strategies.

14.1.3 Analytical Screening

14.1.3.1 Laboratory Analyses

Phase I sampling activities for Site 1 will require the installation of shallow temporary monitoring wells, groundwater sampling, and the collection of surface water, sediment, and soil samples. 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. It should be noted that chlorobenzene has been added to the Phase I analytical screening parameters for Site 1 due to its detection in previous investigation samples.

Surface Water — Three surface water samples will be collected from the Golf Course Pond east of the landfill, two surface water samples will be collected from the marshy area/Beaver Pond west of the Golf Course Pond, two surface water samples will be collected from North Pond, and three surface water samples will be collected from Bayou Grande Pond north of the landfill (see Figure 14-2). In each of the surface water bodies, water samples will be collected from a zone 1 foot above bottom using a Kemmerer sampling device. A small boat will be used as

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Table 14-1

PHASE I SAMPLING AND ANALYTICAL REQUIREMENTS-GROUP A

SITE 1

Medium	No. of Samples	Duplicates	Total	Analytical Suite[a,b]
Surface Water	10	1	11	A
Sediment	15	1	16	A
Soil	14	1	15	A
Groundwater[d]	28	2	30	A
TOTAL	67	5	72	

Medium	No. of Samples	Duplicates	Trip Blanks[f]	Field Blanks	Rinsate Blanks	Preservative Blanks[g]	Total	Analytical Suite[a,c]
Groundwater[e]	16	2	2	1	2	1	24	B

14[NASP]UH1101:T0393/168/12

[a]Analytical suite designations are as follows:

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

B = Target Compound List (TCL) volatile organic compounds plus xylene and ketones, TCL base/neutral and acid extractable organic compounds, TCL pesticides and PCBs, total recoverable hydrocarbons, TCL metals (total [i.e., unfiltered], and dissolved [i.e., millipore-filtered]), cyanide, gross alpha, 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-[5] of the Generic Quality Assurance Project Plan.

[c]Specific constituents encompassed by the various chemical groups included within analytical suite B are identified in tables 9-[6] through 9-[15] of the GQAPP.

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

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

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

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

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

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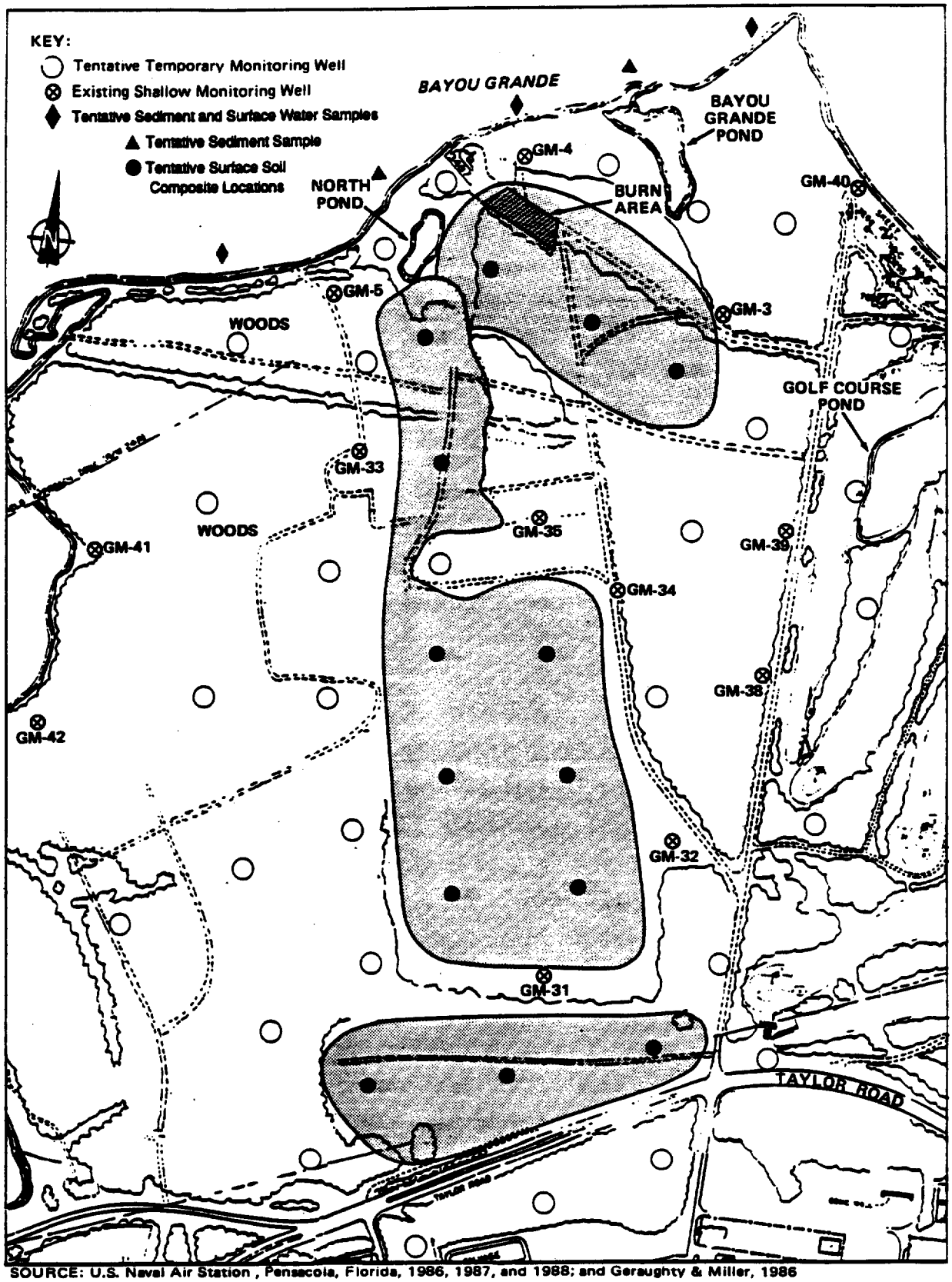

SOURCE: U.S. Naval Air Station, Pensacola, Florida, 1986, 1987, and 1988; and Geraughty & Miller, 1986

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Figure 14-2 TENTATIVE TEMPORARY MONITORING WELL LOCATIONS AND SURFACE WATER, SEDIMENT, AND SOIL SAMPLING LOCATIONS, SITE 1 — PHASE I

necessary to access desired sample locations. All sampling and equipment decontamination activities will be conducted in accordance with sections 6.9.1 and 6.10 of the GQAPP, respectively.

Sediment--Three sediment samples will be collected from the Golf Course Pond, two sediment samples will be collected from North Pond, two sediment samples will be collected from the marshy area/Beaver Pond west of the Golf Course Pond, and three sediment samples will be collected from Bayou Grande Pond (see Figure 14-2). In each of the ponds, the samples will be collected from a depth interval of surface to approximately 4 inches. The samples will be retrieved using either a bucket-type mud auger (in areas where the depth of the pond is less than 6 feet), or an Eckman Dredge (in areas where the depth of the pond is greater than 6 feet). The composition of bottom materials retrieved by the sampling devices will be recorded in the field notebook. All sediment sampling and equipment decontamination activities will be conducted in accordance with sections 6.9.2 and 6.10 of the GQAPP, respectively.

Soils — Approximately 14 composite surface soil samples will be collected from the surface of the landfilled areas (see Figure 14-2). The purpose of this sampling is to determine the focus of Phase II soil sampling and ultimately to provide the data to evaluate the need for formal air sampling. The data will also be pertinent to Risk Assessment tasks. If surface runoff pathways to Bayou Grande are identified, soil samples will be collected in the areas of the pathways.

Each sample will be collected as a composite of five aliquots from within a 50-foot diameter area. Each aliquot will be collected at a depth interval of surface to 6 inches. For each location, the five aliquots will be homogenized to comprise a single sample. All sampling and compositing will be performed in accordance with Section 6.6 of the GQAPP. Equipment decontamination will be performed in accordance vith Section 6.10 of the GQAPP.

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Groundwater — Approximately 28 temporary stainless steel monitoring wells will be installed around the landfill area. Each well will have 5 feet of 0.01-inch slotted screen and will be installed to a depth at which the well screen brackets the water table (i.e., the top of the screen extends slightly above the water level). As shown on Figure 14-2, the locations for these wells are tentative. The interpreted results of the geophysical investigation, as well as information gained from field reconnaissance surveys and aerial photograph interpretations, will allow adjustments and finalization of the temporary shallow well network. Also, as shown on Figure 14-2, the existing shallow wells around Site 1 will be utilized as part of the Phase I shallow groundwater screening network, where practical.

The 28 temporary wells and 16 existing monitoring wells will be purged and sampled in accordance with Section 6.8 of the GQAPP.

14.1.4 Hydrologic Assessment

The temporary wells and existing well network will be surveyed to obtain top of casing (TOC) elevations referenced to USGS datum or to a suitable established benchmark located within the vicinity of Site 1. Static water levels will be measured in each well to determine shallow groundwater flow direction. and horizontal hydraulic gradient.

In conjunction with the wellhead survey, the elevations of other nearby features such as ponds, streams, and leachate seeps will be established. A staff gauge will be emplaced in the Golf Course Pond and monitored over the course of field investigation activities. At least one rain gauge station will be established in the vicinity of Site 1 and precipitation monitored during field work activities.

Hydrologic data collected during Phase I will be evaluated alongside geophysical and analytical screening data, and evidence of lateral contaminant migration in shallow groundwater assessed. Conclusions drawn from these evaluations will form the basis for permanent monitoring well installations during phases II and 111.

14.2 Phase II--Characterization/Extent Delineation

This section of the Contamination Assessment/Remedial Activities Investigation Vork Plan--Group A (Site 1, Sanitary Landfill), Naval Air Station Pensacola, Pensacola, Florida, has been entirely revised to reflect the results of the Phase I activities proposed in the original vork plan document ([June] 1990). The original version ([June] 1990) of Section 14.2 of this work plan is presented in Appendix D. Figure 14-3 shows the actual Phase I sampling locations and location designations. The results of the Phase I investigation of Site 1 are presented in B & E's Final Interim Data Report, Contamination Assessment/Remedial Activities Investigation, Sanitary Landfill (Site 1), Naval Air Station Pensacola, Pensacola, Florida, Volumes I and II, October 1991.

In general, the results of E 6 E's Phase I investigation of Site 1, reviewed in combination with those of previous investigations of the site (NEESA 1983; G&M 1984, G&M 1986), indicated the following:

- Site vicinity surface waters and sediments (Bayou Grande, North Pond, Bayou Grande Pond, Golf Course Pond, and Beaver Pond) may have been impacted by metal and organic contaminant migration from the landfill; however, it is not clear vhether the nature, magnitude, and distribution of the detected contamination are sufficient to constitute an environmental threat and thereby warrant remediation.

- Surface and subsurface soil metal and organic contamination at very high levels are likely present within several areas of the landfill where "concentrated" disposal of wastes may have occurred; two such areas of surface soil contamination are clearly present (locations S005 and S012, see Figure 14-[3]) based on the Phase I analytical results. At least three other such locations may be present based on the Phase I aerial photograph analyses; in addition, the Phase I analytical results suggest potential aquifer matrix soils contamination by metals resulting from leachate migration via groundvater flow.

- The groundwaters of the surficial zone of the Sand-and-Gravel Aquifer on site and in the site vicinity exhibit organic and, possibly, metal contamination at levels exceeding federal and state standards or guidance

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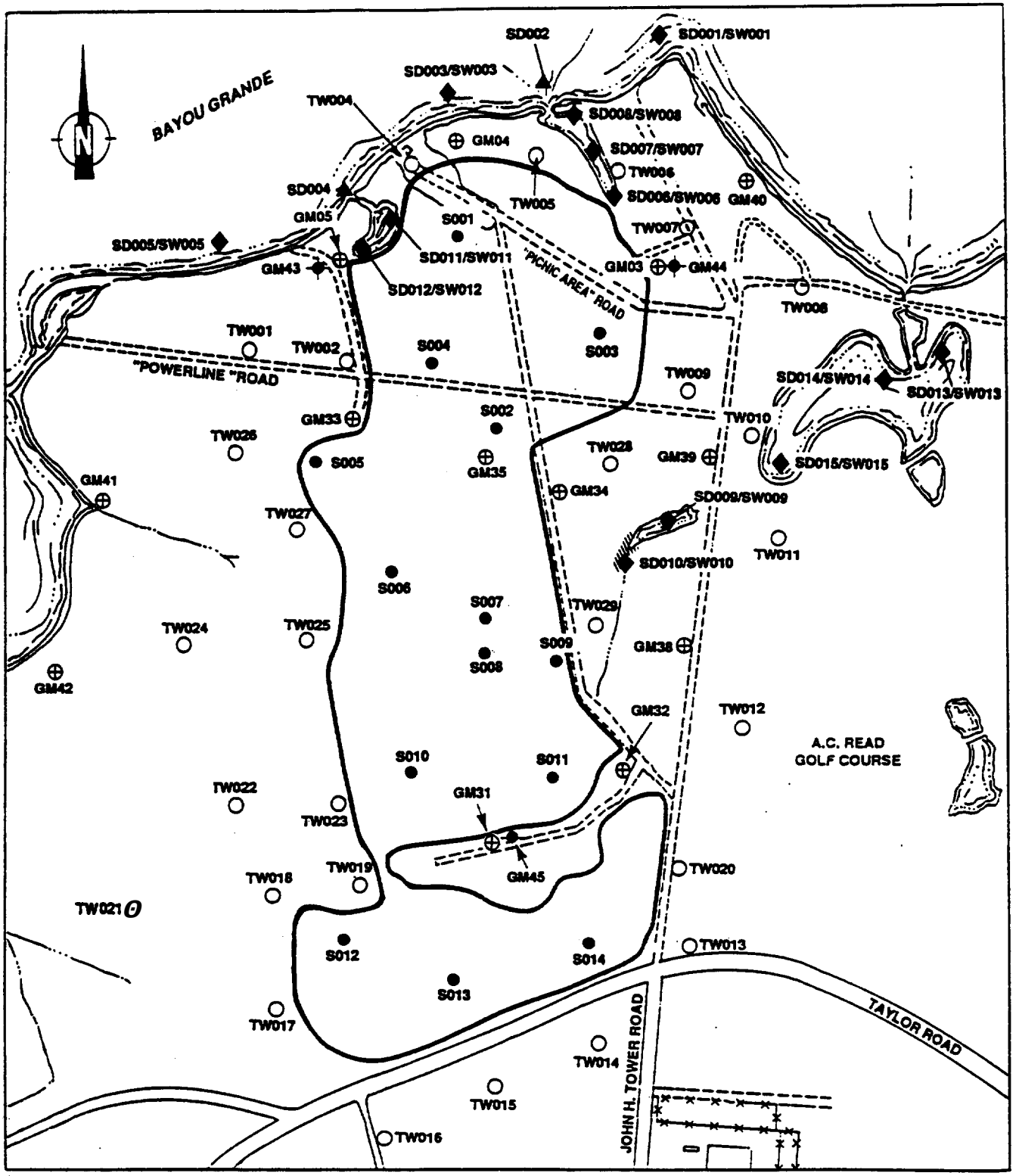

SOURCE: Ecology and Environment, Inc., 1991

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KEY:

- Landfill Boundary
- Unpaved Road
- Fence
- Permanent Shallow Monitoring Well
- Permanent Deep Monitoring Well
- Temporary Monitoring Well
- GM04 Permanent Monitoring Well Number
- TW001 Temporary Shallow Monitoring Well Number
- Sediment Sample Location
- Sediment and Surface Water Sample Location
- Surface Soil Sample Location
- SW001 Surface Water Sample Number
- SD001 Sediment Sample Number
- S001 Soil Sample Number

Figure 14-3 TEMPORARY MONITORING WELL LOCATIONS AND SURFACE WATER, SEDIMENT, AND SURFACE SOIL SAMPLING LOCATIONS — NAS PENSACOLA SITE 1 PHASE I

concentrations; the Phase I data indicate generally limited off-site migration within the surficial zone, but also suggest the potential for more extensive off-site migration within deeper zones of the Sand-and-Gravel Aquifer.

In light of the Phase I results summarized above, the objectives of the Phase II investigation of Site 1 will be as follows:

- Identify to the greatest extent possible any additional areas of the landfill where "concentrated" disposal of wastes may have occurred, as well as the potential presence of ambient sources of contamination in the site vicinity;
- Determine the nature, magnitude, and nearshore extent of potential Bayou Grande surface water and sediment contamination as well as the contamination of these media in the other surface water bodies in the site vicinity;
- Delineate the nature, magnitude, and lateral/vertical extents of known/suspected areas of soil and groundwater contamination;
- Initiate the Risk Assessment and Feasibility Study for the site.

In order to meet the above objectives, the Phase II investigation of Site 1 will include the following elements:

- Contaminant source survey;
- Surface water, sediment, and soil sampling;
- Installation of shallow, intermediate, and deep monitoring vells;
- Collection of groundwater samples from all existing and newly installed wells;
- Eydrologic 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 the

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Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Superfund Amendments and Reauthorization Act (SARA), as well as all other ARARs. For Site 1, 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 17-301, FAC (Surface Waters of the State);
- Chapter 17-302, FAC (Surface 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 1 because no evidence that Site 1 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 potential contaminants of concern have not been sufficiently characterized. (However, basewide 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).

Every effort will be made to complete the investigation of Site 1 during Phase 11. To the greatest extent possible, the results of the Phase I investigation, as well as field data and/or observations generated during the Phase II investigation, will be utilized to adjust and/or redirect the Phase II efforts in order to maximize the amount of

information obtained regarding the horizontal and vertical extents of possible contamination at the site. Adjustments to the Phase II scope of work ray include, but ray not be limited to: 1) sampling of additional media which are not already included in this work plan; 2) installation of additional and/or deeper (i.e., intermediate and/or deep) permanent monitoring wells; 3) collection and analysis of additional samples from *any* given medium; and 4) performance of full-scale aquifer tests or other studies to further characterize the hydraulic properties of the soil or aquifer matrix. Bovever, sampling and/or analysis will not be performed on media for which these procedures are not described in the approved GQAPP. Furthermore, additional data from other site investigations may become available prior to or during the completion of Phase II activities 8t Site 1. This could warrant either an increase or decrease in the scope of work proposed in this work plan.]

Based on the results of the activities identified above, during Phase II E & E will initiate the appropriate Risk Assessment and Feasibility Study activities. 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 vill be completed during Phase II.1

Feasibility Study activities, which will be required for Site 1, 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 II.]

In addition, if warranted, E & E will evaluate the Phase II results to identify whether any interim remedial measures (IRMs) are required and develop recommendations for implementation of these IRMs (see Section 14.2.[5]). [IRMS vill only be implemented following receipt of BPA approval.1

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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 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 Remedial Investigation 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 199[2] version of this document, subject to its approval. [In this section (14.2),] all references apply to the 199[2] version of the GQAPP.

14.2.1 Contaminant Source Survey

A detailed contaminant source survey will be performed at Site 1 in order to obtain a comprehensive understanding of potential contaminant source(s) at the site. The survey will focus on existing information in NAS Pensacola files, previous investigative reports, and interviews with current and former employees of the NAS Pensacola facility. Based on the information obtained from these sources, on-site past and/or present waste streams(s) and waste stream-related activities, on-site buildings and associated activities, on-site past and/or present underground utilities, and potential former and/or existing ambient sources of contamination will be delineated. 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.

The identification of possible past and/or current waste streams, including volumes, disposal methods, and/or any leaks, that may have occurred at or impacted the site will be based on a review of the Phase I historical aerial photograph analyses and Phase I and Phase II on-site

field observations. The compilation of a list of former and existing on-site buildings/structures and delineation of all associated activities will include the development of a detailed summary table and the provision of former and existing building/structure plans, if available. The evaluation of former and existing underground utilities at the site will include determining the former and current use of each utility structure. All former and existing utilities will be shown graphically on a site map (see Engineering Survey, Section 14.2.[4]), based on the detail available in the data base. Finally, 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 activities at each facility, such as aircraft operations, may have created potential, lov-level ambient contaminant source(s).

At Site 1, specific tasks associated with the contaminant source survey and focusing on historical activities will include:

- Identification of specific areas on the Sanitary Landfill where waste disposal activities occurred and coincide with findings and observations of the Phase I investigation; and
- Identification and delineation of areas where the concentrated waste disposal activities occurred.

14.2.[2] Sampling and Analysis

Figures 14-4 and 14-5 shov the proposed Phase II surface water and sediment sampling, and soil boring and monitoring well locations for Site 1, respectively. Table 14-2 summarizes the sampling and analytical requirements, including QA/QC samples, for the Phase II investigation of Site 1. Tables 14-3, 14-4, and 14-5 provide the specific rationale for each proposed Phase II surface water and sediment sample, soil boring, and monitoring well location, respectively, and for the analytical suite associated with each proposed Phase II sampling location. (Groundvater samples to be collected from the 14 existing on-site wells and analyzed for suite A, see belov, are not included in the rationale table 14-5).

The sample location reference numbers listed in Table 14-3 correspond to the location numbers on Figure 14-4; the sample location reference

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

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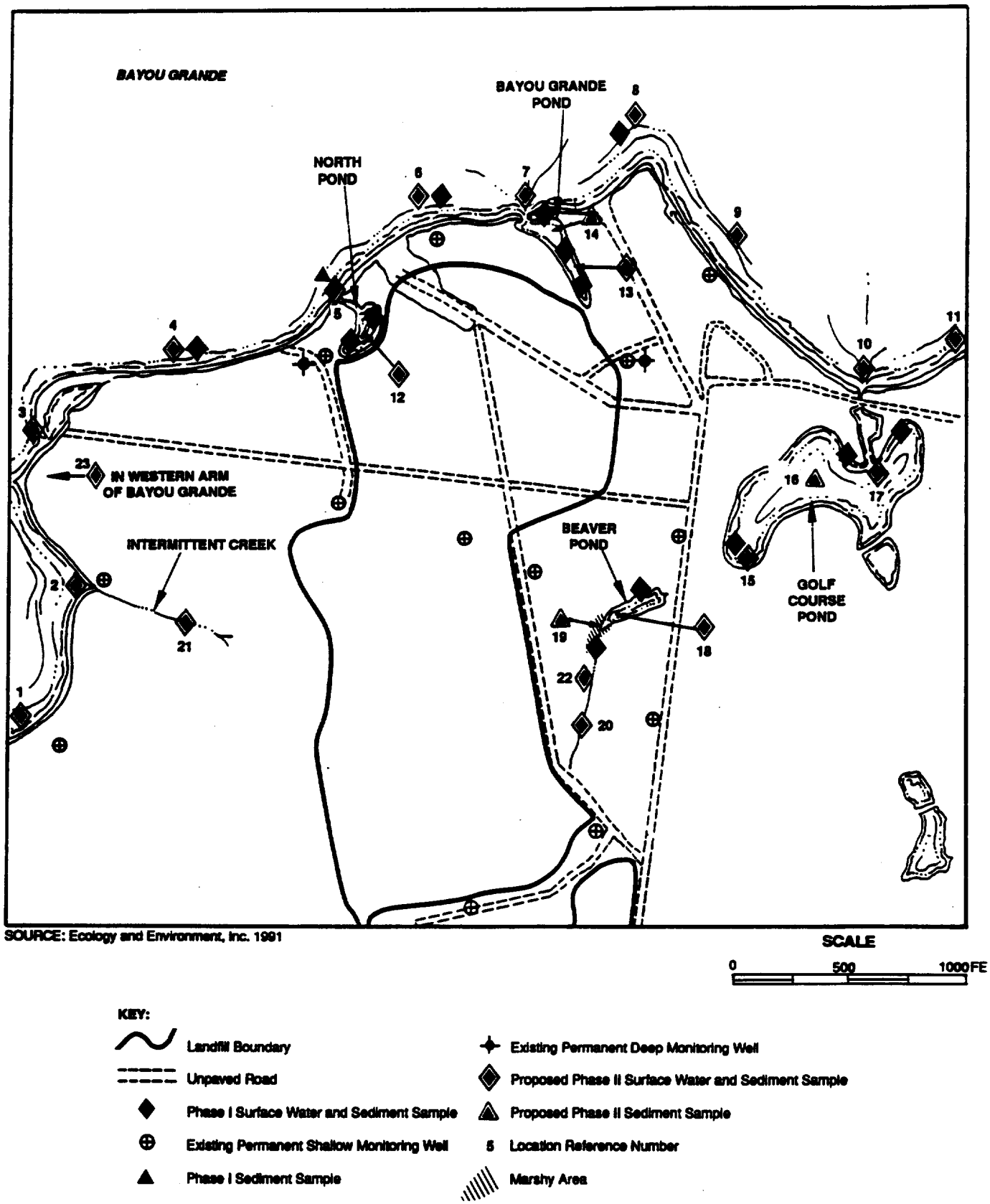
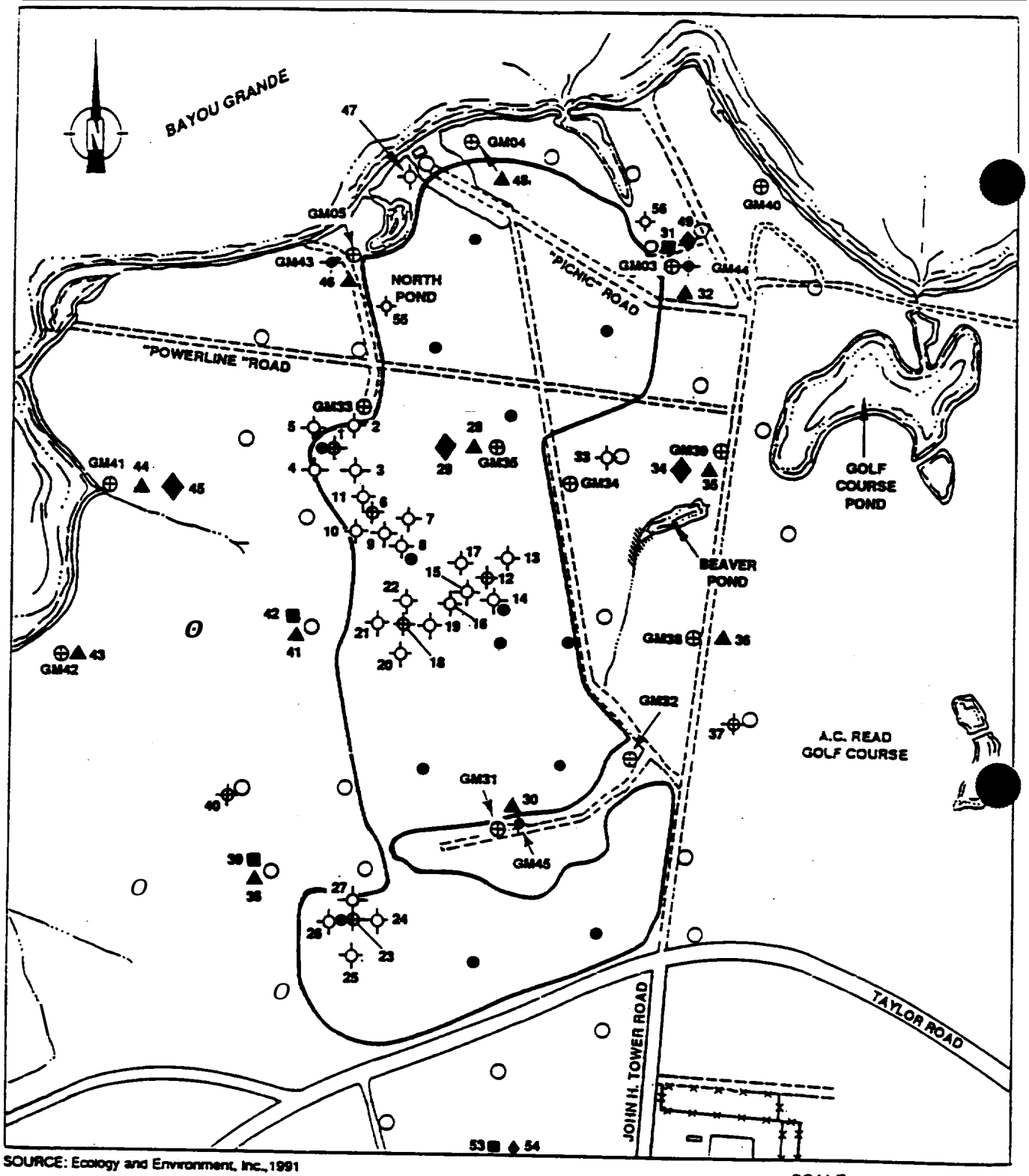


Figure 14-4 PROPOSED SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS - NAS PENSACOLA SITE 1 - PHASE II



SOURCE: Ecology and Environment, Inc., 1991

SCALE

0 500 1000 FEET

KEY:

- Landfill Boundary
- Unpaved Road
- Phase I Temporary Monitoring Well
- Phase I Surface Soil Sample
- Existing Permanent Shallow Monitoring Well
- Existing Permanent Deep Monitoring Well
- Proposed Phase II Soil Boring
- Proposed Phase II Soil Boring and Shallow Monitoring Well
- Proposed Phase II Shallow Monitoring Well
- Proposed Phase II Intermediate Monitoring Well
- Proposed Phase II Deep Monitoring Well
- 47 Location Reference Number
- Marshy Area

Figure 14-5 PROPOSED SOIL BORING AND MONITORING WELL LOCATIONS
NAS PENSACOLA SITE 1 - PHASE II

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Table 14-2

PHASE II SAMPLING AND ANALYTICAL REQUIREMENTS
NAS PENSACOLA SITE 1

Medium	No. of Samples[a]	Dupli-cates	Trip Blanks[b]	Preservative Blanks[b]	Field Blanks	Rinsate Blanks	Total[a]	Analytical Suite[c,d]
Surface Water[h]	[20]	2	--	--	2	2	[26]	A
	(1)	--	2	--	--	--	(1),2	C
	(8)	NR[e]	NR	NR	NR	NR	(8)	D
Sediment[h]	[23]	2	--	NR	NR	2	[27]	A
	(1)	--	2	NR	NR	--	(1),2	C
	(8)	NR	NR	NR	NR	NR	(8)	E
Soil[f]	[184]	18	--	NR	NR	10	[212]	A
	14	1	NR	NR	NR	--	15	B
	(1)	--	10	NR	NR	--	(1),10	C
	8	NR	NR	NR	NR	NR	8	F
	(38)	NR	NR	NR	NR	NR	(38)	E
Groundwater[g]	[50]	5	--	1	4	4	[64]	A
	(1)	--	1	--	--	--	(1),4	C
	(16)	NR	NR	NR	NR	NR	(16)	D
TOTAL	12991	28	18	1	6	18	[370]	
	(74)	NR	NR	NR	NR	NR	(76)	

14[NASP]UH1101:T0393/873/10

Key:

[a]The number of samples shown in parentheses will be analyzed for the additional parameters indicated.

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

[c]Analytical suite designations are as follows:

A = TCL VOCs; TCL base-neutral/acid extractable organic compounds (BNAs); TCL pesticides and polychlorinated biphenyls (PCBs); TRPHs; TAL metals (total [i.e., unfiltered] and dissolved [i.e., millipore-filtered, water only]); cyanide; gross alpha, beta, and gamma radioactivity; total organic carbon; total Kjeldahl nitrogen (TKN; surface water and sediment only); grain size (sediment only); hardness (water only); and alkalinity (water only).

B = TAL metals.

C = Appendix IX VOCs, BNAs, dioxins, pesticides, PCBs, organophosphorus pesticides, herbicides, total metals, cyanide, and sulfide.

D = Total suspended solids, TKN (groundwater only), ammonia nitrogen, orthophosphate phosphorus, dissolved oxygen (in field), 5-day biological oxygen demand (BOD_5), and chemical oxygen demand (COD).

E = pH, alkalinity, percent moisture, grain size (soil only), BTU content. ash content. total organic halogens, sulfur, ignitability, and cation exchange capacity.

F = Permeability only.

[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]NR = Not required.

[f]For Site 1, [28] boring locations x 6 depth intervals = 11611 samples; 4 boring locations x 2 depth intervals = 8 samples: 3 boring locations x 7 depth intervals = 21 samples at three background locations to be selected off the site. 2 samples from four on-site. deep well installation locations (total of 8 samples) for permeability analysis of confining unit matrix. [One sample from native *soil* in dry stream bed (Location 56).]

[g]For Site 1, 14 existing wells + I271 new on-site. wells ([11] shallow, 11 intermediate, and [5] deep) = [41] samples, plus 3 new off-site background shallow + 3 new off-site. background intermediate wells = 6 samples, plus 3 existing supply wells on the base = 3 samples.

[[h]Number of samples includes one background sediment/surface water sample pair collected west of Site 1 in western arm of Bayou Grande.]

Source: Ecology and Environment, Inc., 1992.

Table 14-3

RATIONALE FOR PROPOSED PHASE II SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS AND ANALYSES NAS PENSACOLA SITE 1

Location Reference Number(s)	Sample Type(s)[a]	Location Rationale	Analytical Suite(s)[b]	Analytical Rationale
1	SW SD	Hydraulically downqradiont of landfill; VOCs and BNAs dotoctod in nearby existing shallow well GM42.	A	Characterize full spectrum of potential contaminants.
2	SW ID	Hydraulically downgradient of landfill; discharge area for intermittent stream; VOCs and BNA TICs dotoctod in nearby existing shallow well GM41.	A	Characterize full spectrum of potential contaminants.
3	SW SD	Hydraulically downqradiont of landfill.	A	Characterize full spectrum of potential contaminantr,
4	SW ID	Hydraulically downgradient of landfill; nothinq dotoctod in nearby Pharo I surface wator sample SW005, but corrorponding Pharo I sediment sample SD005 containod PAHs.	A	Confirm absence of surface wator contamination 4t thir location and characterize full spectrum of potontial sediment contarinantr.
5	SW SD	Hydraulically downgradient of landfill; discharge area tor North Pond, where chlorobensene dotoctod in Phase I surface water samples SW011 and SW012.	A D,E	Characterize full spectrum of potontial contaminantr. Support potontial site remediation planning activities.
6	SW ID	Hydraulically domqradiont of landfill; VOCs and DNA TICs dotoctod in nearby existing shallow well GM04; nothinq dotoctod in nearby Pharo I rurfaco wator sample SW003, but corrorpondinq Pharo I sediment sample SD003 containod PAHs.	A	Confirm absence of rurfaco wator contamination at this location and characterize full rpocttum of potontial sediment contaminant..
7	SW ID	Hydraulically downgradient of landfill; discharge area for Bayou Grande Pond; nearby Phase I sediment sample SD002 containod PAHs.	A D,E	Characterize full spectrum of potential contaminants. Support potontial site remediation planning activities.

[a]ey at end of table.

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Table 14-3 (Cont.)

Location Reference Number(s)	Sample Type(s)[a]	Location Rational.	Analytical Suite(s)[b]	Analytical Rational.
8	SW SD	Hydraulically downgradient of landfill; nothing detected in noarby Phase I surface water sample SW001, but corresponding Phase I sodimont sample SD001 contained PAHs and TRPHs.	A	Confirm absence of surtaco water contamination at this location and characterize full spectrum of potential sediment contaminants.
9	SW SD	Hydraulically downgradient of landfill; VOCs and BNA TICs detoctod in nearby existing shallow well GM40.	A	Characterize full spectrum of potential contaminants.
10	SW SD	Hydraulically downgradient of landfill; discharge area for Golf Course Pond	A	Characterize full spectrum of potential contaminants.
11	SW SD	Extent delineation [and control for discharge area from Golf Course Pond.]	A	Characterize contaminant levels in site vicinity.
12	SW SD	Chlorobenzene detected in North Pond Phase I surfaco water sample.	A	Characterize full spectrum of potential surfaco water contaminants and confirm absonco of sediment contamination.
			D,E	Support potential site remediation planning activities.
13	SW SD	PAHs and phenols detected in Bayou Grande Pond Phase I sediment samples.	A	Characterize full spectrum of potential sediment contaminants and confirm absence of surface water contamination.
			C	Meet RCRA requirements.
			D,E	Support potential site remediation planning activities.
14	SD	Delineate extent of detoctod Phase I Bayou Grande Pond sediment contamination.	A	Characterize full spectrum of potential sodimont contaminants.
15	SW SD	PAHs and phenols detected in Golf Course Pond Phase I sodimont samples.	A	Characterize full spectrum of potential sediment contaminants and confirm absence of surfaco water contamination.
			D,E	Support potential site remediation planning activities.

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Key at end of table.

Table 14-3 (Cont.)

Location Reference Number(s)	Sample Type(s)[a]	Location Rationale	Analytical Suite(s)[b]	Analytical Rationale
16	SD	Delineate oxtent of dotoctod Phase I Golf Course Pond sediment contamination.	A	Characterise Cull rpoctrum of potential rodimont contaminantr.
17	SW SD	Outflow to Bayou Grande; delineate oxtent of dotoctod Phase 1 Oolf Course Pond rodimont contamination	A	Characterise full spectrum of potential sediment contaminants and confirm absence of surface wator contamination.
18	SW SD	PAHs and phenols dotoctod in Beaver Pond Phase I rodimont samples.	A	Characterise full rpoctrum of potential rodimont contaminantr and confirm absence of surface wator contamination.
			D,E	Support potential site remediation planning activitior.
19	SD	Define "upstream" oxtent of dotoctod Phase I Beaver Dond sediment contamination at discharge point of intormittont stream.	A	Characterise full rpoctrum of potential rodimont contaminantr.
20	SW SD	Identify potential contamination in intermittent stream closer to landfill.	A	Characterise full rpoctrum of potential contaminants;
			D,E	Support potential site remediation planning activitior.
21	SW SD	Identify potential contamination in intermittent stream close to landfill.	A	Characterise full rpoctrum of potential contaminantr.
			D,E	Support potential site remediation planning activitior.
22	SW SD	Identify potential contamination in circular pool located southwest of Beaver Pond.	A	Characterise full spectrum of potential contaminants.
23	SW SD	Background for all NAS Pensacola surface water and sediment samples.	A	Provide background concentrations for all analytical parameters.]

14[NASP]UH1101:T0393/884/7

Key:

[a]SW = Surface wator; SD = sediment.
[b]Specific parameters included within each analytical suite are given in Table 14-2.

Source: Ecology and Environment, Lnc., 1992.

VOCs = Volatile organic compounds.
BNAs = Base/neutral and acid extractable organic compounds.
TICs = Tentatively identified compounds.
PAHs = Polynuclear aromatic hydrocarbons.
TRPHs = Total recoverable petroleum hydrocarbonr.
RCRA = Resource Conservation and Recovery Act.

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Table 14-4

RATIONALE FOR PROPOSED PHASE II SOIL
SAMPLE LOCATIONS AND ANALYSES
NAS PENSACOLA SITE 1

Location Reference Number(s)	Sample Type(s)[a]	Location Rationale	Analytical Suite(s)[b]	Analytical Rationale
1-5	AWT BUT	Identify nature and extent of contamination detected in Phase I surface soil sample S005 collected in "tar pit" area, which appears as dark, linear feature on aerial photographs.	A	Characterize full spectrum of potential contaminants.
			C (Location 1 0-[1.0] ft)	Meet RCRA requirements.
			E	Support potential site remediation planning activities.
6-11	AWT BWT	Identify nature and extent of potential contamination associated with "tar pit-like," dark, linear feature identified on aerial photographs.	A	Characterize full spectrum of potential contaminants.
			E	Support potential site remediation planning activities.
12-17	AWT BWT	Identify nature and extent of potential contamination associated with dark, irregularly shaped feature identified on aerial photographs.	A	Characterize full spectrum of potential contaminants.
			E	Support potential site remediation planning activities.
18-22	AWT BWT	Identify nature and extent of potential contamination associated with "tar pit-like," dark, linear feature identified on aerial photographs.	A	Characterize full spectrum of potential contaminants.
			E	Support potential site remediation planning activities.

14[NASP]UH1101:T0393/882/7

Key at end of table.

Table 14-4 (Cont.)

Location Reference Number(s)	Sample Type(s)[a]	Location Rationale	Analytical Suite(s)[b]	Analytical Rationale
23-27	AWT BWT	Identify nature and extent of contamination detected in Phase t surface soil sample S012 collocted in "collapse-feature depression" area.	A	Characterise full spectrum ot potential contaminants.
			E	Support potential site remediation planninq activities.
29, 34, 45, 49	CUM	Deep well locationr where confining unit should bo encountered during installation.	F	Support potential site remediation planninq activitior.
33, 37, 40, 41	BWT	Evaluate potential presence of aquifer matrix roils contamination by metals based on high Phase I temporary well total metal concentrations.	E	Metals are only concern here.
			L	Support potential site remediation planning activities.
50,51,52[c]	AWT	Eackground	A	Characterise full spectrum of background levels of contamination.
	BWT		E	Characterise background levels of metals contamination below tho water table.
[55	AWT	Identify nature and extent of potential contamination associated with area of rubble-filled depression located south of North Pond.	A	Characterise full spectrum of potential contaminants.
IC	AWT	Identify nature and extent of potential contamination associated with dry stream bed that empties into south end of Bayou Grande Pond. One sample will be collected of "native" soil which is overlain by recent fill in this area.	A	Characterise full spectrum of potential contaminants.]

14[NASP]UH1101:T0393/882/7

Key:

[a]AWT = Soil samples colloctod above water table at following intervals (BLS): 0-[1.0] toot, [1.0]-2.5 toot, 2.5-5 feet, and 5-10 feet.
BWT = Soil samples colloctod below water table at following intervals (BLS): 10-15 toot and 15-20 toot.
CUM = Confining unit matrix samples tor permeability analysis to bo colloctod duriaq deep well installation.
[b]Specific parameters included within each analytical suite are given in Table 14-2.
[c]These locationr [are indicated] on Figure 14-16 (vicinity of the deep supply wells)].

RCRA = Resource Conservation and Recovery Act.

Source: Ecology and Environment, tnc., 1992.

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Table 14-5

RATIONALE FOR PROPOSED PHASE II MONITORING WELL LOCATIONS AND GROUNDWATER SAMPLE ANALYSES[a] NAS PENSACOLA SITE 1

Location Reference Number(s)	Sample Type(s)[b]	Location Rationale	Analytical Suit. (s)[c]	Analytical Rationale
1	SGW	Determine presence and nature of potontial shallow groundwatot contamination in "tar pit" area.	A	Characterize full spectrum of potential contaminants.
			C	Meet RCRA requirements.
			D	Support potential site remediation planning activities.
6, 18	SGW	Determine presence and naturo of potential shallow groundwatot contamination in "tar pit-like" areas identified on aerial photographs.	A	Charactorizo full spectrum of potential contaminants.
			D	Support potontial site remediation planning activities.
12	SGW	Determine presence and naturo of potontial shallow groundwator contamination in dark, irregularly shaped area identified on aerial photographs.	A	Characterire full spectrum of potential contaminants.
			D	Support potential site remediation planning activities.
23	SGW	Determine presence and nature of potential shallow groundwator contamination in "collapse-feature depression" area.	A	Characterize full spectrum of potential contaminants.
			D	Support potontial site remediation planning activities.
28, 30 32, 35 36, 38 41, 43 44, 46 48	IGW	Determine presence and naturo of intermediate depth groundwator contamination; proposed wells are located within or downgradient of areas of shallow contamination and are clustered with existing or proposed shallow and deep wells.	A	Charactoriro full spectrum of potential contaminants.
			D (Locations 28, 30, 35, 41, 48)	Support potontial site remediation planning activities.

14[NASP]UH1101:T0393/883/7

Key at end of table.

Table 14-5 (Cont.)

Location Reference Number(s)	Sample Type(s)[b]	Location Rational.	Analytical Suite(s)[c]	Analytical Rational.
29, 34 45, [54]	DGW	Complement existing deep well monitoring network with [four] additional deep wollr located within and down-gradient of central area of landfill.	A	Characterise Cull spectrum of potential contaminantr.
			D	Support potontial site romodiation planning activities.
			[(locations 29, 34, and 45)]	
31	SOW	Replace woll GM03, which has boon buried/ destroyed during regrading activities in tho area.	A	Characterise Cull spectrum of potontial contaminants.
			D	Support potential site remediation planning activities.
37, 40	SOW	High total metals concentrations detected in Phase I temporary wells TW012 and TW022.	A	Characterise full rpocttum of potontial contaminants.
			D (Location 37)	Support potential site romodiation planning activities.
39, 42	SOW	High VOC and/or phenol concentrations detected in Phase I temporary wollr TW018 and TW025.	A	Characterise Cull spectrum of potontirl contaminants.
			D (location 39)	Support potential site romodiation planning activities.
49	DGW	Replace woll GM44, which has boon buried/ destroyed during regrading activities in tho area.	A	Characterise Cull spectrum of potontial contaminants.
[53	SGW	Confirm presence or absence of contamination in this area. Clustered with deep well to also provide vortical control.	A	Characterise full spectrum of potontial contaminants.]

Key:

14[NASP]UH1101:T0393/883/7

[a]All 15 existing wollr will also bo sampled during Phase II for analytical suite A (roo Table 14-2).
[b]SGW = Groundwater sample from shallow monitoring woll; IGW = groundwater sample from intermediate monitoring well; DGW = groundwater sample from deep monitoring woll.
[c]Specific parameters included within each analytical suite are given in Table 14-2.

RCRA = Resource Conservation and Recovery Act.
VOC = Volatile organic compound.

Source: Ecology and Environment, Inc., 1992.

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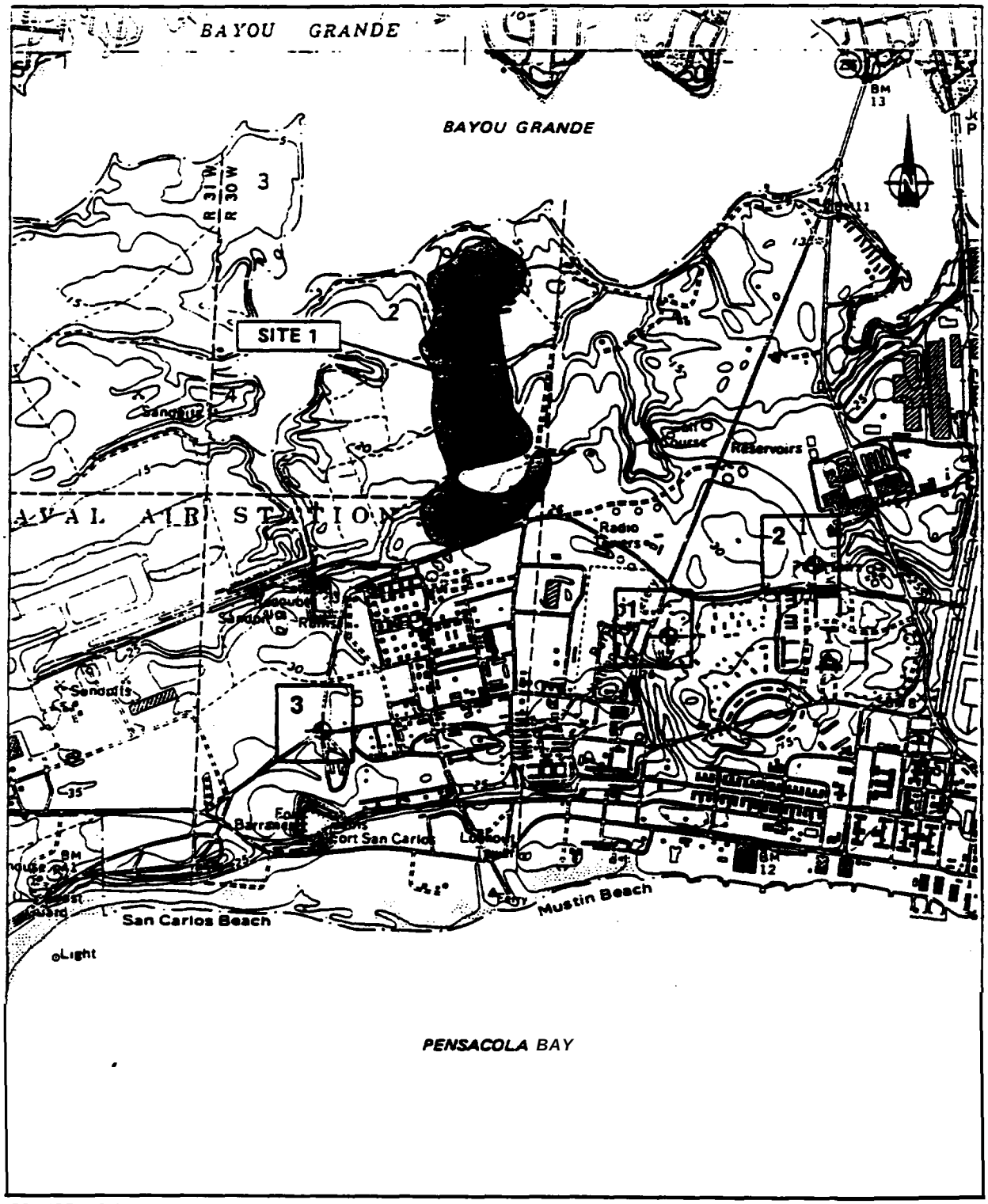
numbers listed in tables 14-4 and 14-5 correspond to the location numbers on Figure 14-5. The analytical suite designations used in tables 14-3, 14-4, and 14-5 correspond to the designations used and defined in Table 14-2.

It is proposed to sample all existing wells and all newly installed wells for analytical suite A during Phase II to provide a uniform, time-synchronous perspective on Site 1 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, [clustered vith the existing deep supply vells (see Figure 14-6). These background soil borings and monitoring vells,] together with the three existing [on-base] deep supply wells, [vill be] sampled for analytical suite A [(see Table 14-2)].

(Soil samples collected below the water table [BUT] 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. These background soil and groundwater samples have only been included in the sampling and analytical requirements for [Group A —]Site 1.

Table 14-2 indicates that one sample from each medium will be additionally analyzed for analytical suite C (Appendix IX parameters) [and also notes] that for these samples, suite A analyses will only be performed for parameters not encompassed by Appendix IX (e.g., gross alpha, beta, and gamma radioactivity). Furthermore, it should be noted that trip blanks will not be analyzed for the full Appendix IX suite of parameters, but only for the Appendix IX VOCs. Finally, it should also be noted that the number of required trip blanks shown on Table 14-2 reflects the total number of trip blanks required to be collected for both the suite A and C samples.



SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangles: Fort Barrancas, Fla. 1970 and West Pensacola, Fla. 1970 Photorevised 1987; Geraghty and Miller, Inc. 1984.

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Supply Well Location and Number

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Figure 14-6 LOCATION OF EXISTING DEEP ZONE SUPPLY WELLS —NAS PENSACOLA

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As noted above, tables 14-3, 14-4, and 14-5 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:

- o Area of known contamination,
- o Area of potential contamination, or
- o 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. The specific, detailed rationales provided in tables 14-3, 14-4, and 14-5 for each sampling location or group of locations clearly meet one or more of the three general criteria defined above.

All three of the above criteria must be met in order to complete a Baseline Risk Assessment and Feasibility Study for the site. Furthermore, in most instances, meeting the above criteria requires that the collected samples be analyzed for the full suite of parameters in analytical suite A. However, in some cases (e.g., evaluation of potential aquifer matrix contributions to the high total metal concentrations detected in Phase I temporary well groundwater samples), a more limited analytical program (e.g., metals only in soils collected BWT) is warranted.

Finally, to support potential remediation planning activities for this site, selected samples from each medium also must be analyzed for those parameters which directly control the viability of various remedial alternatives (see analytical suites D and E, Table 14-2).

14.2.[2].1 Surface Water and Sediment Sampling

During the Phase II investigation at Site 1, surface water samples will be collected at [20] locations and sediment samples vill be collected at [23] locations. As shown on Figure 14-4, combined surface water and sediment sampling locations are as follovs: 11 locations in Bayou Grande (four of which are at discharge points from other surface vater bodies), one sample from the intermittent creek on the west side of the site, one sample from North Pond, one sample from Bayou Grande Pond, two samples from Golf Course Pond, one sample from Beaver Pond, and one sample from the creek that flows from Beaver Pond. In some areas, additional sediment samples will be collected including: one in Bayou Grande Pond, one in Golf Course Pond, and one in Beaver Pond. [In addition, one background surface water/sediment sample pair will be collected vest of Site 1 in the vestern arm of Bayou Grande (see Figure 14-6. These background samples vill be the background samples for all 39 NAS Pensacola sites and will aid in the evaluation of potential, basewide, ambient contaminant sources.)

Surface water samples will be collected in accordance with Section 6.9.1 of the GQAPP. Surface water samples collected at locations in surface water bodies shallower than 1 foot will be collected at the surface [and, whenever possible, directly into the sampling container. If not possible,] a glass or stainless steel beaker or similar sampling device (will be used). Samples collected from water deeper than 1 foot will be collected vithin 1 foot of the bottom using a Kemmerer or similar sampling device. Surface water samples collected in Bayou Grande will be collected approximately 30 to 50 feet from the shore; However, those surface water samples to be collected at surface water body discharge points to Bayou Grande will be collected immediately adjacent to the discharge point. During collection of surface vater samples, the surface water pH, temperature, specific conductance, dissolved oxygen, and turbidity will be recorded in the field notebook. In addition, the water depth and tidal stage for each sample vill be recorded in the field notebook. Equipment decontamination will be conducted in accordance with Section 6.10 of the GQAPP.

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

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Sediment samples will be collected in accordance with Section 6.9.2 of the GOAPP. Sediment samples will be collected at depths of surface to 0.5 foot below the surface with one of the following: a stainless steel trowel, a bucket-type mud auger, an Eckman dredge, or other coring device. Sediment samples collected in Bayou Grande will be collected approximately 30 to 50 feet from the shore. However, those sediment samples to be collected at surface water body discharge points to Bayou Grande will be collected immediately adjacent to the discharge point. The composition of sediment materials retrieved will be recorded in the field notebook. Equipment decontamination activities will be conducted in accordance with Section 6.10 of the GOAPP.

All [20] surface water and all [23] sediment samples will be analyzed for the analytical parameters included in analytical suite A (see Table 14-2). In addition, one of the [20] surface water samples and one of the [23] sediment samples will be analyzed also for the Appendix IX parameters included in analytical suite C (sample location 13; see Figure 14-4 and tables 14-2 and 14-3), and eight of the [20] surface water samples and eight of the [23] sediment samples will be analyzed also for the parameters included in analytical suite D (sample locations 5, 7, 12, 13, 15, *18*, 20, and 21; see Figure 14-4 and tables 14-2 and 14-3).

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

14.2. [2].2 soil Sampling

During the Phase II soil boring and monitoring well installation (sections 14.2.[2].3 and 14.2.[2].4), soil samples will be collected at [37] locations across Site 1 (see Figure 14-5). At an additional three locations (shown on Figure 14-6,] background soil samples will be collected. 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, except as noted below, composite samples will be collected from each of the following depth intervals: 0 to [1.0] foot BLS, [1.0] foot to 2.5 feet BLS, 2.5 to 5 feet BLS, and then every 5-foot interval to a depth 10 feet below the vater table. For the purpose of estimating sample numbers, the depth to the water table is assumed to be 10 feet BLS. At the four soil boring locations outside the landfill boundary (see Figure 14-5), soil samples will be collected only from two depth intervals BUT: 0 to 5 feet BUT and 5 to 10 feet BUT. [At **Phase** II sample **location 56 (see** Figure 14-5 **and** Table 14-4) one **sample** will be collected in a **dry** stream **bed** of "native" soil, **which,** in **this area, is overlain by recent** fill.]

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.

One hundred and [eighty-four] of the [206] soil samples will be analyzed for the parameters included in analytical suite A ([32] sample locations, including the three background locations; see figures 14-5 [and 14-61 and tables 14-2 and 14-4). Fourteen of the [206] soil samples (not of the [184] discussed above) will be analyzed for the parameters included in analytical suite B (sample locations 33, 37, 40, and 47, outside the landfill boundary, and the three background locations 50, 51, and 52 (sample intervals BUT only]). In addition, one of 191 (177 and 14) soil samples (sample location 1) will be analyzed also for the parameters included in analytical suite C, and 38 of 191 soil samples will be analyzed also for the parameters included in analytical suite E. The remaining eight of the [206] soil samples will be analyzed for analytical suite F only (sample locations 29, 34, 45, and 49; see Pigure 14-5 and tables 14-2 and 14-4).

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.

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14.2.[2].3 Soil Boring Completion and On-site Permanent Monitoring Well Installation and Development

A total of [27] permanent monitoring wells will be installed at Site 1. These wells will be located and designed to supplement the Phase I investigation results regarding the lateral and vertical extent of groundwater contamination. The number and target completion depths of these wells are as follows:

- [Blevenj shallow wells, each of which will be approximately 20 feet deep (one of these is proposed to replace existing damaged well GM03);
- Eleven intermediate wells, each of which will be approximately 40 feet deep; and
- [Five] deep wells, each of which will be approximately 65 feet deep (one of these is proposed to replace existing damaged well GM49).

Figure 14-5 shows the locations of the proposed monitoring wells for each of the three depth intervals at Site 1, and Table 14-5 provides the rationale for each of the monitoring well locations, target depths, and corresponding sampling analytical requirements.

In order to detect the presence of any floating product at Site 1, the [11] 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 intermediate and deep wells will be installed to investigate the vertical extent of possible groundwater contaminants, particularly any dense non-aqueous phase liquids (DNAPLs) at Site 1. The 11 intermediate wells will be completed into the lower portion of the surficial zone immediately above the first confining/semi-confining unit. These intermediate wells are expected to be approximately 40 feet deep. The [five] deep wells will be completed into the upper portion of the main producing zone of the Sand-and-Gravel Aquifer immediately below the first confining/semi-confining unit. These deep wells are expected to be approximately 65 feet deep. [Four] of the [five] deep wells will be clustered with one intermediate and one shallow well to assist in

delineating the vertical extent of any contamination at that location as wall as determine the vertical hydraulic gradients between the three monitored zones (see Figure 14-5).

The shallow wells and the majority of the intermediate vells 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.

To prevent the potential downward migration of any shallow contaminants during drilling, intermediate well location 28 (see Figure 14-5) and the [five] deep wells will be installed, using either hollov-stem auger or hydraulic rotary methods, through 8-inchdiameter PVC surface casings. The surface casings will be grouted in place and alloved to set 24 hours prior to drilling the well borehole to the target depth, in accordance with Section 6.7.4 of the GQAPP. The intermediate well surface casing will be set at approximately 30 feet BLS, and the deep vell surface casings will be set several feet into the first confining/semi-confining unit. The [five] deep wells and one intermediate vell installed through the surface casings will be constructed in the same manner as the shallow wells. All drilling and finished monitoring vell construction will be conducted in accordance vith sections 6.7.2 and 6.7.3 of the GQAPP. In addition, all Site 1 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 vell boreholes, continuous spit-spoon samples will be collected to the target completion depth of *each* vell in accordance with Section 6.7.2.3 of the GQAPP. Where wells are constructed in clusters, split-spoon samples will only be collected during drilling of the deepest vell borehole. In addition, during the drilling of each of the deep wells, two Shelby-tube samplers, 2 feet in length, will be driven into the first confining/semi-confining unit to obtain samples for laboratory permeability testing.

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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 GOAPP. 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].4 Background Permanent Monitoring Well Installation and Development

In order to adequately characterize the background level of potential soil and groundwater contaminants in the vicinity of NAS Pensacola, one shallow and one intermediate well will be drilled at each of three separate locations off Site 1. (The background well locations are not included on Figure 14-[5].) These locations will be selected on the basis of land use not directly associated with an obvious source of pollution. To optimally locate the shallow and intermediate background wells with deep wells, preference will be given to areas in proximity to the three inactive NAS Pensacola supply wells that tap the main producing zone of the Sand-and-Gravel Aquifer [(see Figure 14-6)).

Each of the proposed background shallow and intermediate wells will be drilled in conjunction with the Phase II well installation activities at Site 1, and will be constructed in an identical manner to the shallow wells proposed for Site 1. All drilling and finished monitoring well construction will be conducted in accordance with sections 6.7.2 and 6.7.3 of the GQAPP. Each background well will be finished at the surface with an above-grade, steel surface casing and locking cap or at surface grade with a flush-mount security cover and locking cap.

In conjunction with the drilling of the intermediate background well boreholes, continuous split-spoon samples will be collected to the

target completion depth of each well for soil analytical and lithologic logging purposes. These composite soil 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 a depth 10 feet below the water table.

Development of the background wells will be conducted in accordance with Section 6.7.5 of the GQAPP. All drilling and sampling equipment will be decontaminated prior to use and between installation of each well in accordance with Section 6.10 of the GQAPP.

14.2.[2].5 Groundwater Sampling

During Phase II at Site 1, groundwater samples will be collected from 14 existing on-site monitoring wells, [27] newly installed on-site monitoring wells, six newly installed background monitoring wells, and three existing supply wells (set figures 14-5 [and 14-61). 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.

All [50] groundwater samples will be analyzed for the parameters included in analytical suite A. In addition, one of the [50] samples (sample location 1) will be analyzed also for the parameters included in analytical suite C, and 16 of the [50] samples will be analyzed also for the parameters included in analytical suite D (see Figure 14-5 and tables 14-2 and 14-5).

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

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.

14.2.[3] Hydrologic Assessment

The main objective of the Phase II hydrologic assessment is to further delineate the [hydrogeologic character] of the underlying aquifer at Site 1. Slug and short-term specific capacity tests, rather than a [long-tern] pump test, have been proposed for Phase 11 because the location and distribution of contaminants in the various zones of the underlying aquifer have not yet been precisely determined. The hydrologic assessment at Site 1 will include a wellhead elevation survey of all the newly installed permanent monitoring wells; static water level measurements in all the on-site wells and on-site and/or adjacent surface water bodies; short-term specific capacity and/or slug tests on all the newly installed permanent wells; and measurement of tidal currents, wind, and/or stream flow at appropriate surface water locations.

All 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. In addition, staff gauges will be placed in all surface water bodies on site and will be surveyed relative to the same datum as the wells.

At Site 1, static water levels will be measured in all the existing and proposed on-site wells and in the on-site water bodies on at least four occasions: once during 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 1.

Limited aquifer testing will be conducted at Site 1 on all newly installed monitoring wells. This testing will consist primarily of performing short-term specific capacity tests on wells that are capable of sustaining a measurable yield. The specific capacity testing at Site 1 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, intermediate, and/or deep 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. The procedure for slug testing involves measuring the initial static water level in the well and then injecting or withdraving 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.

At each surface water sampling location in Bayou Grande, the prevailing current direction and velocity, wind direction and velocity, water depth, and tidal phase will be recorded during the time of sampling. In addition, in order to evaluate tidal effects on nearsbore areas, these measurements will be recorded at these same locations during high tide, low tide, and mid tide. For all inland surface water bodies on Site 1 in which a flow is noted, velocity, discharge, and stream elevation data will be recorded at the same time that water levels are measured in the

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on-site monitoring wells. A rain gauge will be installed at or near the site and monitored regularly over the course of 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 [July 1992] for a description of the Phase II report.

14.3 Phase III--Extent Delineation

Phase III tasks will be conducted based on the results of phases I and 11, [if deemed necessary.] Although the earlier phases are intended to identify and characterize areas and contaminants of primary concern as they extend laterally from the landfill source(s), Phase III activities will be geared toward further delineating the horizontal and vertical extents of contamination.

14.3.1 Biota Sampling

If deemed appropriate based on the findings of phases I and II, additional biota sampling may be conducted in Phase III. [If required,] a separate biological sampling plan will be prepared. Biota sampling for Site 1 ray potentially include the collection of aquatic vegetation and fauna from the Golf Course Pond, North Pond, the Bayou Grande Pond, and/or Bayou Grande. [Basewide biota sampling will be conducted as part of the investigation of OUs 15, 16, and 17.]

14.3.2 Soil Sampling

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

14.3.3 Shallov Monitoring Well Installation and Development

Additional shallow monitoring vells may be required to further determine the horizontal extent of any shallow groundwater contamination detected in phases I and 11.

14.3.4 Intermediate and Deep Monitoring Well Installation and Development

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

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14.3.5 Groundvater Sampling

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

14.3.6 Hydrologic Assessment

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

[14.3.7 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 vith 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 draving will be produced in mylar and blueline copies; the CAD file for the draving will be kept on diskette.]

14.3.[8] Air Sampling

The need for formal air sampling during Phase III and the techniques to be employed are dependent upon the findings of phases I and 11.

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14.4 Phase IV--Extent Delineation

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

- o Shallow monitoring well installation and development;
- o Intermediate and deep monitoring well installation and development;
- o Groundwater sampling;
- o Eydrologic 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 **QA/QC** Samples

Samples collected for laboratory analysis (both screening and non-screening) during all phases of fieldwork will require the preparation of field QA/QC samples as described in Section **[11.1]** of the GQAPP. The estimated numbers of required field QA/QC samples for phases I and II are shown in tables 14-1 and 14-2.

14.[6] Decontamination and Waste Management Procedures

14.[6].1 Decontamination Procedures

All equipment decontamination procedures for Site 1 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 accordwith Section 6.11 of the GQAPP and EPA's guidance for investigation-derived waste.] All vater generated during monitoring well purging

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and development activities on Site 1 will be discharged onto the ground surface away from the well, or will be containerized, labeled, and moved to a storage area on NAS Pensacola, as directed by the Navy.

Any excess soil auger cuttings generated by soil boring or monitoring well installation activities will be disposed of on the landfill or will be containerized, 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 disposable materials, will be containerized, 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 GSWP. 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 GSWP.

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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:

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

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

To obtain a prediction of plume extent without remediation, E & E will illustrate organic and inorganic simulations for the current time and for one, five, and 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; FEMWATER, a finite-element groundwater model; and FEMWASTE, a finite-element solute transport model.

17. TREATABILITY STUDY

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

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18. BASELINE RISK ASSESSMENT

As part of the Remedial Activities Investigation, a baseline risk assessment will be conducted to determine the level of effort required in the Feasibility Study for remedial actions. The baseline risk assessment will provide an evaluation of the potential threat to human health and the environment in the absence of any remedial action, by providing the basis for determining whether or not remedial action is necessary and the justification for performing any remedial actions. **[The** risk assessment will be performed **in** accordance **with EPA's** 1989 documents, Risk Assessment Guidance for **Superfund:** Volumes I and **II.]**

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

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. [The identification of contaminants of concern will be conducted in accordance with the previously referenced risk assessment guidance documents (BPA 1988a, 1988b).]

18.2 Exposure Assessment

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

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

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

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

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18.3 Toxicity Assessment

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

18.4 Risk Characterization

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

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

- Distance to the closest residence (on or off NAS Pensacola);
- Type of barrier, if any, to prevent access;
- 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 Feasibility Study should be appropriately scaled dovn 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 revieving 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.

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19. FEASIBILITY STUDY

Further details on the specific tasks to be performed as part of the Feasibility Study 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 Feasibility Study, E & E will prepare a summary of field data collected during the Remedial Investigation to compare and evaluate the concentration of the contaminants of concern with the cleanup criteria developed. E & E will prepare a qualitative and quantitative summary of contamination for the scenarios identified during the risk assessment evaluation. The results of this evaluation will serve as a basis for screening applicable remedial technologies for the development and evaluation of remedial action alternatives. [All Feasibility Study tasks will be performed in accordance with EPA's current document, Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA (BPA 1988b)]. If any of the procedures described in this section are in conflict with the current BPA guidance document, the methods described in the EPA guidance document will be followed.]

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 6 E will consider all ARARs, identify problems, and determine pathways of contamination using a receptor-oriented approach based on the threat to the public health, welfare, and the environment. In this summary, pathways will be outlined for each

medium of concern. E & E then will identify applicable remedial technologies for each general response action such as contaminant removal, treatment, disposal, and so on. The identification of technologies will be based on technical selection criteria and E & E's engineering judgment.

19.2 Assessment of Applicable Remedial Technologies

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

19.3 Risk Assessment

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

19.4 Development and Evaluation of Remedial Action Alternatives

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

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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 Feasibility Study report will be provided to the Navy for review and comments.

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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 will be to summarize the findings of Phase I and provide recommendations for the Phase II investigation; the Phase I interim report will not be a formal report. (In general, during the proposed multi-phase investigation process, formal reports will be generated only when little or no additional assessment work appears to be required.) Following the Phase I interim report, the work plans for the Phase II work will be updated accordingly. If the results of Phase II indicate that additional investigation is not warranted, a formal Remedial Investigation report will be produced. However, if the Phase II results indicate that additional investigation is required, the Phase II report will be produced as the Phase II Interim Data Report and will only summarize the Phase II results and provide recommendations for the Phase III investigation. Thus, the Phase II interim report will not be a formal document. Following production of the Phase II interim report, the work plans for the Phase III work will be updated. Once the Phase III investigation is complete, all results will be synthesized and presented in a Remedial Investigation report.

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

For all reports, E & E will prepare a 100% draft report for the Navy and Technical Review Committee (TRC) review. The TRC review comments will be incorporated into draft final reports which will be resubmitted to

the TRC for final approval. The draft final report will then become final if no further comments are received from the TRC.

Each report will be written as an independent document, complete in its own right, and fully supportive of the conclusions vhich 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.]

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21. DOCUMENT REVISION

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

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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 GPHP 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, III, and IV, respectively. Given that the scopes of work for Phase II and beyond are dependent on the results of the preceding phases, the project schedules for phases XI, III, and IV are tentative. In addition, the length of time between phases is subject to the schedule in the Federal Facilities Agreement Site Management Plan (FPASMP). The schedule in the FFASMP will be updated yearly.

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

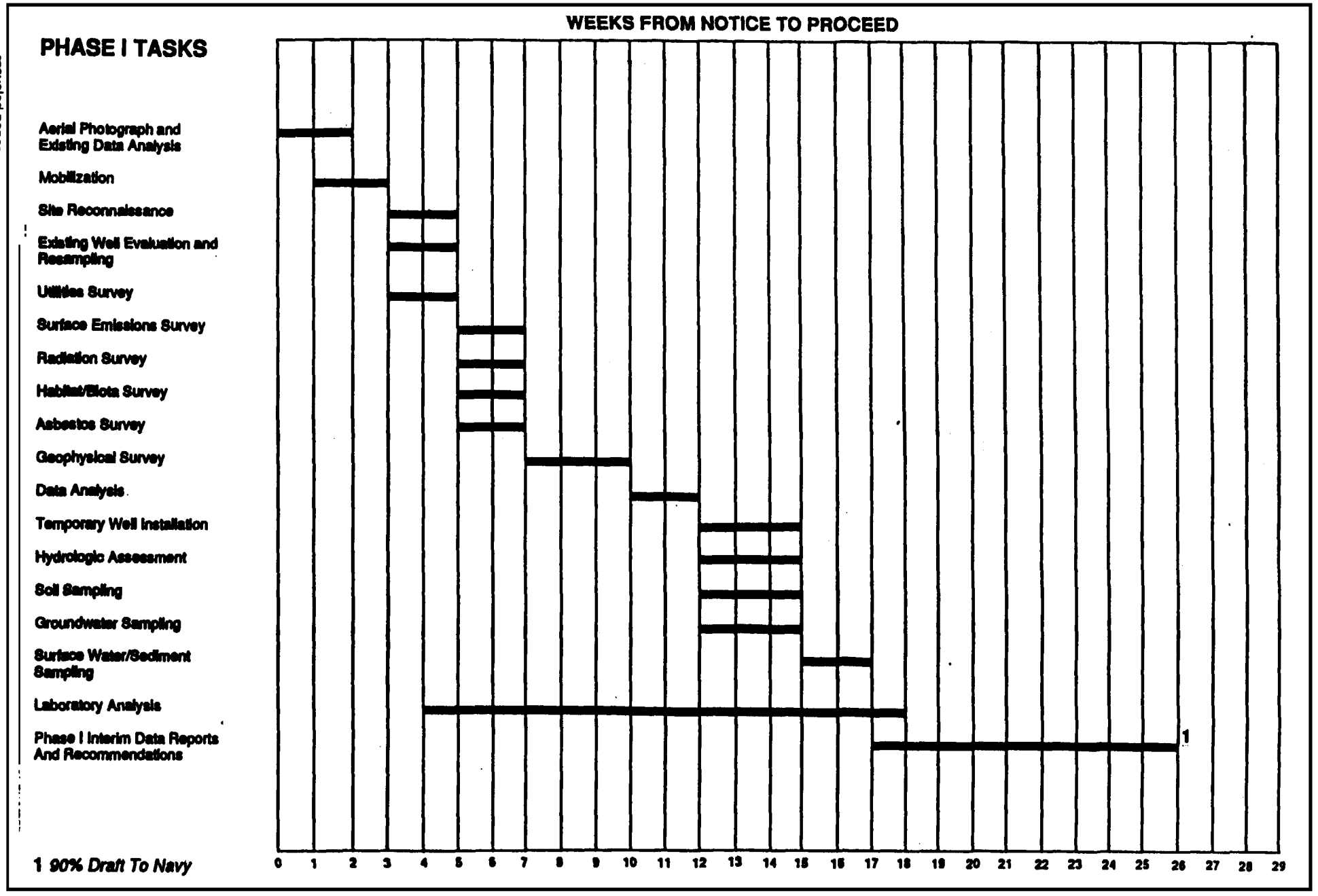

Figure 23-1 PHASE I PROJECT SCHEDULE -- GROUP 2

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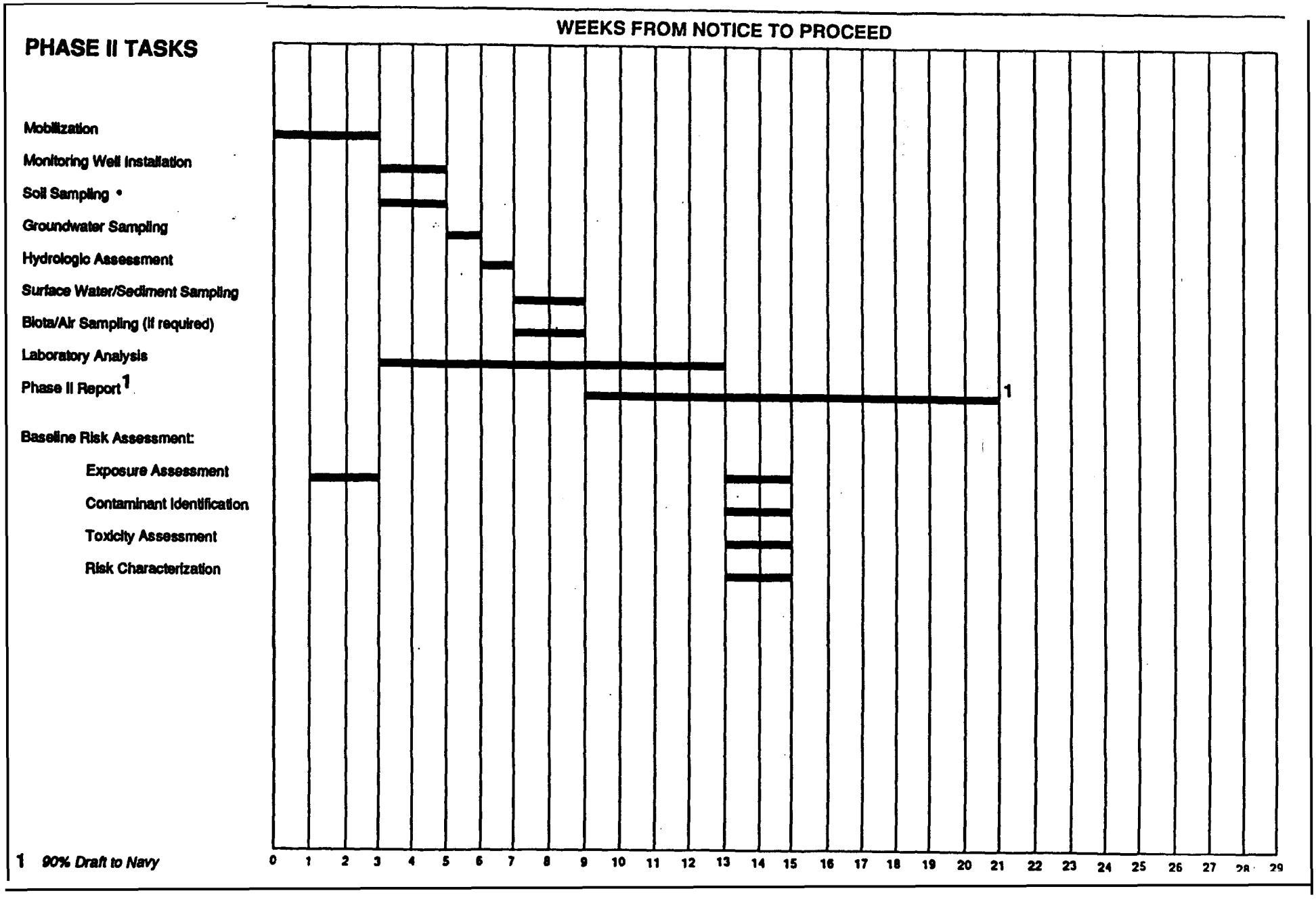

Figure 23-2 PHASE II PROJECT SCHEDULE -- GROUP A

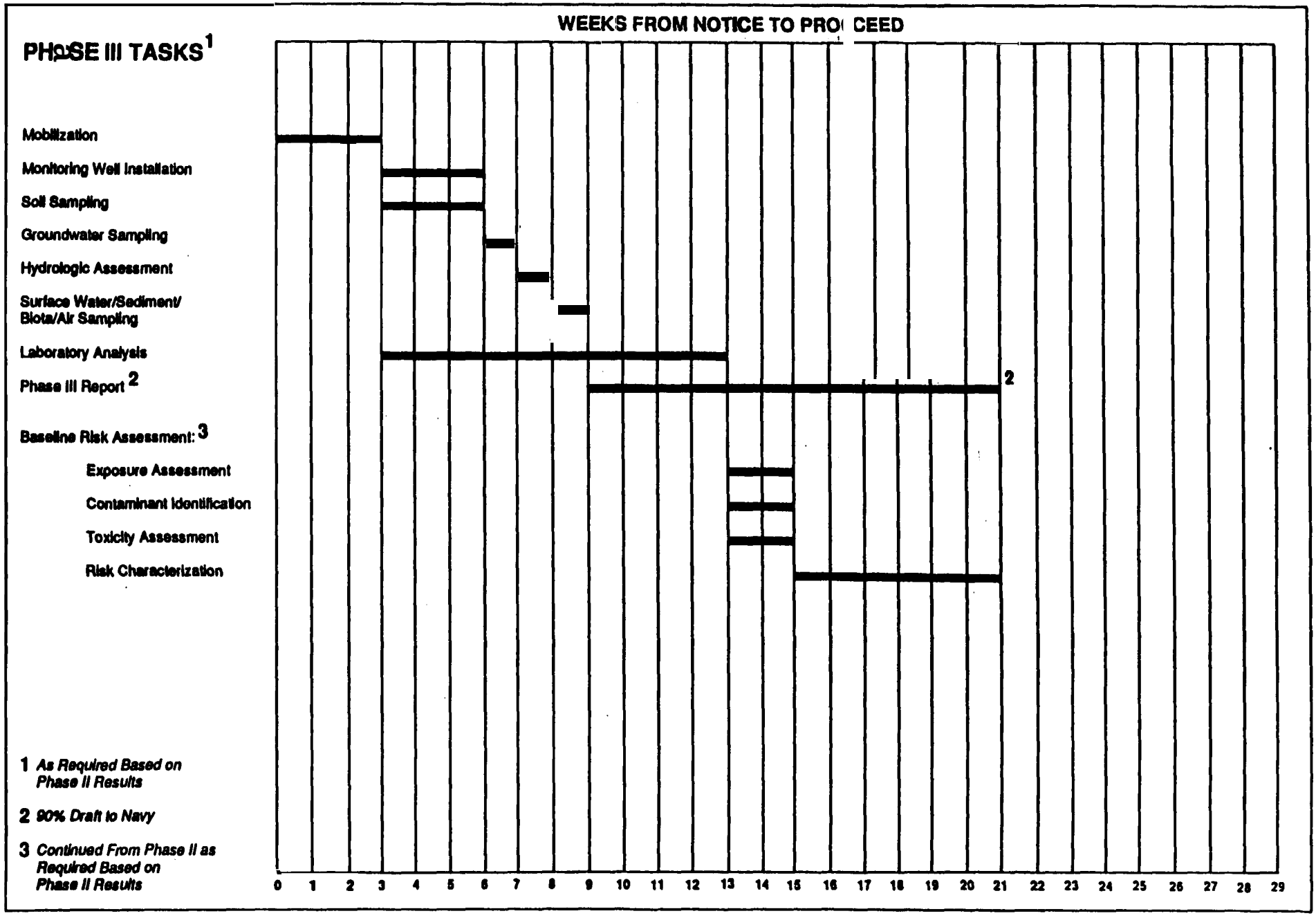

Figure 23-3 PHASE III PROJECT SCHEDULE – GROUP A (SITE 1)

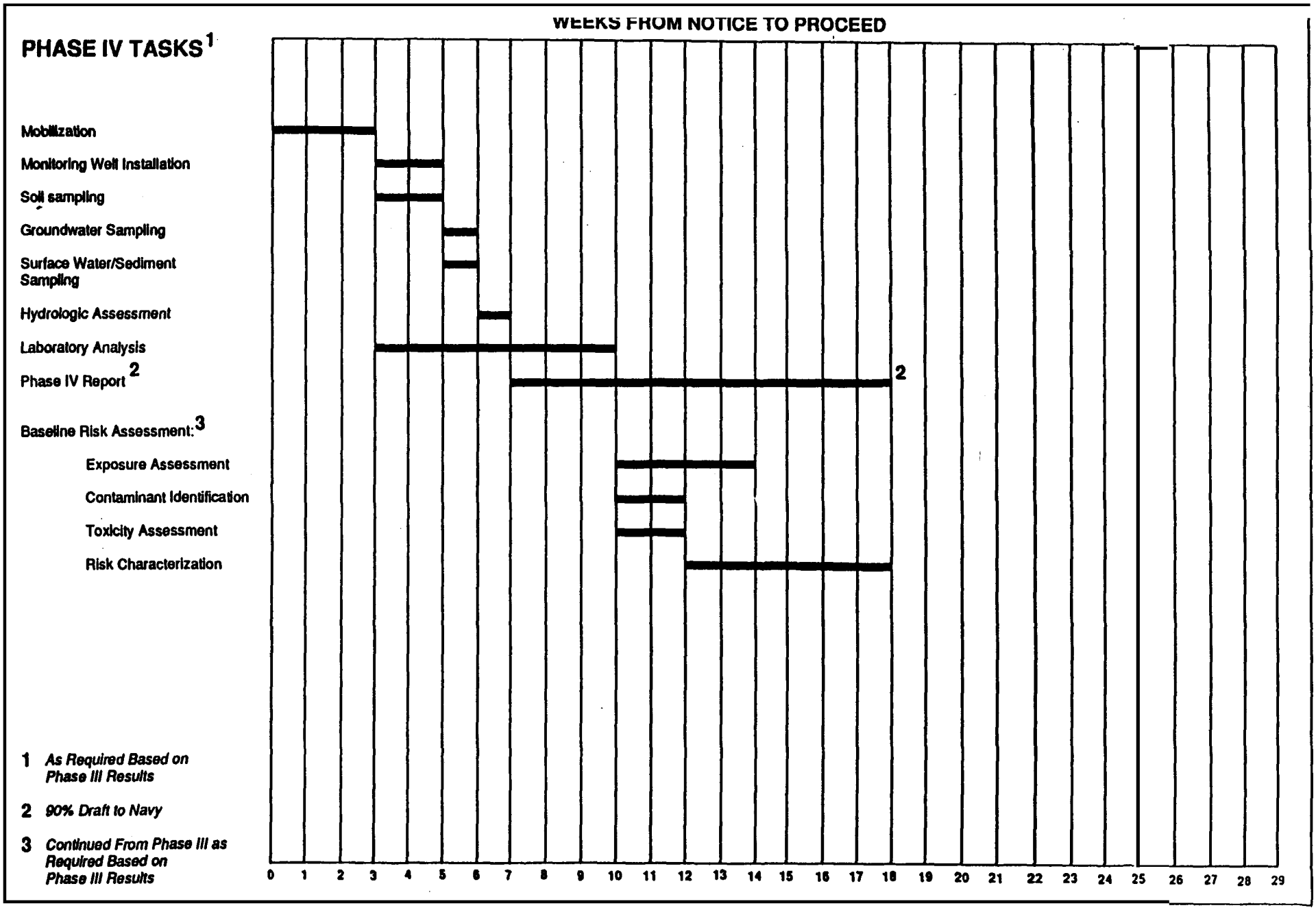

Figure 23-4 PHASE IV PROJECT SCHEDULE – GROUP A

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25. FLORIDA PROPBSSIONAL GEOLOGIST SEAL

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

Name: Barry R. Levine

License Number: P.G. No. 259

State: Florida

Expiration Date: July 31, 1992

Barry R. Levine

Barry R. Levine

7-7-92

Date

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APPENDIX A

SITE-SPECIFIC SAFETY PLAN

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SITS SAFETY PLAN

Version 988

A. GENERAL INFORMATION

Project Title: Site 1 - Sanitary Landfill

Project No.: UH1101

TDD/Pan No.:

Project Wnager: John Barksdale

Project Dir.: Rick Rudy

Location(s): sanitary Landfill - 1/2 mile northeast of Sherman Field.

Prepared by: Hal Davis

Date Prepared: 5-19-89

Approval by: W r y Miller

Date Approved: 5-20-89

Site Safety Officer Review:

Date Reviewed:

Scope/Objective of Work: Physical surveys, surface water and sediment sampling, temporary well installation, groundwater sampling, soil saapling, and hydrologic assessment.

Proposed Date of Field Activities: May 1989

Background Info: Complete: [X] preliminary (No analytical data available) [1

Documentation/Summary:

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

a. SITS —— CHARACTERISTICS

Waste Type(s):

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

Characteristic(s):

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

Other:

Physical Hazards:

Overhead [X]	Confined* Space [ ]	Below Grade [ ]	Trip/Fall [X]
Puncture [ ]	Burn [1	Cut [ ]	Splash [X]
Noise [X]	Other: Near active air field. Heat/cold stress.		

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

Site History/Description and Unusual Features (see Sampling Plan for detailed description):

The landfill was used from the 1950s until 1976 and contains a varied collection of wastes.

Locations of Chemicals/Wastes: Surface, subsurface

Estimated Volume of Chemicals/Wastes: unknown

Site currently in Operation **Yes:** [X] no: [ ]

---

e. HAZARD EVALUATION

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

Physical Hazard Evaluation:

1) **Physical Hazards - Walking in swamps and** creek:

2) **Groundwater** sampling - Splash

3) Soil **Sampling**

4) **Hydrologic Assessment - Splash, personal contamination, automobiles.**

5) **Decontamination Procedures - Using solvents**

***Team members will proceed with caution into wet, marshy and overgrown areas to avoid rattlesnakes and water moccasins.**

Chemical Hazard Evaluation:

Compound	PEL/TWA	Route of Exposure	Acute symptoms	Odor Threshold	Odor Descripti
Methylene Chloride	**500 ppm**	Inh, Cong	Dirsy, Naus, Vomit	**214 ppm**	sweet odor
1,1,1-Trichloroethane	350 **ppm**	Inh, Ing, *Con*	Dizzy, Naus, Vomit	20-100 ppm	chloroform-like
Isopropyl Alcohol	440 **ppm**	" " "	Drowsiness, head.	**7.S-200 ppm**	rubbing **alcohol**
Nitric Acid	**2 ppm**	" " "	Corrosivo	**0.3-1 ppm**	acrid
Naphthalene	10 ppm	" " "	**Naus,** sweat	0.3 ppm	**mothballs**
Benzene	**1 ppm**	" " "	Naus, dizzy, vomit	odorless	odorless
Vinyl chloride	**1 ppm**	Inh, Con	Clear, rough	. 210 ppm	aromatic
1,1-Dichloroethane	100 ppm	**Inh,** Ing, Con	CNS depression		? like
Toluene	**200 ppm**	Inh, Ing, Abs	Fatigue, head	0.17 ppm	aromatic
Xylene	100 ppm	Inh, Ing, **Abs**	Head, naus, *cough*	0.05 ppm	
1,2-Dichlorobenzene	**300 mg/kg**	" " "	Head, vomit, naus	2-30 ppm	
1,2-Dichloroethane	0.01 f/cc	" " "	?, **head,** vomit	6 ppm	sweetish
Chromium	**1 mg/kg**	**Inh, Ing**	**?**	**N/A**	
Sodium Hydroxide	**2 mg/m^3**	**Inh, Ing, Con**	**Corrosive**	**N/A**	**odorless**
Sulfuric Acid	**1 mg/m^3**	**Ing, Derm, Inh**	**Corrosive**	**N/A**	**odorless**
Hydrochloric Acid	**5 ppm**	**Inh, Ing, Derm**	**Corrosive**	**Unknown**	**acrid**

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

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D. SITE SAFETY WORK PLAN

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

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

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

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

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

	A	B	C	D
Task 1				X
Task 2			X	X
Task 3			X	X
Task 4			X	X
Task 5			X	X
Task 6				X

(Expand if necessary)

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

- Level D: O_2 [illegible] >25%, explosive atmosphere >10% LEL, organic vapors above background levels, particulates >_____ mg/m3, other _____
- Level C: O_2 <19.5% or >25%, explosive atmosphere >25% LEL (California-20%), unknown organic vapor (in breathing zone) >1 ppm, particulates >_____ mg/m^3, other _____
- Level B: O_2 <19.5% or >25%, explosive atmosphere >25% LEL (California-20%), unknown organic vapors (in breathing zone) >5 ppm, particulates >_____ mg/m^3, other _____
- Level A: O_2 <19.5% or >25%, explosive atmosphere >25% LEL (California-20%), unknown organic vapors >500 ppm, particulates >_____ mg/m^3, other _____

Air Monitoring (daily calibration unless otherwise noted):

Contaminant of Interest	Type of Sample (area, personal)	Monitoring Equipment	Frequency of Sampling
VOCS	Area	HNu	Continuous

Decontamination Solutions and Procedures for Equipment, Sampling Gear, etc.:

Trisodium phosphate wash, tap water rinse. deionized water rinse, isopropanol rinse (twice), final organic-free water rinse, and allow to air dry as long as possible.

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

Decon solution Monitoring Procedures, if Applicable: Decontamination vill be performed in a well-ventilat area upwind of tho sampling zone.

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

Site Entry Procedures and Special Considerations: E L E's "buddy System" will bo employed at all times during fieldwork activities.

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

All fieldwork activities vill bo performed during daylight hours. Team members will take breaks as needed to prevent heat stress and replace fluids.

General Spill Control, if applicable: N/A

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

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

Sample Handling Procedures Including Protective Wear:

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

Team Member*	Responsibility
To be 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 rots requirements of 29 CFR 1910.134, and ANSI Z88.2 (19601.

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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 - 904-452-2733, Baptist Hospital 904-434-4811 (Life Flight)

Poison Control Center

Police (include local, county sheriff, state) 911

Fire Department 911

Airport

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

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

Fed. Express 1-800-238-5355

Client Contact U.S. Navy Southern Division, Enqinoor-In-Charge—-1403-743-0574

Site Contact NAS Pensacola Enviromental Coordinator, R. Joyner-- 904-452-4515

SITE RESOURCES

Site Emergency Evacuation Alarm Method N/A

Water Supply Source on-sit.

Telephone Location, Number To bo determined on-sit.

Cellular Phone, if available N/A

Radio

Other On-sit. warehouse number to bo determined

EMERGENCY CONTACTS

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

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

3. Regional Safety Coordinator, Sybil Newchurch .....(904) 878-2336 (homo)
   (904) 677-1978 (office)

4. Regional Office Manager, R. Rudy ..... (904) 693-7245 (homo)
   (904) 677-1978 (office)

MEDTOX HOTLINE

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

   What to report:

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

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

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

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

EMERGENCY ROUTES

(NOTE: Field Ton U t Know Rout-(.) Prior to Start of Work)

Directions to hospital (include map) from Site 1

NAS Dispensary - Follow Taylor Road east to Duncan load. Turn right onto Duncan Road and follow it south to its intersection with Turner Street. Turn loft onto Turner Street. The NAS Dispensary is located on Turner Street in Building 3600.

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

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

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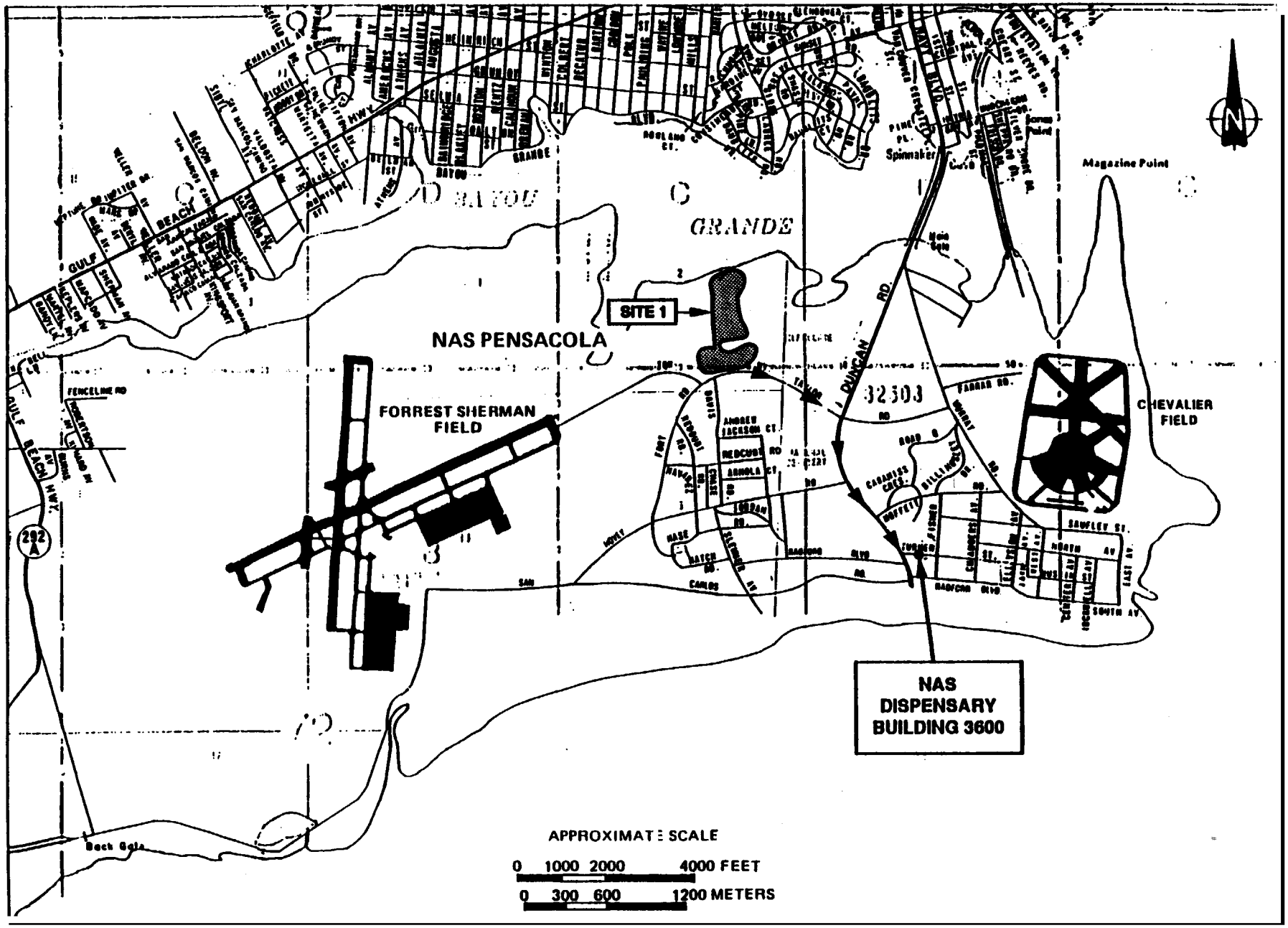
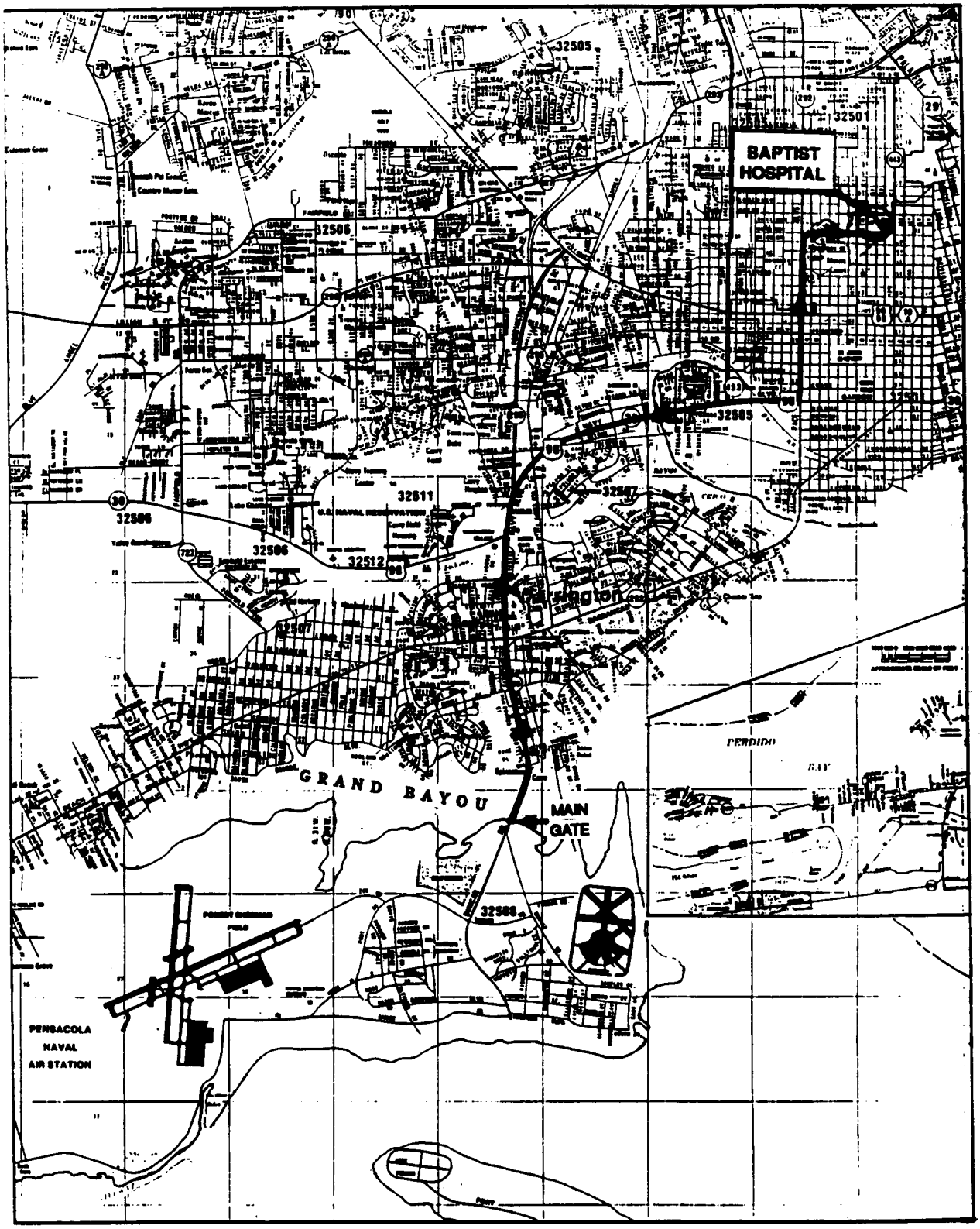


Figure A-1 LOCATION OF NAS DISPENSARY



SOURCE: Ecology and Environment, Inc., 1992

APPROXIMATE SCALE IN FEET

0 2000 4000 6000 8000

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Figure A-2 LOCATION OF BAPTIST HOSPITAL

DRILL RIG SAFETY

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

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

REVISED JANUARY 1990

Prepared by

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

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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 vithout 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 vays 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 vorking in conditions where heat stress is possible.

3 OBJECTIVES

The prevention of heat stress is of paramount importance for field personnel, particularly vhen 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 vho 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 hart is liberated as it is formed, there is no change in body temperature. If the hut is liberated slightly more rapidly, the body cools to a point at which the production of heat is accelerated and the excess is available to bring the body temperature back to normal.

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

4.1 HEAT CRAMPS

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

4.1.1 Symptoms

The symptoms of heat cramps include the following:

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

4.1.2 Emergency Care

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

4.2 HEAT EXHAUSTION

Heat exhaustion occurs in individuals working in hot environments and may be associated with heat cramps. Heat exhaustion is caused by the pooling of blood in the vessels of the skin. The heat is

transported from the interior of the body to the surface by blood. The blood vessels in the skin become dilated and a large amount of blood is pooled in the skin. This condition, plus the blood pooled in the lover extremities vhen 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:

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

4.2.2 Emergency Care

Place the victim in a cool location and remove as much clothing as possible while observing proper decontamination procedures. Administer cool water, Catorade, or its equivalent. If possible, fan the patient continually to remove heat by convection, but do not allow chilling or overcooling. Treat for shock, and take the victim to a medical facility if there is any indication of a more serious problem.

4.3 HEAT STROKE

Heat stroke is a profound disturbance of the heat-regulating mechanism, associated with high fever and collapse. Sometimes this condition results in convulsions, unconsciousness, and even death. Direct exposure to sun, poor air circulation, poor physical condition, and advanced age (over 40) bear directly on the tendency to heat stroke. It is a serious threat to life and carries a 20-percent mortality rate. Alcoholics are extremely susceptible.

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4.3.1 Symptoms

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

- Dry, hot, and flushed skin;
- Sudden onset;
- Pull and fast pulse;
- Dilated pupils:
- Early loss of consciousness;
- Body (cote) temperature's exceeding 105°F;
- Muscle twitching, groving into convulsions; and
- Breathing deeply at first, later shallovly 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 hut 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 vill return much-needed electrolytes to the body's system. Without these electrolytes, body systems cannot function properly, and the represented health hazard will be increased. Therefore, when personnel are working in situations where the ambient temperatures and humidity are high, and especially in situations where levels A, B, and C of protective apparel are required, the SSO must follow the procedures listed below:

- 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 fluid.;

- Ensure that frequent breaks are scheduled so that overheating is less likely to occur;
- Revise vork schedulest when necessary, to take advantage of the cooler parts of the day (i.e., 5:00 a.m. to 1:00 p.m., and 6:00 p.m. to nightfall); and
- Cooling vests should be worn if available.
- NOTE: Taking salt tablets is NOT currently recommended.

5.1 GUIDELINES FOR USE OF PROTECTIVE CLOTHING

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

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

5.2 HEARTRATE MONITORING

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

- During a 3-minute period, count the pulse rate for the last 30 seconds of the first minute, the ~~last~~ 30 seconds of the second minute, and the last 30 seconds of the third minute.
- Double the count.

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

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5.3 MONITORING PERSONNEL BODY TEMPERATURE AND BLOOD PRESSURE

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

5.4 MONITORING THE WORK AREA FOR HEAT STRESS CONDITIONS

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

6 DECONTAMINATION

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

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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

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1 INTRODUCTION

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

B & B personnel are frequently required to work in the field vith drill rigs, taking soil and rock samples, installing piezometers, and monitoring vells. Two general situations discussed separately 8re the supervision of Subcontract Drillers by B & E, and the direct operation of E & B's own drill rig by our personnel.

2 OPERATION OF DRILLING EQUIPMENT BY E & E

2.1 RESPONSIBILITIES AND AUTHORITY OF SITE SAFETY OFFICER

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

E & E personnel are restricted from the borehole area during active drilling. When B & E personnel are doing drilling; they will be restricted from the borehole arm 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 vork day, the E & B driller must inspect the rig to ensure the following components have been properly inspected, maintained, or replaced, or procedures have been performed:

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

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

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

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

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2.3 RESPONSIBILITY AND AUTHORITY OF OTHER E & E PERSONNEL

E & E personnel working at a drilling site must act as support to the Drilling Tau by providing any necessary support functions; however, it is important that personnel are careful not to interfere with the drilling process. Personnel are restricted from approaching the "super exclusion zone" while drilling is undelY.fr. If an B & 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 Tau 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 sbould be aware of emergency facilities, egress routes, and special medical conditions of their team members. As with all E & E field work, the *buddy* system is to be enforced.

3 TRAINING REQUIREMENTS FOR SITE PERSONNEL

3.1 E & E SITE SAFETY OFFICER

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

3.2 E & E DRILLER AND HELPER

The E & E driller and helper shall have taken and passed the basic 40-hour Eealth and Safety Training as prescribed by E & E and mandated by OSHA. They shall also meet the other minimum requirements for field vork 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 reviev will be the basis for determining whether additional training or apprenticeship will be required before allowing this employee to act as Driller. An existing E & E employee shall have a minimum of 1 year experience as a Driller's Helper on an assortment of field projects before he or she *can* be revieved 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. Folloving 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 6 E DRILLING PERSONNEL

All E 6 E personnel shall have taken the basic 40-hour Eealth and Safety Training course.. Field personnel must meet medical and respiratory fit test requirements established by E & E and OSHA, as well.

3.4 SUBCONTRACT DRILLER AND OTHER SUBCONTRACT DRILLING PERSONNEL

Subcontract Drillers and their support personnel must, at a minimum, have passed basic 40-hour Eealth and Safety Training as prescribed by OSHA 29 CFR1910.120. They shall be medically approved and trained to use the level(s) of respiratory protection required onsite. Certification of training by the Subcontractor shall be required as a deliverable included in E 6 E's 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 vith, 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 rite history must be obtained to verify absence of burled 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 u p of hospital route.
- A "super exclusion zone" must be established around the borehole, using a 4- by 8-foot sheet of plywood. This defined area vill 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 & E personnel are forbidden from entering the "super exclusion zone" around the borehole vhile the rig is actively drilling. The SSO must not attempt to take air readings in or around the auger while in use, nor are cutting samples taken while the auger is in motion. An O_2/explosimeter should be set up if possible for unmanned (alarmed) operations at the rig using an extension hose to continuously draw samples from the borehole area during drilling operations.

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

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

The folloving 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;

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- 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 vithout safety belt and other equipment.

Because heat stress is a constant threat during warm weather, the SSO is responsible for determining whether conditions are unsuitable for work. Where workers cannot work vith the assistance of work modifications, cooling vests, and other cooling means, the SSO may decide that work should not continue. The need for worker monitoring through blood pressure and oral temperature checks will be determined by the SSO vith assistance from the RSO 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 follw the terms of the SSP and the direction of the SSO. Because the SSO cannot be in all places at all times, the crw 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.

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

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

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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 6-foot "super exclusion area" will be established around the moving auger at all tines. No personnel, except the Driller and the Driller's Xelper, will enter this zone during drilling. The SSO will issue warnings to those personnel who breach this zone.
- Continuous O_2/explosimeter monitoring at borehole using remote sampling hose will exist at all times.
- All field team members will be briefed on planned drilling operations and possible problems before work begins on day 1. All will be shown the location and operation of "kill switches," which will be operationally checked each morning.
- Fire extinguisher(s) will be staged next to the rig before drilling and refueling operations.
- Velding and cutting activities will only be performed away from ignition sources at a distance approved by the SSO or Team Leader.
- Appropriate personnel protective equipment (based on hazards associated vith 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 vithin hearing range of the job site vill signal vork termination until the SSO and Team Leader notify personnel otherviseı

- 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., shutdovn and inerting of gas lines).

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

- Only trained, experienced staff vho have studied proper drilling methods and served as a Helper under an experienced Driller vill operate the catheadı

- 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 6 S staff. Because the boom is not equipped vith a ladder, it should be lovered for repairs.

5.1.2 Rotary and Core Drill

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 svivels 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 veight of the drill rod string, in addition to otber expected hoisting lords.

  - All hoses to and from the pump should be checked for properly installed coupling.; couplings should be secured vith 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 lowering of drill rods:

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

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

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

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

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

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

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

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

5.1.3 Cathead Usage

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

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- 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 Ray "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 aftu turning off the engine.

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

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

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

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

- Do not leave a cathead unattended vith the rope wrapped on the dnm.

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

- 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 vire 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 vires, wear, reduction in rope diameter, reduction in vire diameter, fatigue, corrosion, damage from heat, improper weaving, jamming, crushing, bird caging, kinking, core protrusion, and damage to lifting hardware. All related equipment must conform to standards as established by the American Iron and Steel Institute Wire Rope Users Manual. vire ropes should be replaced when inspection indicates excessive damage according to the Wire Rope Users Manual. All vire ropes which have not been wed 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 rod., swivel bearings should be inspected and lubricated daily to ensure that the swivel freely rotates under load.

- If a rod slipping device is wed 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 vith loose tool joints and do not make up, tighten, or loosen tool joints while the rod column is king 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 vith hands or by tensioning the slipping device.

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

- Wire ropes must be properly matched with each sheave--if the rope is too large, the sheave will pinch the wire rope--if the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger vire 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; hovever, drills may be moved using the main hoist if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.

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

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

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

- Avoid sudden loading in cold weather.

- Never we frozen ropes.

- Protect wire rope from sharp corners or edges.

- Do not operate the rig vith 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 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.

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6 REFERENCES

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

Diedrich D-50 Safety Manual.

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

Wire Rope Users Manual, American Iron and Steel Institute.

MALLINCKRODT

Material Safety Data Sheet

Mallinckrodt, Inc. Science Products Division, P.O. Box M Paris, KY 40361

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Emergency Telephone Number: 314-982-5000

HYDROCHLORIC ACID, 37%

PRODUCT IDENTIFICATION:

Synonyms: Muriatic acid

Formula CAS No.: 7647-01-0

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 FATA IF SWALLOWED. HARMFUL IF INHALED.** ALATIC MAY **CAUSE LUNG DAMAGE.**

Do not get in e on skin, **or** on thing
Avoid breathing it
Use only with adequate ventilation.
Wa thoroughly after ig
Store in a tightly e container.
Remove and **wash** i thi **promptly.**
This substance is classified as a POISON rndcr the Federal Gustic Poison Act.

EMERGENCY/FIRST AID

In case of contact, immediately flush skin or eyes with plenty of water lor at least IS minutes. If swallowed, DO NO INDUCE VOMITING!
Give large quantities of water or milk if available. Ncvcr 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 orygen. 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 n t e r with slight evolution of heat.

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

Melting Point: -74°C (-101°F)

Specific Gravity: 1.18

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

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

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

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

Explosion:
Not considered to be an explosion hazard.

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

Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the prcssurc 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 n t e r 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 toric 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 sires: 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 Fla ility: 0 Reactivity: 0

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SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

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

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

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

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

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

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

B. FIRST AID

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

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

Skin Exposure:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

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

C. TOXICITY DATA (RTECS, 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 Recommended Practices", most recent edition, for details.

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

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

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

SECTION 7 Storage and Special Information

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

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ISOPROPYL ALCOHOL

PRODUCT IDENTIFICATION:

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

Formula CAS No.: 67-63-0

Molecular Weight: 60.10

Chemical Formula: $(CH_3)_2$ CHOH

Hazardous Ingredients: Not applicable.

PRECAUTIONARY MEASURES

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

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

EMERGENCY/FIRST AID

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

DOT Hazard Class: Flammable Liquid

SECTION 1 Physical Data

Appearance: Clear, colorless liquid.

Odor: Rubbing alcohol.

Solubility: Infinite in water.

Boiling Point: 82°C **(180°F).**

Melting Point: -89°C **(-128°F).**

Specific gravity: 0.79

Vapor Density (Air = 1): 2.1

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

Evaporation Rate: (n-BUAC = 1) 2.83

SECTION 2 Fire and Explosion Information

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

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

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

Special Information:
In **the event** of a fire, **wear** full protective clothing and NIOSH-approved **self-contained** breathing **apparatus** with full facepiece operated in t k 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 a fire involving isopropyl alcohol.

Hazardous Polymerization:
Will not occur.

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

SECTION 4 Leak/Spill Disposal Information

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

Ensure compliance with local, state and federal regulations.

NFPA Ratings: Health: [illegible] 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.

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-DUAC = 1) 2.83

SECTION 2 Fire and Explosion Information

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

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

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

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

SECTION 3 Reactivity Data

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

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

Hazardous Polymerization:
Will **not occur.**

Incompatibilities:
Heat, flame, **strong** oxidizers, acetaldehyde, 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 lime **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.

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

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4 Material Safety Data

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Emergency Phone Number: 314-982-5000

Mallinckrodt, Inc., Science Products Division, P.O. Box M, Paris, KY 40361.

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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 akin or eyes with pkntyd 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 loan 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 Haz[illegible]lass: Oxidizer

SECTION 1 Physical Data

Appearance: Clear, colorless to slightly yellow liquid.

Odor: Suffocating acrid.

Solubility: Infinite in water.

Boiling Point: 122°C (252°F)

Melting Point: -34°C (-29°F)

Specific Gravity: 1.41

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

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

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

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

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

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

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

SECTION 3 Reactivity Data

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

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

Hazardous Polymerization:
Will not occur.

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

SECTION 4 Leak/Spill Disposal Information

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

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

Ensure compliance with local, state and federal regulations.

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NFPA **Ratings:** Health: [illegible] [illegible]mmability: 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 least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

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

C. TOXICITY DATA (RTECS, 1982)

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

SECTION 6 Occupational Control Measures

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

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it 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

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

Formula CAS No.: 1310-73-2

Molecular Weight: 40.00

Chemical Formula: NaOH

Hazardous Ingredients: None.

PRECAUTIONARY MEASURES

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

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

EMERGENCY/FIRST AID

If swallowed, do NOT induce vomiting. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician immediately. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. In all cases call a physician.
SEE SECTION 5.

DOT Hazard Class: Corrosive Material

SECTION 1 Physical Data

Appearance: White, deliquescent pellets.

Odor: Odorless.

Solubility: 111 g/100 g of water.

Boiling Point: 1390°C (2534°F)

Melting Point: 318°C (604°F)

Specific Gravity (water=1): 2.13

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

Vapor Pressure (mm Hg): Negligible.

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

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

Explosion:
Not considered to be an explosion hazard.

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

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

SECTION 3 Reactivity Data

Stability:
Stable under ordinary conditions of use and storage. Very hygroscopic. Can slowly pick up moisture from air and react with carbon dioxide from air to form sodium carbonate.

Hazardous Decomposition Products:
Sodium oxide.

Hazardous Polymerization:
This substance does not polymerize.

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

SECTION 4 Leak/Spill Disposal Information

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

Ensure compliance with local, state and federal regulations.

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SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Iohalation:
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 mere burns of mouth, throat, and stomach. Severe scarring of tissue and death may result.

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

Eye **Contact:**
Corrosivel May cause irritation of eyes, and with greater exposures, mere bum with possibly blindness resulting.

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

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

B. FIRST AID

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

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

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

Eye **Exposure:**
Wash eyes with plenty of n t c r for at least 15 minuter, lifting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS, 1982)

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

SECTION 6 Occupational Control Measures

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

Ventilation System:
A system o llocal and/or general exhaust is recommended to keel 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', mort recent edition, lor 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. Consu respirator supplier for limitations. Alternatively, a supplied air lull facepiece respirator or airlined hood may be worn.

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

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

SECTION 7 Storage and Special Information

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

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Emergency Phone Number: 314-982-5000

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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.

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DANGER! CORROSIVE. LIQUID *AND* MIST CAUSE **SEVERE BURNS TO ALL BODY TISSUE.** HAY **BE I IF SWALLOWED. HARMFUL IF INHALED. INHALATION I** CAUSE **; DAMAGE.**

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

EMERGENCY/FIRST AID

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

DOT Hazard Class: Corrosive Material

SECTION 1 Physical Data

Appearance: Colorless, oily liquid.

Odor: Odorless.

Solubility: Infinite @ 20°C.

Boiling Point: ca. 310°C (590°F)

Melting Point: ca. -14°C (6°F).

Specific Gravity: 1.84

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

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

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

Fire:
Not combustible, but substance is a 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 Fi[illegible]ility: 0 Reactivity: 2 Other: Water reactive

Effective Date: 10-21-86 Supersedes 09-05-85

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Inhalation:
Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. May cause lungedema. 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. (‘all a physician.

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

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

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

C. TOXICITY DATA (RTECS, 1982)

Oral rat LD50: 2140mg/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 respiralor inay 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, aiid 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 Naphthalene Date 7/06/92

DOT Name/U.N. No. 1334 Job No.

CAS Number 91-20-3

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: Naphthalin, Tar camphor, White tar)

Chemical Formula $C_{10}H_8$ Molecular Weight 128.2

Physical State solid Solubility (H2O) 0.003 8 Boiling Point 424°F

Flash Point 174°F Vapor Pressure/Density 0.08 mm Hg Melting Point 176°F

Specific Gravity 1.12 Odor Characteristic 0.038 ppm Flammable Limits

Incompatabilities Nitric acid, strong oxidizers, chromic anhydride

Biological Properties:

TLV-TWA 10 ppm PEL 10 ppm Odor/Odor Threshold tar, mothballs

IDLH 500 ppm Human Aquatic Rat/Mouse 1250 mg/kg

Route of Exposure inh, ing, derm

Carcinogen Teratogen Mutagen

Radiological Properties:

N/A

Handling Recommendations: (Personal protective measures)

Tyvek, gloves (PVA, Viton); APR in windy/dusty areas

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

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

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

Chronic: Kidney and/or liver damage; cataracts

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Benzene Date 3/23/92

DOT Name/U.N. NO. 1114 Job No. UH8000

CAS Number 71-43-2

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: Benzol, Benzole, Cyclohexatriene)

Chemical Formula C_6H_6 Molecular Weight 78

Physical State Liquid Solubility (H2O) Slightly Boiling Point 176°F

Flash Point 12°F vapor Pressure/Density 75 mm Freezing Point 42°F

Specific Gravity 0.079 Odor Characteristic 4.68 ppm Flammable Limits 1.3-7.1%

Incompatabilities Strong oxidisers, chlorine, bromine

Biological Properties:

TLV-TWA 10 ppm PEL 1 ppm Odor/Odor Throrhold Aromatic

IDLH 100/CNS Human Aquatic Rat/Mouse 50/24H

Route of Exposure Inhalation, ingestion, eye (ocular), dermal absorption

Carcinogen Human - suspected Teratogen Mutagen Experimental

Radiological Properties:

Handling Recommendations: (Personal protective measures)

10 ppm use SCM. Use protective clothing: oxcal-viton: good-neoprono, saranax; poor-butyl, natural rubber for gloves. Avoid skin/eye contact

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

Do not induce vomiting or give water or milk: got medical attontion immediately, remove to fresh air, give artificial respiration if needed, medical attention, flush with water, rinse/wash skin with soap and water thoroughly

Symptoms: Acute: Skin irritant, CNS depressant, mostly IHL, initial excitation followed by headache, dizziness, vomiting, delirium, severe exposure may see tremors, blurred vision, shallow respiration, convulsions

Chronic: Anorexia, drowsiness, anemia, bleeding under skin, reduced blood clotting; liver, kidney, bone marrow damage, leukemia

HAZARD EVALUATION OF CHEMICALS

Chemical Name: Chromium (hexavalent) Date: 3/23/92

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

CAS Number 7440-47-3

References Consulted (circle):

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

Toxic and Hazardous Safety Manual ACGIH Other: SAX, Aldrich

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

Chemical Properties: (Synonyms: Chromic Oxide, soluble chromic salts)

Chemical Formula Cr Molecular Weight 52

Physical State solid Solubility (H2O) insoluble Boiling Point 4788°F

Flash Point N/A Vapor Pressure/Density 0 mm Freezing Point 3452°F

Specific Gravity 7.14 Odor Characteristic Flammable Limits

Incompatabilities Strong oxidizers

Biological Properties:

TLV-TWA 0.5 mg/m^3 PEL 1 mg/m^3 Odor/Odor Threshold

IDLH N/A Human Aquatic Rat/Mouse

Route of Exposure Inhalation, Ingestion

Carcinogen Teratogen Mutagen

Radiological Properties:

Handling Recommendations: (Personal protective measures)

APR: any detectable limit- SCBA. Wear gloves and booties. Prevent skin/eye contact.

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

ING: give large amounts of water, induce vomiting, immediate medical attention. INH: move to fresh air, CPR if necessary, immediate medical attention. DER: Rinse with large amounts of water.

Symptoms: Acute: Contact dermatitis; irritation of mucous membranes and upper respiratory tract, coughing, wheezing, headache, fever, nausea, vomiting.

Chronic: Carcinogen, liver and kidney damage, bronchitis, ulceration of skin, lung cancer.

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HAZARD EVALUATION OF CHEMICALS

Chemical Name 1,2-Dichlorobenzene Date 3/23/92

DOT Name/U.N. NO. 1591 Job lo. UH8000

CAS Number 95-50-1

References Conrultod (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: o-Dichlorobonrono, o-DCB)

Chemical Formula $C_6H_4Cl_2$ Molecular Weight 147.0

Physical State liquid Solubility (H2O) 0.011 Boiling Point 357° F

Flash Point 151° F vapor Pressure/Density 1 mm Freezing Point 1° F

Specific Gravity 1.30 Odor Characteristic .7 ppm Flammable Limits

Incompatabilities Sttonq oxidizers, aluminum acids, acid fumes, chlorides

Biological Properties:

TLV-TWA SO ppm PEL SO ppm Odor/Odor Threshold pleasant, aromatic

IDLH 1000 ppm Human Aquatic Rat/Mouse

Route of Exposure Inhalation, Ingestion, Dermal

Carcinogen Teratogen Mutagen

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Monitoring Recommendations:

OVA or HNu

Disposal/Waste Treatment:

Health Hazards and First Aid:

ING & INH: seek medical attontion: DER: wash with soap and water, seek medical attontion.

symptoms: Acute: nausea, tearing of eyes, coughing

Chronic: Liver or kidney disfunction

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HAZARD EVALUATION OF CHEMICALS

Chemical Name 1,1-Dichloroethane Date 3/23/92

DOT Name/U.N. No. 2362 Job No. UH8000

CAS Number 75-34-3

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: Ethylene dichloride

Chemical Formula CHCl2CH3 Molecular Weight 98.96

Physical State Liquid Solubility (H2O) 0.8% Boiling Point 135 °F

Flash Point 22 F Vapor Pressure/Density 230 mm Freezing Point -32.3°F

Specific Gravity 1.253 Odor Charactristic 5 ppm Flammable Limits 6.2

Incompatabilities Strong oxidisers, caustics, chemically active metals

Biological Properties:

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

IDLH 4,000 ppm Human Aquatic Rat/Mouse 400 mg/kg

Route of Exposure Inhalation, contact, ingostion, eye (occular)

Carcinogen X Teratogen Mutagen

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Disposable coveralls (Saranex), full face mask, impermeable gloves, respirators with organic cartridges

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

Ingestion - induce vomiting. Contact - flush with copious amounts of water. Get medical attention.

Inhalation- remove to fresh air.

Symptoms: Acute: Nausea, vomiting, drunkenness, CNS depression, coneal injury, chemical burns.

Chronic: Liver & kidney damage.

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HAZARD EVALUATION OF CHEMICALS

Chemical Name 1,2-Dichloroethane Date 1/5/92

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

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 Proportias: (Synonyms: Ethylene dichloride, Freon 150)

Chemical Formula $Cl_2C_2H_4$ Molecular Weight 98.96

Physical State liquid Solubility (H2O) 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 Limits 6.2% - 15.68

Incompatabilities Oxidizers, caustics, active metals

Biological Properties:

TLV-TWA 10 ppm P6L 1 ppm Odor/Odor Threshold 100 ppm

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

Route of Exposure inhalation, ingostion, contact

Carcinogen X Teratogen Mutagen

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Organic vapor/acid gas cartridge or SCBA, 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

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

Chronic:

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Methylene Chloride **Date** 3/23/92

DOT Name/U.N. No. 1593 **Job No.** UH8000

CAS Number 75-09-2

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 Proportiom: (**Synonyms:** Dichloromethane, Methylene Dichloride)

Chemical Formula CH_2Cl_2 Molecular Weight

Physical State Liquid Solubility (H2O) Slightly Boiling Point 104°F

Flash Point Vapor Pressure/Density 310 mm Hg Freezing Point -142°F

Specific Gravity 1.33 Odor Characteristic Like chloreform Flammable Limits

Incompatabilities

Biological Properties:

TLV-TWA 50 ppm **PEL** 500 ppm Odor/Odor Threshold Sweet, pleasant/160 ppm

IDLH 5,000 ppm Human Aquatic Rat/Mouse

Route of Exposure Oral, inh, ing, derm

Carcinogen Human/animal **Teratogen** **Mutagen** Experimental

Radiological Properties:

N/A

Handling Recommendations: (Personal protective measures)

Tyvek, gloves (PVA, Viton); any detectable concentrations-SCBA: no APR cartridge available

Monitoring Recommendations:

OVA continuously

Disposal/Waste Treatment:

Health Hazards and First Aid:

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

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

Chronic: Heart palpitations, malaise, death

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HAZARD EVALUATION OF CHEMICALS

Chemical Name: Toluene

Date: 3/23/92

DOT Name/U.N. No.: 1294

Job No.: UH8000

CAS Number: 108-88-3

References Consulted (circle):

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

Toxic and Hazardous Safety Manual ACGIH Other:

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

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

Chemical Formula: C_7H_8 Molecular Weight: 92

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

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

Specific Gravity: 0.8669 odor Characterimtic: 0.2ppm Flammable Limits: 1.3% - 7.1%

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

Biological Properties:

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

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

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

Carcinogen: Experimental Teratogen: Experimental Mutagen: Experimental

Radiological Properties:

Handling Recommendations: (Personal protective measures)

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

Monitoring Recommendations:

Disposal/Waste Treatment:

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

Wealth Hazards and First Aid:

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

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

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

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HAZARD EVALUATION OF CHEMICALS

Chemical Name 1,1,1-Trichloroethane **Date** 3/23/92

DOT Name/U.N. No. 2831 **Job Do.** 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 Physics**

Chemical Properties: **(Synonyms:** Methyl chloroform)

Formula CH_3CCl_3 **Molecular Weight** 133.4

Physical State liquid **Solubility (H2O)** 0.48 **Boiling Point** 165° F

Flash Point B/A Vapor **Pressure/Density** 100 mm **Freezing Point** -23° F

Specific Gravity 1.34 **Odor Characteristic** 390 ppm **Flammable Limits**

Incompatabilities Strong caustics or oxidizers, water

Biological Properties:

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

IDLH 1,000 ppm **Human** **Aquatic** **Rat/Mouse**

Route of Exposure Ingestion, Inhalation, Dermal

Carcinogen **Teratogen** **Mutagen**

Radiological Properties:

Handling Recommendations: **(Personal protective measures)**

Monitoring Recommendations:

OVA or HNu with the 11.7 eV probe.

Disposal/Waste Treatment:

Health Hazards and First Aid:

INH & INS: 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

Chemical Name Vinyl Chloride Data April 13. 1989

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

CAS Number

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:** Chloroethylene, VC, Chloroethene)

Chemical Formula C_2H_3CL **Molecular Weight** 62.5

Physical **State** Colorless 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/Mouse**

Route of Exposure Inh

Carcinogen Human Teratogen Mutagen Suspect

Radiological Properties:

Handling Recommendations: (**Personal protective measures**)

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

Monitoring Recommendations:

PID 10:2, FID

Disposal/Waste Treatment:

N/A

Health Hazards and First Aid:

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

Symptoms: **Acute:** **Giddiness, intoxication, nausea, light headedness, CNS depression**

Chronic: **Liver damage, CNS depression, reproductive effects**

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HAZARD EVALUATION OF CHEMICALS

Chemical Name: Xylene Date: 3/23/92

DOT Name/U.N. No.: 1307 Job No.: UN8000

CAS Number: 1330-73-8

References Consulted (circle):

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

Toxic and Hazardous Safety Manual ACGIH Other:

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

Chemical Properties: (Synonyms: Dimethylbenzene, Xylol)

Chemical Formula: C_8H_{10} Molecular Weight: 106

Physical State: Colorless Liquid Solubility (H2O): boiling point: 292°F

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

Specific Gravity: 0.86 Odor Characteristic: 0.1 ppm Flammable Limits: 1.0% - 7.01;

Incompatabilities: strong oxidizers, strong acid, heat, peroxide

Biological Properties:

TLV-TWA: 100 ppm m: 100 ppm Odor/Odor Threshold: Aromatic

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

Route of Exposure: Inhale, skin

Carcinogen: Experimental Teratogen: Mutagen:

Radiological Properties:

Handling Recommendations: (Personal protective measures)

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

Monitoring Recommendations:

Disposal/Waste Treatment:

OSHA standard 29 CFR 1910. 106 applies

Health Hazards and First Aid:

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

Symptoms:

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

Chronic: More severe than above, hyperplasia of bone marrow

APPENDIX B

SITE-SPECIFIC QUALITY ASSURANCE PROJECT PLAN

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

Section 1.0 -- Title Page

Work Plan Group: A
Site No.: 1
Site Name: Sanitary Landfill

Prepared by: Amy Twitty
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1203 Governor's Square Boulevard, Suite 401
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Prepared for: Department of the Navy
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive, P.O. Box 10068
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Contract Number N62467-88-C-0200

Signature Approvals:

E & E Project Manager: John D. Barksdale
J. Barksdale

E & E Regional QA/QC Coordinator: Kimberly A. Walker
K. Walker

E & E ASC Director: Gary Hahn for
XXXXXXXXXX W.F. Hall, Ph.D

K. Walker for
E & B QA/QC Project Officer: Marcia Meredith
M. Meredith

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Section 3.0 -- Project Summary

Vork Plan Group: A

Site No.: 1

Site Name: Sanitary Landfill

Site Description: A complete site description and history are presented in Sections 2.0 and 3.0 of the attached work plan.

Phase I — Field Screening

Physical Survey (check all that apply):

- X Overall Physical Reconnaissance
- X HNu/OVA Surface Emission Survey
- X Radiation Survey
- X Habitat/Biota Survey
- X Asbestos Survey (in Rubble)
- X Hydrologic Assessment

Geophysical Survey (check all that apply):

- X Electromagnetic Conductivity:
  - X EM-31 X 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 : Planned Number of Samples ___
- X Laboratory Analyses:

PLANNED NUMBER OF SAMPLES		CATEGORIES OF ANALYSES
Surface Water	10	X Volatile Organic Compounds
Sediment	10	X Polynuclear Aromatic Eydrocarbons
Soil	___	X Phenols
Groundwater	41	___ Organophosphorus Pesticides
Duplicates	4	___ Chlorinated Eerbicides
Trip Blanks	___	___ Carbamates
Field Blanks	___	X Pesticides/Polychlorinated Biphenyls
Rinsate Blanks	___	X Total Recoverable Petroleum Eydrocarbons
Other	___	X Metals
		___ Gross Alpha

Section 3.0 -- Project Summary (Continued)

Phase II — Characterization

PLANNED NUMBER OF SAMPLES

Surface Water	20	Air	___	Duplicates	28
Sediaent	23	Biota:		Trip Blanks	18
Soil	206	Flora	___	Field Blanks	6
Groundwater	50	Fauna	___	Rinsatc Blanks	18
				Preservative Blanks	1

CATEGORIES OF ANALYSES

- X Purgeable Aromatics
- X Purgeable Halocarbons
- X Base/Neutral Extractables
- X Acid Extractables
- ___ Polynuclear Aromatic Hydrocarbons
- X Dioxins
- X Organophosphorus pesticides
- X Herbicides
- X Pesticides
- X Polychlorinated Biphenyls
- X Total Recoverable Petroleum Hydrocarbons
- X Metals
- X Cyanide
- X Sulfide

Additional analytical categories are identified belov:

- X Gross Alpha
- X Gross Beta
- X Gamma scan
- X Total Organic Carbon
- X Hardness (vater only)
- X Alkalinity
- X Total Suspended Solids (water only)
- X Total Kjeldahl Nitrogen
- X Ammonia Nitrogen
- X Orthophosphate Phosphorus
- X Dissolved Oxygen (in field)
- X 5-day Biological Oxygen Demand
- X Chemical Oxygen Demand
- X pH
- X Percent Moisture
- X Grain Size
- X BTU Content
- X Ash Content
- X Total Organic Halogens
- X Sulfur
- X Ignitability
- X Cation Exchange Capacity
- X Permeability

Section 4.0 -- Project Organization and Responsibility

The overall organizational structure for this site is discussed in Section 4.0 of the GQAPP. Site-specific designated personnel and their responsibilities are listed below:

Site Manager:
Team/Task Leader(s): To Be Determined
Field Support Personnel:

Biographies for those personnel listed above which are not included in the GQAPP are included in Appendix A of this document.

Section 5.0 — QA/QC Objectives for Measurement Data

Criteria for reporting the accuracy, precision, and completeness of data are presented in Section 5.0 of the GQAPP. Detection limits for screening and quantitative analyses are presented in Section 9.0 of the GQAPP. Procedures used to assess data accuracy, precision, and completeness are presented in Section 14.0 of the GQAPP. All analytes (including field parameters), sample media, and method numbers relevant to the investigation of this site are listed in the following table, which also identifies any modifications to the accuracy (A), precision (P), completeness (C), and detection limit (DL) criteria specified in the above-referenced GQAPP sections.

Analyte	Media	Method No.	A	P	C	DL
Laboratory Screening Analyses*						
Volatile Organic Compounds	S/W	--	N/M	N/H	N/H	N/H
Polynuclear Aromatic Eydrocarbons	S/W	--	N/M	N/H	N/H	N/H
Pesticides	S/W	--	N/M	N/H	N/H	N/M
Polychlorinated Biphenyls	S/W	--	N/M	N/M	N/M	N/H
Total Recoverable Petroleum Eydrocarbons	S/W	EPA 418.1	N/H	N/H	N/M	TBD
Phenols	S/W	--	N/H	N/M	N/M	N/H
Arsenic	S/W	--	N/H	N/H	N/H	N/H
Cadmium	S/W	--	N/H	N/M	N/H	N/H
Chromium	S/W	--	N/M	N/M	N/M	N/H
Copper	S/W	--	N/H	N/M	N/M	N/H
Lead	S/W	--	N/M	N/H	N/H	N/H
Nickel	S/W	--	N/M	N/H	N/H	N/H
Silver	S/W	--	N/H	N/M	N/M	N/M
Zinc	S/W	--	N/M	N/H	N/H	N/H
Laboratory Analyses						
Gross Alpha	S/W	EPA 900.0	N/M	N/H	N/M	N/H
Gross Beta	S/W	EPA 900.0	TBD	TBD	TBD	TB
Gamma scan	S/W	EPA 901.1	TBD	TBD	TBD	TB
TCL Purgeables + xylene	S/W	EPA 8240/624	N/H	N/H	N/H	N/H
TCL BNAs	S/W	EPA 8270/625	N/M	N/M	N/H	N/H
TCL Pesticides & PCBs	S/W	EPA 8080/608	N/M	N/M	N/H	N/W
Total Recoverable Petroleum Hydrocarbons	S/W	EPA 418.1	N/H	N/H	N/M	N/M
Dioxins	S/W	EPA 8280	N/M	N/M	N/M	N/M
Organophosphorus Pesticides	S/W	EPA 8140	N/H	N/H	N/M	N/H
Herbicides	S/W	EPA 8150 (Mod)/509B	N/M	N/H	N/M	N/M
TAL Metals:						
Aluminum	S/W	EPA 6010	N/H	N/H	N/M	N/H
Antimony	S/W	EPA 6010	N/H	N/H	N/M	N/H
Arsenic	S/W	EPA 7060	N/M	N/H	N/M	N/M
Barium	S/W	EPA 6010	N/M	N/H	N/M	N/H
Beryllium	S/W	EPA 6010	N/H	N/M	N/M	N/H
Boron	S/W	EPA 6010	N/H	N/M	N/H	N/M
Cadmium	S/W	EPA 6010	N/H	N/M	N/M	N/M
calcium	S/W	EPA 6010	N/H	N/H	N/M	N/H
Chromium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Cobalt	S/W	EPA 6010	N/M	N/H	N/M	N/H
Copper	S/W	EPA 6010	N/M	N/H	N/H	N/M

Aualyte	Media	Method No.	A	P	C	DL
Iron	S/W	EPA 6010	N/M	N/M	N/M	N/H
Lead	S/W	EPA 7421	N/M	N/M	N/H	N/M
Magnesium	S/W	EPA 6010	N/M	N/M	N/M	N/H
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/H
Nickel	S/W	EPA 6010	N/M	N/M	N/M	N/M
Selenium	S/W	EPA 7740	N/M	N/M	N/H	N/M
Silver	S/W	EPA 6010	N/M	N/M	N/H	N/M
Sodium	S/W	EPA 6010	N/M	N/M	N/H	N/M
Thallium	S/W	EPA 7841	N/M	N/H	N/M	N/M
Tin	S/W	EPA 7870	N/M	N/H	N/H	N/H
Vanadium	S/W	EPA 6010	N/M	N/M	N/M	N/H
Zinc	S/W	EPA 6010	N/M	N/H	N/H	N/H
Cyanide	S/W	EPA 9010/335.2	N/H	N/H	N/M	N/H
Sulfide	S/W	EPA 376.1	N/M	N/M	N/M	N/H
TOC	S/W	EPA 415.1	N/M	N/M	N/H	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/H	N/M
Total Suspended Solids	W	EPA 160.2	N/M	N/M	N/M	N/H
Total Kjeldahl Nitrogen	S/W	EPA 351.3	N/M	N/M	N/H	N/M
Nitrogen-Ammonia	S/W	EPA 350.2	N/M	N/M	N/M	N/H
Orthophosphate Phosphorus	S/W	EPA 365.2	N/M	N/M	N/W	N/M
5-day Biological Oxygen Demand	W	SM 5210	N/M	N/M	N/M	N/M
Chemical Oxygen Demand	W	EPA 410.4	N/M	N/M	N/H	N/H
pH	W	EPA 150.1	N/M	N/M	N/M	N/M
Percent Moisture	S	ASTH D-2216-80	N/M	N/H	N/M	N/H
Grain Size	S	ASTH D-422-63	N/M	N/M	N/H	N/M
BTU Content	S	ASTH D-2015-77	N/H	N/M	N/H	N/M
Ash Content	S	ASTH D-482	N/M	N/M	N/M	N/M
Total Organic Halogens	S	SW 9020	TBD	TBD	TBD	TBD
Sulfur	S	ASTM D-129-64	N/M	N/M	N/H	N/M
Ignitability	S/W	EPA 1010	N/M	N/H	N/H	N/M
Cation Exchange Capacity	S	EPA 9081	N/M	N/M	N/H	N/M
Permeability	S	ASTH 2430	75-125	35	95%	100 mg/k
Field Parameters						
pH	W	150.1	N/M	N/M	N/M	N/M
Specific Conductance	W	120.1	N/M	N/M	N/H	N/H
Temperature	W	170.1	N/M	N/M	N/M	N/H
Dissolved Oxygen	W	EPA 360.1	N/M	N/M	N/M	N/M

Notes: S = Soil and/or sediment
W = Groundwater and/or surface water
N/M = No Modifications from GOAPP
TBD = To Be Determined

* With the exception of Total Recoverable Petroleum Hydrocarbons and Gross Alpha, the laboratory screening analyses do not have EPA method numbers.

Section 6.0 — Fieldvork and Sampling Procedures

Fieldwork and sampling procedures are presented in Section 6.0 of the GQAPP. Modifications to these procedures are described belov:

No Modifications

Section 7.0 — Sample Custody

Sample custody procedures are presented in Section 7.0 of the GQAPP. Modifications to these procedures are described 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. Hodifications 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 — Preveutive Maintenance

Preventive maintenance procedures are presented in Section 13.0 of the GOAPP. Hodifications to these procedures are described below:

No Hodifications

Section 14.0 — Procedures Used to Assess Accuracy, Precision, and Completeness of Data

Procedures used to assess the accuracy, precision, and completeness of data are presented in Section 14.0 of the GQAPP. Modifications to these procedures are described below:

No Hodifications

Section 15.0 — Corrective Action

Corrective action procedures are presented in Section 15.0 of the GQAPP. Hodifications to these procedures are described below:

No Hodifications

Section 16.0 — Quality Assurance Reports to Management

Quality assurance report procedures are presented in Section 16.0 of the GQAPP. Hodifications to these procedures are described below:

No Hodifications

Appendix A -- Additional Personnel Biographies

Personnel assigned to this site investigation whose biographies do not appear in the GQAPP are listed below; biographies for these site personnel are presented on the following pages.

To Be Determined

APPENDIX C

THREATENED AND ENDANGERED FLORA AND FAUNA ASSOCIATED WITH NAS PENSACOLA

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

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Key at end of table.

Table Appendix C (Cont.)

Scientific Name	Common Name	Base Status[a]	FGFWFC (or FDA)	USFWS	Habitat
MAMMALS					
Mustela vison lutensis	Florida mink	U		UR 2	Terrestrial habitats
Peromyscus polionotus trissyllepsis	Perdido Key beach mouse	N/A	T	E	Beach dunes
Trichechus manatus latirostris	West Indian manatee	M	E		Atlantic and Gulf coasts
BIRDS					
Charadrius melodus	Piping plover	P	T	T	Open, dry, sandy beaches
Charadrius alexandrinus	Snowy plover	P	T	UR 2	Open, dry, sandy beaches
Dendroida dominica stoddardi	Stoddard's yellow throated warbler	P-U		UR 2	Wooded habitats
Dendroica kirtlandii	Kirtland's warbler	U	E	E	Wooded habitats
Haematopus palliatus	American oystercatcher	U	SSC		Coastal habitats
Egretta rufescens	Reddish egret	P-U	SSC	CT 2	Freshwater/coastal wetlands
Egretta caerulea	Little blue heron	PW	SSC		Freshwater/coastal wetlands
Egretta th[illegible]	Snowy egret	P-2	SSC		Freshwater/coastal wetlands
Grus [illegible]s pratensis	Florida sandhill crane	U	T		Freshwater wetlands
Falco peregrinus tundrius	Arctic peregrine falcon	M	E	T	Winter on coasts
Falco sparverius paulus	Southeastern kestrel	2	T	UR 2	Open pine forests clearings
Haliaeetus leucocephalus	Bald eagle	PW	T	E	Pine forests/coastal habitat
Pandion haliaetus	Osprey	R	SSC		Near water
Pelecanus occidentalis	Brown pelican	R	SSC	AC	Mangrove trees, coasts

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Table Appendix C (Cont.)

Scientific Name	Common Name	Base Status[a]	Status[b] FGFWFC (or FDA)	Status[b] USFWS	Habitat
Picoides borealis	Red-cockaded woodpecker	P-u	T	E	Cavity nests/old pine stands
Vermivora bachmanii	Bachmann's warbler	U	E	E	Wooded habitats
Campephilus principalis	Ivory-billed woodpecker	U	E	E	Wooded habitats
Sterna antillarum	Least torn	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		u R 2	Associated w/gopher tortoise
Chrysopsis gossypina cruiseana	Cruise's golden-aster	P	E	UR 1	Coastal dunes
Drosera intermedia	Spoon-leaved sundew	R	T		Aquatic habitats
Epigaea repens	Trailing arbutus	U	E		Dry, acid, sandy soil
Kalmia latifolia	Mountain laurel	U	T		Rich, moist, shady woods
Lilaeopsis carolinensis	Carolina lilaeopsis	R		U R 2	
Lilium iridollae	Panhandle lily	U	E	UR 2	Black, lucky soils
Pinguicula planifolia	Chapman's butterwort	U	RE	u R 2	
Polygonella macrophylla	Large-leaved jointweed	R	T	UR 1	Sand pine-oak scrub
Rhododendron austrinum	Orange azalea	U	E	UR 5	Moist, woody habitats

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Key at end of table.

Table Appendix C (Cont.)

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

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Key:

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

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

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

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APPENDIX D

JUNE 1990 SECTION *14.2*
PEASE **II--CHARACTERIZATION**

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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 1 will involve the collection of surface water, sediment, leachate, 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 1, 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.

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Table 14-2

PHASE II SAMPLING AND ANALYTICAL REQUIREMENTS-GROUP A

SITE 1

Medium	No. of Samples	Dupli-cates	Trip Blanks[a]	Field Blanks	Rinsate Blanks	Preservative Blanks[b]	Total[e]	Analytical Suite[c,d]
Surface Water	6	1	1	1	1	1	11 (2)	A B
Sediment	24	3	2	NR	2	NR	31 (4)	A C
Soil	25	3	3	NR	4	NR	35 (4)	A C
Groundwater	13	1	2	NR	2	NR	18 (3)	A B
TOTAL	68	8	8	1	9	1	95(13)	

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Key:

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

[b]Preservative blanks will be analyzed for TCL volatile organic compounds, total recoverable hydrocarbons, dissolved 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 rise, BTU content, ash content, total organic halogens, sulfur, ignitability, and cation exchange capacity.

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

[e]The number of samples shown in parentheses will be analyzed for the additional parameters indicated.

NR = U t required.

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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 Surface Water and Sediment Sampling

The actual number of surface water and sediment samples, as well as appropriate sampling locations, will be determined pending the results of Phase I. However, for planning purposes it is assumed that two surface water samples will be collected from the Golf Course Pond, one will be collected from the marshy area/Beaver Pond west of the Golf Course Pond, one from North Pond and two from Bayou Grande Pond. Sample collection techniques will be the same as those employed for Phase I. It is also assumed that four sediment sample locations will be required in the Golf Course Pond, two in the marshy area/Beaver Pond west of the Golf Course Pond, two in North Pond and four in the Bayou Grande Pond. At each location, sediment samples will be collected from two depth intervals, namely, surface to 4 inches, and from 18 to 24 inches. Sediment samples will be collected using an Eckman Dredge and/or manually driven split spoons or other suitable coring devices.

At locations where known or suspected leachate seeps are identified during Phase I field reconnaisance surveys, samples will be collected. As a general rule, no more than one sample will be collected from each seepage area. Liquid phase samples will be collected from active seeps. Sediment samples will be collected from suspected seepage locations ,whichare inactive or dry. However, potential instances of overland flow, ponding, discharge to surface water bodies, and multi-phase liquids may present a need for the collection of multiple samples.

14.2.3 Soil Sampling

Composite surface soil samples will be collected from landfilled areas. For planning purposes, a total of five samples are assumed at locations based on the Phase I soil sample results. Each sample will consist of

five aliquots and be collected and composited similarly to the Phase I soil samples (see Section 14.1.3.1) and in accordance with Section 6.6 of the GQAPP. Equipment decontamination will be performed in accordance with Section 6.10 of the GQAPP.

Soil samples will be collected as part of the shallow monitoring well installation, described below in Section 14.2.4. At each location, samples will be collected from two composite intervals; surface to 5 feet and from 5 feet to the water table. Where the water table is observed to occur within 5 feet of the surface, only one sample will be collected. The soil samples will be collected using a split-spoon sampling device during well drilling. All sampling, compositing, and lithologic logging 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.

For planning purposes, two soil samples are assumed at each well location. The folloving Section 14.2.4 assumes ten shallow monitoring well locations in Phase 11, thus a total of 20 soil saaples is tentatively projected.

14.2.4 Shallov Monitoring Well Installation and Development

The actual number and locations for shallov monitoring wells to be installed in Phase II will be determined based on Phase I findings. For planning purposes, the number of permanent shallov monitoring wells to be installed is ten. All shallov wells will be constructed of two-inch PVC, and bracket the water table with 10 feet of screen. To investigate the potential for groundwater contamination by "sinker" solvents at Site 1, several wells will also be installed to greater depths during Phase 11. For planning purposes, three deeper wells will be installed to a corpletion depth of 40 feet. Each of these deeper monitoring wells will be clustered with shallow monitoring wells in order to enable determination of vertical hydraulic gradient. The wells will be installed utilizing hollow-stem auger techniques and in accordance vith Sections 6.7 and 6.10 of the GQAPP.

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Depending on the results obtained during Phase I, 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.

14.2.5 Groundwater Sampling

Groundwater samples will be collected from the estimated 13 newly installed permanent wells, shown on Figure 14-2. The purging and sampling of wells will be conducted in accordance with Scetions 6.8 and 6.10 of the GOAPP.

14.2.6 Hydrologic Assessment

Well head elevations will be surveyed for all newly installed monitoring wells and water levels will be measured in all wells. Surface water staff gauges will be monitored during the investigation and the elevations will be recorded.

Limited aquifer testing will be conducted on all newly installed and existing monitoring wells. These will consist primarily of performing short-duration specific capacity tests during development of the newly installed monitoring wells and 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 in conjunction with well development is that the test itself does generate additional potentially contaminated water which requires disposal. Slug testing does not generate any potentially contaminated water.

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

14.2.7 Air Sampling

The need for formal air sampling will be based on the findings of the Phase I surface emissions survey and particulate air sampling, and the Phase I shallow soil sampling.

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