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PHASE II

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

Pesticide Rinsate Disposal Area (Site 15) DDT Mixing Area (Site 24)

July 1992

Prepared for:

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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 Pesticide Rinsate Disposal Area (Site 15) and the DDT Mixing Area (Site 24) 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 6 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.

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The main objectives/advantages of this phased approach are as follows:

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

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

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

It is anticipated that some of the NAS Pensacola sites may not require investigation beyond Phase II and hence will comprise Contamination Assessment-type investigations. On the other hand, sites which have documented contamination will likely require the additional phases of vork, 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, vhich will provide all the information necessary for the development and completion of a Feasibility Study.

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2. SITE DESCRIPTION

21 Site 15 - Pesticide Rinsate Disposal Area

The Pesticide Rinsate Disposal site is located within the golf course maintenance area of NAS Pensacola, approximately 600 feet south of Bayou Grande (Figure 2-1). The site area is unpaved except for an asphalt wash pad that covers approximately 36 square feet. There are four buildings in the immediate site vicinity (buildings 2692, 2640, 747, and 1831) with access via an unpaved gravel road (see Figure 2-2). Potential contaminant source areas include two pesticide storage areas: Building 2692, including an unpaved area northeast of this building; and the equipment rinsate area southeast of Building 2692.

There are two existing monitoring wells on site: well GM-60 (15 feet deep, 2.5 feet screened), located near the southeast corner of Building 2692; and well GM-59 (17 feet deep, 2.5 feet screened), located approximately 15 feet northwest of the former outdoor pesticide storage area (see Figure 2-2). Both monitoring wells were installed in 1986 by Geraghty and Miller, Inc., (G 6 M) as part of a Characterization Study.

Building 3586, located approximately 375 feet east of Site 15 in the golf course maintenance area, has been, and may still be used for the storage, mixing, and disposal of pesticides. A sink on the outside of Building 3586 and a drain in a concrete pad to the north of the building both discharge into a holding tank. This tank was periodically pumped out by a contracted agent.

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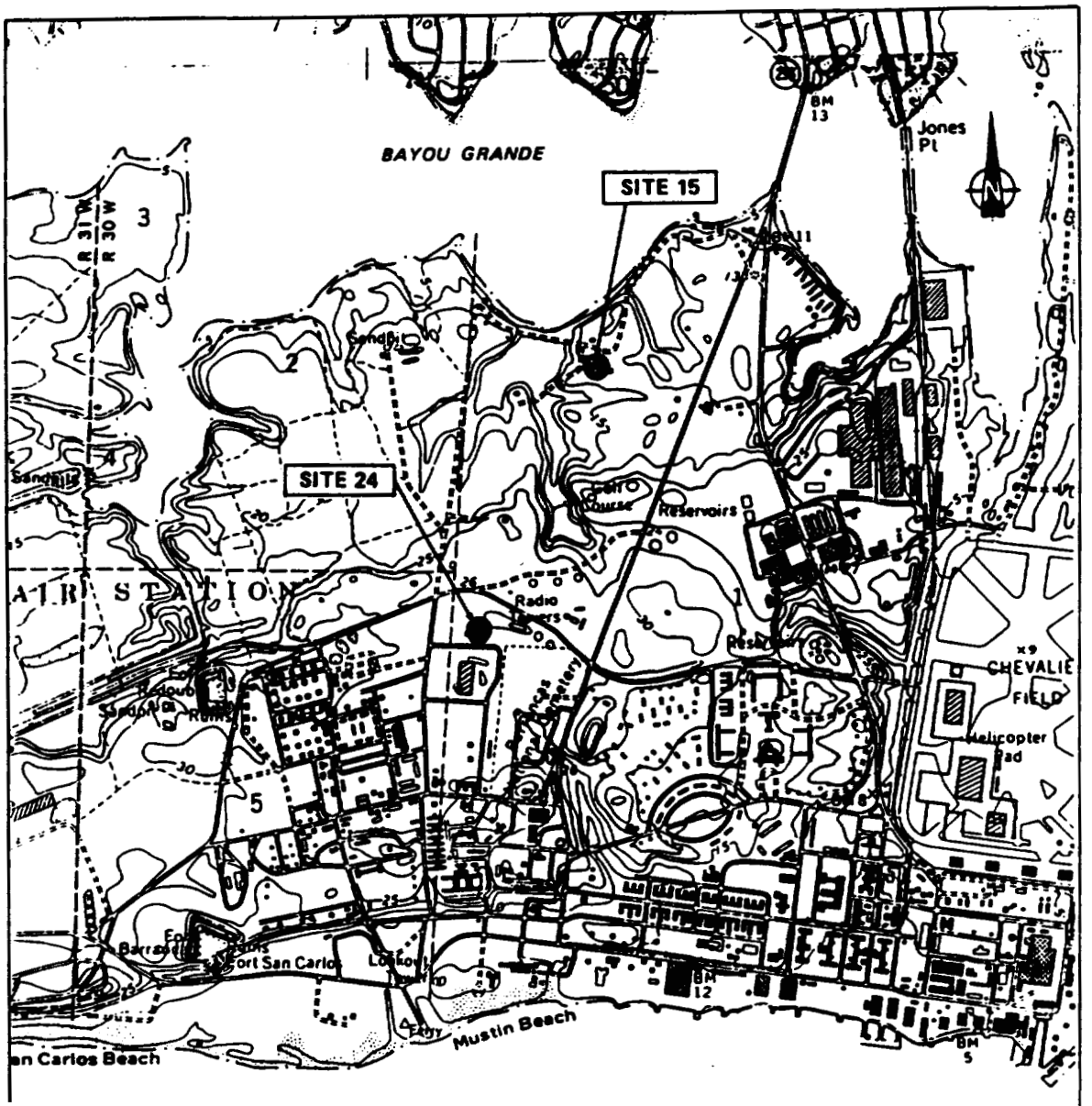

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SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangles: Fort Barrances, Fla. 1970 and West Pensacola, Fla. 1970. Photorevised 1987

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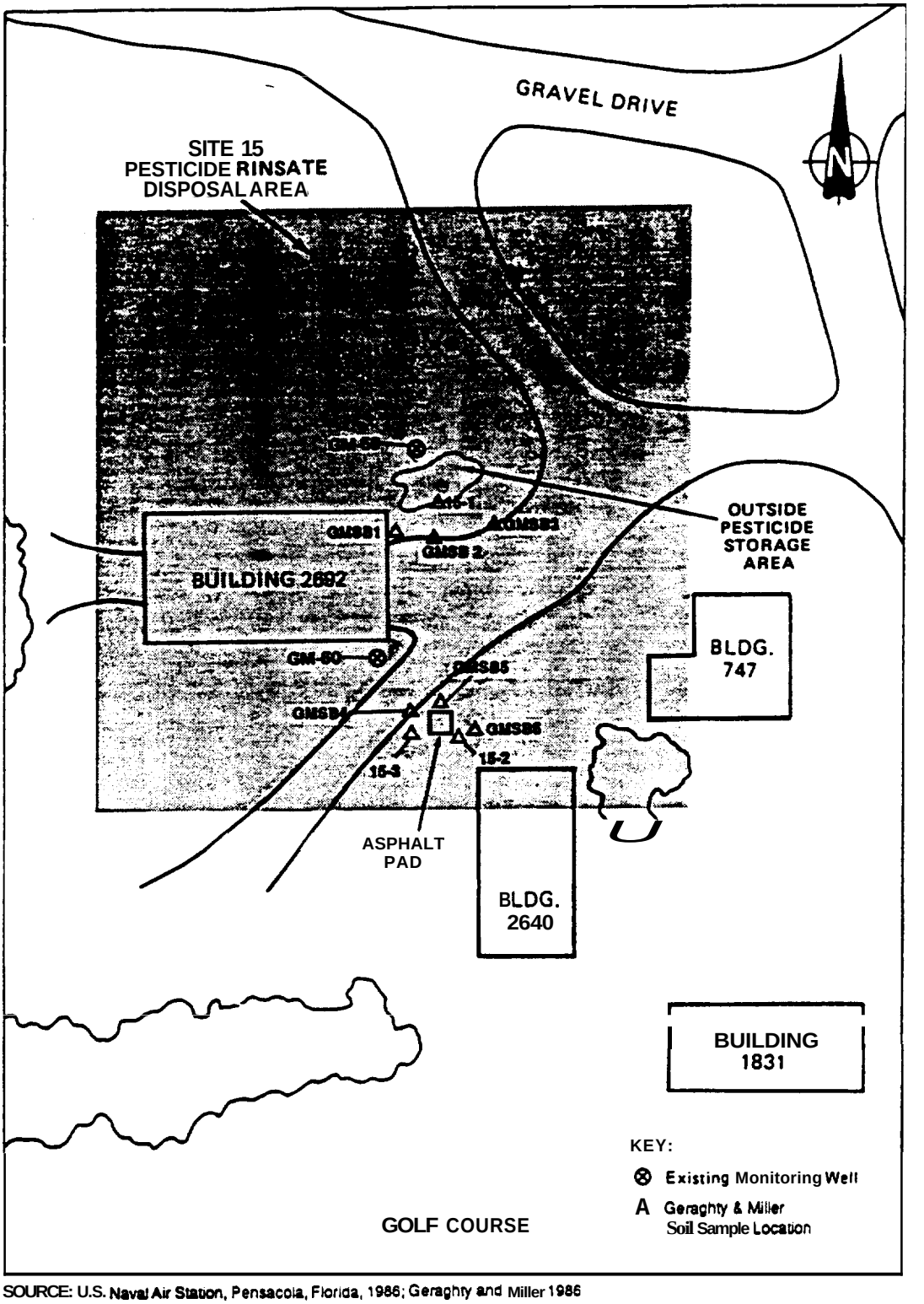
Figure 2–1 LOCATION MAP – NAS PENSACOLA – SITES 15 and 24



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

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0 50 100 200 300 FEET

Figure 2–2 SITE MAP – NAS PENSACOLA SITE 15

22 Site 24 - DDT Mixing Area

The DDT Mixing Area is located approximately 200 feet north of Building 3561 near the northwest corner of the Barrancas National Cemetery (see figures 2-1 and 2-3). The site was used as a location for mixing DDT with fuel oil for mosquito control in the 1950s and early 1960s.

A concrete pad, adjacent to Building 3561, vas apparently used as a pesticide rinsate disposal area after the discontinued use of DDT. In addition, Building 3561 may have been previously used as a pesticide storage area. In March 1981, a tank vashrack rinsing area vas constructed near Building 3561. The rinsate vas collected and diverted into the sanitary sewer system (Naval Energy and Environmental Support Activity [NEESA] 1983).

The area immediately surrounding Building 3651 is mostly paved; however, the former DDT mixing area is primarily unpaved and sparsely vegetated with native grasses. Surface soils are primarily sands and, topographically, the area is generally flat. Land surface elevations average approximately 26 feet above mean sea level (MSL). Surface flows are most likely precluded by the high permeability of the surficial soils vhich allow direct infiltration of precipitation and spills.

There are no monitoring wells located on site. A vater supply well (NAS Pensacola Well No. 1) is located approximately 0.3 mile southeast of Site 24. This well is infrequently used as a secondary vater supply to augment the primary well field located at Corry Station.

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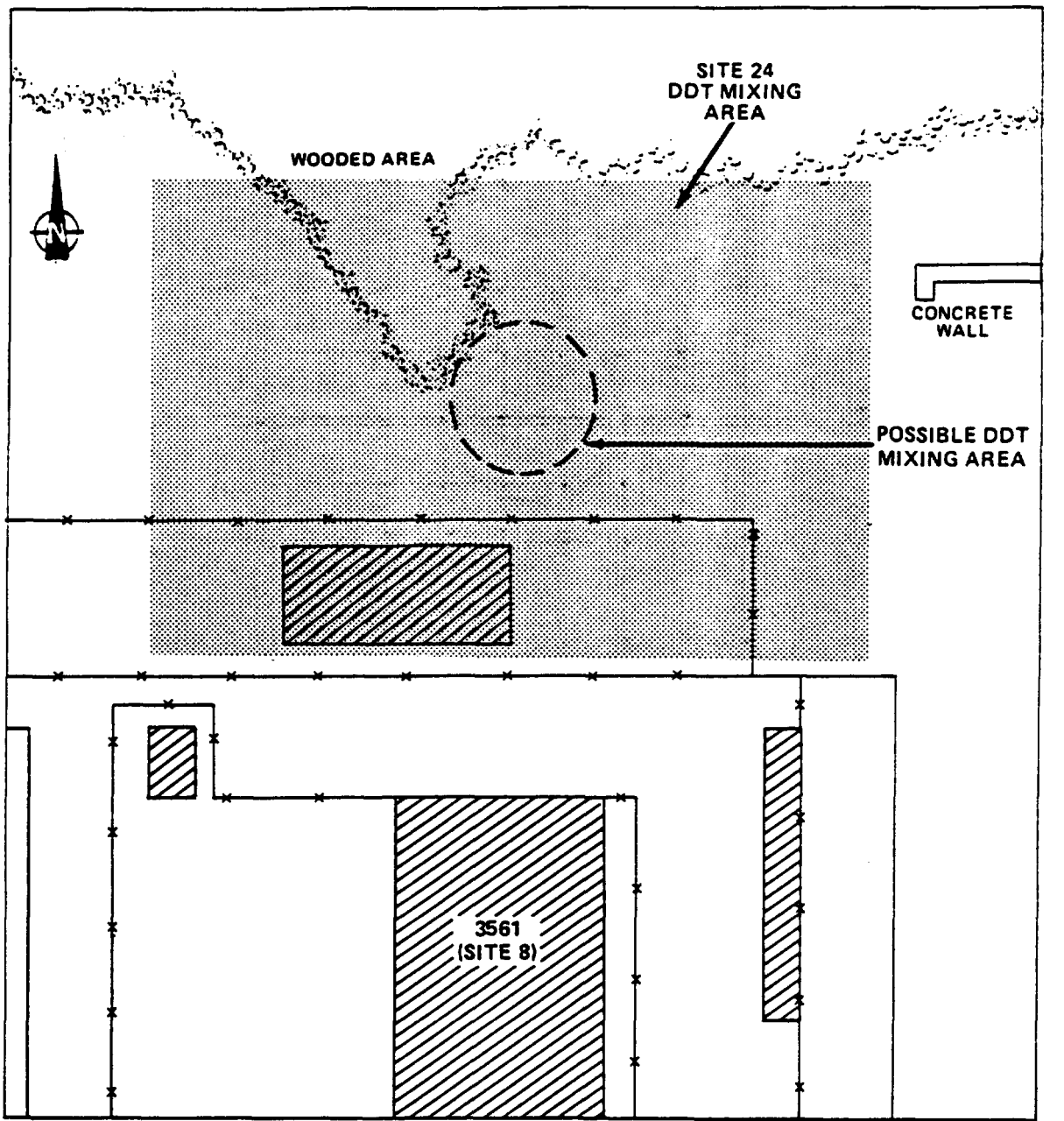

SOURCE: U.S. Naval Air Station, Pensacola, Florida, 1987.

SCALE

0 50 100 200 300 FEET

KEY:

Building

Figure 2-3 SITE MAP – NAS PENSACOLA SITE 24

3. SITE HISTORY

3.1 Site 15 - Pesticide Rinsate Disposal Area

From 1963 until 1979, the Pesticide Rinsate Disposal site was used as an area for the storage of pesticides and the cleaning of pesticide mixing and application equipment. Building 2692 and an outdoor area near the northeast corner of the building were used for the storage of pesticides (NEESA 1983). The floor of this building and the outdoor area are not cemented or paved, thereby creating the potential for direct infiltration of spilled or leaking pesticides. This building is currently used for the storage of fertilizers.

Equipment cleaning operations at the site's asphalt wash pad involved the disposal of dilute rinsate solutions directly onto the ground surface surrounding the pad (see Figure 2-2). These rinsates were allowed to infiltrate into the soil. The pesticide rinsate solutions are reported to have contained organic phosphates, chlorinated hydrocarbons, carbaryl, and carbamates (G & M 1986).

Previous environmental studies of the site vere conducted under the Navy Assessment and Control of Installation Pollutants (NACIP) program. Former environmental investigations include an Initial Assessment Study (IAS) and a two-part Confirmation Study.

The IAS Report evaluated the Pesticide Rinsate Disposal site based on information from historical records, field inspections, and personnel interviews. The study concluded that discarded pesticide rinsates were not of sufficient concentration to constitute a threat to human health or the environment. It was recommended that no further study was

necessary to further characterize the site. Hovever, environmental sampling and laboratory analyses vere not performed; therefore, the data for a thorough assessment of the magnitude and extent of residual contamination vere not available.

In 1984, G & M vas retained by the Navy to perform a Confirmation Study at NAS Pensacola. The Confirmation Study consisted of a Verification Study and a subsequent Characterization Study.

As part of the Verification Study, G & X (1984) collected soil samples from three boring locations at depths of 1 inch, 12 inches, and 24 inches. Boring number 15-1 vas located in the outdoor pesticide storage area, 15-2 and 15-3 were located on the perimeter of the asphalt wash pad (see Figure 2-2). The samples vere analyzed for arsenic, chlorinated pesticides, and polychlorinated biphenyls (PCBs). The analyses indicated moderate to lov concentrations of several pesticides vith a generally consistent decrease in concentration vith depth (see Table 3-1). Chlordane and 4,4'-DDT exhibited the highest concentrations and the widest distribution, with the elevated concentrations (21 ppm and 1.2 ppm, respectively) at the 1-inch depth in boring 15-1. Degradation products of 4,4'-DDT (4,4'-DDE and 4,4'-DDD) and of chlordane (heptachlor and heptachlor epoxide) were also detected in lov concentrations, as vere two other pesticides, Dieldrin and Beta-BBC. Concentrations of total arsenic ranged from 1.6 to 31 ppm. The highest concentrations vere found at the 1-inch depth in boring 15-3 and throughout boring 15-2.

These initial results suggested the need for inclusion of the site in G & M's 1986 Characterization Study. During this study, six more soil sample sets (1-inch, 12-inch, and 24-inch sampling depths) vere collected and tvo shallov monitoring vells vere installed on site (GX-59 and GX-60). Vater level measurements performed on five dates from June 11 to July 11, 1985 indicated an average depth to the water table of 13.11 feet in GH-59 and 13.66 feet in GX-60. Monitoring well GM-60 vas installed at the southeastern corner of Building 2692, and well GH-59 installed less than 5 feet from the northvest edge of the outdoor

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Table 3-1

SUMMARY OF ANALYTICAL RESULTS
PESTICIDE RINSATE DISPOSAL AREA (SITE 15)

Analytical Parameter	Sample Location								
	15-1 Depth (inches)			15-2 Depth (inches)			15-3 Depth (inches)		
	1	12	24	1	12	24	1	12	24
Pesticides and PCBs (ug/g or ppm)									
Chlordane	21.0	6.30	0.41	0.41	1.1	0.59	--	0.2	--
Chlordane	21.0	6.30	0.41	1.1	0.59	--	0.29	0.06	--
4,4'-DDT	1.2	0.79	0.01	0.69	0.40	0.01	--	--	--
4,4'-DDE	1.2	*	*	*	0.19	--	*	*	--
Heptachlor						--			--
Hetachlor Epoxide	--	0.16	0.03	--	--	--	--	--	--
Dieldrin	--	--	--	0.17	0.1	0.01	0.1	0.44	0.02
4,4'-DDD	--	--	--	--	0.03	--	--	--	--
4,4'-DDD	--	--	--	--	0.03	--	--	0.01	--
BHC-beta	--	--	--	--	0.03	--	--	--	--
Total Pesticides and PCBs	23.4	7.25	0.45	1.96	1.34	0.02	0.39	0.51	0.02
Total Arsenic	15.0	8.0	3.2	15.0	19.0	19.0	31.0	1.6	2.4

Note: * Heptachlor is a constituent of chlordane and is present below quantifiable limits.

Source: Geraghty and Miller, Inc. 1984

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storage area. Well GW-60 vas completed to a depth of 15 feet belov land surface (BLS), with a screen interval of 12.5 feet to 15 feet. Well GH-59 vas completed to a depth of 17 feet BLS, vith 2.5 feet of screen from 14.5 to 17 feet. Groundvater samples vere collected from the tvo wells and analyzed for chlorinated pesticides, PCBs, and arsenic. No pesticides or PCBs vere detected in the water samples; hovever, lov concentrations of arsenic (0.153 ppm) vere detected in the sample from well GW-59.

Three soil sample sets (GHSB-1 through B-3) were collected from the southern perimeter of the storage area, and three vere collected (GHSB-4 through B-6) from the northern perimeter of the asphalt wash pad. The soil samples vere analyzed for BP-Toxicity arsenic. Arsenic concentrations ranged from not detectable to 12.7 ppm. These levels exceeded the EP-Toxicity maximum contaminant level (MCL) of 5 ppa in two of the 18 samples (12.7 ppm in GHSB-2-1 and 5.2 ppm in GHSB-2-12).

The exceedance of the EP-Toxicity MCL indicates that these soils may be characterized under the Resource Conservation and Recovery Act (RCRA) as a hazardous vaste. This implies that further horizontal and vertical delineation of contamination is necessary to provide the data required for determining appropriate remedial measures at the site.

3.2 Site 24 - DDT Mixing Area

Prom the early 1950s until the early 1960s, the DDT Mixing Area site vas used as a location for mixing DDT with diesel fuel for mosquito control. Reportedly, spills occurred within the mixing area vhen DDT vas transferred from drums to spray tanks. The unintentional spillage of DDT concentrate may have contaminated site soils and groundwater (NEESA 1983).

The aerial application of DDT vas performed for at least 10 years to control mosquito outbreaks. In later years, a fogger machine vas used for DDT application. On the average, two or three mosquito outbreaks occurred each year during the spring and summer. For each aerial

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application, 500 gallons of 20% DDT were mixed with 500 gallons of diesel oil. The fogger machine used 300 gallons of each product. Two applications during a one-week period were performed for each mosquito outbreak (NEESA 1983).

Previous environmental studies of NAS Pensacola were conducted under the NACIP program. Former environmental investigations at NAS Pensacola consisted of an IAS and a two-part Confirmation Study. The Navy's 1983 IAS report evaluated the DDT Mixing Area site based on information taken from historical records, field inspections, and personnel interviews. This report included an estimate that approximately 20 gallons of pesticide mixture, containing about 3.3 pounds of DDT, were inadvertently spilled during the entire period of operations. The Navy study concluded that this estimated level of DDT contamination posed no threat to human health or to the environment. The DDT mixing area site was not investigated during the subsequent Confirmation Study.

In addition, Building 3561 was used as a pesticide storage and equipment rinsing area after the use of DDT was discontinued. A typical inventory of stored pesticides is included in Table 3-2. In March 1981, a tank washrack rinsing area was constructed near Building 3561. The rinsate was collected and diverted into the sanitary sewer system (NEESA 1983).

The activities involved in the storage and disposal of pesticides in Building 3561 and the adjacent concrete pad were not detailed in any of the previous investigations. It is unknown whether the operations are still in progress or if any potentially harmful releases have occurred. To date, no environmental sampling has been performed on any portion of this site.

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Table 3-2

GENERAL PESTICIDE INVENTORY
GOLF COURSE PESTICIDE SEOP, BUILDING 3586
(From 1979 Pest Management Plan)

Pesticides	Invcntory
Insecticides	
Carbaryl, 80% WP	10 pounds
Diazinon, 47.5% EC	2 gallons
Dursban, 41% EC	10 gallons
Dursban, .5% Mole Cricket Bait	900 pounds
Trichorfon, 80% SP (Dylox)	2 pounds
Herbicides	
CAMA, 10.3% EC (Calar)	3 gallons
Copper, 7% SC	5 gallons
Dalapon, 46.72 SP	100 pounds
Glyphosate, 41% EC	5 gallons
Kerb, 50% UP	21 pounds
MSMA, 47.8% WP	16 gallons
Simazine, 80% UP	20 pounds
2, 4-D, 49.8% Amine	4 gallons
Hiscellaneous	
Dexon, 35% WP	57 pounds
Maneb, 80% WP	110 pounds
Hethyl bromide, 98% LPU	30 pounds
Nemacur, 15% Granules	275 pounds

Source: NEESA 1983

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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 in only a few minutes (Wolfe ~~et al~~. 1988).

Precipitation rates in the NAS Pensacola vicinity are relatively high with an average annual rainfall of approximately 60 inches. Rainfall amounts are highest in July and August during almost daily thunderstorms (averaging 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, which reduces the potential recharge resulting from heavy summer rains. Spring and fall rains are generally less intense but longer in duration, producing less surface runoff and higher rates of infiltration and net recharge.

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

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the coast, commonly knovn 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 semi-natural (plantation) condition, primarily in the western portion of the facility.

5.1 Regional Biological Resources

5.1.1 Terrestrial

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

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

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Quercus spp. (scrub oak species, geminata, champanii, myrtifolia, and inopina), Cladonia species, and Ceratiola ericoides (rosemary). This community type has been ranked by FNAI as imperiled statewide because of its rarity and because of its vulnerability to extinction due to some artificial or biological factor. This community type can have three to five distinct habitats (Volfe et al. 1988).

Two other community types may be found in the western portions of the NAS Pensacola facility. These are flatwoods and sandhill vegetative communities. Platwoods vegetation occupies areas which were ocean bottoms in recent geologic times. Primary overstory vegetation is dominated by Pinus palustris (longleaf pine), Pinus elliottii (slash pine), and Serenoa repens (saw palmetto). Platwoods 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 rnonophylla (black titi), Cyrilla raceniflora (swamp titi), and other hydric or riparian species. Open moist savannah areas within flatwoods are dominated by the herbaceous plants Pinguicula spp. (butterwort), Sarracenia spp. (pitcher-plants), Uticularia spp. (bladderworts), Polygala spp. (milkworts), and Drosera spp. (sundews; Volfe et al. 1988).

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

Freshwater Wetland Vegetation. Much of the geological material underlying the NAS Pensacola facility is deep, porous sand often containing relatively impermeable clay lenses. In combination with high

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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.

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

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

5.1.2 Aquatic

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

Coastal Wetlands. There are no reported coastal marshes or estuarine wetlands around the NAS Pensacola facility, principally along the lov energy shores of Bayou Grande. The habitat type is usually dominated by saltmarch cordgrass (Spartina alternaflora) 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 Pgnsacola Bay in the 1950s disappeared by 1961. An examination of historical aerial photographs (see Section 12) may elucidate past distributions of seagrasses.

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

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

spp., various spionids, and Eaploscoloplos spp.) and bivalves (Anodontia alba and Tellina spp.) during most of the year. FDER samples collected along the wastewater treatment plant outfall show a drastic drop in species abundance and diversity close to the sevage 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 lov density yet moderate diversity of benthic infaunal organisms vhen compared to other estuarine systems within and around the turning basin. A complete comparison of the Navy's data with other literature cannot be made at this time because their data are not given in numbers per unit area. Eovever, the Navy's data reveal that very few deep dwelling organisms reside in the areas around the turning basin, and a lack of deep dwelling benthic organisms may be an indication of a benthic community under stressed conditions (Luckenbach et al. 1988).

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

Fish diversity was highest in the more saline vaters near the NAS Pensacola facility during spring and summer. In the less saline vaters of East Bay, diversity was lowest in summer and highest during the vinter 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).

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

Sport and Commercial Fishing. A moderate amount of commercial fishing occurs in Escambia County, accounting for 2% of the total Florida landings for 1980 to 1985 (Navy 1986). The dominant finfish species in terms of total weight was the black mullet., The most economically important species of finfish was the red snapper. E & E examined the commercial landing data for Escambia County for 1987 and 1988 (Heil 1989) and found that the most important commercial species by weight were: black mullet (24% of county landings), brown shrimp (21%), vermillion snapper (19.5%), red snapper (7.6%), porgies (4.7%), and amberjack (4%). Other less important commercial fish caught were Spanish mackerel, sand seatrout, black grouper, spotted seatrout, blue crab, and squid. These data, as well as the Navy's data, also suggest that a significant tuna fishery may be developing in the Pensacola Bay area (0 pounds landed in 1983; 1,582 pounds in 1987).

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

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

90 percent 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 accuaulated by the organisms residing near the facility.

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

Although no surveys of marine mammals have been conducted, it can be assumed that they are quantitatively ranked as uncommon to common in abundance within the 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 Pensacola facility (see Appendix C). Many rare, threatened, and endangered species are associated vith the wetland or bog habitats found on NAS Pensacola. A total of 57 occurrences for six plant species vere recorded in an inventory conducted by FNAI (1988b) of the UAS Pensacola facility (see Appendix C). Most of these plants were found in the area around Sherman Field and habitats to the vest. Any site renediation 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 vaters surrounding the NAS Pensacola facility, as well as nesting and feeding animals on the

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facility grounds. Complete biotic surveys may be necessary to determine the presence of threatened or endangered species and potential pathways of contamination to these species.

5.2 Site-Specific Biological Resources

Site 15 is found in an area of sand pine scrub communities which are dominated by scrub oaks and shrub vegetation. The majority of the habitat within the immediate vicinity of Site 15 has been partially altered for the construction of several buildings. The understory consists mostly of grass species, instead of shrubs and herbaceous plants. The areas to the west and southwest of Site 15 consist of a cultivated golf course to the east, and a relatively undisturbed sand pine scrub community to the north. Because of the abundance of relatively undisturbed vegetative communities in the vicinity of Site 15, it is expected that many species of birds, reptiles, amphibians, and mammals use the site for feeding, nesting, or as a migration corridor.

Site 24 has been cleared of most vegetation for the construction of buildings and storage areas; therefore, grasses are the only dominant vegetation. The site is surrounded on the north and west by sand scrub vegetative communities. A cemetery lies to the east-southeast. It is expected that few faunal species, primarily small mammals and some birds, use this habitat for feeding, but a moderate number of species may use this site habitat as a migration corridor to the wooded area north of the site.

There are no aquatic habitats located on either site: however, Bayou Grande is located approximately 1/4-mile northwest of Site 15.

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6. SURFACE WATER HYDROLOGY

6.1 General Occurrence and Significance of Surface Vater

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.

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The discharge of surface waters into Pensacola Bay, Bayou Grande, and the coastal wetland areas presents the potential for transport of contaminants into these systems. This could have a significant impact on seagrass and other sensitive plant communities, as well as on shell fishing, recreational fishing, and swimming in these coastal zones. Discharges, either through the surface vater or groundwater, into wetland areas found on site could also have a significant impact on the biotic communities that are dependent on those habitats.

6.2 Site-Specific Surface Water Considerations

No significant surface water bodies are located on or in the immediate vicinity of Site *24.* The nearest surface water body to Site *24* is a pond on the A.C. Read Golf Course, approximately 0.3 mile to the northeast.

No significant surface vater bodies occur in the immediate vicinity of Site 15. The closest surface water body, the Golf Course Pond, is located approximately 500 feet vest of the site. Bayou Grande is located approximately *600* feet to the north, and an unnamed pond is located approximately *650* feet to the northeast. Given the permeable nature of the soils (which vould limit surface runoff) and the distance from Site 15, it is not likely that these surface water bodies would be significantly impacted by site contamination. However, the potential for impact on these water bodies will be re-evaluated during the course of this investigation.

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7. PHYSIOGRAPHY AND HYDROGEOLOGY

7.1 Physiography and Regional Eydrogeology

7.1.1 Physiography

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

7.1.2 Regional Eydrogeology

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.

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1984). In this portion of Florida, the Surficial Aquifer constitutes an iaportant 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 groundvater from vells that tap the Sand-and-Gravel Aquifer in southern Escambia County (Clemens et al. 1989), the groundvater 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 with land surface and recharge occurs principally by the direct infiltration of precipitation, the aquifer is particularly susceptible to contamination from surface sources. In the NAS Pensacola vicinity, the Sand-and-Gravel Aquifer is made up of three zones based on contrasting permeabilities. These zones are referred to as the surficial zone, the lov permeability zone, and the main producing zone (Vilkins et al. 1985).

Surficial Zone. The surficial zone is contiguous with land surface and contains groundwater under water table or perched water table conditions. The results of numerous borings conducted at NAS Pensacola (G & M 1984; 1986) indicate that the surficial zone ranges in thickness between 40 and 70 feet and consists of tan and brown, fine- to medium-grained quartz sand. Depth to the water table within the surficial zone is variable depending on location and ranges from less than 1 foot near surface water bodies to more than 20 feet in areas of higher elevation. In general, the direction of ground water flov is controlled by the topography and by discharge to surface water bodies. Consequently, shallow groundwater in the surficial zone moves toward areas of lower elevation and/or the nearest surface vater body. Overall, the surficial zone has a high peraeability. Numerous aquifer (slug) tests and laboratory permeability tests conducted on wells in or sediments from the surficial zone at NAS Pensacola (G & M 1986) yielded hydraulic conductivity values ranging from 16 to 56 ft/day. Horizontal groundvater flov velocities in the surficial zone will depend on site-specific hydraulic conductivities and horizontal hydraulic gradients: hovever, velocities would generally be expected to be high.

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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 semi-confining unit inhibiting the flow of groundwater between the surficial zone and the underlying main producing zone. The low permeability zone has been encountered in at least 16 borings at widely spread locations throughout the NAS Pensacola (G & M 1984; 1986). Although additional boring or geophysical techniques would be required to confirm its presence at a given location, it is likely that this unit is ubiquitous at NAS Pensacola. Few, if any, wells are open to the low permeability zone at NAS Pensacola; thus, no information is available regarding groundwater flow direction.

Main Producing Zone. The bottom portion of the Sand-and-Gravel Aquifer is called the main producing zone and is composed mainly of sand and gravel interbedded with thin beds of silt and clay. The depth at which the main producing zone is encountered is somewhat variable, ranging from 60 to approximately 120 feet BLS at NAS Pensacola. This zone generally has the highest permeability characteristics due to thicker and more persistent sand and gravel beds, and is tapped by most of the major wells in the Pensacola area (Wilkins ~~et al.~~ 1985). NAS Pensacola has three supply wells which produce water from this zone; however, due to high iron content in the water, the wells are infrequently used (G 6 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 groundvater flov vithin this zone; hovever, the flow direction is assumed to be generally southvard under ambient conditions. Pumpage of the supply wells would locally cause groundwater in this zone to flow toward the vells.

As a result of the overlying lov permeability zone, groundvater vithin the main producing zone occurs under confined or semi-confined conditions. At one nested well location on NAS Pensacola (east of Building 648), the water level elevation in a well open to the main producing zone is approximately 7 feet lower than that in an adjacent well open to the surficial zone (G 6 M 1986). This indicates that a significant downward hydraulic gradient exists betveen these tvo zones. Thus, a considerable potential exists for vertical groundvater flov from the surficial to the main producing zone at this location. It is not knovn to what extent this potential exists elsewhere at NAS Pensacola.

7.1.2.2 Intermediate System

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

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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 comprises the Middle to Lower Miocene Chickasawhay Limestone and undifferentiated Tampa Stage Limestone. Groundwater within the Floridan Aquifer in this area is highly mineralized and is not used for water supply (Wagner et al. 1984).

7.2 Site Hydrogeology

7.2.1 Site 15 - Pesticide Rinsate Disposal Area

Two monitoring wells (GM-59 and GH-60) were installed on site by G & M in 1986 as part of a Characterization Study. Well GM-59 was completed to a depth of 17 feet BLS, with 2.5 feet of screen from 14.5 to 17 feet. Well GM-60 was completed to a depth of 15 feet BLS with a screened interval from 12.5 feet to 15 feet. Lithologic drilling logs for the two wells indicate that the surficial zone of the Sand-and-Gravel Aquifer at both locations consists of fine- to medium-grained tan sands to a depth of at least 15 feet. Lithologic information from nearby borings indicate that there are primarily fine- to medium-grained quartz sands at depths of approximately 15 to 50 feet BLS (G 6 M 1986).

Water level measurements performed on five dates from June 11 to July 11, 1985 indicate an average depth to the water table of 13.11 feet in GM-59 and 13.66 feet in GM-60. The direction of groundwater flow can not be determined from these two wells; however, the site's proximity to Bayou Grande indicates that groundwater flow should be to the west and northwest (G & M 1986).

In addition, there is a NAS Pensacola supply well (Well No. 1) located approximately 0.7 mile south of Site 15. This well is infrequently used as a secondary water supply to augment the primary well field located at Corry Station. The supply well was installed in 1942 to a depth of 174.5 feet with bronze screen from approximately 106 to 174

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feet. The vell yield, when in use, is about 650 gallons per minute (gpm), and depth to the vater table (in 1942) vas approximately 23 feet (G & M 1986).

7.2.2 Site 24 - DDT Mixing Area

The soils of Escambia County are primarily derived from marine and stream deposit parent material. The IAS soil association map (NEESA 1983) indicates that the soils at Site 24 are predominately a sandy fill Material. This material vas most likely deposited as fill material for construction purposes. The location of the site indicates that it may overlie the poorly drained, gray, sandy lovland soils of the Series. There are currently no monitoring wells on site and there is no currently available site-specific hydrogeologic data. Eovever, land surface elevations are approximately 26 feet above MSL and the depth to groundwater has been roughly estimated to be 10 feet. Lithologic information from nearby borings indicate that there are primarily fine- to medium-grained quartz sands at depths of approximately 15 to 50 feet BLS.

In addition, there is an NAS Pensacola supply vell (Well No. 1) approximately 0.3 mile southeast of Site 24. This well is infrequently used as a secondary vater supply to augment the primary vell field located at Corry Station. The supply vell vas installed in 1942 to a depth of 174.5 feet vith bronze screen from approximately 106 to 174 feet. The vell yield, vhen in use, is about 650 gpm and the depth to the static vater level (in 1942) was approximately 23 feet.

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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 6 E's project management guidelines (see Section 22).

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9. SITE MANAGEMENT PLAN

The Generic Site Management Plan (GSMP) defines the management procedures for field activities on both the site and program level. The management and implementation of all field activities conducted as part of the Contamination Assessment/Remedial Activities Investigation of Sites 15 and 24 will follov 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.

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10. HEALTH AND SAFETY PLAN

A comprehensive General Health and Safety Plan (GHSP) and individual site-specific safety plans (SSPs[; 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 (e.g., hospitals, ambulatory units, poison control centers, fire departments, and police/ sheriff departments). The SSP will also identify first-aid and personal safety equipment and will provide recommended site security precautions. The GHSP and the SSP will comply with the Occupational Safety and Health Administration (OSHA) Guidelines for Hazardous Waste Operations (29 CFR Section 1910).

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11. QUALITY ASSURANCE PROJECT PLAN

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

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

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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 fieldvork 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 that 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.

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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.

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14. FIELDWORK METHODOLOGY

14.1 Phase I — Field Screening

The primary objective of the Phase I field screening investigation is to effectively and efficiently focus the Site Characterization (Phase II) and subsequent Extent Delineation (Phase III and Phase 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 Pesticide Rinsate Disposal and DDT Mixing 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, and areas of exposed debris.

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

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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 equipment during valkovers of landfilled areas, in accordance vith Section 6.1.1 of the GQAPP. In the event that any [areas with readings above background] are located, the area(s) will be flagged and identified on a site map for future reference. All findings of the physical reconnaissance will be mapped in detail and recorded in the field logbook.

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

During the establishment of the geophysical survey grid netvork (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 vith 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 vith 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 GOAPP.

14.1.1.3 Habitat/Biota *Survey*

On-site and surrounding vegetation and wildlife will be examined to determine any past, present, or future potential threat resulting from existing contamination, migration of contaminants, investigative work, and remedial action, if any. [Using historical aerial photographs and the survey results, a map illustrating the identified habitats will be generated.]

14.1.2 Geophysical Survey

A magnetometry survey will be conducted using a proton magnetometer or gradiometer. The magnetometer will be carried along transects at SO-foot intervals at both sites 15 and 24 to identify potential buried

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metallic objects, such as pipes, drums, or storage tanks. The results of the survey may aid in the identification of potential contaminant sources and plumes and in the selection of drilling locations. The magnetometer survey will be performed in accordance with procedures detailed in Section 6.2.3 of the GQAPP.

14.1.3 Analytical Screening

14.1.3.1 Laboratory Analyses

Phase I sampling activities for sites 15 and 24 will require soil sampling, installation of shallow temporary monitoring wells, and groundwater sampling. All samples will be analyzed in the laboratory for analytical screening parameters. The analytical screening program has been developed for the Phase I effort to efficiently and cost effectively focus subsequent phases of site characterization and contaminant extent delineation. Analytical screening is addressed in detail in Section 9.1 of the GQAPP. Analytical requirements for samples collected in Phase I are shown in Table 14-1.

Soil - Approximately 48 soil borings will be drilled using either a solid stem auger extraction method or a hand-operated bucket auger. Borings will be completed to an approximate depth of 12 feet at Site 15 and 10 feet at Site 24, or to the water table, whichever is greater. Soil samples will be collected over 5-foot intervals (0-5, 5-10 feet, etc.); soil lithologies will be characterized and recorded in the field notebook. All drilling and sampling equipment will be decontaminated in accordance with sections 6.6 and 6.10 of the GQAPP.

Assuming the water table is at a depth of 12 feet at Site 15 and 10 feet at Site 24, a total of 87 samples will be collected at Site 15 and 38 samples will be collected at Site 24.

Tentative sample locations are shown on figures 14-1 and 14-2. The approximate locations indicated were selected based on both site history information pertaining to potential source areas (see Section 2) and on an approximation of the potential size of source areas. Sample numbers

Table 14-1

PHASE I SAMPLING AND ANALYTICAL REQUIREMENTS-GROUP D

SITE 15

Medium	no. of Samples	Duplicates	Total	Analytical Suite[a,b]
Soil	87	4	91	A
Groundwater[d]	L0	1	11	A
TOTAL	61	4	65	

Medium	No. of Samples	Dupli-cates	Trip Blanks[f]	Field Blanks	Rinsate Blanks	Preservative Blanks[g]	Total	Analytical suite[a,c]
Groundwater[e]	2	1	1	1	1	1	7	B

SITE 24

Medium	No. of Samples	Duplicates	Total	Analytical Suite[a,b]
Soil	38	2	40	A
Groundwater[c]	5	1	6	A
TOTAL	43	3	46	

14[NASP]UM1104:T0396/898/10

'Analytical suite dosignations are as follows:

A = Volatile organic compounds. polynuclear aromatic hydrocarbons, organophosphorous posticidos, carbamates, posticidos and total PCBs, total recoverable hydrocarbons, and metals (total. unfiltered).

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

[b]Specific constituents encompassed by tho various chemical groups included vithin analytical suite A are identified in Tables 9-1 through 9-[5] of tho GQAPP.

[c]Specific constituonts oncompassod by tho various chemical groups included within analytical suite B are identified in Tables 9-[6] through 9-[15] of tho GQAPP.

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

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

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

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

[Source: Ecology and Environment, Inc., 19921

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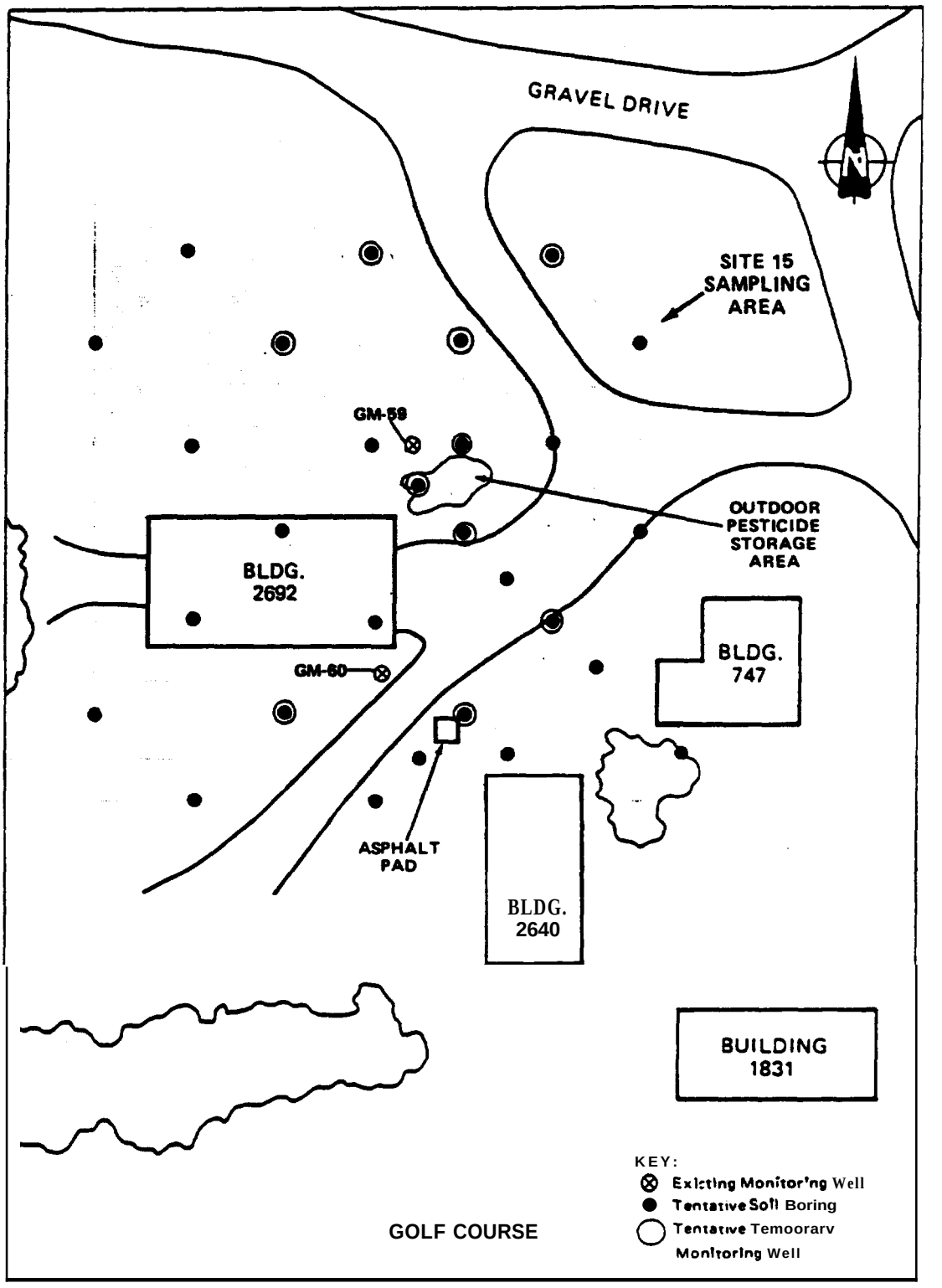
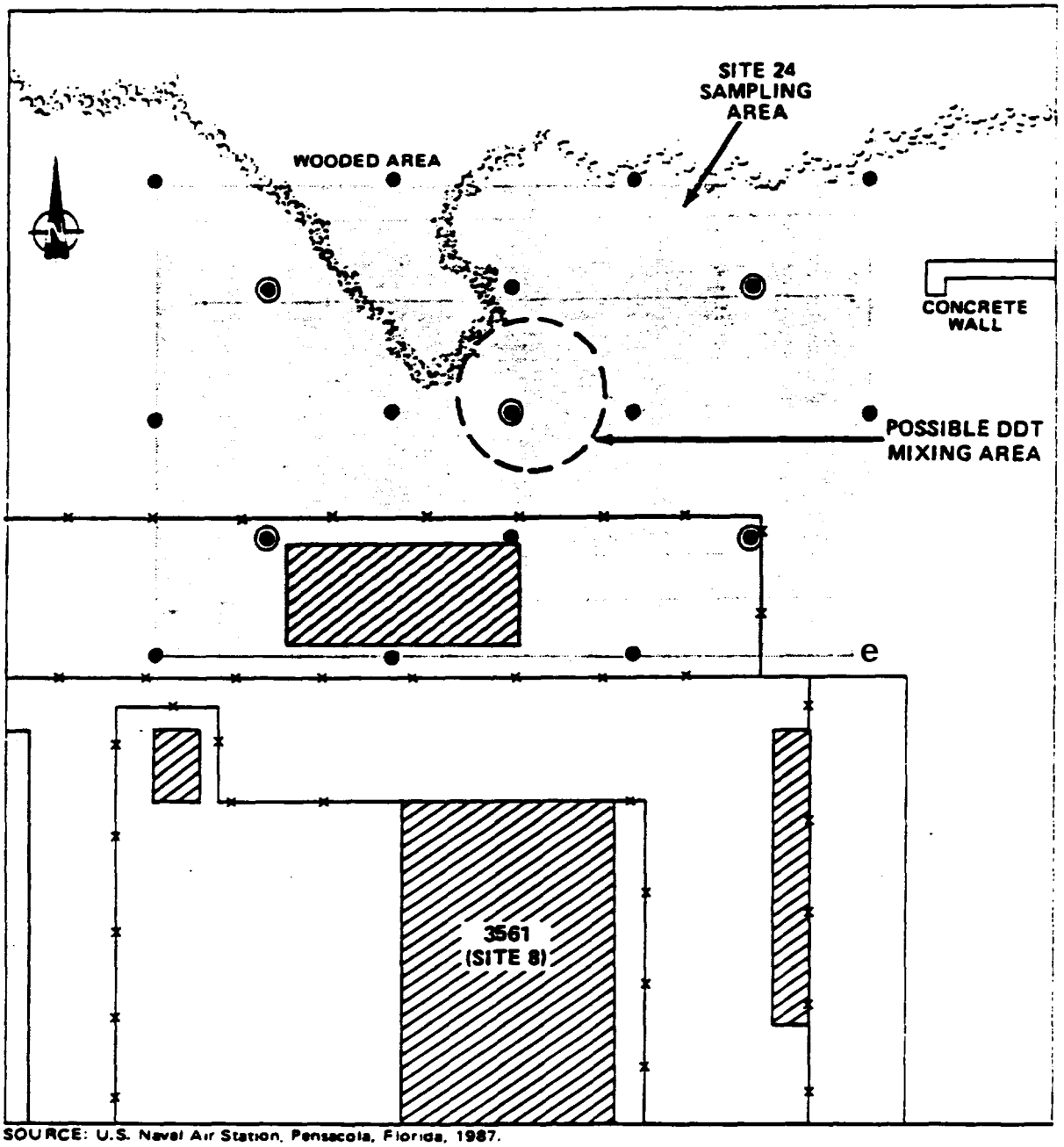


SOURCE: U.S. Naval Air Station, Pensacola, Florida, 1986

SCALE

0 50 100 200 300 FEET

Figure 14–1 TENTATIVE SOIL BORING AND TEMPORARY MONITORING WELL LOCATIONS, SITE 15 – PHASE I



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

SCALE

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KEY:

- ● Tentative Soil Boring
- ○ Tentative Temporary Monitoring Well
- ▨ Building

Figure 14–2 TENTATIVE SOIL BORING AND TEMPORARY MONITORING WELL LOCATIONS, SITE 24 – PHASE I

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and locations are approximate and may be altered subject to the evaluation of more detailed site-specific data from the reconnaissance and geophysical surveys.

Groundvater - At Site 15, approximately 10 stainless steel temporary monitoring wells will be installed to an estimated depth of 16 feet with 5 feet of screen from 11 to 16 feet. At Site 24, approximately five temporary wells will be installed to an estimated depth of 14 feet with a screen interval from 9 to 14 feet. The screened interval will be installed to bracket the water table for the collection of immiscible, floating contaminants, if any. Soil samples will be collected, as described above, during well installation, and observations regarding lithology will be recorded in the field notebook.

Tentative temporary monitoring well locations are shown on figures 14-1 and 14-2. The approximate locations indicated were selected based on both site history information pertaining to potential source areas (see Section 2), and on an approximation of the potential transport size of source areas.

All wells will be installed, developed, and sampled in accordance with sections 6.7 and 6.8 of the GOAPP. In addition, the two existing monitoring wells at Site 15 (GM-59 and GM-60) will be sampled. Decontamination of drilling and sampling equipment will be in accordance with Section 6.10 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 sites 15 and 24. static water levels will be measured in each well to determine shallow groundwater flow direction and horizontal hydraulic gradient. Geophysical, analytical screening, and hydrologic data collected during Phase I will be evaluated 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 Work Plan--Group D (Site 15, Pesticide Rinsate Disposal Area; Site 24, DDT Mixing Area) Naval Air Station Pensacola, Pensacola, Florida, has been entirely revised to reflect the results of the Phase I activities proposed in the original work plan document ([June] 1990). The original version ([June] 1990) of Section 14.2 of this work plan is presented in Appendix D. Figures 14-3 and 14-4 shov the actual Phase I sampling locations and location designations. The results of the Phase I investigations of sites 15 and 24 are presented, respectively, in E 6 E's Final Interim Data Report, Contamination Assessment/Remedial Activities Investigation, Pesticide Rinsate Disposal Area (Site 15), Naval Air Station Pensacola, Pensacola, Florida, October 1991; and E & E's Final Interim Data Report, Contamination Assessment/Remedial Activities Investigation, DDT Mixing Area (Site 24), Naval Air Station Pensacola, Pensacola, Florida, October 1991.

In general, the results of E & E's Phase I investigations of sites 15 and *24*, revieved in combination with those of previous investigations of the sites (NEESA 1983; and [Site 15 only] G&M 1984, 1986), indicated the following:

Site 15

- Contamination is apparently limited regarding lateral/vertical extent and concentration magnitude, and, for the most part, is associated with probable, historical, on-site source areas: the former outside pesticide storage area and the asphalt pad equipment cleaning and rinsate disposal area; hovevcr, both off-site (volatile organic compounds [VOCs]) and ambient (total recoverable petroleum hydrocarbons [TRPHs]) sources of contamination may also be impacting the site.

- Soils exhibited elevated levels of arsenic, TRPHs, and three VOCs (trans-1,2-dichloroethene; 1,1,1-trichloroethanc; and possibly methylene chloride), as well as low to trace levels of polynuclear aromatic hydrocarbons (PAHs) and trace levels pesticides; chlordane, detected at

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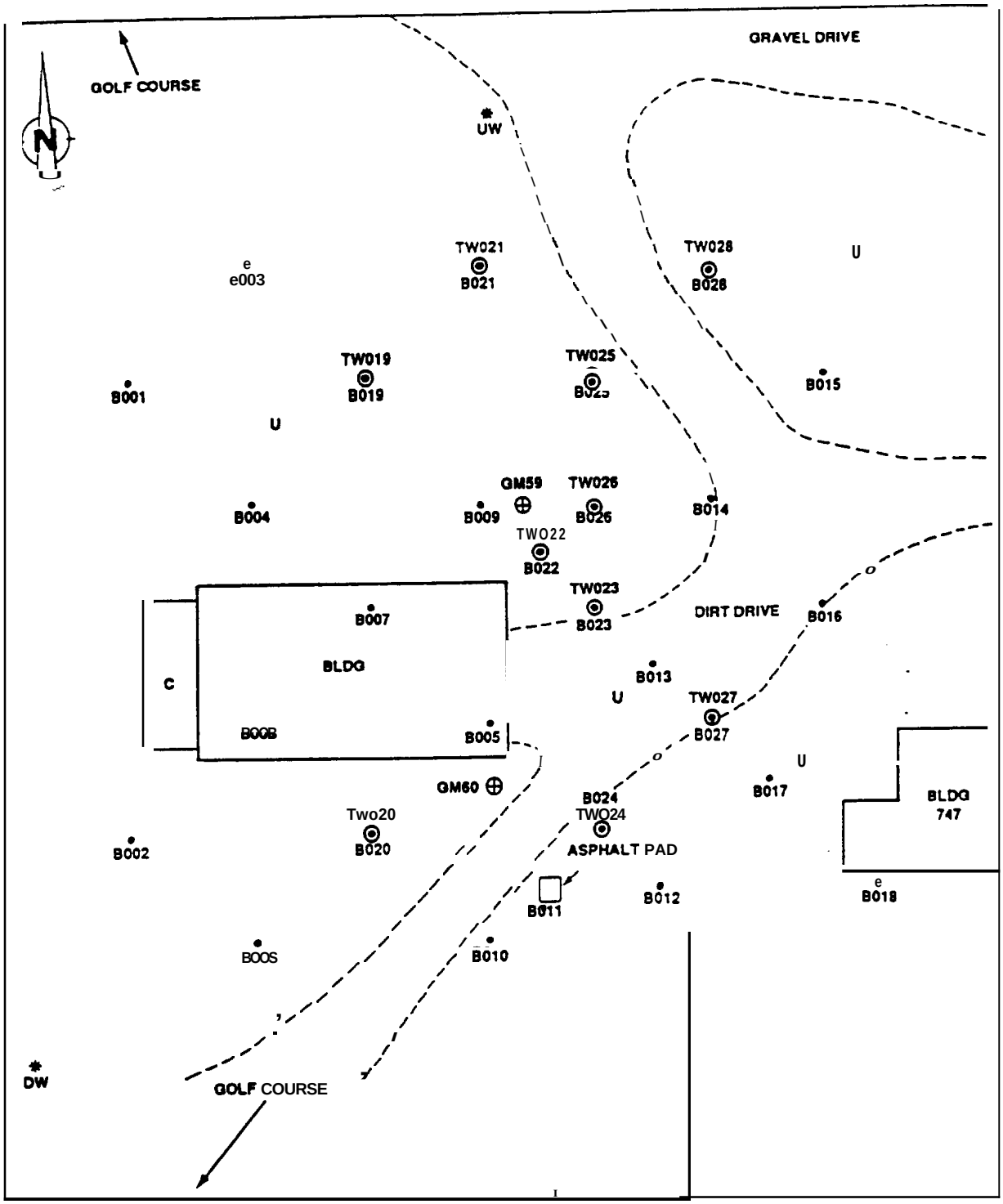


SOURCE: U.S. Naval Air Station, Pensacola, Florida 1987; and E 6 E 1991

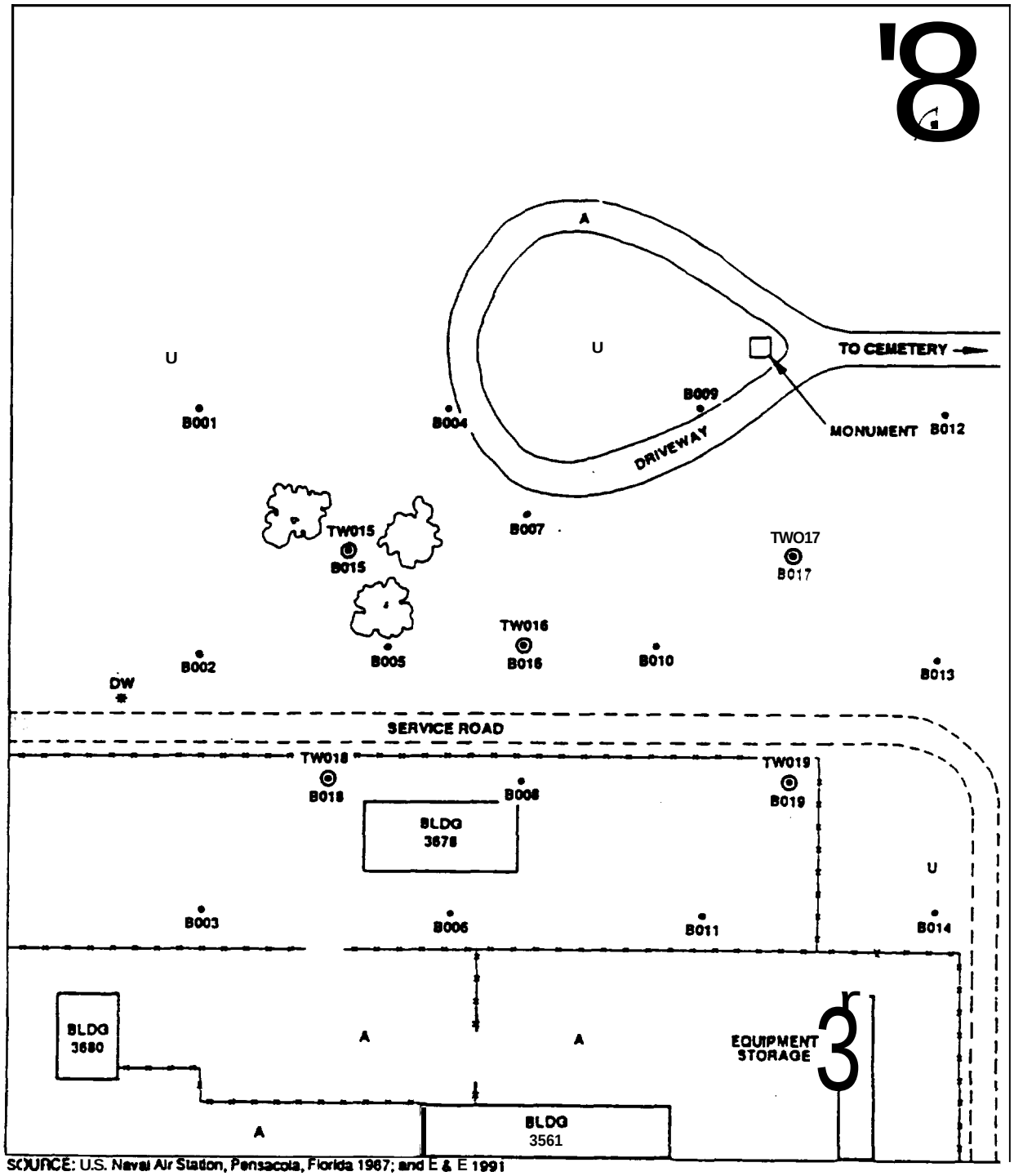
SCALE

0 50 100 FEET

KEY:

BLDG 747		○	Temporary Monitoring Well	✱	Particulate Air Sampling Location
	Unpaved Road	•	Soil Boring	DW/UW	Downwind/Upwind
⊕	Existing Permanent Shallow Monitoring Well	TW019	Temporary Monitoring Well Number		
C	Concrete Paved Area	B019	Soil Boring Number		
U	Unpaved Area				

Figure 14-3 PARTICULATE AIR SCREENING, SOIL BORING, AND TEMPORARY MONITORING WELL LOCATIONS — NAS PENSACOLA SITE 15 — PHASE I



SOURCE: U.S. Naval Air Station, Pensacola, Florida 1987; and E & E 1991

SCALE

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KEY:

	Tree	DW/UW	Downwind/Upwind		Temporary Monitoring Well
BLDG 3678	Building	A	Asphalt Paved Area		Soil Boring
	Fence	U	Unpaved Area	TW015	Monitoring Well Number
	Particulate Air Sampling Location		Unpaved Road	B015	Soil Boring Number

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Figure 14-4 PARTICULATE AIR SCREENING, SOIL BORING, AND TEMPORARY MONITORING WELL LOCATIONS — NAS PENSACOLA SITE 24 — PHASE I

relatively high levels in the G&H *1984* soil samples, was not detected in any of the E & E Phase I soil samples; in addition, the Phase I results suggest the presence of aquifer matrix soils contamination by metals (especially arsenic).

- Groundwaters of the surficial zone of the Sand-and-Gravel Aquifer commonly exhibited Concentrations of one or more metals exceeding federal and state standards or guidance concentrations; however, this may reflect metals contamination of aquifer matrix soils rather than actual groundwater contamination; trace levels of dieldrin/4,4-DDE were detected in three Phase I samples.

Site 24

- DDT, the most probable, site-related contaminant, was not detected in any of the Phase I soil or groundwater samples.

- Soils commonly exhibited elevated lead and/or TRPH concentrations, as well as low to trace levels of PAHs; an ambient source for at least some of the detected contamination cannot be discounted; the carbamate pesticide fluometuron was detected in two soil samples (S005B = 1,200 µg/kg and S013B = *20,000* µg/kg; however, carbamate pesticides reportedly were not commonly used at the time of Site *24* DDT mixing activities.

- Groundwaters of the surficial zone of the Sand-and-Gravel Aquifer commonly exhibited concentrations of one or more metals exceeding federal and state standards or guidance concentrations; however, this may reflect metals contamination of aquifer matrix soils rather than actual groundwater contamination.

- Tetrachloroethene was detected in one groundwater sample (GW019), collected in the southeast corner of the site, at a concentration exceeding the federal and state standards; the source of this contaminant may be located south-southeast of Site 24 or may be associated with former activities at Building 3561 (Site 8, Rifle Range Disposal Area).

- Trace levels of the carbamate pesticide methomyl were detected in four of five groundwater samples at trace levels below the state guidance concentration; as noted above, carbamate pesticides reportedly were not commonly used at the time of Site *24* DDT mixing activities.

[Based on these Phase I results, the Site 24 investigation is no longer limited to screening, but will encompass a full-scale RI/FS.]

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In light of the Phase I results summarized above, the objectives of the Phase II investigations of sites 15 and 24 will be as follovs:

Site 15

- o Identify to the greatest extent possible any additional off-site sources of contaaination as well as potential ambient sources of contamination in the site vicinity;
- o Fully characterize the nature/magnitude and delineate the overall extent of on-site soil and groundwater contamination; and
- o Initiate the Risk Assessment and Feasibility Study for the site.

Site 24

- o Identify to the greatest extent possible any additional off-site sources of contaaination as well as potential ambient sources of contamination in the site vicinity;
- o Fully Characterize the nature/magnitude and delineate the overall extent of on-site soil and groundwater contamination; and
- o Initiate the Risk Assessment and, as varranted, the Feasibility Study for the site.

In order to meet the above objectives, the Phase II investigations of sites 15 and 24 will include the following elements:

- o Contaminant source survey;
- o Soil sampling;
- o Installation of shallow monitoring wells;
- o Collection of groundwater samples from all existing (Site 15) and newly installed wells;
- o Hydrologic assessment; and
- o 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 and previous analytical results have both

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been evaluated regarding all requirements of CERCLA and Superfund Amendments and Reauthorization Act (SARA), as well as all' other ARARs. For sites 15 and *24*, these *ARARs* include:

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

Formal, quantitative air sampling will not be conducted during Phase II at sites 15 and 24 because no evidence that either site 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. No intermediate or deep monitoring wells will be installed and sampled during Phase II because the presence, nature, distribution, and source area(s) of shallow groundwater contamination have not been adequately established. No surface water bodies or aquatic habitats are impacted by sites 15 or 24. [Eowever, 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 sites 15 and *24* 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

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

possible contamination at these sites. Adjustments to the Phase II scope of vork may include, but may not be limited to: 1) sampling of additional media which are not already included in this vork plan; 2) installation of additional and/or deeper (i.e., intermediate and/or deep) permanent monitoring vells; 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. However, sampling and/or analysis will not be performed on media for which the associated 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 at sites 15 and 24. This could warrant either an increase or decrease in the scope of vork proposed in this vork plan.]

Based on the results of the activities identified above, during Phase II E 6 E will initiate the appropriate Risk Assessnent and, as warranted, 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 sites. [If no data gaps are identified, the Baseline Risk Assessment will be completed during Phase II.]

Feasibility Study activities, vhich may be required for sites 15 and 24, 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 vhether any interim remedial measures (IRMs) are required and develop recommendations for implementation of these IRMs (see Section 14.2.5). [IRMs will only be implemented following receipt of KPA approval.]

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All Phase II investigation activities and results will be discussed in a separate Interim Data Report for each site 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 [1992] version of this document, subject to its approval. [In this section (14.2),] all references apply to the [1992] version of the GQAPP.

14.2.1 Contaminant Source Survey

A detailed contaminant source survey will be performed at sites 15 and 24 in order to obtain a comprehensive understanding of potential contaminant source(s) at the sites. 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 sites 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 sites 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 foraer 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, low-level ambient contaminant source(s).

At sites 15 and 24, specific tasks associated with the contaminant source survey will focus on:

- Determination of current use of all on-site buildings including buildings 747, 2640, and 2692 at Site 15 and Building 3678 at Site 24.
- Identification of any former and existing underground utilities associated with the buildings at sites 15 and 24.

14.2.2 Sampling and Analysis

Figures 14-5 and 14-6 show the proposed Phase II soil boring and monitoring well locations for sites 15 and 24, respectively. Tables *14-2* and 14-3 summarize the sampling and analytical requirements, including QA/QC samples, for the Phase II investigations of sites 15 and 24, respectively. Tables 14-4 and 14-5 provide the specific rationale for each proposed Phase II Site 15 soil boring and monitoring well location, respectively, and for the analytical suite associated with each proposed Phase II sampling location. (Groundwater samples to be collected from the two existing on-site wells and analyzed for suite A, see below, are not included in rationale table 14-5). Tables 14-6 and 14-7 provide the specific rationale for each proposed Phase II Site 24

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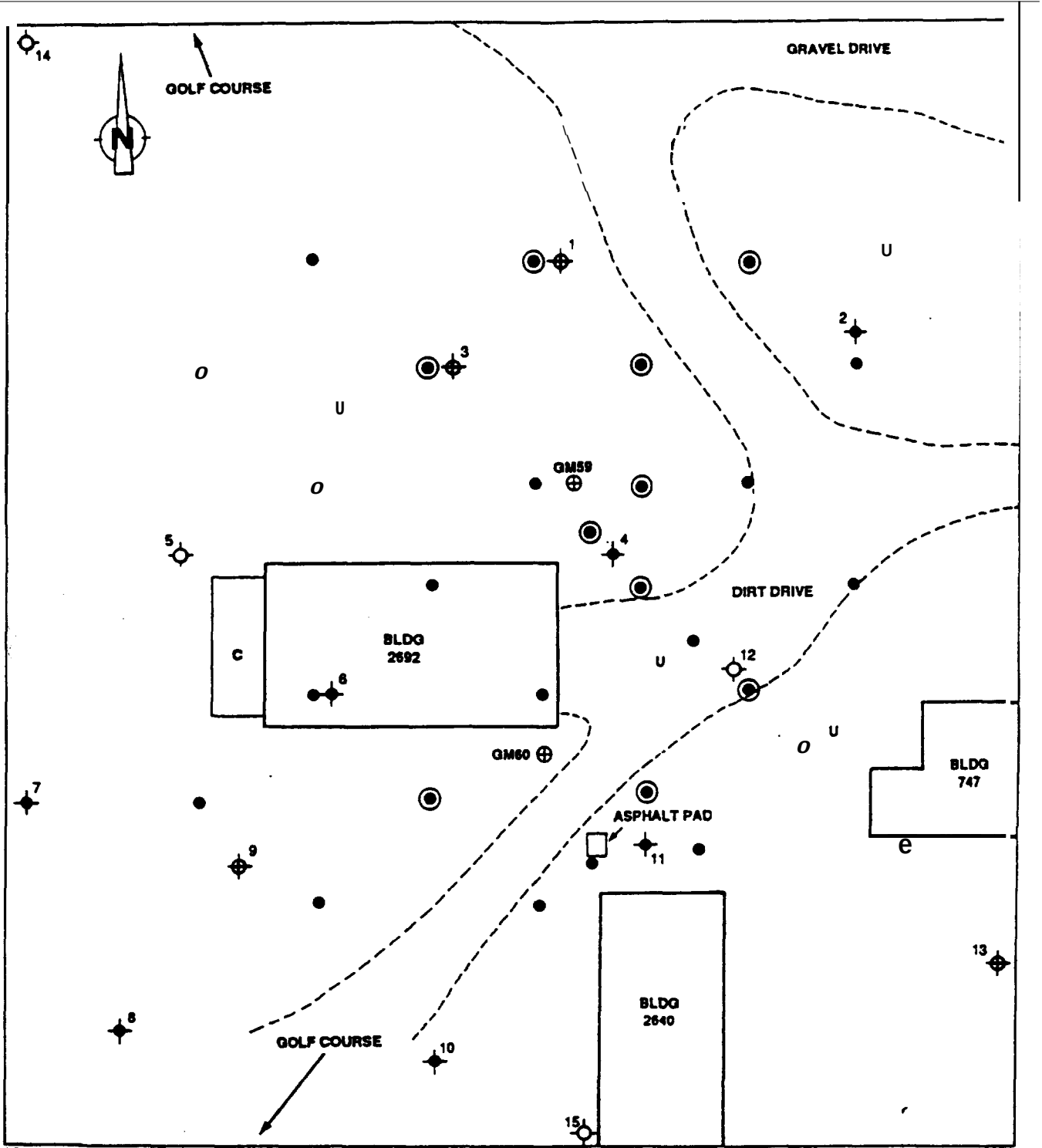


SOURCE: U.S. Naval Air Station, Pensacola, Florida 1991; Ecology and Environment, Inc. 1991

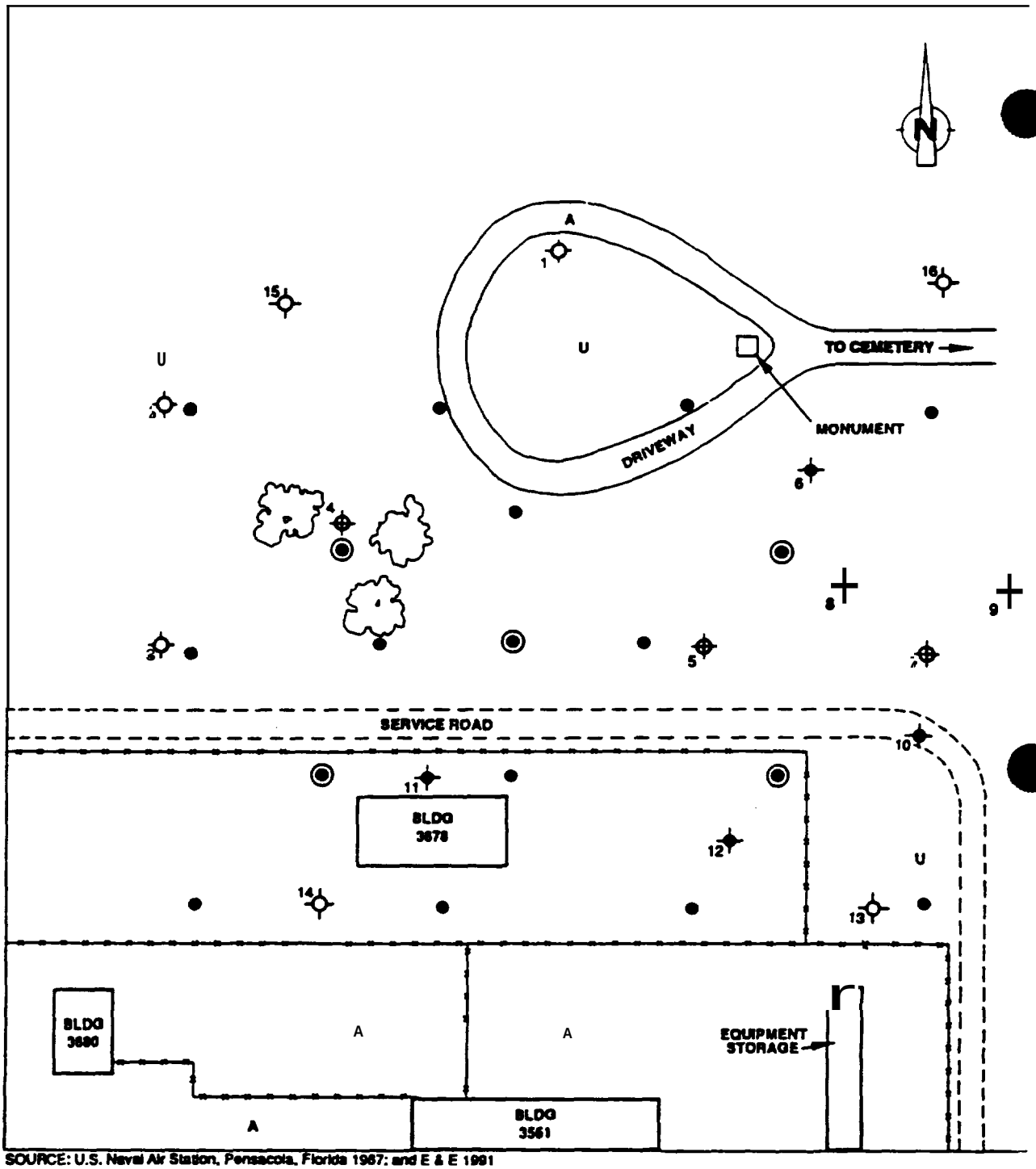
SCALE

0 50 100 FEET

KEY:

BLDG 747	Building	○	Phase I Temporary Monitoring Well
	Unpaved Road	✦	Proposed Phase II Soil Boring
C	Concrete Paved	⊖	Proposed Phase II Shallow Monitoring Well
U	Unpaved	⊕	Proposed Phase II Soil Boring and Shallow Monitoring Well
●	Phase I Soil Boring	5	Location Reference Number
⊕	Existing Permanent Shallow Monitoring Well		

Figure 14-5 PROPOSED SOIL BORING AND MONITORING WELL LOCATIONS NAS PENSACOLA SITE 15 — PHASE II



SOURCE: U.S. Naval Air Station, Pensacola, Florida 1987; and E & E 1991

SCALE

0 100 200 FEET

KEY:

- Trees
- BLDG 3678 — Building
- Fence
- A
- U — Unpaved
- Unpaved Road
- Phase I Soil Boring
- Phase I Temporary Monitoring Well
- Proposed Phase II Soil Boring
- Proposed Phase II Shallow Monitoring Well
- Proposed Phase II Soil Boring and Shallow Monitoring Well
- 5 — Location Reference Number

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Figure 14-6 PROPOSED SOIL BORING *AND* MONITORING WELL LOCATIONS NAS PENSACOLA SITE 24 — PHASE II

Table 14-2

PHASE II SAMPLING AND ANALYTICAL REQUIREMENTS
NAS PENSACOLA SITE 15

Medium	No. of Samples[a]	Dupli-cates	Trip Blanks[b]	Preservative Blanks[b]	Field Blanks	Rinsate Blanks	Total'	Analytical Suite[c,]
Soil[e]	55	6	--	NR[f]	NR	2	63	A
	(1)	--	2	NR	NR	--	(1),2	B
	2	--	NR	NR	NR	--	2	C
	(27)	NR	NR	NR	NR	NR	(27)	D
Groundwater[g]	[10]	1	--	1	1	1	[14]	A
	(1)	--	1	--	--	--	(1),1	B
	(4)	NR	NR	NR	NR	NR	(4)	E
TOTAL	[67]	7	3	1	1	3	1821	
	(33)	NR	NR	NR	NR	NR	(33)	

14[NASP]UH1104:T0396/875/10

Key :

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

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

[c]Analytical suite designations are as follows:

A = TCL VOCs; TCL base-neutral/acid extractable organic compounds (BNAs); TCL posticidos 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 radio-activity: total organic carbon: hardness (water only): and alkalinity (water only).

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

C = TAL motals.

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

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

[d]Specific constituents encompassed by the various chemical groups included within tho above-listed analytical suites are identified in tables 9-[6] through 9-[15] of the GQAPP.

[e]Total of 10 boring locations X 5 depth intervals = 50 samplos, plus 1 boring location X 7 depth intervals = 7 samplos.

[f]NR = Not required.

'Total of 2 existing wells + [8] now shallow wells = [10] samplos.

Source: Ecology and Environment, Inc., 1992.

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

Table 14-3

PHASE II SAMPLING AND ANALYTICAL REQUIREMENTS
NAS PENSACOLA SITE 24

Medium	No. of Samples[a]	Dupli-cates	Trip Blanks[b]	Preservative Blanks[b]	Field Blanks	Rinsate Blanks	Total'	Analytical Suite[c,d]
Soil[e]	30	3	1	NR[f]	NR	1	35	A
	15	2	NR	NR	NR	1	18	B
	2	--	NR	NR	NR	--	2	C
	(12)	NR	NR	NR	NR	NR	(12)	D
Groundwater[g]	[10]	1	1	1	1	1	[15]	A
	(2)	NR	NR	NR	NR	NR	(2)	E
TOTAL	[57]	6	2	1	1	3	[70]	
	(14)	NR	NR	NR	NR	NR	(14)	

14[NASP]UH1104:T0396/877/10

Key:

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

[b]Trip blanks will bo analyzed for Target compound List (TCL) volatile organic compounds (VOCs) only. Preservative blanks will bo analyzed for TCL VOCs, total recoverable petroleum hydrocarbon. (TRPHs), dissolved Target Analyte List (TAL) rtals. and cyanide.

'Analytical suite designations are as follows:

A = TCL VOCs; TCL base-neutral/acid extractable organic compounds (BNAs); TCL posticidos and polychlorinated biphenyls (PCBs); organophosphorus posticidos: carbamate posticidos: 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: hardness (water only): and alkalinity (water only).

B = Carbamate posticidos.

C = TAL metals.

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

E = Total suspended solids, total Kjeldahl nitrogen (TKN), ammonia nitrogoa, orthophosphate phosphorus, dissolved oxygon fin field), 5-day biological oxygon demand (BOD_5), and chorical oxygon demand (COD).

[d]Specific constituents encompassed by tho various chemical groups included within tho above-listed analytical suites are identified in tables 9-[6] through 9-[15] of tho GQAPP.

'Total of 8 soil borings x 5 depth intervals = 40 samples, plus one soil boring x 7 depth intervals = 7 samples.

[f]NR = Not required.

[g]Total of [10] now shallow wells = [10] samples.

Source: Ecology and Environront, Inc., 1992.

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Table 14-4

RATIONALE FOR PROPOSED PHASE II SOIL SAMPLE LOCATIONS AND ANALYSES NAS PENSACOLA SITE 15

Location Reference Number(s)	Sample Type(s)[a]	Location Rational.	Analytical Suite(s)[b]	Analytical Rational.
1	AWT	High methylene chloride concentrations detected in Phase I soil boring 8021.	A	Confirm presence of methylene chloride and characterize full spectrum of other potential contaminants.
			D	Support potential site **remediation** planning activities.
2	AWT	Delineate extent of on-site contamination.	A	Confirm absence of soil contamination at this location.
3	AWT	Slightly elevated arsenic concentration detected in Phase I soil boring B019.	A	Characterize arsenic concentrations in soils above water table and confirm absence of other contaminants.
	BWT	Evaluate potential presence of aquifer matrix soils contamination by **metals** based on high Phase I groundwater sample GW019 metal (especially arsenic) concentrations.	C	Metals are only concern here.
			D	Support potential site remediation planning activities.
4	AWT	High arsenic and VOC concentrations detected in Phase I soil borings 8022 and B023.	A	Characterize full spectrum of potential contaminants.
			B ([**1.0**] - 2.5 feet)	**Meet** RCRA requirements.
			D	Support potential site remediation planning activities.
6	AWT	Trace levels **dieldrin/4,4-DDE** detected in Phase I soil boring B008.	A	Characterize full spectrum of potential contaminants.
			D	Support potential site remediation planning activities.

14[NASP]UH1104:T0396/1029/7

Key at end of table.

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

Table 14-4 (Cont.)

Location Reference Number(s)	Sample Type(s)[a]	Location Rational.	Analytical Suit. (s)[b]	Analytical Rational.
7, 8, 9, 10	AWT	Identify nature and extent of VOC contamination dotoctod in Pharo I roil boringr B002 and 1006.	A	Characterize full spectrum of potential contaminants.
			D (Location 9 only)	Support potential site remediation planning activities.
11	AWT	VOC, PAH, and pesticide contamination detected in surrounding Pharo I boringr B011, 1012, and 1024.	A	Characterize full spectrum of potontial contaminants.
			D	Support potontial site remediation planning activities.
13	AWT	Extent delineation.	A	Characterize contaminant levels in site vicinity.

14[NASP]UN1104:T0396/1029/7

Kay:

[a]AWT = soil samples colloctod above water table at following intervals (BLS): 0-[1.0] foot, [1.0]-2.5 foot, 2.S-5 foot, 5-10 feet, and 10-15 foot.
BWT = Soil samples colloctod below water table at following intervals (BLS): 15-20 foot and 20-25 foot
[b]Specific parameters included within each analytical suite are given in Table 14-2.

VOC = Volatile organic compound.
RCRA = Resource Conservation and Recovery Act.
PAH = Polynuclear aromatic hydrocarbon.

Source: Ecology and Environment, Inc., 1992.

[Bold items enclosed in brackets denote changes to tho 1/ version of document]

Table 14-5

RATIONALE FOR PROPOSED PHASE II MONITORING WELL LOCATIONS AND GROUNDWATER SAMPLE ANALYSES[a] NAS PENSACOLA SITE 15

Location Reference Number(s)	Sample Type(s)[b]	Location Rational.	Analytical Suite(s)[c]	Analytical Rational.
1	SGW	At location of Phase I soil boring B021/ torporary well TW021 (high methylene chloride in soils only) and cross-gradient fror Phase I temporary well TW019 thigh arsonic and other metals).	A	Confirm absence of organic and arsonic contamination; confirm and characterize additional metals contamination.
			E	Support potontial site remediation planning activitios.
3	SGW	High total metals (especially arsonic) concentrations detected in Phase I temporary well TW019.	A	Characterize full spoctrum of potontial contaminants.
			B	Meet RCRA requirements.
			E	Support potential site remediation planning activitios.
5	SGW	Cross-gradient from Phase I temporary well TWO19 thigh arsenic and other metals); downgradient fcor Phase I soil borings 8002 and 8006 = area of potontial VOC shallow groundwater contarination.	A	Characterize full spoctrum of potential contaminants.
9	SGW	Potential shallow groundwater VOC contamination in this area based on Phase I soil borings B002 and B006.	A	Charactorire full spoctrum of potontial contaminants.
			E	Support potontial site remediation planning activitios.

14[NASP]UH1104:T0396/1030/7

Key at end of table.

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Table 14-5 (Cont.)

Location Reference Number(s)	Sample Type(s)[b]	Location Rational.	Analytical Suite(s)[c]	Analytical Rationale
12	SGW	Upgradient of apparent source area of arsonic contanination (Phase I soil boringr B022 and 8023); trace level pesticides detected in Phase I groundwater sample GW027.	A	Characterize tull spectrum of potontial contaminants.
			E	Support potontial site remediation planning activities.
13[, 15]	SGW	Upgradient location.	A	Characterize ambient groundwater quality in immediate site vicinity.
14	SGW	Downgradient from Phase I temporary wall TW019 (high arsonic and other metals).	A	Characterize full spectrum of potontial contaminantr.

14[NASP]UH1104:T0396/1030/7

Koy :

[a]Both oxirtinq wells will also bo sampled during Phase II for analytical suite A (roo Table 14-2).
[b]SGW = Qroundwator sample from shallow monitoring well.
[c]Specific parameters included within each analytical suite are given in Table 14-2.

VOCs = Volatile organic compounds.
RCRA = Resource Consorvation and Recovery Act.

Source: Ecoloqy and Environment, Inc., 1992.

[Bold items enclosed in brackets denote changes to the la 'ersion of document]

Table 14-6

RATIONALE FOR PROPOSED PHASE II SOIL SAMPLE LOCATIONS AND ANALYSES NAS PENSACOLA SITE 24

Location Reference Number(s)	Sample Type(s)[a]	Location Rationale	Analytical Suite(s)[b]	Analytical Rationale
4	AWT	Metals, PAHs, and TRPHs detected in Phase I soil boring 8015.	A	Characterize full spectrum of potential contaminants.
	BWT	Evaluate potential presence of aquifer matrix soils contamination by metals based on high Phase I temporary well TW015 metal concentrations.	D	support potential site remediation planning activities.
			C	Metals are only concern here.
			D	Support potential site remediation planning activities.
5, 11, 12	AWT	PAHs detected in several Phase I soil borings in this area.	A	Characterize full spectrum of potential contaminants.
6	AWT	Lead and PAHs detected in several Phase I borings in this area.	A	Characterize full spectrum of potential contaminants.
7	AWT	Very high levels of carbamate pesticide fluometuron detected in Phase I soil boring 8013.	A	Characterize full spectrum of potential contaminants.
			D	Support potential site remediation planning activities.
8, 9, 10	AWT	Delineate extent of fluometuron contamination detected in Phase I soil boring 8013.	C	Carbamate pesticides are only concern here.

14[NASP]UH1104:T0396/1031/7

Key:

[a]AWT = Soil samples collected above water table at following intervals BLS): 0-[1.0] foot, [1.0]-2.5 feet, 2.5-5 feet, 5-10 feet, 10-15 foot;
BWT = Soil samples collected below water table at following intervals BLS): 15-20 feet, 20-25 feet;
[b]Specific parameters included within each analytical suite are given in Table 14-3.

PAHs = Polynuclear aromatic hydrocarbons.
TRPHs = Total recoverable petroleum hydrocarbons.

Source: Ecology and Environment, Inc., 1992.

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Table 14-7

RATIONALE FOR PROPOSED PHASE II MONITORING WELL LOCATIONS AND GROUNDWATER SAMPLE ANALYSES[a] NAS PENSACOLA SITE 24

Location Reference Number(s)	Sample Type(s)[a]	Location Rational.	Analytical Suite(s)[b]	Analytical Rational.
1, 2, 3[, 15]	SGW	Determine extent of potential shallow groundwater contamination, especially downgradient/cross-gradient from Phase I temporary well TW015, which contained very high metals and trace PAHs.	A	Define presence/absence of contaminants downgradient/cross-gradient of site.
4	SGW	High metals and trace PAHs detected in Phase I temporary well TW015.	A	Characterize full spectrum of potential contaminants.
			E	Support potential site remediation planning activities.
5, 13	SGW	Downgradient and upgradient from Phase I temporary well TW019, where tetra-chloroethene and methomyl (carbamate pesticide) detected.	A	Characterize full spectrum of potential contaminants.
7	SGW	Potential shallow groundwater carbamate pesticide contamination based on high fluometuron levels detected in Phase I soil boring 8013.	A	Characterize full spectrum of potential contaminants.
			E	Support potential site remediation planning activities.
[14, 16	SGW	Determine presence and nature of potential groundwater contamination. Proposed wells are hydraulically downgradient of contamination detected on Site 24.	A	Characterize full spectrum of potential contaminants.]

14[NASP]UH1104:T0396/1032/7

Key:

[a]SGW = Groundwater sample from shallow monitoring well.
[b]Specific parameters included within each analytical suite are given in Table 14-3.

PAHs = Polynuclear aromatic hydrocarbons.

Source: Ecology and Environment, Inc., 1992

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soil boring and monitoring well location, respectively, and for the analytical suite associated with each proposed Phase II sampling location.

The sample location reference numbers listed in tables 14-4 and 14-5 correspond to the location numbers on Figure 14-5; the sample location reference numbers listed in tables 14-6 and 14-7 correspond to the location numbers on Figure 14-6. The analytical suite designations used in tables 14-4, 14-5, 14-6 and 14-7 correspond to the designations used and defined in tables 14-2 and 14-3.

It is proposed to sample the two Site 15 existing wells and all newly installed wells for analytical suite A during Phase II to provide a uniform, time-synchronous perspective on sites 15 and 24 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 wells. These background soil borings and monitoring wells,] together with the three existing [on-base] deep supply wells, [will be] sampled for analytical suite A. (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 regarding on-site occurrences of potential contaminants as well as aid in evaluating the impact of potential, base-wide ambient contaminant sources. The collection of these background soil and groundwater samples is discussed in the work plan for [Group A--]Site 1 (Sanitary Landfill; [E 6 E 1992a]).

Table 14-2 indicates that one sample from each medium at Site 15 will be additionally analyzed for analytical suite B (Appendix IX parameters). It should be noted 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 suite A (Site 24)

parameters, but only for VOCs. Finally, it should also be noted that the number of required trip blanks shovn on tables 14-2 and 14-3 reflects the total number of trip blanks required to be collected for the entire sampling program.

As noted above, tables 14-4, 14-5, 14-6, and 14-7 provide specific rationales for proposed Phase II sampling locations and analyses. In general, sampling locations vere selected based on the Phase I results in accordance vith one of the folloving criteria:

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

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 contaaination 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 14-4, 14-5, 14-6, and 14-7 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, as varranted, 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 vell groundwater samples), a more limited analytical program (e.g., TAL metals in soils collected BWT) is varranted.

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Finally, to support potential remediation planning activities for these sites, 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, tables 14-2 and 14-3).

14.2.2.1 Soil Sampling

All Phase II soil sampling, compositing, and lithologic logging at sites 15 and 24 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; and 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.

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.

Site 15

During the Phase II soil boring and shallow monitoring well installation (Section 14.2.2.2), soil samples will be collected at 11 locations across Site 15 (see Figure 14-5). At each location, except as noted below, composite soil samples will be collected from each of the following depth intervals: 0 to [1.0] foot BLS, [1.0] to 2.5 feet BLS, 2.5 to 5 feet BLS, and then every 5-foot interval to the water table. For the purpose of estimating sample numbers, the depth to the water table is assumed to be 15 feet BLS across the site. At one boring location (location 3; see Figure 14-51, soil samples will also be collected from two depth intervals BWT: 0 to 5 feet BUT and 5 to 10 feet BUT.

Pifty-five of the 57 soil samples will be analyzed for the parameters included in analytical suite A (all 11 sample locations); the two samples collected BWT at location 3 will be analyzed for analytical suite C (see Figure 14-5 and tables 14-2 and 14-4). In addition, one of the 57 soil samples will be analyzed also for the parameters included in

analytical suite B (sample location 4), and 27 of the 57 soil samples will be analyzed also for the parameters in analytical suite D (see Figure 14-5 and tables 14-2 and 14-4).

Site 24

During the Phase II soil boring and monitoring well installation (Section 14.2.2.2), soil samples will be collected at nine locations across Site 24 (see Figure 14-6). At each location, except as noted below, composite soil 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 the water table. For the purpose of estimating sample numbers, the depth to the vater table is assumed to be 15 feet BLS across the site. At one boring location (sample location 4; see Figure 14-6), soil samples will also be collected from two depth intervals BUT: 0 to 5 feet BUT and 5 to 10 feet BWT.

Thirty of the 47 soil samples will be analyzed for the parameters included in analytical suite A (six sample locations). Fifteen of the 47 samples (not of the 30 discussed above) will be analyzed for the parameters included in analytical suite B (sample locations 8, 9, and 10). The remaining two of the 47 samples will be analyzed for the parameters included in analytical suite C (sample location 4, BWT only). In addition, 12 of the 47 samples will also be analyzed for the parameters included in analytical suite D (see Figure 14-6 and tables 14-3 and 14-5).

14.2.2.2 Soil boring Completion and Permanent Monitoring Well Installation and Development

A total of [eight] permanent shallow monitoring wells will be installed at Site 15 and **[10]** will be installed at Site 24. These vells 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:

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Site 15:

- [Eight] shallow wells, each of which will be approximately 20 feet deep.

Site 24:

- [Ten] shallow wells, each of which will be approximately 25 feet deep.

Figures 14-5 and 14-6 show the locations of the proposed monitoring wells for sites 15 and 24, respectively, and tables 14-5 and 14-7 provide a detailed rationale for the selection of each of the monitoring well locations, target depths, and corresponding sampling analytical requirements at sites 15 and 24, respectively.

In order to detect the presence of any floating product at sites 15 and 24, the 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.

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

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

After installation, each of the new monitoring wells will be developed using a submersible pump and/or bailer in accordance with Section 6.7.5 of the GQAPP. Development waste will be contained in 55-gallon drums,

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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 betveen the installation of each well in accordance vith Section 6.10 of the GQAPP. All borehole cuttings and drilling fluids will be stored in 55-gallon drums, labeled, and moved to a storage area on NAS Pensacola, as directed by the Navy (see also Section 14.[6].2).

14.2.2.3 Groundvater Sampling

Purging and sampling of each well will be performed in accordance vith sections 6.8.2 and 6.8.3 of the GQAPP, respectively. Equipment decontamination activities will be performed in accordance vith Section 6.10 of the GQAPP. The number and types of groundvater field QA/QC samples to be collected vere determined in accordance with Section 11.1 of the GQAPP.

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

Site 15

During Phase II, groundvater samples will be collected from tvo existing on-site monitoring wells and [eight] newly installed on-site monitoring vells at Site 15 (see Figure 14-5).

All [10] groundvater samples will be analyzed for the parameters included in analytical suite A. In addition, one of the [10] samples (sample location 3) will also be analyzed for the parameters included in analytical suite B, and four of the [10] samples (sample locations 1, 2, 3, and 9) will also be analyzed for the parameters included in analytical suite E (see Figure 14-5 and tables 14-2 and 14-4).

Site 24

During Phase 11, groundvater samples will be collected from [10] newly installed on-site shallov monitoring vells at Site 24 (see Figure 14-6).

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All [10] groundwater samples will be analyzed for the parameters included in analytical suite A (see Figure 14-6 and tables 14-3 and 14-7). Two of these samples will be analyzed also for the parameters included. in analytical suite E (sample locations 4 and 7).

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 sites 15 and 24. Slug and short-term specific capacity tests, rather than a (long-term] pump test, have been proposed for Phase II 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 sites 15 and 24 will include static water level measurements in all the on-site wells and on-site and/or adjacent surface water bodies; and short-term specific capacity and/or slug tests on all the newly installed permanent wells.

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 sites 15 and 24, 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 to accurately evaluate tidal influences on water level elevations at these sites.

Limited aquifer testing will be conducted 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 sites 15 and 24 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 withdrawing a known volume from the well, using a solid stainless steel cylinder, to create an instantaneous change in water level. The water level is then recorded continuously over time until the water level equilibrates to the initial static level.

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

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

14.2.4 Engineering Survey

A comprehensive engineering survey will be conducted to accurately identify all site sampling locations 'and cultural and topographic

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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 IRH 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 19921) for a description of the Phase II report.

14.3 Phase 111--Extent Delineation

Phase III tasks will be conducted based on the results of phases I and II, [if deemed necessary.] Although the earlier phases are intended to identify and characterize areas and contaminants of primary concern as

they extend laterally from these sites, Phase III activities will be geared toward further delineating the horizontal and vertical extents of contamination.

14.3.1 Soil Sampling

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

14.3.2 Shallw Monitoring Well Installation and Development

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

14.3.3 Intermediate and Deep Monitoring Well Installation and Development

The installation of additional monitoring vells 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 Phase II findings.

14.3.4 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.

14.3.5 Hydrologic Assessment

All wells installed during Phase III will require a wellhead survey to obtain TOC elevations. Water level measurements will bt made for all site monitoring wells and nearby surface water bodies. Aorizontal and vertical hydraulic gradients will be determined. Aquifer testing will be performed, as required, to determine aquifer physical characteristics. On sites where contamination is found in the surficial zone during phases I and/or 11, the low permeability zone will be

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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.

[14.3.6 Engineering Survey

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

14.3.[7] Air Sampling

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

14.4 Phase IV--Extent Delineation

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

- o Shallow monitoring well installation and development;
- o Intermediate and deep monitoring well installation and development;
- o Groundwater sampling; and
- o Hydrologic assessment; [and
- o Engineering survey.]

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4.[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 fieldvork will require the preparation of field QA/QC samples as described in Section [11.1] of the GOAPP. The estimated numbers of required field QA/QC samples for Phases I and II are shown in tables 14-1, 14-2, [and 14-3].

14.[6] Decontamination and Waste Management Procedures

14.[6].1 Decontamination Procedures

All equipment decontamination procedures for sites 15 and 24 will be performed in accordance vith Section 6.10 of the GOAPP.

14.[6].2 Waste Management Procedures

[All investigation-derived vaste handling will be performed in accordance vith Section 6.11 of the GQAPP and EPA's guidance for investigation-derived vaste.] All water generated during monitoring vell purging and development activities on sites 15 and 24 will be discharged onto the ground surface away from the vell, 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 vell installation activities will be disposed of on the sites or will be containerized, labeled, and moved to a storage area on NAS Pensacola, as directed by the Navy.

Other investigation-derived vastes, such as potentially contaminated clothing and disposable materials, will be containerized, labeled, and moved to a storage area on NAS Pensacola.

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15. LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

Laboratory QA/QC procedures are designed to ensure the accuracy, precision, completeness, representativeness, and comparability of all analytical data. Laboratory QA/QC has been addressed both in the GQAPP and GSMP. All phases of fieldwork will incorporate a different level of data quality and requisite laboratory QA/QC. These levels are discussed in detail in the GQAPP and GSMP.

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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:

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

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17. TREATABILITY STUDY

As indicated in tables 14-2 and 14-3, 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 tables 14-2 and 14-3, 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 vith the previously referenced risk assessment guidance documents (EPA 1988a, 1988b.)]

18.2 Exposure Assessment

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

1) A source mechanism of chemical release into the environment;
2) An environmental transport medium (e.g., air, groundvater, 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 vith 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, retirement homes, etc.);
- Activities (recreational and/or occupational) which take place near the sites and the estimated number of people involved;

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- 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 nay 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 down or eliminated. The results of the Remedial Activities Investigation and baseline risk assessment will serve as the primary basis of documenting a no further action decision.

It should be emphasized that all the tasks conducted as part of the baseline risk assessment will be performed on an interactive basis between the various disciplines required (e.g., hydrogtologists, chemists, risk assessors, etc.), 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 Investigations and Feasibility Studies Under CERCLA (BPA 1988b). If any of the procedures described in this section are in conflict with the current 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 & 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,

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velfare, 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 6 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 6 E will perform a detailed risk analysis to determine the acceptable levels of risk. This will allov the Navy to balance the increase in costs associated vith 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 vithout 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.

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 RI report will be produced. However, if the Phase II results indicate that additional investigation is required, the Phase II report will be produced as the Phase II Interim Data Report and will only summarize the Phase II results and provide recommendations for the Phase III investigation. Thus, the Phase II interim report will not be a formal document. Following production of the Phase II interim report, the work plans for the Phase III work will be updated. Once the Phase III investigation is complete, all results will be synthesized and presented in an RI report.

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

For all reports, E & E will prepare a 100% draft report for the Navy and Technical Review Committee (TBC) 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.**

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Each report will be written as an independent document, complete in its own right, and fully supportive of the conclusions which it contains. Where appropriate, public participation issues will be summarized, as will IRMs 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 fieldvork 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.

22. PROJECT MANAGEMENT

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

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23. PROJECT SCHEDULE

Figures 23-1, 23-2, 23-3, and 23-4 show the project schedules for phases I, 11, 111, and IV, respectively. Given that the scopes of work for Phase II and beyond are dependent on the results of the preceding phases, the project schedules for phases 11, 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 (PFASMP). The schedule in the FFASMP will be updated yearly.

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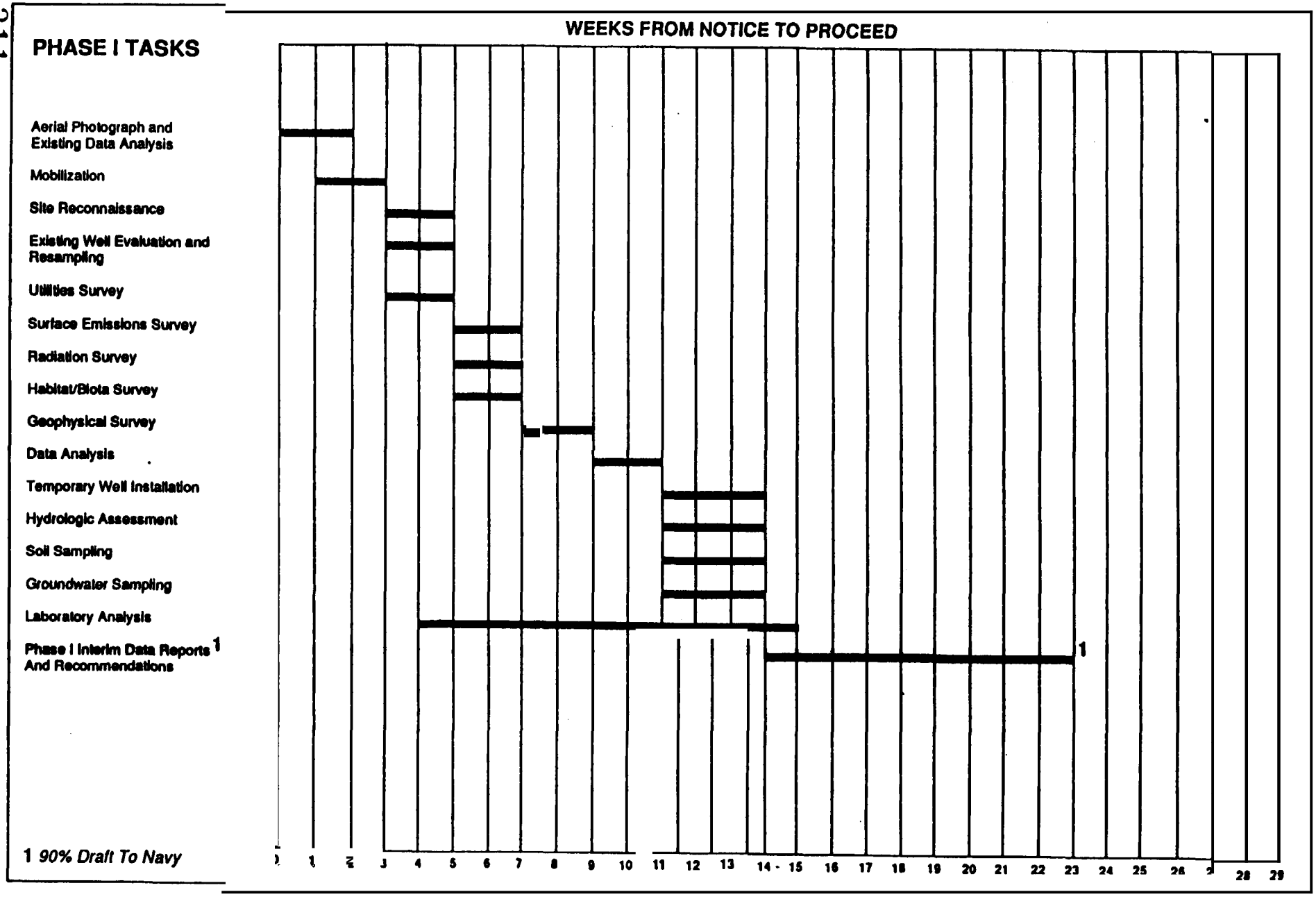

Figure 23-1 PHASE I PROJECT SCHEDULE -- GROUP D

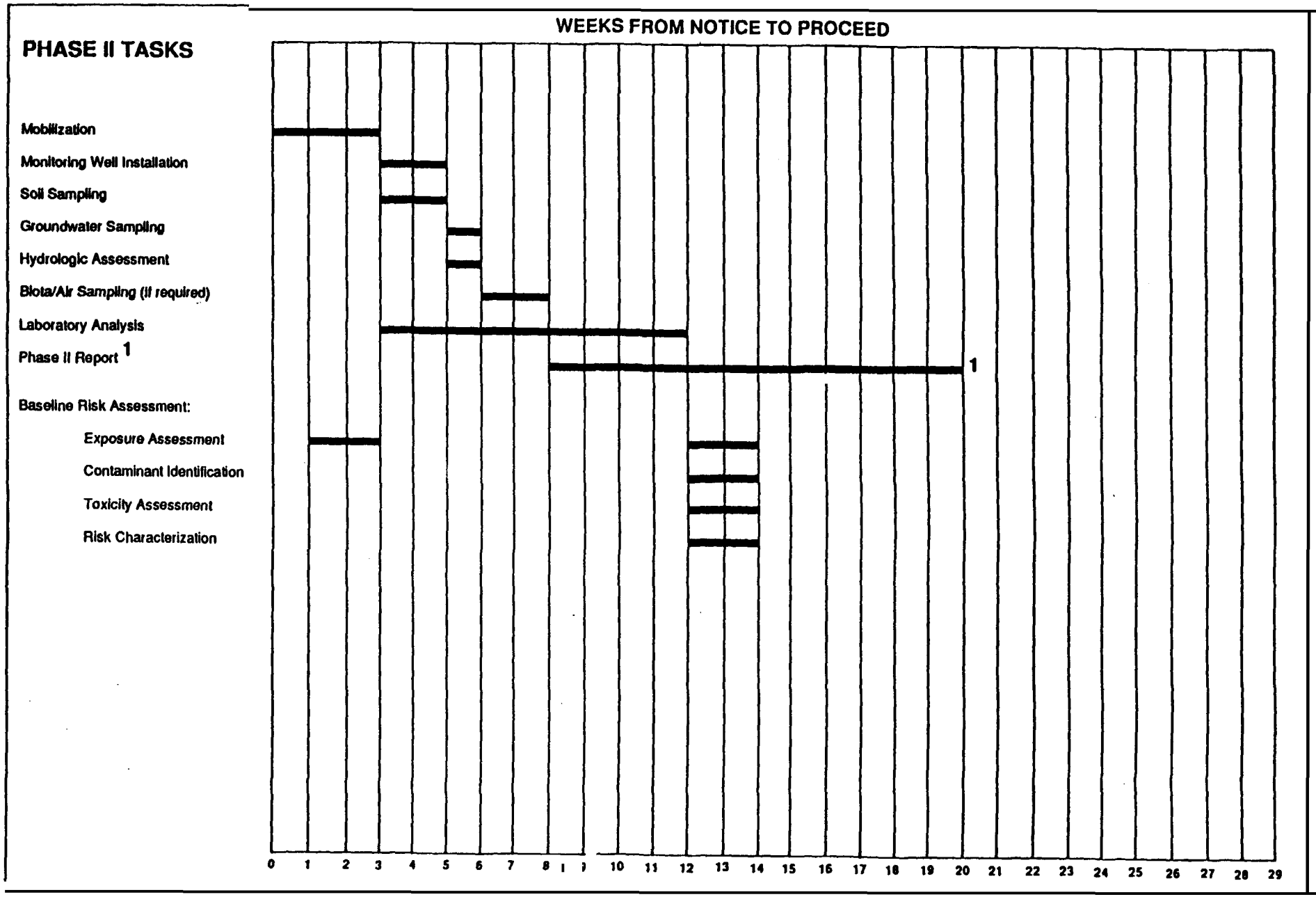

Figure 23-2 PHASE II PROJECT SCHEDULE -- GROUP D

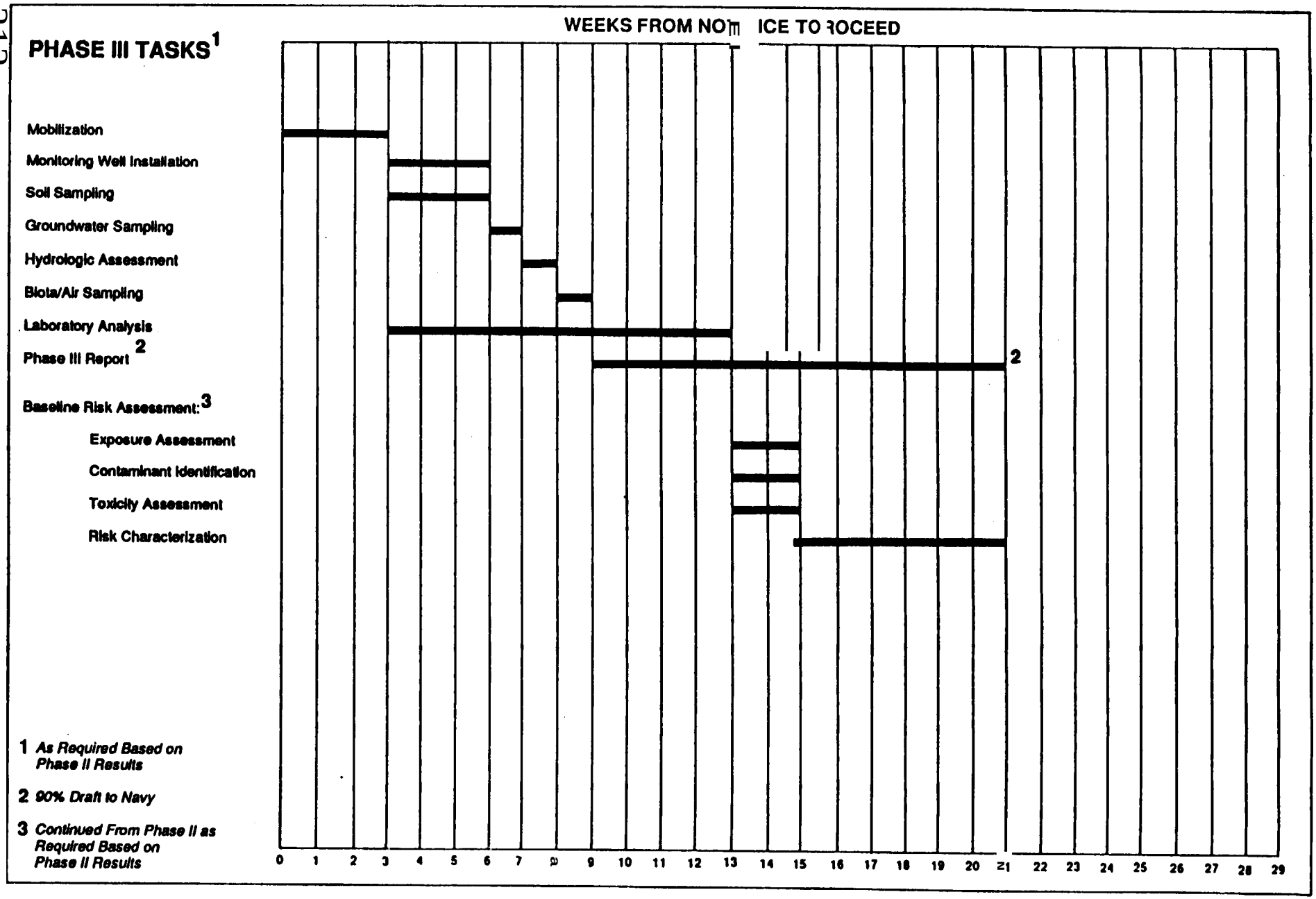

Figure 23-3 PHASE III PROJECT SCHEDULE -- GROUP D

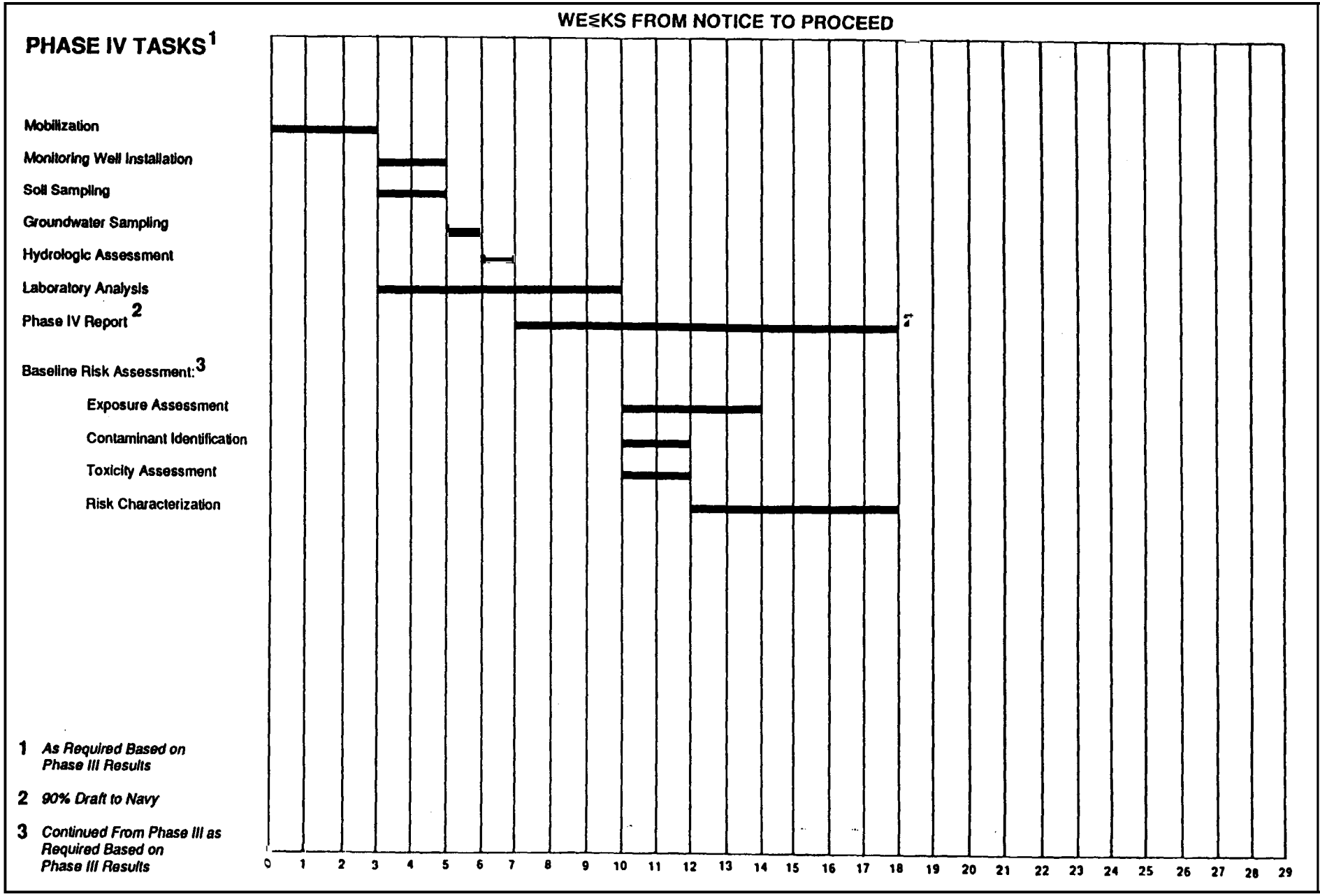

Figure 23-4 PHASE IV PROJECT SCHEDULE – GROUP D

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25. FLORIDA **PROFESSIONAL GEOLOGIST** SEAL

I hereby affix my seal to the Contamination Assessment/Remedial Activities Investigation Work Plan, Group D, 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 PLANS

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

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SITE SAFETY PLAN

Version 988

A. GENERAL INFORMATION

Project Title: Site 15 - Pesticide Disposal Area Project No.: UH1104

TDD/Pan No.:

Project Manager: John Barksdale Project Dir.: Rick Rudy

Location(s): Pesticide Disposal Area - Located within tho golf corse maintenance area

Proparod by: Hal Davis Dato Proparod: 4-21-89

Approval by: Mary Miller Dato Approved:

Site Safety Officer Review: Date Reviewed:

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

Proposed Dato of Field Activities: August 1989

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

Documentation/Summary:

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

B. SITE/WASTE CHARACTERISTICS

Waste Type(s):

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

Characteristic(s):

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

Other:

Physical Hazards:

Overhead [X]	Confined* Space [ ]	Below Grade [ ]	Trip/Fall [X]
Puneturo [ ]	Burn [ ]	Cut [ ]	Splash [X]
Noise [X]	Other: Vehicular traffic in site area. 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): From 1963 until 1979, tho Pesticide Rinsate Disposal Area vas used as an area for tho storage of posticidos and tho cleaning of pesticide mixing and application equipment. Building 2692 and an outdoor area near tho northeast corner of the building were used for the storage of posticidos. Tho floor of tho building and tho outdoor area are not k Ddilute rinsate solutions were discarded onto tho ground surface at tho site. Soil analyses have indicated moderate to low concentrations of several posticidos. Chlordan. and 4,4-DDT appeared in tho highest concontrations (21 ppm and 1.2 ppm, respectively).

Locations of Chemicals/Wastes: Contaminants have boon found in surface and subsurface soils.

Estimated Volume of Chemicals/Wastes: unknown

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

C. HAZARD EVALUATION

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

Physical Hazard Evaluation:

1) Physical Surveys - Automobile hazards;

2) Temporary Monitoring Well Installation - Using portable drill rig:

3) Soil Sampling - Using portable drill rig:

4) Groundwater Sampling - Splash, personal contamination:

5) Decontamination Procedures - Using solvents.

6) Hydrologic Assessment - Splash, personal contamination.

Chemical Hazard Evaluation:

Compound	PEL/TWA	Route of Exposure	Acute Symptoms	Odor Threshold	Odor Description
Chlordane	0.5 mg/m3	Inh, Abs	convulsions	odorless	odorless
4,4-DDT	1.0 mg/m^3	Inh,Ing,Derm,Eye	tremors, convulse	slight	slight/odorless
Isopropyl Alcohol	440 ppm	" "	drowsiness,head.	7.5-200 ppm	rubbing alcohol
Nitric Acid	2 ppm	" "	corrosive	0.3-1 ppm	acrid
Sulfuric Acid	1 mg/m^3	Ing, Derm, Inh	corrosive	N/A	odorless
Heptachlor	0.5 mg/m^3	Inhale, absorb	tremors, convulse	0.2 ppm	camphor odor
Epoxide	--	Ing/Abs	Skin Irritant	--	--
Dieldrin	0.25 mg/m^3	Inh, Ing, Con	nausea, convulse	0.6 mg/m3	
Hydrochloric Acid	5 ppm	Inh, Ing, Derm	corrosive	unknown	acrid
Sodium Hydroxide	2 mg/m^3	Inh, Ing, Derm	corrosive	N/A	odorless
PCBs	0.5 mg/m^3	Inh, Ing, Con	nausea,vomit,head	N/A	hydrocarbon odor
Arsenic	0.5 mg/m^3	Inh, Ing, Con	naus,vomit,diarrhe	N/A	garlic-like

Note: Complete and attach a Rarard Evaluation Shoot 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 sits showing hot zone, contamination reduction. zone, otc.

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

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

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

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

Task 1				X
Task 2			X	
Task 3			X	
Task 4			X	
Task 5			X	
Task 6				X

(Expand if necessary)

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

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

- o Level D: O_2 t19.52 or >25%, oxplosive atmosphere >10% LEL, organic vapors above background levels, particulates >_____ mg/m^3, other _____
- o Lovol C: O_2 <19.5% or >25%, oxplosivo atmosphere >25% LEL_3(California-20%), unknown organic vapor (in breathing zone) >1 ppm, particulates >_____ mg/m^3, other _____
- o Lovol B: O_2 <19.5% or >25%, explosive atmosphere >25% LEL_3(California-20%), unknovn orgnnic vapors (ir broathinq zone) >5 ppn, particulates >_____ mg/m^3, othct _____
- o Lovol A: O_2 t19.52 or >25%, oxplosivo ntmosphero >25% LEL (California-20%), unknovn orqanic vapors >500 ppm, particulates >_____ mg/m^3, other _____

Air Monitoring (daily calibration unless otherwise noted):

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

(Expand if nocossary)

Docontarination Solutions and Procedures for Equipmont, Sampling Gear, etc.:

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

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

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

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

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

Site Entry Procoduros and Special Considerations: E & E's 'Buddy System" will be employed at a11 times during fiolduork activities. Personnel will exercise caution in tho vicinity of Chevalier Field and along nearby roadways. If above background radiation levels are encountered team members will evacuate tho sampling area, and contact tho corporate health physics group to reassess tho site.

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

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

General Spill Control, if applicable: N/A

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

All fiolduork vasto materials will be double baggod, drumwd, labeled and transported to a designated location for final disposal by tho Navy.

Sample Handling Procoduros Including Protoctivo Wear:

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

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

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

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E. EMERGENCY INFORMATION

(Use supplemental shoots, if necessary)

LOCAL RESOURCES

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

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

Hospital Emergency 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 - 904-453-8170, General Infornation 904-153-8282

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

Fed. Express 1-800-238-5355

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

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

SITE RESOURCES

Site Emergency Evacuation Alarm Method N/A

Water supply Source on-sfto

Telephone Location. Number To bo determined on-site

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 Cnvironaont, Inc., Safety Director
   Paul Jonmaire ..... (716) 684-8060 (office)
   (716) 655-1260 (home)

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

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

MEDTOX HOTLINE

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

   What to report:

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

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

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

   a. 24 hour hotline - (716) 684-8940
   b. Corporato Safety Director - Paul Jonmaire - homo # (716) 655-1260
   c. Assistant Corp. Safety Officer - Steven Sherman - how # (716) 688-0014

EMERGENCY ROUTES

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

Directions to hospital (include rap) from Site 15

NAS Dispensary - Take Duncan Road south to Turner Road. Turn loft (east) onto Turner Road. Tho NAS Dispens is located on Turner Street in Building 3600.

Baptist Hospital - Take Duncan Road (Navy Blvd.) north to exit tho base. Navy Blvd. becomes HWY 98 and curves to tho east. Follow Navy Blvd./Hwy. 91 oast approx. 3mi to Pace Blvd. turn loft (north) on Pace Blvd. and proceed approx. 1mi to Cervantes St. (Hwy. 90). Turn riqht on Cervantes/Hwy. 90 and follow this road for about 8 blocks and turn loft (north) onto E street. Tho hospital is about 6 blocks north on tho loft.

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

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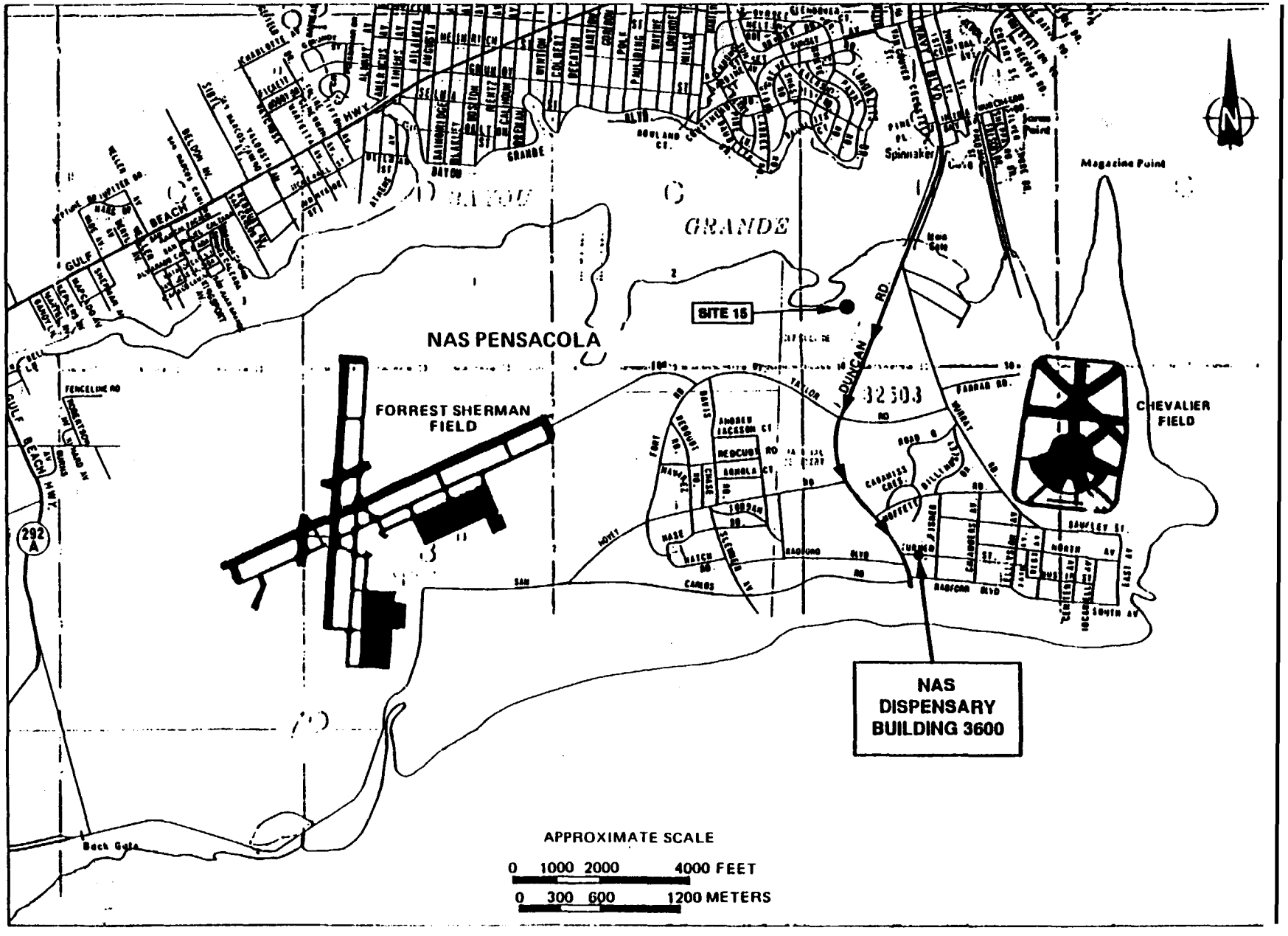
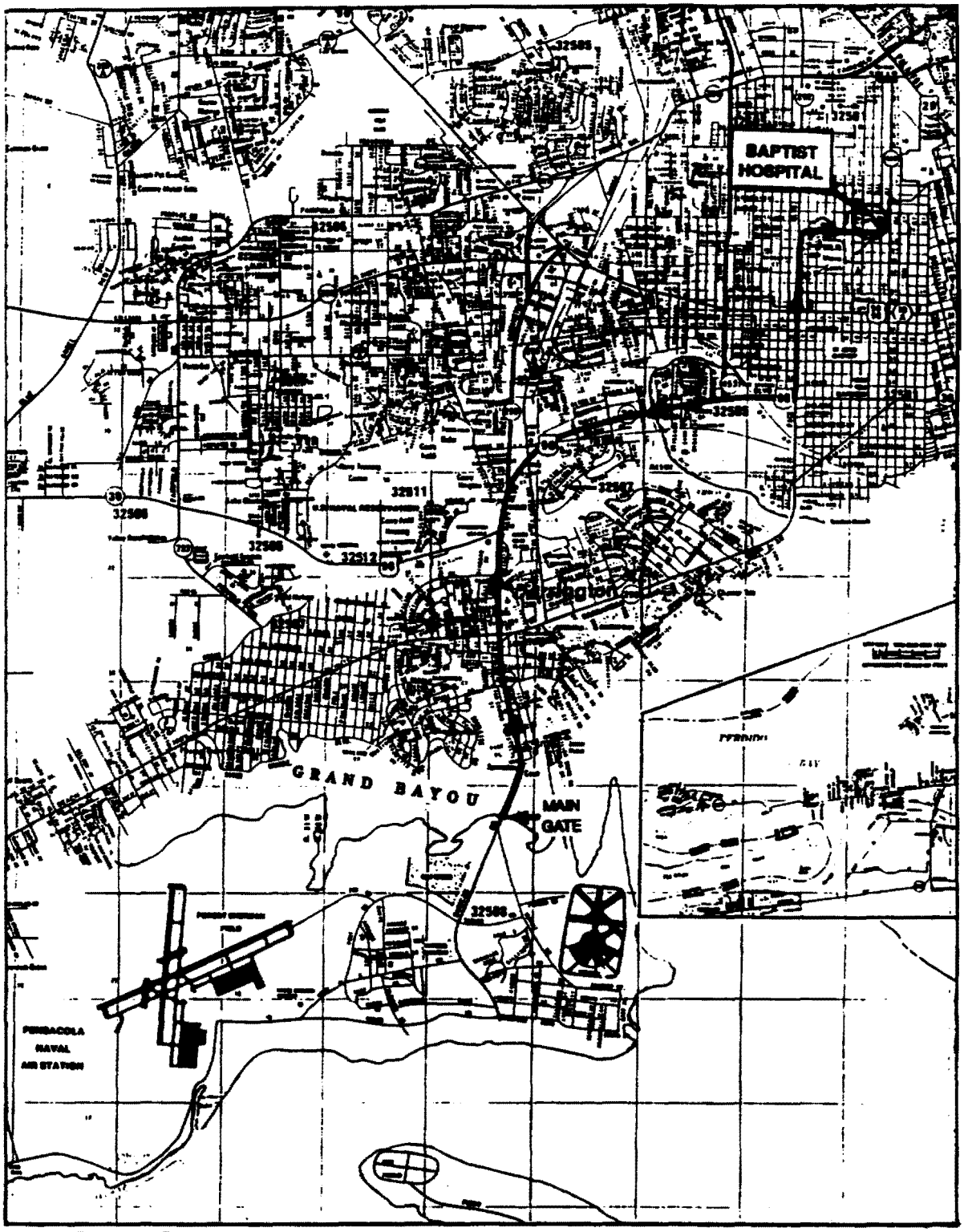


Figure A-1 LOCATION OF NAS DISPENSARY



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

	ecology and environment, inc.	
	Title: SOP-Beat Stress Monitoring	
	Category: H & S, TRAINING 2.1	Revised: ANUARY 1990
		E. Van Cleave

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

REVISED JANUARY 1990

Prepared by

151323

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1 INTRODUCTION

Field operations present a variety of hazards to the employee. During hot days or vhen vearing 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 ways to avoid heat stress, such as frequent rest periods, carefully timed excursions in protective clothing, and monitoring heartrate and'body temperature. The Site Safety Officer (SSO) has overall responsibility for seeing that these guidelines are folloved in the field. Hovever, each individual must be cautious vhen working 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 vhat to do in a heat emergency. For example, a person who recognizes the symptoms of heat stroke can provide lifesaving first-aid to another, while medical assistance is summoned.

4 EFFECTS OF HEAT

Normal oxidation processes vithin the body produce a predictable amount of heat. If the heat is liberated as it is formed, there is no change in body temperature. If the heat is liberated slightly more rapidly, the body cools to a point at vhich the production of heat is accelerated and the excess is available to bring the body temperature back to normal.

Interference 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 produces a cycle in vhich certain body processes speed up and generate additional heat. Then the body must eliminate not only the normal but also the additional quantities of heat.

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Heat produced vithin 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. Hovever, vhen 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 (sveat) from the skin surface. As the air becomes more humid (contains more moisture), vaporization from the skin slovs down. Thus, on a day vhen the temperature is 95°F to 100°F, vith high humidity and little or no breeze, heat is retained vithin the body. It is on such a day or, more commonly, after a succession of such days (a heat vave) that medical emergencies due to heat are likely to occur. Such emergencies are classified in three categories: hut cramps, hut exhaustion, and heat stroke.

4.1 HEAT CRAMPS

Heat cramps usually affect people vho vork in bot 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 vater or other drinks either too quickly or in too large a quantity. Heat cramps generally occur during vork, but may appear hours later in sow cases.

4.1.1 Symptoms

The symptoms of heat cramps include the folloving:

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

412 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 vater 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 vorking in bot environments and may be associated vith heat cramps. Heat exhaustion is caused by the pooling of blood in the vessels of the skin. The hut is

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transported from the interior of the body to the surface by blood. The blood vessels in the skin become dilated and a large amount of blood is pooled in the skin. This condition, plus the blood pooled in the lower extremities when an individual is in an upright position, may lead to an inadeauate return of blood to the heart and eventually to physical collapse.

4.2.1 Symptoms

The symptoms of heat exhaustion are as follows:

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

4.2.2 Emergency Care

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

4.3 HEAT STROKE

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

4.3.1 Symptoms

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

- o Dry, hot, and flushed skin;
- o Sudden onset:
- o Full and fast pulse;
- o Dilated pupils;
- o Early loss of consciousness:
- o Body (core) temperature's exceeding 105°F;
- o Muscle twitching, groving into convulsions; and
- o 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 airvay. Reduce body temperature promptly, preferably by vrapping the victim in a vet sheet or dousing the body vith vater. If cold packs are available, place them under the arms, around the neck, on the ankles, or any place vhere blood vessels located close to the skin can be cooled. Protect the victim from injury during convulsions, especially tongue biting.

5 PREVENTION OF HEAT STRESS

Please note that in the case of heat cramps or heat exhaustion, Gatorade or its equivalent is suggested as part of the treatment regime. The reason for this type of liquid refreshment is that such beverages will return much-needed electrolytes to the body's system. Without these electrolytes, body systems cannot function properly, and the represented health hazard will be increased. Therefore, vhen personnel are vorking in situations vhere the ambient temperatures and humidity are high, and especially in situations vhere levels A, B, and C of protective apparel are required, the SSO must follov the procedures listed belov:

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

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- Ensure that frequent breaks are scheduled so that overheating is less likely to occur;
- Revise vork schedules, when necessary, to take advantage of the cooler parts of the day (i.e., 5:00 a.m. to 1:00 p.m., and 6:00 p.m. to nightfall); and
- Cooling vests should be vorn 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 follovs:

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 HONITORING

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

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

If the recovery pulse rate during the last 30 seconds of the first minute is at 110 beats/minute or less and the deceleration betveen 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 vhen air temperatures are very high, the monitoring of body temperature and blood pressure is another vay of checking for symptoms of heat stress. Careful adherence to existing medical guidelines could identify an individual vho 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 tvo most important measurements for determining the likelihood that a heat stress situation will occur. The reading can be achieved using both a dry and vet 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 vrapped in plastic (or other protective material) for his or her own safety as well as the safety of ambulance and hospital personnel. Carefully avoid action that vould result in the victim's being further overheated.

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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 E & E SOPs for field operations and hazardous waste site operations, and incorporates by reference all the safety precautions required therein. It specifically addresses the functions and responsibilities of personnel vorking on or around drilling operations.

E & E personnel are frequently required to vork in the field vith drill rigs, taking soil and rock samples, installing piezometers, and monitoring vells. Two general situations discussed separately are the supervision of Subcontract Drillers by E & E, and the direct operation of E & E's ovn 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 vith the exception of the increased emphasis on the hazards unique to drilling vork. This section details specific drilling concerns of an SSO.

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

2.2 RESPONSIBILITIES AND AUTHORITY OF E & E DRILLER

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

- Kill svitches 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 vorking order;
- Rig leveled and stabilized;
- Check for veld cracks in mast; and
- Safety hooks operational.

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

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

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

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

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

2.3 RESPONSIBILITY AND AUTHORITY OF OTHER E & E PERSONNEL

E & E personnel vorking at a drilling site must act as support to the Drilling Team by providing any necessary support functions; hovever, it is important that personnel are careful not to interfere vith the drilling process. Personnel are restricted from approaching the "super exclusion zone" vhile drilling is underway. If an E 6 E crev member recognizes an unsafe condition in the vork area or on the rig, he should bring it to the attention of the SSO and Team Leader, if it is not resolved in a tiwly 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 6 E personnel to carry their issued nondisposable gear, including hard hat, face shield, respirator, steel-toed boots, eyepiece inserts, safety glasses, and appropriate outervear for the expected climate.

All personnel should be aware of emergency facilities, egress routes, and special medical conditions of their team members. As vith all E 6 E field vork, 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 vorked as a team member on field drilling projects in order to have a vorking knovledge of the drill rig and its inherently hazardous nature. Where monitoring instrumentation is to be used, the SSO must be properly trained prior to field vork. The SSO must have an understanding of the hazards of heat and cold stress, their associated symptoms, and proper vork modifications to protect field staff fror potential injury.

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3.2 E & E DRILLER AND BELPER

The E & E driller and helper shall have taken and passed the basic 40-hour Iiealth 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 vhether additional training or apprenticeship will be required before alloving this employee to act as Driller. An existing E 6 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. Following successful completion of such a course, the Driller's Helper will be observed on sites for a period of approximately 6 months, during which time he or she will vork on several drilling projects performing assorted types of drilling. The E 6 E Drilling Team will determine, based on these field observations, vhether 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 Realth 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 Iiealth 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 vork.

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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 folloving: rig inspections, personnel monitoring, and personnel protection.

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

- The mast must be located at lust 25 feet from any overhead or underground utility lines.
- The location and operation of operational and unencumbered kill svitcher must be reiterated to all site personnel.
- Outriggers, stabilizers, or jacks are in place, and the rig is level.
- A geophysical survey (electromagnetic or ground-penetrating radar) or a reliable site history must be obtained *to* verify absence of buried obstacles, tanks, or drums.
- A first aid kit and filled eyevash 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 vith emergency phone list and map of hospital route.
- A "super exclusion zone" must be established around the borehole, using a 4- by 8-foot sheet of plywood. This defined area will be entered during active drilling only by the Driller, except in emergency situations.

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

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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 vith 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 vorking order. Day-to-day operations, as well as calibration data, must be recorded in the equipment log or SSO log. Adequate supplies such as breathing air, drinking liquids, and calibration gas must be maintained.

E 6 E personnel are forbidden from entering the "super exclusion zone" around the borehole vhile the rig is actively drilling. The SSO must not attempt to take air readings in or around the auger vhile in use, nor are cutting samples taken while the auger is in motion. An O_2/explosimeter should be set up if possible for unmanned (alarmed) operations at the rig using an extension hose to continuously draw samples from the borehole area during drilling operations.

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

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

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

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

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

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

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

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

4.2 RESPONSIBILITIES AND AUTHORITY OF *OTHER* E & E PERSONNEL

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

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

B & 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 vork interruption.
- Only approved Drillers will remain in proximity to the borehole during drilling, and an approximate 4- by 8-foot "super exclusion area" will be established around the moving auger at all times. No personnel, except the Driller and the Driller's Helper, will enter this zone during drilling. The SSO will issue warnings to those personnel who breach this zone.
- Continuous O_2/explosimeter monitoring at borehole using remote sampling hose will exist at all times.
- All field team members will be briefed on planned drilling operations and possible problems before work begins on day 1. All will be shovn 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 vorn 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 within 25 feet of overhead lines.

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- Electrical storms vithin hearing range of the job site will signal vork termination until the SSO and Team Leader notify personnel othervisa.

- 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 will operate the cathead.

- Only properly licensed staff will drive the drill rig. A daily safety check of the vehicle, folloving E 6 E protocol, will be carried out by the driver.

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

5.1.2 Rotary and Core Drilling

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

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

  - Rods and bit should be open and clear.

  - Vater svivels and hoisting plugs should be lubricated and *checked* for "frozen" beatings before use.

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

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

  - All hoses to and from the pump should be checked for properly installed couplings: couplings should be secured vith locking devices on "quick connect" fittings or vire 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 vrench from the chuck.

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

- Drill rods should not be held or lovered 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 vith hands or a vrench.

- 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 dovn before breaking the first tool joint.

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

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

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

5.1.3 Cathead Usage

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

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

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

- Should the rope 'grab' the cathead or othervise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel, including the Operator, to rapidly back avay 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 vatch the suspended tools, quickly backing avay after turning off the engine.

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

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

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

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

- Do not leave a cathead unattended vith the rope vrapped on the drum.

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

- When using the cathead and rope for driving or back-driving, make sure that all threaded connections are tight, vhile staying as far avay 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.

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S.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 RPH.

- Apply an adequate amount of down pressure before rotation to seat the auger head below the ground surface.

- Check auger flights for nicks or burrs that could catch clothing during rotation, and file them down.

- Watch the auger head vhile slowly engaging the clutch or rotation control, and start rotation. Stay clear of the auger.

- Slovly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about 1 foot or more below ground surface.

- If the auger head slides out of alignment, disengage the clutch dr 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 avay from the auger column and that the auger fork is removed before starting rotation.

- Only use the manufacturer's recommended method of securing the auger to the pover coupling. Do not touch the coupling or the auger with your hands, a vrench, or any other tool during rotation.

- Whenever possible, use tool hoists to handle auger sections.

- Never place hands or fingers under the bottom of an auger section 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 allov feet to get under the auger section that is being hoisted.

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- 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 avay from the auger. Never use your hands or feet to move cuttings avay from the auger.

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

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

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

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

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

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- Host 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 vith the manufacturer of the drill rig.

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

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

- Vhen stuck tools or similar loads cannot be raised vith 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 avay from the vire rope. Do not attempt to use tool hoists to pull out a mired vehicle or drill rig carrier.

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

- Avoid sudden loading in cold weather.

- Never use frozen ropes.

- Protect vire rope from sharp corners or edges.

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

- Clutches and brakes on hoists should be periodically tested.

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

- Always vear gloves when handling wire rope.

- Polloving the installation of a nev wire rope, first lift a light load to allov the vire rope to adjust.

- Never carry out hoisting operations vhen weather conditions are such that hazards to personnel, the public, or property are creatcd.
- 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 folloving operation manuals are incorporated by reference in this SOP:

Diedrich D-SO Safety Manual.

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

Wire Rope Users Hanual, American Iron and Steel Institute.

MALLINCKRODT

Material Safety Data Sheet

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

Emergency Telephone Number: 314-982-5000

HYDROCHLORIC ACID, 37%

PRODUCT IDENTIFICATION:

Synonym 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 FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG DAMAGE.**

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

EMERGENCY/FIRST AID

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

DOT Hazard Class: Corrosive Material

SECTION 1 Physical Data

Appearance: Clear, colorless fuming liquid.

Odor: Pungent odor of hydrogen chloride.

Solubility: Infinite in water with slight evolution of heat.

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

Melting **Point:** -74°C (-101°F)

Specific Gravity: 1.18

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

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

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

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

Explosion:
Not considered to be an explosion hazard.

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

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

SECTION 3 Reactivity Data

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

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

Hazardous Polymerization:
Will not occur.

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

SECTION 4 Leak/Spill Disposal Information

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

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

Ensure compliance with local, state and federal regulations.

AD

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

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

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

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

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

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

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

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

B. FIRST AID

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing *h* 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 LDSO 900 mg/kg (Hydrochloric acid concentrated) Mutation references cited.

SECTION 6 Occupational Control Measures

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

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, "Industrial Ventilation. A Manual of Recomm Practices", most recent edition, 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 th maximum use concentration specified by the respirator supplier, whichever is less. Alternatively, a supplied air full facepiece respirator or airlined hood may be worn.

SUO 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 *h* 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 a d 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: $(CH_3)_2CHOH$

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% (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 form. or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

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

SECTION 5 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** time for **fumes** to clear hood, then ignite paper in a suitable location away from combustible materials. Contain **and recover liquid for reclamation when possible. Larger spills and lot sizes can be collected** as **hazardous waste and atomized** in a suitable RCRA approved combustion chamber, or **absorbed** with vermiculite, dry sand, earth or similar material for disposal as hazardous waste in a RCRA approved facility.

Ensure compliance with local, state and federal regulations.

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

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ISOPROPYL ALCOHOL

PRODUCT IDENTIFICATION:

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

Formula CAS No.: 67-63-0

Molecular Weight: 60.10

Chemical Formula: $(CH_3)_2CHOH$

Hazardous Ingredients: Not applicable.

PRECAUTIONARY MEASURES

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

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

EMERGENCY/FIRST AID

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

DOT Hazard Class: Flammable Liquid

SECTION 1 Physical Data

Appearance: Clear, colorless liquid.

Odor: Rubbing alcohol.

Solubility: Infinite in water.

Boiling Point: 82°C (180°F).

Melting Point: -89°C (-128°F).

Specific gravity: 0.79

Vapor Density (Air = 1): 2.1

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

Evaporation Rate: (n-BUAC = 1) 2.83

SECTION 2 Fire and Explosion Information

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

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

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

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

SECTION 3 Reactivity Data

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

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

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Heat, flame, strong oxidizers, 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 time for fumes to clear hood, then ignite paper in a suitable location away from combustible materials. Contain and recover liquid for reclamation when possible. Larger spills and lot sizes can be collected as hazardous waste and atomized in a suitable RCRA approved combustion chamber, or absorbed with vermiculite, dry sand, earth or similar material for disposal as hazardous waste in a RCRA approved facility.

Ensure compliance with local, state and federal regulations.

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

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Emergency Phone Number: 314-982-5000

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

NITRIC ACID, 70%

PRODUCT IDENTIFICATION:

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

Formula CAS No.: 7697-37-2

Molecular Weight: 63.00

Chemical Formula: HNO_3

Hazardous Ingredients: Not Applicable

PRECAUTIONARY MEASURES

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

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

EMERGENCY/FIRST AID

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

DOT Hazard Class: Oxidizer

SECTION 1 Physical Data

Appearance: Clear, colorless to slightly yellow liquid.

Odor: Suffocating acrid

Solubility: Infinite in water.

Boiling Point: 122°C (252°F)

Melting Point: **-34°C (-29°F)**

Specific Gravity: 1.41

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

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

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

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

Explorloor
Reacts explosively with combustible or ynk 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 d a *Om,* **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 a d hydrogen nitrate. Will react with n t c r or steam to **produce heat and toxic** a d **corrosive fumes.**

Hazardous Polymerization:
Will not occur.

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

SECTION 4 Leak/Spill Disposal Information

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

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

Ensure compliance with local, state and federal regulations.

AD

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

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

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

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

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

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

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

Aggravation 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 d 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 n l c r or milk if available. Never give anything by mouth lo on 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 (Pet):
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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Material Safety Data

Emergency Phone Number: 314-982-5000

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SODIUM HYDROXIDE

PRODUCT IDENTIFICATION:

Synonyms: Caustic soda; lye; radium hydroxide **solid;** radium **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 Mtdlr:
Use any means suitable for extinguishing surrounding fire. Adding water to caustic solution generates large amounts of heat.

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

SECTION 3 Reactivity Data

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

Hazardous Decomposition Products:
Sodium oxide.

Hazardous Polymerization:
This substance does not polymerize.

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

SECTION 4 Leak/Spill Disposal Information

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

Ensure compliance with local, state **and federal regulations.**

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

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

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

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

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

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

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

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

B. FIRST AID

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

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

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

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

C. TOXICITY DATA (RTECS, 1912)

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

SECTION 6 Occupational Control Measures

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

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

Personal Respirators: **(NIOSH** Approved)
If **the TLV** is exceeded, a **dust/mist** respirator with chemical **goggles** may be worn, in general, up to ten times the **TLV. Consult respirator** supplier for **limitations.** Alternatively, a supplied air full faceplece respirator or airlined hood may be worn.

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

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

SECTION 7 Storage and Special Information

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

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Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

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

SULFURIC ACID *96%*

PRODUCT IDENTIFICATION:

Synonyms: Oil of Vitriol

Formula CAS **No.: 7664-93-9**

Molecular Weight: 91.07

Chemical **Formula:** H_2SO_4

Hazardous Ingredients: Not applicable.

PRECAUTIONARY MEASURES

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

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

EMERGENCY/FIRST AID

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

DOT Hazard Class: Corrosive **Material**

SECTION 1 Physical Data

Appearance: Colorless, oily liquid.

Odor: **Odorless.**

Solubility: Infinite @ 20°C.

Boiling Point: ca. 310°C **(590°F)**

Melting Point: ca. -14°C (6°F).

Specific Gravity: 1.84

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

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

Evaporation Rate: NO information found.

SECTION 2 Fire and Explosion Information

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

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

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

Special Information:
In the event of 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.

Insure compliance with local, **state** and federal regulations.

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

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

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

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

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

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

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

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

B. FIRST AID

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

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

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

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

C. TOXICITY DATA (RTECS, 1982)

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

SECTION 6 Occupational Control Measures

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

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

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

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

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

SECTION 7 Storage and Special Information

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

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Chlordane Date December 16, 1991

DOT Name/U.N. no. 2762 Job No.

CAS Number 57-74-9

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: 7-methanoindene)

Chemical Formula $C_{10}H_6Cl_8$ Molecular Weight 409.8

Physical State Liquid Solubility (H_2O) Insoluble Boiling Point Decomposes

Flash Point N/A Vapor Pressure/Density 0.00001 mm Freezing Point Unknown

Specific Gravity 1.56 (77°F) Odor Characteristic Pungent, chlorine-like Flammable Limits Non

Incompatabilities Strong oxidizers, alkaline reagents

Biological Properties:

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

IDLH Human 500 mg/m^3 Aquatic Rat/Mouse

Route of Exposure Inh, Abs, Ing, Con

Carcinogen Yes Teratogen Mutagen

Handling Recommendations: (Personal protective measures)

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

Monitoring Recommendations:

Continuous HNu/OVA

Disposal/Waste Treatment:

Health Hazards and First Aid:

Eye: wash immediately; skin: wash immediately; Swallow: immediate medical attention - irritation from exposure requires immediate medical attention.

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

Chronic: Tremors, convulsions, lung, liver or kidney damage

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HAZARD EVALUATION OF CHEMICALS

Chemical Name DDT Date 7/01/92

DOT Name/U.N. lo. 2761 Job lo.

CAS Number 50-29-3

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: Dichlorodiphenyltrichloroethane)

Chemical Formula $(C_6H_4Cl)_2CHCCl_3$ Molecular Weight 354.5

Physical State solid Solubility (H2O) Insoluble Boiling Point 230°F

Flash Point Vapor Pressure/Density 0 mm Hg Freezing Point

Specific Gravity 0.99 Odor Characteristic Flammable Limits

Incompatabilities

Biological Properties:

TLV-TWA .5 mg/m^3 PEL 1 mg/m^3 Odor/Odor Threshold aromatic

IDLH Human Aquatic Rat/Mouse

Route of Exposure inh, ing, dorm

Carcinogen Human/animal Toratogen Mutagen Experimental

Radiological Properties:

N/A

Handling Recommendations: (Personal protective measures)

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

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 contusion, light-headedness, nausea/vomiting, headache, staggering, unconsciousness, irritation of eyes/resp/skin, skin burns

Chronic: Liver and/or kidney damage, CNS detects. paralysis of hands

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Heptachlor Date December 16, 1991

DOT Name/U.N. No. 2761 Job lo.

CAS Number 76-44-8

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: 7-methanoindene)

Chemical Formula $C_{10}H_5Cl_7$ Molecular Weight 373.4

Physical State Solid Solubility (H_2O) Insoluble Boiling Point 293°F

Flash Point N/A Vapor Pressure/Density 0.0003 mm (77°F) Freezing Point N/A

Specific Gravity 1.66 Odor Characteristic Camphor-like Flammable Limits Non

Incompatabilities Iron, rust

Biological Properties:

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

IDLH Human 700 mg/m^3 Aquatic Rat/Mouse

Route of Exposure Inh, Abs, Ing, con

Carcinogen Yes Teratogen Mutagen

Handling Recommendations: (Personal protective measures)

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

Monitoring Recommendations:

Continuous HNu/OVA

Disposal/Waste Treatment:

Health Hazards and First Aid:

Eye: wash immediately; skin: wash immediately; Swallow: immediate medical attention - irritation from exposure requires immediate medical attention.

Symptoms: Acute: in animals: tremors, convulsions

chronic: in animals: liver damage

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Dieldrin Date 7/06/92

DOT Name/U.N. No. 2761 Job lo.

CAS Number 60-57-1

References Consulted (circle):

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

Toxic and Hazardous Safety Manual ACGIH Other:

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

Chemical Properties: (Synonyms: HEOD, Oxtalox)

Chemical Formula $C_{12}H_8Cl_6O$ Molecular Weight 380.9

Physical State solid Solubility (H2O) 0.02% Boiling Point Decomposes

Flash Point N/A Vapor Pressure/Density 0 mm Hg Melting Point 349°F

Specific Gravity 1.75 Odor Characteristic 0.04 ppm Flammable Limits

Incompatabilities strong oxidizers, acids, active metals, phenols

Biological Properties:

TLV-TWA .25 mg/m^3 PEL .25 mg/m^3 Odor/Odor Threshold mild insecticide

IDLH 450 mg/m^3 Human Aquatic Rat/Mouse

Route of Exposure inh, ing, derm

Carcinogen Human/animal Toratogen Mutagen Experimental

Radiological Properties:

N/A

Handling Recommendations: (Personal protective measures)

Tyvek, gloves (PVA, Piton); 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, skin burns

chronic: Liver and/or lung damage, potential carciogen, brain damage

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HAZARD EVALUATION OF CHEMICALS

Chemical Name PCBs Date 3/23/92

DOT Name/U.N. No. UN2315 Job No. UMS000

CAS Number 1336-36-3

References Consulted (circle):

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

Toxic and Hazardous Safety Manual ACGIH Other: Chemtex data

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

Chemical Proportior: (Synonyms: Aroclor 1254, 1221, 1232, 1242, 1245, etc.)

Chemical Formula $C_{12}H_5C_{12}$ (Approx) Molecular Weight 326

Physical State Liquid Solubility (H2O) Insoluble Boiling Point 617° to 691°F

Flash Point 431.3°F Vapor Pressure/Density 0.001 mm Freezing Point -2°F

Specific Gravity 1.3 - 1.8 odor Characteristic _____ Flammable Limits _____

Incompatabilities Strong oxidizers

Biological Proportior:

TLV-TWA 1.0 $\mu g/m^3$ PEL 0.5 mg/m^3 Odor/Odor Threshold mild hydrocarbon

IDLH 5 mg/m^3 Human _____ Aquatic _____ Rat/Mouse _____

Route of Exposure _____

Carcinogen X Teratogen _____ Mutagen Suspect

Radiological Proportior:

Handling Recommendations: (Personal protective measures)

Impermeable clothing, gloves, face shields. Use neoprene, butyl rubber, saranex.

Monitoring Recommendations:

Disposal/Waste Treatment:

Store contaminated clothing in closed container until discarded or laundered.

Health Hazards and First Aid:

Skin or eye contact - flush with water for at least 15 miautor.

Symptoms: Acute: Irritates eyes and rkia: jaundice, dark urine; chloracne; nausea; vomiting.

Chronic: Liver damage.

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Arsonic Date 3/26/92

DOT Name/U.N. No. 1558 Job No. UH8000

CAS Number 7784-42-1

References Consulted (circle):

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

Toxic and Hazardous Safety Manual ACGIH Other:

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

Chemical Proportior: (Synonyms: Arsenia)

Chemical Formula As Molecular Weight 74.9

Physical State Solid Solubility (H2O) Insoluble Boiling Point Sublimes

Flash Point N/A Vapor Pressure/Density 0 mm Freezing Point N/A

Specific Gravity 5.73 odor Charactoristic N/A Flammable Limits Non

Incompatabilities STRONG OXIDIZERS, BROMINE AZIDE. HYDROGEN GAS

Biological Proportior:

TLV-TWA 0.002 mg/m3 PEL 0.010 mg/m3 Odor/Odor Threshold Odorless

IDLH 100 mg/m^3 Human Aquatic Rat/Mouse

Route of Exposure Inh, Abs, Ing, Con

Carcinogen Yes Teratogen Hutagon

Handling Recommendations: (Personal protective measures)

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

Monitoring Recommendations:

Continuous Mini-Ram

Disposal/Waste Treatment:

Health Hazards and First Aid:

Eye: wash immediately; akin: wash immediately; Swallow: immediate nodical attontion - irritation from exposure requires immediate medical attontion.

Symptoms: Acute: Headache, dizziness, nausea, voaiting, convulsions

Chronic: Coma

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SITE SAFETY PLAN

Version 988

A. GENERAL INFORMATION

Project Title: Site 24 - DDT Mixing Area

Project No.: UH1104

TDD/Pan No.:

Project Manager: John Barksdale

Project Dir.: Rick Rudy

Location(s): DDT Mixing Area - Near the northwest corner of the Barrancas National Cemetary

Prepared by: Hal Davis

Date Prepared: 4-27-89

Approval by: Mary Miller

Date Approved:

Site safety Officer Review:

Date Reviewed:

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

Proposed Date of Field Activities: August 1989

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

Documentation/Summary:

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

B. SITE/WASTE CHARACTERISTICS

Waste Type(~):

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

Characteristic(s):

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

Other:

Physical Hazards:

Overhead	[X]	Confined. Space	[ ]	Below Grade	[ ]	Trip/Fall	[X]
Puncture	[ ]	Burn	[ ]	Cut	[ ]	Splash	[X]
Noise	[X]	Other:	Vehicular traffic in site area. Heat/cold stress.				

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

Site History/Description and Unusual Features (see Sampling Plan for detailed description): From tho early 1950's until tho early 1960's tho DDT mixing area site was used as a location for mixing DDT with diesel fuel for mosquito control. Roportodly, spills occurod within tho mixing area when DDT was transferred from drums to spray tanks. An estimated 20 gallons of posticido mixture, containing about 3.3 pounds of DDT, were inadvertently spilled during tho entire period of operations. Building 3561 vas used as a posticido storage and oquipwnt rinsing area after tho use of DDT was discontinued.

Locations of Chemicals/Wastes: Contaminants are likely contained in subsurface media.

Estimated Volume of Chemicals/Wastes: 20 gallons of posticido

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

C. HAZARD EVALUATION

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

Physical Hazard Evaluation:

1) Physical Surveys - Automobile harards:

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

3) soil Sampling - Using portable drill rig:

4) Groundwater Sampling - splash, personal contamination:

5) Docontamination Procedures - Using solvents;

6) Hydrologic Assessment - Splash. personal contamination.

Chemical Hazard Evaluation:

Compound	PEL/TWA	Route of Exposure	Acute symptoms	Odor Threshold	Odor Description
Chlordan.	0.5 mg/m3	Inh, Abs	convulsions	odor1oss	odorless
4.4-DDT	1.0 mg/m^3	Inh,Ing,Derm,Eye	tremors, convulse	slight	slight/odorless
Isopropyl Alcohol	440 ppm	" "	drowsiness,head.	7.5-200 ppm	rubbing alcohol
Nitric Acid	2 ppm	" "	corrosive	0.3-1 ppm	acrid
Hoptachlor	0.5 mg/m^3	Inhale, absorb	tremors, convulse	0.2 ppm	camphor odor
Epoxide	--	Inh. Abs	Skin Irritant	--	--
Dieldrin	0.25 mg/m3	Inh, Ing, Con	nausea, convulse	0.6 mg/m3	
PCBs	0.5 mg/m^3	Inh, Ing, Con	nausea,vomit,head	N/A	hydrocarbon odor
Arsenic	0.5 mg/m^3	Inh, Ing, Con	naus,vomit,diarrhe	N/A	garlic-like
Sulfuric Acid	1 mg/m^3	Ing, Derm, Inh	corrosive	N/A	odorless
Hydrochloric Acid	5 ppm	Inh, Ing, Dorm	corrosive	Unknown	acrid
Sodium Hydroxide	2 mg/m^3	Inh, Ing, Con	corrosive	N/A	odorloss

Complete and attach a Hazard Evaluation Shoot 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 zono. contamination coduction, zono, otc.

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

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

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

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

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

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

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

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

Air Monitoring (daily calibration unless otherwise noted):

Contaminant of Interest	Type of Sample (area, personal)	Monitoring Equipment	Frequency of Sampling
vocs	Area	OVA	Continuous
Radiation	Area	Mini-Rad	Continuous
Explosive Gases	Area	02/Explosimeter	Continuous

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

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

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

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

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

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

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

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

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

General Spill Control, if applicable: A/A

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

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

Sample Handling Procedures Including Protective Wear:

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

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

*All entries into exclusion zone require Buddy System use. All E & E fiold staff participate in medical monitoring program and have completed applicable training per 29 CFR 1910.120. Respiratory protection program meets requirements of 29 CPR 1910.134. and M S I 288.2 (1980).

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E. EMERGENCY INFORMATION

(Use supplemental shoots, if necessary)

LOCAL RESOURCES

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

Ambulance On Base -- 904-152-1138, Off Base -- 911

Hospital Emergency Room NAS Dispensary - 901-452-2733. 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 W C 1-716-631-0360

Fed. Express 1-000-238-5355

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

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

SITE RESOURCES

Site Emergency Evacuation Alarm Method U/A

Water Supply Source On-sit.

Telephone Location, Number To bo determined on-sit.

Cellular Phone, if available N/A

Radio

Other On-site 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) 877-1978 (office

4. Regional Office Manager, R. Rudy ..... 904) 893-7245 (home)
   904) 177-1978 (office

MEDTOX HOTLINE

1. Twenty-four hour answering sorvico: (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 ororgoncy.
   - Action taken.

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

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

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

EMERGENCY ROUTES

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

Directions to hospital (include map) fror Site 24

NAS Dispensary - Take Andrew Jackson Court west to Davis Road. Turn right (north) onto Davis Road and continuo to Taylor Road. Turn right (east) onto Taylor Road and continuo to Duncan Road. Turn riyht onto Duncan Road and continuo south to Turnor Road. Turn loft (east) onto Turnor Street; the NAS Dispensary is located on Turnor street in Buildiny 3600.

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

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

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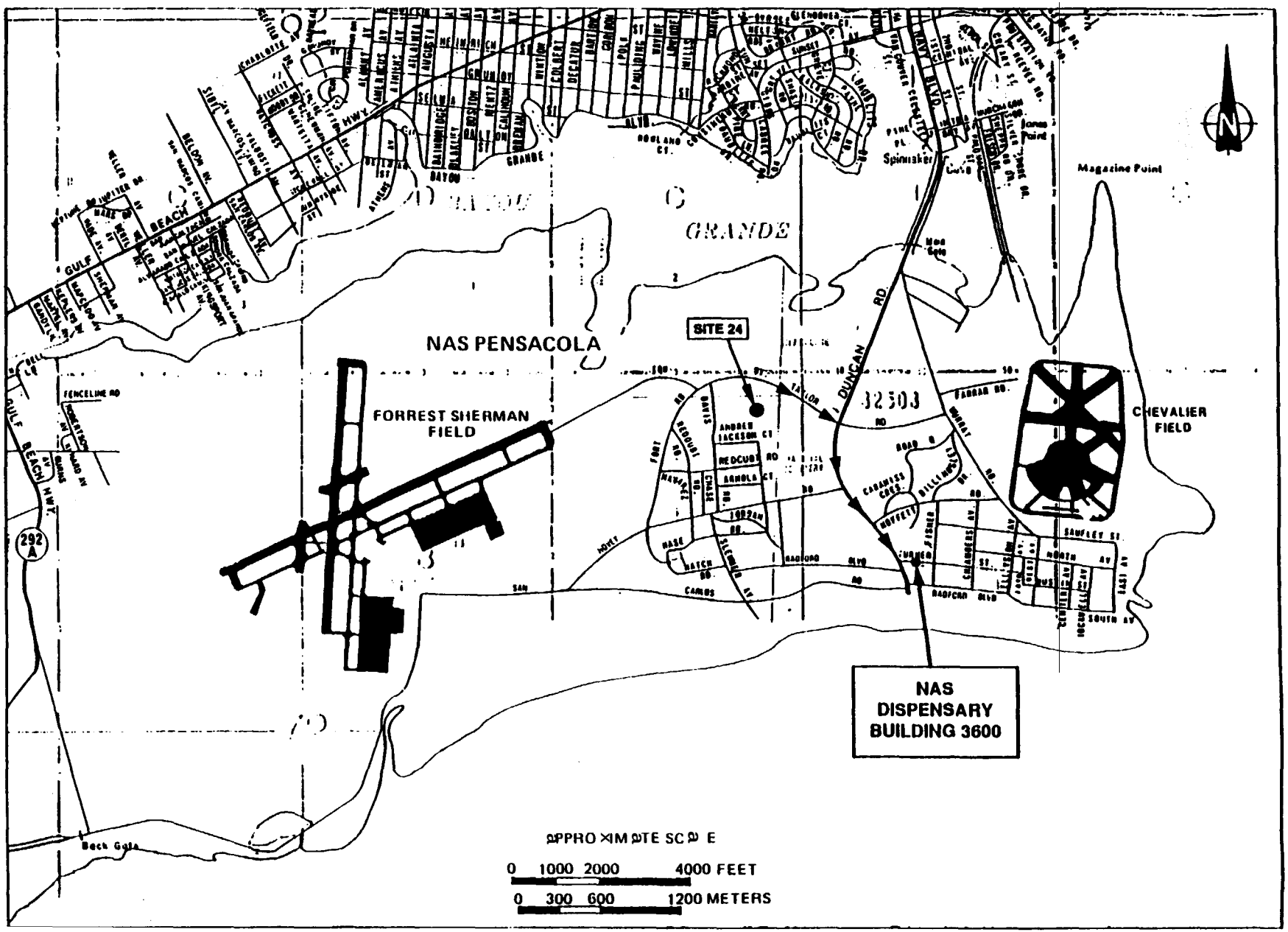

Figure A-3 LOCATION OF NAS DISPENSARY

APPENDIX B

SITE-SPECIFIC QUALITY ASSURANCE PROJECT PLANS

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

Section 1.0 -- Title Page

Work Plan Group: D
Site No.: 15
Site Name: Pesticide Rinsate Disposal Area

Prepared by: Amy Twitty
Ecology and Environment, Inc.
1203 Governor's Square Boulevard, Suite 401
Tallahassee, Florida 32301

Prepared for: Department of the Navy
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive, P.O. Box 10068
Charleston, South Carolina 29411-0068
Contract Number N62467-88-C-0200

Signature Approvals:

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

E 6 E Regional QA/QC Coordinator: Kimberly R. Walker
K. Walker

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

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

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Section 3.0 -- Project Summary

Vork Plan Group: D

Site No.: 15

Site Name: Pesticide Rinsate Disposal Area

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

Phase I -- Field Screening
Physical Survey (check all that apply):

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

Geophysical Survey (check all that apply):

- ___ Electromagnetic Conductivity:
  - ___ EM-31 ___ EM-34
- X Hagnetometry
- ___ 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	___	X Volatile Organic Compounds
Sediment		X Polynuclear Aromatic Hydrocarbons
Soil.	87	___ Phenols
Groundwater	10	X Organophosphorus Pesticides
Duplicates	5	___ Chlorinated Herbicides
Trip Blanks	___	X Carbamates
Field Blanks	___	X Pesticides/Polychlorinated Biphenyls
Rinsate Blanks	___	X Total Recoverable Petroleum Hydrocarbons
Other	___	X Metals
		___ Gross Alpha

Section 3.0 -- Project Summary (Continued)

Phase II -- Characterization

PLANNED NUMBER OF SAMPLES

Surface Vater	___	Air	___	Duplicates	7
Sedinent	___	Biota:		Trip Blanks	3
Soil	57	Plora	___	Pield Blanks	1
Groundvater	10	Pauna	___	Rinsate Blanks	3
				Preservative Blanks	1

CATEGORIES OF ANALYSES

- X Purgeable Aromatics
- X Purgeable Ralocarbons
- X Base/Neutral Extractables
- X Acid Extractables
- ___ Polynuclear Aromatic Hydrocarbons
- ___ Dioxins
- X Organophosphorus Pesticides
- X Sulfide
- X Berbicides
- X Pesticides
- X Polychlorinated Biphenyls
- X Total Recoverable Petroleum Hydrocarbons
- X Hetals
- X Cyanide

Additional analytical categories are identified below:

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

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

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

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Analyte	Media	Method No.	A	P	C	DL
Lead	S/W	EPA 7421	N/M	N/M	N/M	N/M
Hagnesium	S/W	EPA 6010	N/H	N/M	N/M	N/M
Hanganese	S/W	EPA 6010	N/M	N/M	N/M	N/M
Mercury	S/W	EPA 747117470	N/M	N/M	N/M	N/M
Nickel	S/W	EPA 6010	N/M	N/M	N/M	N/M
Selenium	S/W	EPA 7740	N/M	N/M	N/M	N/M
Silver	S/W	EPA 6010	N/M	N/M	N/M	N/M
Sodium	S/W	EPA 6010	N/M	N/H	N/M	N/M
Thallium	S/W	EPA 7841	N/M	N/M	N/M	N/M
Tin	S/W	EPA 7870	N/M	N/M	N/H	N/M
Vanadium	S/W	EPA 6010	N/H	N/M	N/M	N/M
Zinc	S/W	EPA 6010	N/M	N/M	N/M	N/M
Cyanide	S/W	EPA 9010/335.2	N/M	N/M	N/H	N/M
Sulfide	S/W	EPA 376.1	N/M	N/M	N/M	N/M
TOC	S/W	EPA 415.1	N/M	N/M	N/M	N/M
Hardness	W	EPA 130.2	N/H	N/M	N/H	N/M
Alkalinity	W	EPA 310.1	N/M	N/M	N/M	N/M
Total Suspended Solids	W	EPA 160.2	N/M	N/M	N/M	N/M
Total Kjeldahl Nitrogen	S/W	EPA 351.3	N/M	N/M	N/M	N/M
Nitrogen-Ammonia	S/W	EPA 350.2	N/M	N/M	N/M	N/M
Orthophosphate Phosphorus	S/W	EPA 365.2	N/M	N/M	N/M	N/M
5-day Biological Oxygen Demand	W	SM 5210	N/M	N/M	N/H	N/M
Chemical Oxygen Demand	W	EPA 410.4	N/M	N/M	N/M	N/M
pH	W	EPA 150.1	N/M	N/M	N/M	N/H
Percent Moisture	S	ASTM D-2216-80	N/M	N/M	N/H	N/M
Grain Size	S	ASTH D-422-63	N/M	N/M	N/M	N/M
BTU Content	S	ASTH D-2015-77	N/M	N/M	N/M	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/M	N/M
Ignitability	S/W	EPA 1010	N/M	N/M	N/M	N/M
Cation Exchange Capacity	S	EPA 9081	75-125	35	95%	100 mg/kg
Field Parameters						
pH	W	150.1	N/H	N/H	N/H	N/H
Specific Conductance	W	120.1	N/M	N/M	N/H	N/M
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/H = No Modifications from GQAPP
TBD = To Be Determined

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

Section 6.0 -- Fieldvork and Sampling Procedures

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

No Hodifications

Section 7.0 — Sample Custody

Sample custody procedures are presented in Section 7.0 of the GQAPP. Hodifications to these procedures are described belov:

No Modifications

Section 8.0 -- Calibration Procedures and Frequency

Calibration procedures and frequency are presented in Section 8.0 of the GQAPP. Hodifications to these procedures are described belov:

No Hodifications

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:

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No Modifications

Section 10.0 -- Data Reduction, Validation, and Reporting

Data reduction, validation, and reporting procedures are presented in Section 10.0 of the GQAPP. Modifications to these procedures are described below:

No Modifications

Section 11.0 -- Internal Quality Control Checks

Internal quality control check procedures are presented in Section 11.0 of the GOAPP. Modifications to these procedures are described belov:

No Modifications

Section 12.0 -- Performance and System Audits

Performance and system audit procedures are presented in Section 12.0 of the GOAPP. Specific audits planned for this site investigation are listed belov:

Audit Type	Frequency/Date	Description
	To Be Determined	

Section 13.0 -- Preventive Maintenance

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

No Modifications

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

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

No Modifications

Section 15.0 -- Corrective Action

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

No Hodifications

Section 16.0 -- Quality Assurance Reports to Management

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

No Modifications

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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

Section 1.0 -- Title Page

Work Plan Group: D
Site No.: 24
Site Name: DDT Mixing Area

Prepared by: Amy Twitty
Ecology and Environment, Inc.
1203 Governor's Square Boulevard, Suite 401
Tallahassee, Florida 32301

Prepared for: Department of the Navy
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive, P.O. Box 10068
Charleston, South Carolina 29411-0068
Contract Number N62467-88-C-0200

Signature Approvals:

E 6 E Project Manager: John D. Barksdale
J. Barksdale

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

E & E ASC Director: Gary Hall for
~~Acc Chief~~ W.F. Hall, Ph.

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

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Section 3.0 -- Project Summary

Vork Plan Group: D

Site No.: 24

Site Name: DDT Mixing Area

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

Phase I -- Field Screening
Physical Survey (check all that apply):

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

Geophysical Survey (check all that apply):

- ___ Electromagnetic Conductivity:
  - ___ EM-31 ___ EM-34
- X Magnetometry
- ___ Very Low Frequency
- ___ Ground Penetrating Radar
- ___ Seismic Refraction
- ___ Seismic Reflection

Analytical Screening (check all that apply):

- ___ Field Analyses:
- ___ Soil Headspace Analyses: Planned Number of Samples ___
- ___ Soil Gas Analyses : Planned Number of Samples ___
- X Laboratory Analyses:

PLANNED NUMBER OF SAMPLES		CATEGORIES OF ANALYSES
Surface Water	___	X Volatile Organic Compounds
Sediment	___	X Polynuclear Aromatic Hydrocarbons
Soil	38	___ Phenols
Groundwater	5	X Organophosphorus Pesticides
Duplicates	3	X Carbamates
Trip Blanks	___	X Pesticides/Polychlorinated Biphenyls
Field Blanks	___	X Total Recoverable Petroleum Hydrocarbons
Rinsate Blanks	___	X Metals
Other	___	___ Gross Alpha

Section 3.0 -- Project Summary (Continued)

Phase 11 -- Characterization

PLANNED NUMBER OF SAMPLES

Surface Water	___	Air	___	Duplicates	6
Sediment	___	Biota:		Trip Blanks	2
Soil	47	Flora	___	Field Blanks	1
Groundvater	10	Fauna	___	Rinsate Blanks	3
				Preservative Blanks	1

CATEGORIES OF ANALYSES

- X Purgeable Aromatics
- X Purgeable Halocarbons
- X Base/Neutral Extractables
- X Acid Extractables
- ___ Polynuclear Aromatic Hydrocarbons
- X Pesticides
- X Carbamate Pesticides
- X Organophosphorus Pesticides
- X Polychlorinated Biphenyls
- X Total Recoverable Petroleum Bydrocarbons
- X Xetals
- X Cyanide

Additional analytical categories are identified belov:

- X Gross Alpha
- X Gross Beta
- X Gama 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 Ealogens
- X Sulfur
- X Ignitability
- X Cation Exchange Capacity

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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
ory Screening Analyses*						
Volatile Organic Compounds	S/W	--	N/M	N/M	N/M	N/M
Polynuclear Aromatic t carb	S/W	--	N/M	N/M	N/M	N/M
Pesticides	S/W	--	N/M	N/M	N/M	N/M
Polych Bipheny	S/W	--	N/M	N/M	N/M	N/M
t Recoverable P eu Hydrocarbons	S/W	EPA 418.1	N/M	N/M	N/M	TBD
Arsenic	S/W	--	N/H	N/M	N/M	N/M
Cadmium	S/W	--	N/M	N/M	N/M	N/M
romi	S/W	--	N/M	N/M	N/M	N/M
p	S/W	--	N/M	N/M	N/M	N/M
Lead	S/W	--	N/M	N/M	N/M	N/M
Nickel	S/W	--	N/M	N/M	N/M	N/M
lver	S/W	--	N/M	N/M	N/M	N/M
Zinc	S/W	--	N/M	N/M	N/M	N/M
Laboratory Analyses						
TCL Purgeables + xylene	S/W	EPA 8240/624	N/M	N/M	N/M	N/M
TCL BNAs	S/W	EPA 8270/625	N/M	N/M	N/M	N/M
TCL Pesticides & PCBs	S/W	EPA 8080/608	N/M	N/M	N/M	N/M
Total Recoverable Petroleum Eydrocarbons	S/W	EPA 418.1	N/M	N/M	N/M	N/H
Gross Alpha	S/W	EPA 900.0	N/M	N/M	N/M	N/M
Gross Beta	S/W	EPA 900.0	TBD	TBD	TBD	TBD
Gamma Scan	S/W	EPA 901.1	TBD	TBD	TBD	TBD
Organophosphorus Pesticides	S/W	EPA 8140	N/M	N/M	N/M	N/M
Carbamate Pesticides	S/W	EPA 8318 (draft)	N/M	N/M	N/M	N/M
TCL Metals:						
Aluminum	S/W	EPA 6010	N/M	N/M	N/M	N/M
Antimony	S/W	EPA 6010	N/M	N/M	N/M	N/M
Arsenic	S/W	EPA 7060	N/M	N/M	N/M	N/M
Barium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Beryllium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Boron	S/W	EPA 6010	N/M	N/M	N/M	N/H
Cadmium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Calcium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Chromium	S/W	BPA 6010	N/M	N/M	N/M	N/M
Cobalt	S/W	EPA 6010	N/M	N/M	N/M	N/M
Copper	S/W	EPA 6010	N/M	N/M	N/M	N/M

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Analyte	Media	Method No.	A	P	C	DL
Iron	S/W	EPA 6010	N/M	N/M	N/M	N/M
Lead	S/W	EPA 7421	N/M	N/M	N/M	N/M
Magnesium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Manganese	S/W	EPA 6010	N/M	N/M	N/M	N/M
Hercury	S/W	EPA 7471/7470	N/M	N/M	N/M	N/M
Nickel	S/W	EPA 6010	N/M	N/M	N/M	N/M
Selenium	S/W	EPA 7740	N/M	N/M	N/M	N/M
Silver	S/W	EPA 6010	N/M	N/M	N/M	N/M
Sodium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Thallium	S/W	EPA 7841	N/M	N/M	N/M	N/M
Vanadium	S/W	EPA 6010	N/M	N/M	N/M	N/M
Zinc	S/W	EPA 6010	N/M	N/M	N/M	N/M
Cyanide	S/W	EPA 9010/335.2	N/M	N/M	N/M	N/M
TOC	S/W	EPA 415.1	N/M	N/M	N/M	N/M
Hardness	W	EPA 130.2	N/M	N/M	N/M	N/M
Alkalinity	W	EPA 310.1	N/M	N/M	N/M	N/H
Total Suspended Solids	W	EPA 160.2	N/M	N/M	N/M	N/M
Total Kjeldahl Nitrogen	S/W	EPA 351.3	N/M	N/M	N/M	N/M
Nitrogen-Ammonia	S/W	EPA 350.2	N/M	N/M	N/M	N/M
Orthophosphate Phosphorus	S/W	EPA 365.2	N/M	N/M	N/M	N/M
5-day Biological Oxygen Demand	W	SM 5210	N/M	N/M	N/M	N/M
Chemical Oxygen Demand	W	EPA 410.4	N/M	N/M	N/M	N/M
pH	W	EPA 150.1	N/M	N/M	N/M	N/M
Percent Moisture	S	ASTM D-2216-80	N/M	N/M	N/M	N/M
Grain Size	S	ASTH D-422-63	N/M	N/H	N/M	N/M
BTU Content	S	ASTM D-2015-77	N/M	N/M	N/M	N/M
Ash Content	S	ASTM D-482	N/M	N/M	N/M	N/M
Total Organic Halogens	S	SW 9020	TBD	TBD	TBD	TBD
Sulfur	S	ASTM D-129-64	N/M	N/M	N/M	N/M
Ignitability	S/W	EPA 1010	N/M	N/M	N/M	N/M
Cation Exchange Capacity	S	EPA 9081	75-125	35	95%	100mg/kg
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/M
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 GQAPP
TBD = To Be Determined

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

Section 6.0 -- Pieldvork and Sampling Procedures

Pieldvork and sampling procedures are presented in Section 6.0 of the GOAPP. Hodifications to these procedures are described belov:

No Hodifications

Section 7.0 -- Sample Custody

Sample custody procedures are presented in Section 7.0 of the GQAPP. Modifications to these procedures are described belov:

No Modifications

Section 8.0 -- Calibration Procedures and Frequency

Calibration procedures and frequency are presented in Section 8.0 of the GQAPP. Hodifications to these procedures are described belov:

No Hodifications

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. Hodifications to any other of the analytical procedures are described belov:

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No Hodifications

Section 10.0 -- Data Reduction, Validation, and Reporting

Data reduction, validation, and reporting procedures are presented in Section 10.0 of the GQAPP. Modifications to these procedures are described belov:

No Hodifications

Section 11.0 — Internal Quality Control Checks

Internal quality control check procedures are presented in Section 11.0 of the GQAPP. Hodifications to these procedures are described belov:

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 belov:

Audit Type	Frequency/Date	Description
	To Be Determined	

Section 13.0 -- Preventive Maintenance

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

No Modifications

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

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

No Modifications

Section 15.0 -- Corrective Action

Corrective action procedures are presented in Section 15.0 of the GOAPP. Modifications to these procedures are described belov:

No Modifications

Section 16.0 -- Quality Assurance Reports to Management

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

No Modifications

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

14[NASP]UH1104:T0396/1885/2

Key at end of table.

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Table Appendix C (Cont.)

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

14[NASP]UH1104:T0396/1885/2

Key at end of table.

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-bi11ed woodpecke	U	E	E	Wooded habitats
Sterna antillarum	Least tarn	U	T		Coastal habitats
Mycteria americana	Wood stock	U	E	E	Freshwater/coastal wet ands
Rostrhamus sociabilis	Snail kite	U	E	E	Freshwater/coastal wet ands
INVERTEBRATES					
Copris gopheri	Scarab beetle	P		u R 2	Associated w/gopher tortoise
Chrysopsis gossypina cruisoana	Cruise's goldon-astor	P	E	UR 1	Coastal dunes
Drosera intermedia	Spoon-leaved sundew	R	T		Aquatic habitats
Epigaea repens	Trailing arbutus	U	E		Dry, acid, sandy soil
Kalmia latifolia	Mountain laurel	U	T		Rich, moist, shady woods
Lilaeopsis carolinensis	Carolina lilaeopsis	R		u R 2	
Lilium iridollae	Panhandlo lily	U	E	UR 2	Black, mucky soils
Pinguicula planifolia	Chapman's buttorwort	U	RE	u R 2	
Polygonella macrophylla	Large-leaved jointwood	R	T	UR 1	sand pino-oak scrub
Rhododendron austrinum	Orange azalea	U	E	UR 5	Moist, *woody* habitats

14[NASP]UH1104:T0396/1885/2

Key at end of table.

Table Appendix C (Cont.)

Scientific Name	Common Name	Base status[a]	status[b] FGFWFC (or FDA)	status[b] USFWS	Habitat
Sarracenia leucophylla	Whit.-top pitchorplant	R	E		Open acid bogs
Sarracenia rubra	Sweet pitchorplant	U	C	u12	Acid bogs/slash pine woods
Stewartia malacodnedron	Silky camellia	U	C		Slopes of wooded ravines

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Key :

[a]Status of species on tho NAS Pensacola facility:
R = 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 for listing.
UR 1 = Under review for federal listing with substantial evidence indicating at least some degree of biological vulnerability and/or threat.
UR 2 = Under review, insufficient biological data available.
UR 5 = Candidate species but taxa has proven to bo more widespread than previously believed and/or those species that are not subject to any identifiable throat.
FDA = Florida Department of Agriculture.
FGFWFC = Florida Game and Freshwater Fish Commission.
USFWS = U.S. Fish and Wildlife Service.

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

APPENDIX D

JUNE 1990 SECTION *14.2*
PHASE II--CHARACTERIZATION

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

14.2 Phase 11--Characterization

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

- o To characterize the nature and magnitude of the full spectrum of potential site contaminants;
- o 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;
- o To support the preliminary identification, screening, and evaluation data requirements of potential remedial alternatives.

Phase II characterization will consist of limited soil sampling; the installation, development, and sampling of shallow monitoring wells, and the sampling of existing wells; a continuation of hydrologic assessment; and air sampling if necessary. Analytical requirements for Phase II are shown on Table 14-2.

During the Phase II investigation of Site 15, 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.

14.2.1 Biota Sampling

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

Table 14-2

PHASE II SAMPLING AND ANALYTICAL REQUIREMENTS-GROUP D

SITE 15

Medium	No. of Samples	Dupli-cates	Trip Blanks[a]	Field Blanks	Rinsate Blanks	Preservative Blanks[b]	Total	Analytical Suite[c,d]
Soil	30	3	2	1	2	1	39 (10)	A C
Groundwater	3	1	1	NR	1	NR	6 (2)	A B
TOTAL	33	4	3	1	3	1	45 (12)	

SITE 24

Medium	No. of Samples	Dupli-cates	Trip Blanks[a]	Field Blanks	Rinsate Blanks	Preservative Blanks[b]	Total	Analytical Suite[c,d]
Soil	25	3	1	1	1	1	32 (10)	A C
Groundwator	3	1	1	NR	1	la	6 (2)	A B
TOTAL	28	4	2	1	2	1	38 (12)	

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

[b]Preservative blankr will be analyzed for TCL volatilo organic compound., total rocovorablo hydrocarbons, dissolved TCL metals, and cyanide.

[c]Analytical suite designations are as follows:

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

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Table 14-2 (Cont.)

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

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

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

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

NR = Not required.

14.2.2 Soil Sampling

Soil samples will be collected as part of the shallow monitoring well installation (described below in Section 14.2.2) and from shallow soil borings at both Sites 15 and 24.

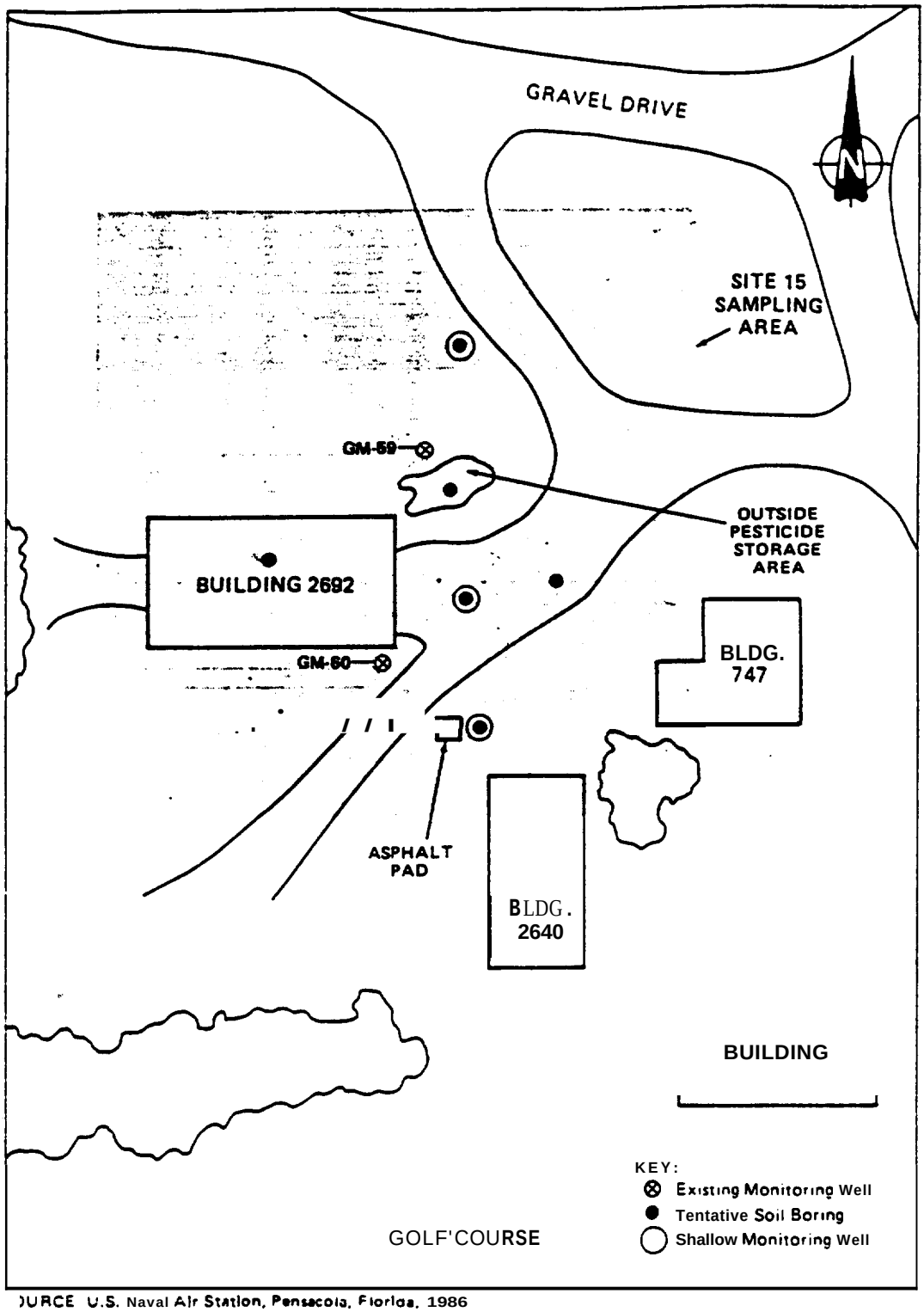
At Site 15, it is tentatively planned that soils will be sampled during the installation of three wells and during three shallow borings, for a total of six locations (shown on Figure 14-3). At Site 24, it is tentatively planned that soils will be sampled during the installation of three wells and during two shallow borings, for a total of five locations (see Figure 14-4).

The samples will be retrieved by split-spoon samplers during hollow-stem auger drilling or by hand-operated bucket augers. The soil samples will be collected from the boreholes at intervals of: surface to 0.5 feet, 0.5 to 2.5 feet, and every 2.5-foot interval thereafter to a maximum depth of 10 feet, or until water table conditions are encountered, whichever is less. Water table is estimated to occur at Site 15 at a depth of 12 feet, and therefore each boring will involve five samples from each location. The total number of soil samples for Phase II at Site 15 is estimated to be 30. At Site 24, water table conditions are estimated to occur at 10 feet, and will require that five samples be collected at each of the five locations, totaling 25 samples for Site 24 during Phase 11.

Each soil sample will be collected as a composite of the material retrieved from a depth interval. All sampling, compositing, and lithologic logging will be conducted in accordance with Section 6.6 of the GQAPP. Equipment decontamination will be conducted in accordance with Section 6.10 of the GQAPP.

It is not anticipated that the number of soil samples projected for Phase II at Sites 15 and 24 will change; however, the findings of Phase I will determine the information needs of Phase 11. The number of shallow wells and their locations and the number of soil samples may be altered.

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

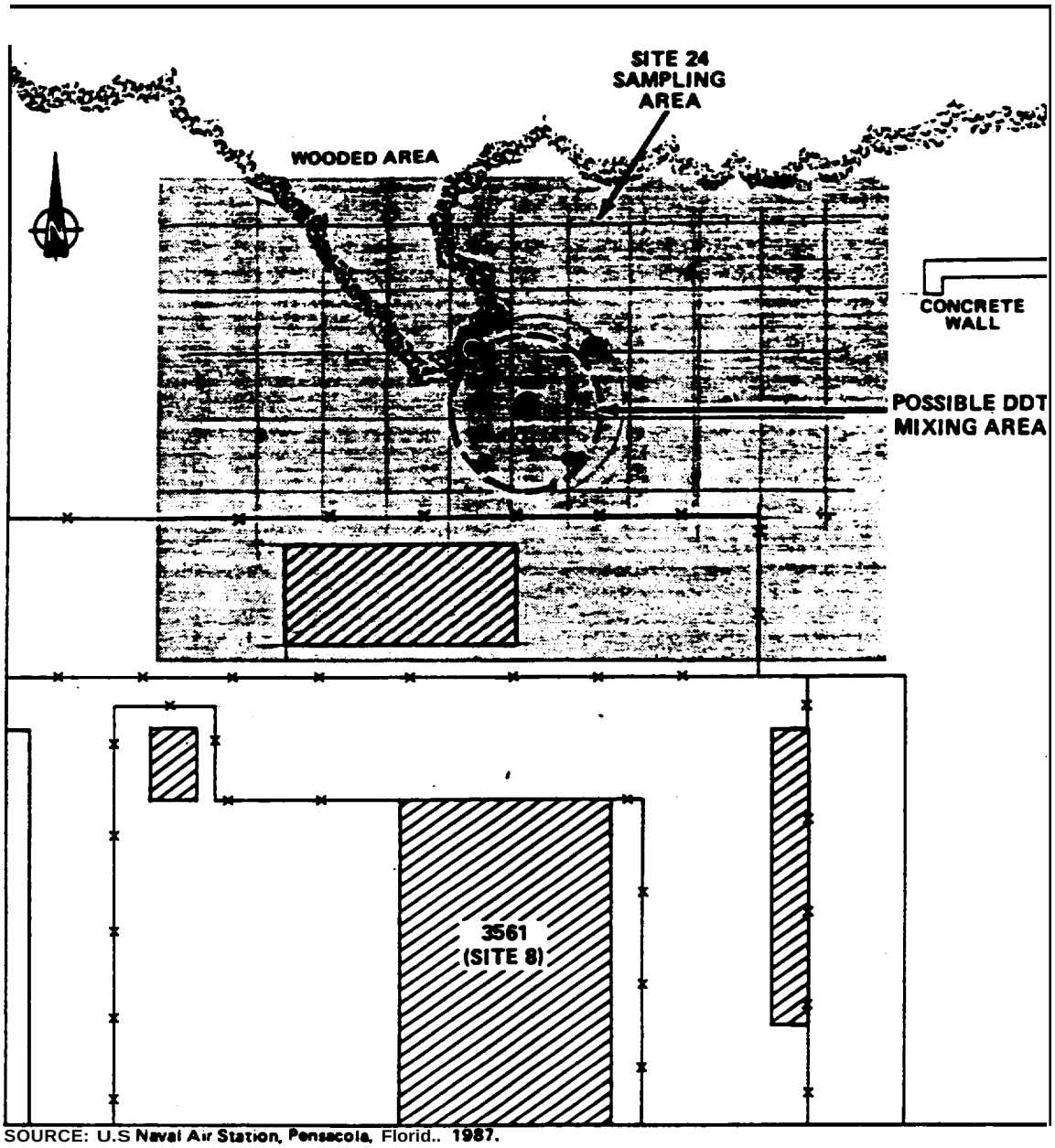


)URCE U.S. Naval Air Station, Pensacola, Florida, 1986

SCALE

0 50 100 200 300 FEET

Figure 14–3 TENTATIVE SOIL BORING AND SHALLOW MONITORING WELL LOCATIONS, SITE 15 – PHASE II



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

SCALE

0 50 100 200 300 FEET

KEY:

- Tentative Soil Boring
- Tentative Shallow Monitoring Well
- Building

Figure 14-4 TENTATIVE SOIL BORING AND SHALLOW MONITORING WELL LOCATIONS, SITE 24 – PHASE II

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14.2.3 Shallow Honitoring Well Installation and Development

The actual number and locations of monitoring wells to be installed in Phase II will be based on Phase I findings. For planning purposes, the number of permanent shallow monitoring wells to be installed at each site is three. All shallow wells will be of two-inch diameter PVC construction, and bracket the water table with 10 feet of screen. The anticipated well depths are 25 feet at Site 15 and 20 feet at Site 24. The wells will be installed utilizing hollow-stem auger techniques, constructed and developed in accordance with Section 6.7 of the GQAPP. Drilling equipment will be decontaminated in accordance with Section 6.10 of the GQAPP.

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

14.2.4 Groundvater Sampling

Groundwater samples will be collected from the tvo existing monitoring wells and the estimated three newly installed permanent wells at Site 15. The existing monitoring well network is shown on Figure 14-3. The three new monitoring wells at Site 24 will also be sampled. The purging and sampling of wells will be conducted in accordance with Sections 6.8 and 6.10 of the GQAPP.

14.2.5 Hydrologic Assessment

Well head elevations will be surveyed for all newly installed monitoring wells and water levels will be measured in all wells. .

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

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particularly useful for deriving first estimates of aquifer hydraulic properties (i.e., hydraulic conductivity, transmissivity).

The advantages of conducting specific capacity tests in conjunction vith well development is that the test itself does not generate additional potentially contaminated vater, which requires disposal. Slug testing does not generate any potentially contaminated vater.

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

14.2.6 Air Sampling

Formal air sampling will be performed in Phase II as deemed appropriate based on Phase I surface emission surveys and particulate air sampling, and the Phase I shallow soil sampling.

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