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PHASE II

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

Buildings 649 and 755 (Site 30)

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 Buildings 649 and 755 (Site 30) 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 1989.

E & E has developed a phased approach for performing the NAS Pensacola site investigations. Phase I (Field Screening) is directed toward identifying the principal area(s) and primary contaminants of concern at a site, thereby providing a mechanism for focusing the sampling and analytical efforts during subsequent phases of the investigation. Phase II (Characterization) is directed toward the formal confirmation and quantification of the full spectrum of site contaminants (if any), thereby allowing determination 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

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support the screening and evaluation of potential remedial alternatives. The main objectives/advantages of this phased approach are as follows:

- o Efficient identification of those sites vhere environmental contamination has actually occurred as a result of past and/or present operations, thereby alloving non-contaminated sites to be eliminated from the program in the most environmentally sound, cost-effective, and timely manner possible;
- o Focused placement of sampling locations and focused selection of analytical parameters in later phases of the investigation, thereby allowing full characterization of site contamination in the most environmentally sound, cost-effective, and timely aanner possible; and
- o Early screening of potential remedial alternatives, vhich, 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 vhich have documented contamination will likely require the additional phases of work, and hence will comprise a full-scale Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation/Feasibility Study (RI/FS). For simplicity, the investigations for all NAS Pensacola sites will be referred to as Contamination Assessment/Remedial Activities Investigations. The final results of site investigations that do not require study beyond Phase II will be incorporated into a Contamination Assessment report. If appropriate, these sites will be recommended for No Further Action. The final results of site investigations that require vork beyond Phase II will be incorporated into a Remedial Investigation report, vhich will provide all the information necessary for the development and completion of a Feasibility Study.

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2. SITE DESCRIPTION

Site 30 consists of two buildings (649 and 755), which were formerly metal-plating facilities, and an adjacent wetland area. The site is located on the eastern portion of NAS Pensacola between Murray Road and the golf course (see Figure 2-1). The wetland is a headwater of a small creek that discharges to a paved drainage ditch west of the Chevalier Field complex. The main channel of the paved ditch extends from near the intersections of Moffit and Murray roads and discharges into an outlet to Bayou Grande, north of Chevalier Field (see Figure 2-2). The confluence of the creek from Site 30 is at approximately the mid-point of the paved ditch. In addition to the creek discharge, there are numerous other storm water outfalls to the paved ditch. Runoff from a number of sites, including sites 9, 10, 23, 25, 27, 29, 31, and 34, may have an affect on water quality in the paved ditch.

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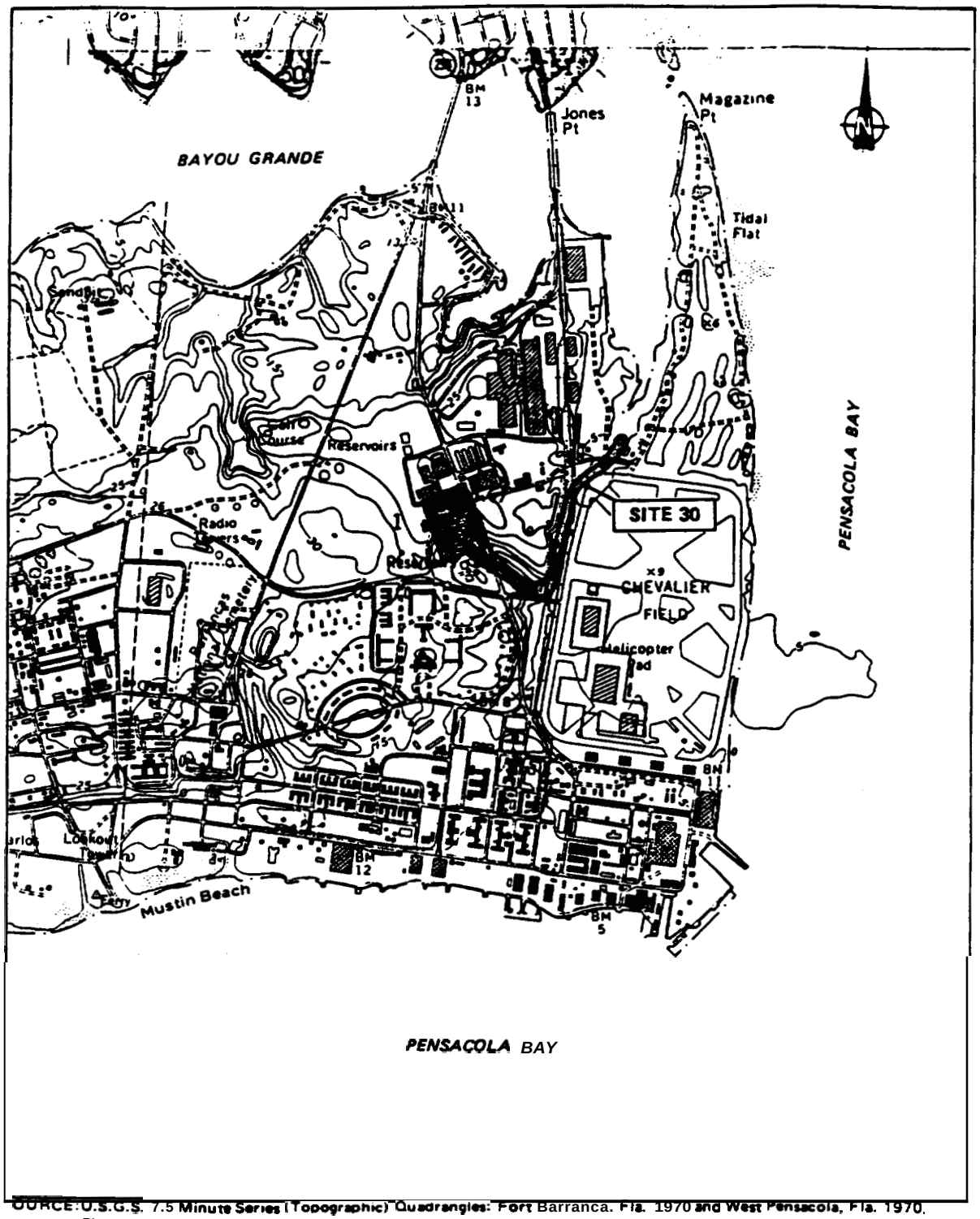

SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangles: Fort Barranca, Fla. 1970 and West Pensacola, Fla. 1970, Photorevised 1987

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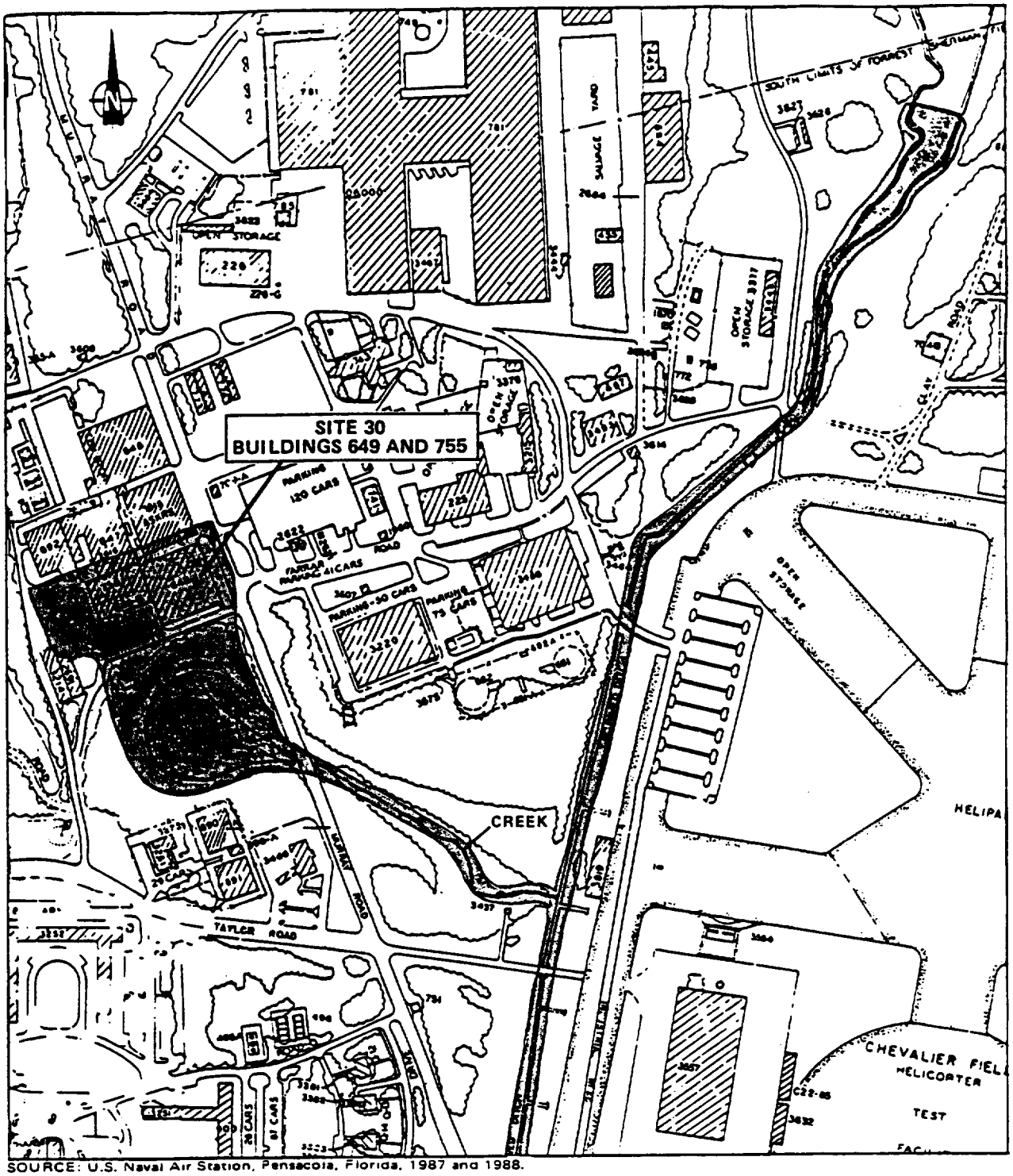
Figure 2–1 LOCATION MAP – NAS PENSACOLA SITE 30



SOURCE: U.S. Naval Air Station, Pensacola, Florida, 1987 and 1988.

SCALE

0 200 400 600 800 FEET

KEY:

Site 30 Area

Swamp Area

Figure 2–2 SITE MAP – NAS PENSACOLA SITE 30 AND CREEK

3. SITE HISTORY

Building 649 was utilized from the 1940s to the 1950s as a tin-cadmium plating operation. Fifteen tanks, ranging in size from 200 to 500 gallons, contained tin-, cadmium-, and cyanide-laden solutions. The contents of these tanks were allegedly emptied each month into the ditch east of the building. A 250-gallon tank containing 1,1,1-trichloroethylene (TCE) was also emptied into the ditch during the 1940s and 1950s. In the 1960s and 1970s, the tin-cadmium operation was replaced by a magnesium treatment line. The 15 tanks contained nitric acid, phosphoric acid, caustics, potassium permanganate, de-greasers, and chromate solutions. These tanks were drained monthly or less frequently into the ditch. Plating operations at Building 649 ceased in the 1970s (NEESA 1983).

Prior to 1962, concentrated cyanide solutions were drained into drums or into a tank truck, taken to the Building 709 plating shop, and disposed of into the sanitary sewer.

From 1962 until the shop closed down in 1970, concentrated cyanide solutions were drained into steel drums. The drums were stored adjacent to Building 3215, loaded onto a Navy boat, and disposed of about 15 miles offshore in the Gulf of Mexico. About 10 drums of concentrated cyanide solution were disposed of each year (Geraghty and Miller, Inc. [G & M] 1984).

Building 755 operated as a plating shop during the 1960s and 1970s. Fifty tanks, ranging in size from 50 to 200 gallons, contained solutions of nickel, silver, lead, tin, chromium, and other metals. These tanks

were drained each month into the ditch east of the building. Plating operations at Building 755 ceased in the 1970s (G 6 M 1984).

During the Verification Study performed by G & M in 1984, four sediment samples were collected from the drainage ditch that plating solutions were drained into (see Figure 3-1 and Table 3-1). These samples were analyzed for **[EP]** toxicity, and vere identified to contain low levels of cadmium (10 to 20 µg/L), magnesium (500 to 1,700 µg/L), and copper (<10 to 20 µg/L). The buildings were not investigated, and no samples were analyzed for TCE.

The Verification Study concluded that the drainage ditch was a groundvater discharge zone and that pollutants introduced to it would be confined to the water course. The study stated that plating waste contaminants have been either immobilized in sediments or have been discharged to Bayou Grande. It was recommended that no further study of the site be conducted (G & M 1984).

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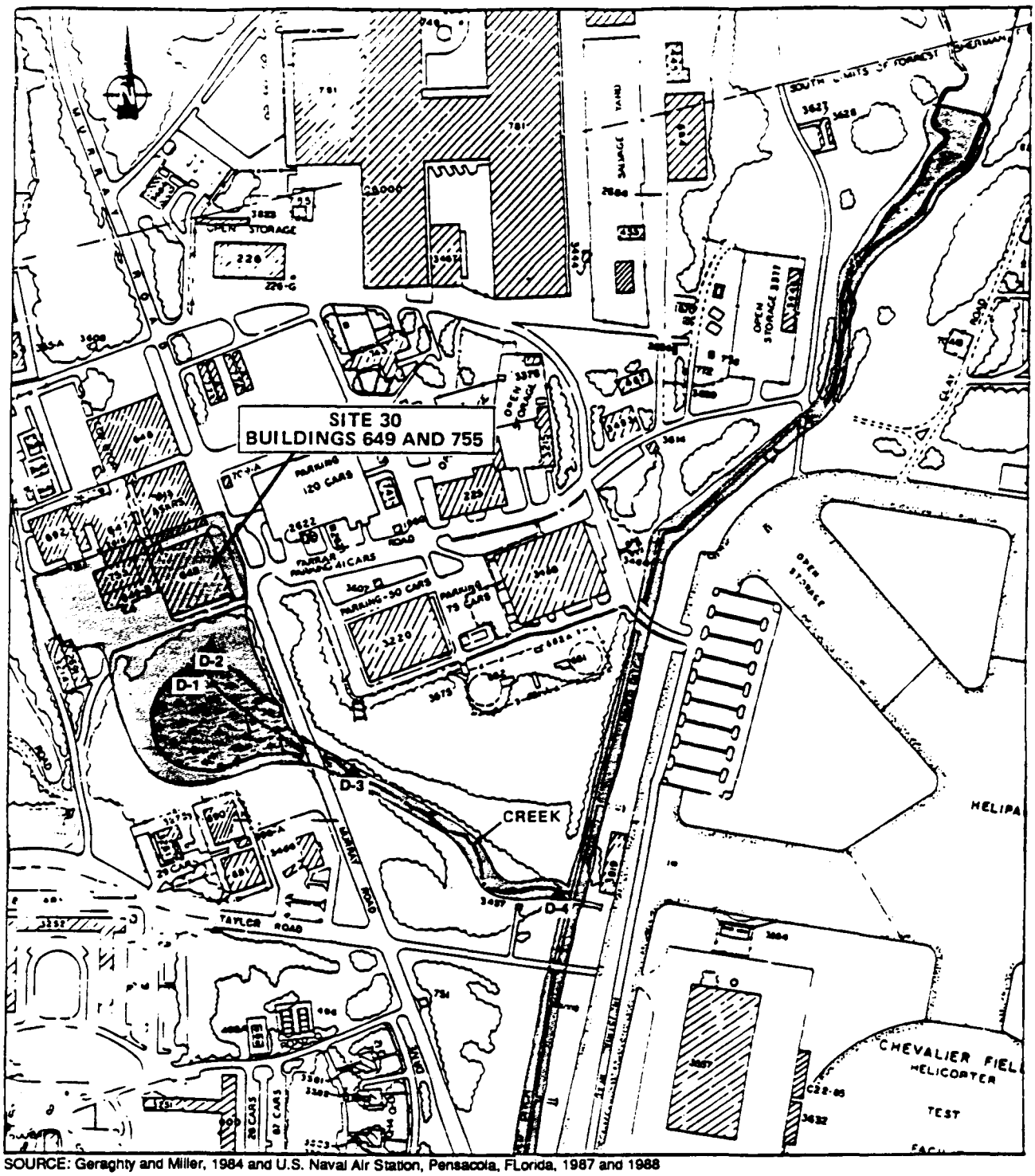

SOURCE: Geraghty and Miller, 1984 and U.S. Naval Air Station, Pensacola, FLorida, 1987 and 1988

SCALE

0 200 400 600 800 FEET

KEY:

Site 30 Area

Swamp Area

▲ Sediment Sampling Location

D-1 Sediment Sample Number

Figure 3-1 SEDIMENT SAMPLING LOCATIONS, G & M 1984 VERIFICATION STUDY NAS PENSACOLA SITE 30 AND CREEK

TABLE 3-1

EP TOXICITY RESULTS FOR SEDIMENT SAMPLES COLLECTED DURING SITE 30 VERIFICATION STUDY
Results in ug/L

Parameter	Sample Number D1	D2	D3	D4
Tin	<5000	<5000	<5000	<5000
Cadmium	20	10	10	SO
Magnesium	1000	800	1700	500
Chromium +6	<10	<10	<10	<10
Nickel	<100	<100	<100	<100
Silver	<10	<10	<10	<10
Lead	<100	<100	<100	<100
Copper	<10	<10	<10	20
Cyanide	<1	<1	<1	<1

Source: G & M 1984

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

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5. BIOLOGICAL RESOURCES

The NAS Pensacola facility consists of approximately 5,800 acres and encompasses approximately 15 terrestrial and aquatic habitats. The majority of the land on the eastern side of the facility is developed for military use or is designated as a historical or cultural resource. However, the NAS Pensacola installation has approximately 3,500 acres in natural or 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), Quercus spp. (scrub oak species, geminata, champanii, ayrtifolia, and inopina), Cladonia species, and Ceratiola ericoides (rosemary). This community type has been ranked by FNAI as imperiled statevide because of its rarity and because of its vulnerability to extinction due to some artificial or biological factor. This community type can have three to five distinct habitats (Volfe et al. 1988).

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

Sandhill communities are found in dry soils vhich are lover '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 (vild persimmon) and Crataegus lacrimata (Pensacola hawthorn). The more abundant herbaceous plants found in moist areas are Pteridium aquilinum (bracken fern) and Aristida stricta (vire grass). These habitats were verified with walk-through surveys and ground truthing by the Navy in March 1986 (Navy 1986).

Freshvater Vetland Vegetation. Much of the geological material underlying the NAS Pensacola facility is deep, porous sand often containing relatively impermeable clay lenses. In combination vith 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. Host 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 vere 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 water bodies can be detrimental to existing populations of reptiles and amphibians utilizing that water body.

5.1.2 Aquatic

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

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

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 Aalodule beaudettei. Seagrass beds in the area surrounding the facility have not been historically mapped, and very little is known of their composition, locality, or areal extent. Grass beds of unknown species composition extending along the north shore of Pensacola Bay in the 1950s disappeared by 1961. An examination of historical aerial photographs (see Section 12) may elucidate past distributions of seagrasses.

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

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

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

Samples collected by the Navy (1986) indicate a lov density yet aoderate diversity of benthic infaunal organisms when compared to other estuarine systems within and around the turning basin. A complete comparison of the Navy's data with other literature cannot be made at this time because their data are not given in numbers per unit area. 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 ritchilli), 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; Eeil 1988).

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

Moderate densities of blue crab (Callinectes sapidus), shrimp (Penaeus duorarum, P. setiferus, and P. aztecus), and oysters (Crassostrea virginica) have been collected throughout Pensacola Bay (Heil 1989).

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

Sport and Commercial Fishing. A moderate amount of commercial fishing occurs in Escambia County, accounting for 2% of the total Florida landings for 1980 to 1985 (Navy 1986). The dominant finfish species in terms of total weight was the black mullet. The most economically important species of finfish was the red snapper. E & E examined the commercial landing data for Escambia County for 1987 and 1988 (Heil 1989) and found that the most important commercial species by weight were: black mullet (24% of county landings), brown shrimp (21%), vermillion snapper (19.5%), red snapper (7.6%), porgies (4.7%), and amberjack (4%). Other less important commercial fish caught were Spanish mackerel, sand seatrout, black grouper, spotted seatrout, blue 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 vithin seagrass beds or other protected habitats until maturity. Any contamination of the vater or sediments around NAS Pensacola could be detrimental to fish and shellfish population structure or could be accumulated by the organisms residing near the facility.

Marine Mammals. Few mammals have been sighted vithin 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 vaters. The Atlantic bottlenose dolphin (Tursiops truncatus), hovever, has been sighted regularly off the NAS Pensacola facility. Manatees have been sighted irregularly, vith one recent sighting in the area recorded by the Florida Natural Areas Inventory (FNAI) in October 1988. A goosebeaked whale (Ziphius cavirostris) was reported stranded on Santa Rosa and a pilot wh (Globicephala macrorhynchus) wa r stranded on a beach near Pensacola (Navy 1986).

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

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

Several aquatic and terrestrial habitats are identified in the Site 30 area. The site consists of the land area from Building *649* southeast to the steephead swamp, the creek that flows from the swamp, and the paved ditch that flows into Bayou Grande.

The terrestrial community around Building *649* comprises primarily cultivated grass and woody shrub species. Immediately southeast and adjacent to the site lies a steephead swamp vegetated by scrub oaks, buttonwood, sweetbay, star anise, spiked cat brier, and possibly some cypress species. The understory appears to be dominated by palmettos, yucca, and woody shrubs. This habitat is relatively undisturbed and may support many species of birds, amphibians, reptiles, fish, and mammals. A creek, which forms at the base of a culvert along the southeast side of the swamp, flows southeasterly towards a paved ditch. This creek is vegetated primarily by herbaceous plants and grasses; however, a dense woody shrub canopy is found along the banks of the creek in some places. The same fauna associated with the steephead swamp may be found associated with this habitat as well.

The paved ditch is vegetated primarily along the banks by grasses and woody shrubs. There does not appear to be any vegetation growing within the paved ditch, although it is assumed that the ditch is no longer an impermeable barrier. Along the western side of the paved ditch lies a heavily wooded sand pine scrub community. The overstory in this community is dominated by *oak* species with woody shrubs in the understory. This area of Site 30 may be used by many faunal species as a feeding area and as a migration corridor between different habitats; species associated with aquatic habitats may use this site as a nesting area.

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The wetland area at the mouth of the paved ditch, just before Bayou Grande, has been primarily undisturbed by base development activities. The flora and fauna associated with this habitat are unknom at this time. However, it is expected that the dominant vegetative types are hardwood tree species, herbaceous plants, and freshwater vetland grasses. Fauna associated with wetlands, principally wading birds, reptiles, and amphibians, are expected to be found on this portion of Site 30. Species associated with nearby habitats may also use this habitat as a feeding area or as a migration corridor to other nearby habitats. The nearshore portions of Bayou Grande and associated marine communities may be affected by discharges from Site 30.

6. SURFACE WATER HYDROLOGY

6.1 General Occurrence and Significance of Surface Water

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

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

There are no naturally occurring perennial streams on NAS Pensacola; however, there are approximately 10 naturally occurring intermittent streams and numerous artificial drainage pathways which include many stormwater outfalls. Discharge is mainly to the south into Pensacola Bay; however, some small intermittent streams discharge into Bayou Grande to the north from Sherman Field and Chevalier Field (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 vaters into Pensacola Bay, Bayou Grande, and the coastal wetland areas presents the potential for transport of contaminants into these systems. This could have a significant impact on seagrass and other sensitive plant communities, as well as on shell fishing, recreational fishing, and swimming in these coastal zones. Discharges, either through the surface vater or groundwater, into vetland areas found on site could also have a significant impact on the biotic communities that are dependent on those habitats.

6.2 Site-Specific Surface Vater Hydrology

As previously discussed, the investigation of Site 30 will include assessment of the drainage system within which it is located. The study will 'focus primarily on the swamp south of Building 649,'the creek vhich drains the area to the paved ditch, and the paved ditch north of the creek confluence and to the Bayou Grande outlet.

The paved ditch carries a significant portion of the runoff from the eastern interior of NAS Pensacola to Bayou Grande. The majority of surface runoff enters the system via an artificial storm drain network vhich serves the western side of the Chevalier Field complex and other urbanized areas in the vicinity. The drainage system removes concentrated runoff, largely attributable to extensive impervious surfaces (i.e., pavement and buildings). Due to the sandy and highly permeable surface soils in nonurbanized areas, rapid infiltration of precipitation negates any accumulation of overland flov, and surface runoff entering the drainage system from undeveloped areas is less significant.

The rapid recharge to the shallov Surficial Aquifer folloving periods of precipitation directly affects the discharge of the drainage system vhich serves as a sink for shallov groundvater. In turn, the drainage system potentially has a significant affect upon the potentiometric surface and horizontal hydraulic gradient in this area.

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An important part of the Site 30 assessment is to delineate the boundaries of this surface water drainage system, and to characterize the relationships between it and the shallow zone of the surficial aquifer. An understanding of this system is an integral step in understanding and remediating the waste sites in the area which may be affecting it.

7. PHYSIOGRAPHY AND HYDROGEOLOGY

7.1 Physiography and Regional Hydrogeology

7.1.1 Physiography

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

7.1.2 Regional Hydrogeology

There are three principal hydrogeologic units of importance which underlie the NAS Pensacola. These are, in descending order, the Surficial Aquifer,, the Intermediate System, and the Floridian 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 comprised of a sequence of unconsolidated to poorly indurated clastic deposits (Wagner et al. 1984). In this portion of Florida, the Surficial Aquifer constitutes an important source of water supply and is called the Sand-and-Gravel Aquifer (Southeastern Geological Society [SEGS] 1986). [Based on the total dissolved solids (TDS) content of groundwater from vells that tap the Sand-and-Gravel Aquifer in southern Escambia County (Clemens et al. 1989), the groundwater is classified as Class G l (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 low permeability zone, and the main producing zone (Wilkins et al. 1985).

Surficial Zone. The surficial zone is contiguous with land surface and contains groundwater under water table or perched water table conditions. The results of numerous borings conducted at NAS Pensacola (G & M 1984, 1986) indicate that the surficial zone ranges in thickness between 40 and 70 feet and consists of tan and brown, fine- to medium-grained quartz sand. Depth to the water table within the surficial zone is variable depending on location and ranges from less than 1 foot near surface water bodies to more than 20 feet in areas of higher elevation. In general, the direction of groundwater flow is controlled by the topography and by discharge to surface water bodies. Consequently, shallow groundwater in the surficial zone moves toward areas of lover elevation and/or the nearest surface water body. Overall, the surficial zone has a high permeability. Numerous aquifer (slug) tests and laboratory permeability tests conducted on wells in or sediments from the surficial zone at NAS Pensacola (G & M 1986) yielded

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hydraulic conductivity values ranging from **16** to **56** ft/day. Horizontal groundwater flow velocities in the surficial zone will depend on site-specific hydraulic conductivities and horizontal hydraulic gradients; however, velocities would generally be expected to be high.

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 6** M **1984, 1986).**

The results of laboratory permeability tests conducted on samples from this zone indicate that vertical hydraulic conductivities are low, ranging from **4.2 x** 10^{-5} to **9.9 x** 10^{-2} ft/day. Thus, the low permeability zone probably functions as a confining or semi-confining unit inhibiting the flow of groundwater between the surficial zone and the underlying main producing zone. The low permeability zone has been encountered in at least **16** borings at widely spread locations throughout **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 lov permeability zone at NAS Pensacola; thus, no information is available regarding groundwater flow direction.

Main Producing Zone. The bottom portion of the Sand-and-Gravel Aquifer is called the main producing zone and consists mainly of sand and gravel interbedded with thin beds of silt and clay. The depth at which the main producing zone is encountered is somewhat variable, ranging from **60** to approximately **120** feet below land surface (BLS) at NAS Pensacola. This zone generally has the highest permeability characteristics due to thicker and more persistent sand and gravel beds, and is tapped by most of the major wells in the Pensacola area (Wilkins ~~et al~~. **1985).** **NAS** Pensacola has three supply wells which produce water from this zone; however, due to high iron content in the water, the wells are

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infrequently used (G 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 groundwater flov within this zone; hovever, the flow direction is assumed to be generally southward under ambient conditions. Pumpage of the supply wells vould locally cause groundvater in this zone to flow toward the wells.

As a result of the overlying low permeability zone, groundwater within the main producing zone occurs under confined or 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 between these tvo zones. Thus, a considerable potential exists for vertical groundvater flow from the surficial to the main producing zone at this location. It is not known to what extent this potential exists elsewhere at NAS Pensacola.

7.1.2.2 Intermediate System

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

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approximately 1,100 feet thick and is composed of the lower portion of the Miocene Coarse Clastics, the Upper Member of the Pensacola Clay, the Escambia Sand Member of the Pensacola Clay, and the Lower Member of the Pensacola Clay, all of Miocene Age.

7.1.2.3 Floridan Aquifer System

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

7.2 Site Hydrogeology

In the general area of Site 30, the surficial zone of the Sand-and-Gravel Aquifer occurs from land surface to depths ranging from approximately 40 to 75 feet, depending on location and surface elevation. Lithologic descriptions of numerous borings conducted in the vicinity of Site 30 indicate that this zone primarily consists of tan and brown, fine- to medium-grained quartz sand (G 6 M 1984, 1986, 1987). The depth to the water table varies from less than 5 feet, in the immediate vicinity of the creek and Bayou Grande, to over 15 feet near buildings 649 and 755. The dominant influence on the shallow groundwater flow direction in the vicinity of Site 30 is the creek itself, which primarily acts as a groundwater discharge area. Thus, the direction of groundwater flow in the immediate Site 30 area will be generally toward the creek. However, given that the creek receives stormwater via surface runoff and sewer outfalls and that the lower reaches of the creek (near Bayou Grande) are tidally influenced, normal groundwater flow directions may be temporarily reversed along portions of the creek following rainfall events and during high tides. Hydraulic conductivities in the surficial zone range from about 16 to 57 ft/day based on tests on shallow wells in the Site 30 vicinity and elsewhere on NAS Pensacola (G & M 1984, 1986).

Immediately underlying the surficial zone in the Sand-and-Gravel Aquifer is the low permeability zone. In the Site 30 area, the top of this unit is encountered at depths ranging from 40 to 75 feet. Based on borings in the Site 30 area (G & M 1984, 1986, 1987) the low permeability zone generally consists of green, blue, and gray, sandy, silty clay and clayey sand with some shell fragments, and ranges in thickness from approximately 8 to 30 feet. As a result of the lithology, this unit would be expected to function as a confining or semi-confining unit in this area, restricting the flow of groundwater betveen the surficial zone and the underlying main producing zone. The direction of groundwater flow within the low permeability zone is unknown.

The top of the main producing zone is encountered at depths ranging from 60 to approximately 110 feet in the Site 30 area and consists of fine- to medium-grained quartz sands. No site-specific information is available regarding the thickness of this unit. Monitoring wells open to the main producing zone in the site area indicate that the water level elevations in this zone are generally lover than those in the surficial zone (G & M 1984, 1986). Thus a potential exists for groundwater flow from the surficial zone to the main producing zone.

The direction of groundwater flow within the main producing zone at Site 30 is unknown; however, a generally southward flow is expected under ambient conditions. An NAS Pensacola supply well (Well No. 2), located approximately 800 feet southwest buildings 649 and 755, is screened between 110 and 160 feet BLS and is thus open to the main producing zone. This well is utilized by NAS Pensacola for backup water supply only during periods of peak demand. However, during these periods of pumping, the direction of flow in the main producing zone would be directly toward the supply well. Insufficient data exist for wells open to the main producing zone to allow a determination of hydraulic gradient at NAS Pensacola.

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No aquifer test data exist for monitoring wells open to the main producing zone at NAS Pensacola. However, records on file with the Northwest Florida Water Management District (1985) indicate that Well No. 2 has a specific capacity of 21 gallons per minute per foot (gpm/ft) at a pumping rate of 650 gpm. These data can be used to calculate a rough approximation of the hydraulic conductivity (Lohman 1979) for the main producing zone of 100 ft/day.

8. PROJECT MANAGEMENT PLAN

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

9. SITE MANAGEMENT PLAN

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

10. HEALTH AND SAFETY PLAN

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

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

11. QUALITY ASSURANCE PROJECT PLAN

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

12. AERIAL PHOTOGRAPH ANALYSIS

Prior to the initiation of fieldwork, E 6 E will examine all available aerial photographs of NAS Pensacola for past and present conditions, features, and developments which may have direct relevance to the fieldwork methodology. The aerial photograph analysis task will involve assembling and stereoscopically analyzing historical photographic imagery and topographic maps available for the site area. For the purpose of supporting the development of field investigation strategies, efforts will be made to obtain photographs of an appropriate scale that will allow for analysis of past and present surface conditions, drainage, and land use. Photographs showing the history of site activities will be analyzed to obtain information regarding the evolution of site features which might have affected hydrologic conditions. The historical perspective gained by studying aerial photographs will provide insight applicable to such tasks as field reconnaissance and monitoring well placement. In addition, the analysis of historical and current aerial photographs, performed in conjunction with geophysical investigation, will aid in the accurate determination of the extent of the formerly used area at the site.

13. UTILITIES SURVEY

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

14. FIELDWORK METHODOLOGY

14.1 Phase I — Field Screening

The primary objective of the Phase I field screening investigation is to effectively and efficiently focus the Site Characterization (Phase 11) and subsequent Extent Delineation (Phase III and 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 will be conducted on and around Site 30. Available aerial photographs will be used as guides in locating surface features. Visual inspections will be made in and around buildings 649 and 755, in and around the swamp, and along the banks of the creek and paved ditch. Outfalls to the drainage system will be visually located and plotted on site maps. Upstream areas will be surveyed as well, and potential contaminant source areas to the drainage system will be noted. The reconnaissance survey team will utilize air monitoring equipment during walkovers of the site areas in accordance with Section 6.1.1

of the GQAPP. In the event that any [areas with readings above background) are located, the area(s) will be flagged and identified on a site map for future reference.

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

During the site reconnaissance 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. The monitoring will be conducted continuously during the walkover. Readings will be recorded in the site logbook and plotted on site maps for future reference.

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

14.1.1.3 Habitat/Biota Survey

During the physical reconnaissance, an E & E biologist/ecologist will determine the on-site terrestrial and aquatic habitats, and the surrounding habitats vhich may be affected by off-site contaminant migration. During the walkover survey, rare, threatened, and endangered species and their potential habitats will be identified, and an evaluation will be made of general site conditions to support viable populations of plants and animals. [Using historical aerial photographs and the survey results, a map illustrating the identified habitats will be generated.] A habitat/biota survey, as well as an evaluation of the literature, will be conducted for Site 30.

14.1.2 Geophysical *Survey*

An electromagnetic terrain conductivity survey will be performed in the area betveen buildings 649 and 755 and the wetland (see Figure 14-1) using an EM-31 survey instrument. The purpose of the survey will be to identify areas of elevated ground conductivity, and possibly identify the location of areas vhere metal plating solutions vere disposed.

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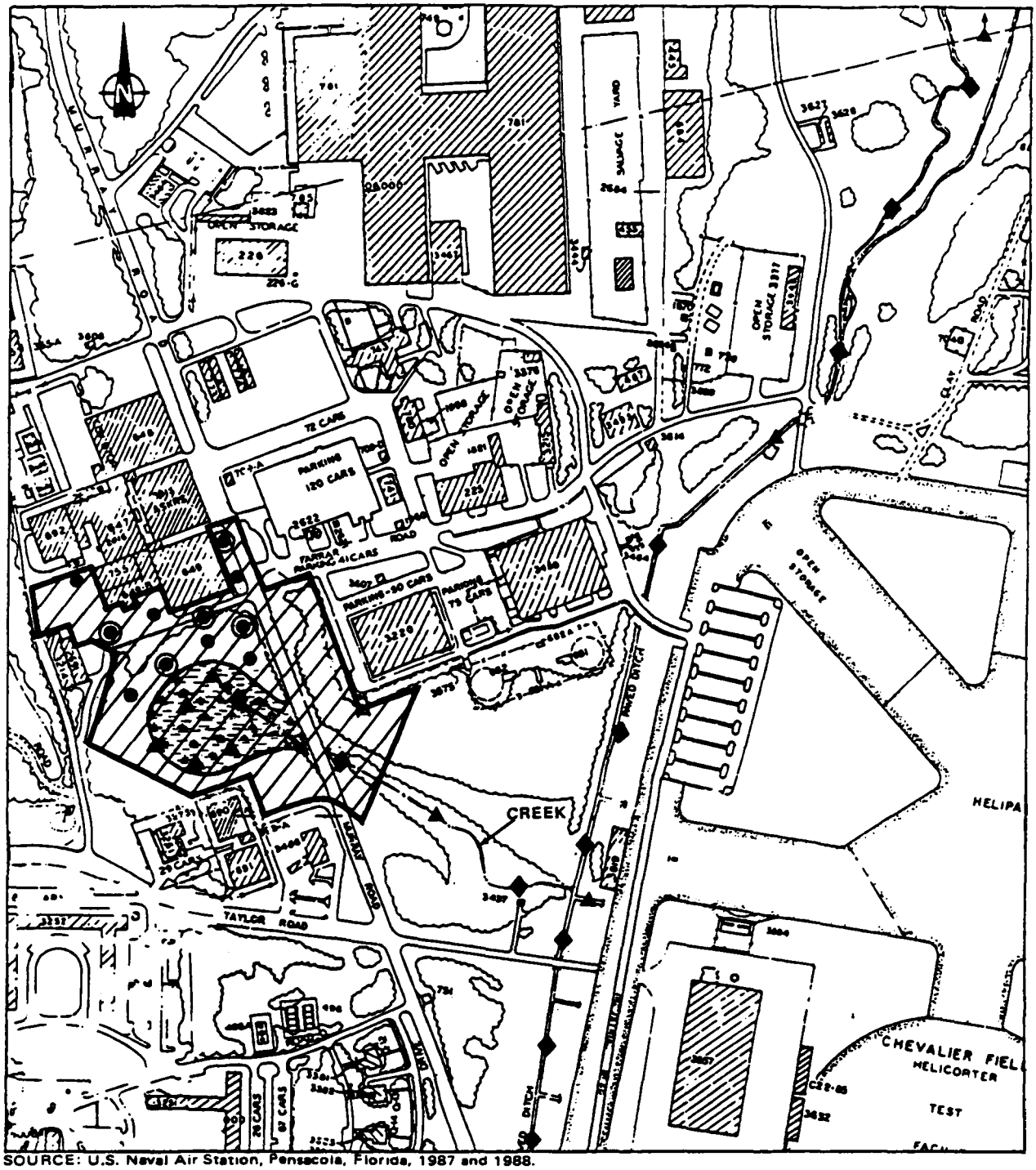

SOURCE: U.S. Naval Air Station, Pensacola, Florida, 1987 and 1988.

SCALE

0 200 400 600 800 FEET

KEY:

Geophysical Investigation Area

● Tentative Soil Boring

▲ Tentative Sediment Sample

◆ Tentative Surface Water and Sediment Sample

○ Tentative Temporary Monitoring Well

Swamp Area

Figure 14–1 TENTATIVE SOIL BORING, TEMPORARY MONITORING WELL, SEDIMENT AND SURFACE WATER SAMPLE LOCATIONS, SITE 30 – PHASE I

An electromagnetic-metal detection (EM-MD) survey will be conducted in areas where soil boring and well drilling activities will occur. The subsurface locations of cables and pipes will be identified and marked on the surface as well as on site maps.

The En-31 and EX-HD surveys, as well as subsequent data interpretations, will be conducted in accordance with 6.2 of the GQAPP.

14.1.3 Analytical Screening

14.1.3.1 Laboratory Analyses

The Phase I field sampling program will be implemented to screen the investigation area on a broad basis and subsequently facilitate focusing the sampling and analytical requirements on areas of primary concern. Analytical screening will be conducted for soil, sediment, surface vater, and groundvater samples, the collection of which is discussed below. The rationale and methodologies for analytical screening are discussed in Section 9.1 of the GQAPP. The analytical requirements for Phase I at Site 30 are provided in Table 14-1.

Surface Water -- A total of 12 surface water samples will be collected from the swamp, creek, paved ditch, and Bayou Grande (see Figure 14-1). Where samples are collected from the shallow waters of the drainage system, a glass or stainless steel beaker will be used as a collection device. The samples collected from deeper waters of Bayou Grande may be collected with a Kemmerer sampling device, submerged to mid-depth of the vater column. All sampling and equipment decontamination activities will be conducted in accordance with sections 6.9.1 and 6.10, respectively, of the GQAPP.

Sediment Sampling — Tventy-one sediment samples will be collected from the swamp, creek, paved ditch, and Bayou Grande (see Figure 14-1). The sediment samples will be collected at depths of surface to 0.5 feet with stainless steel trowels. The composition of sediment materials

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TABLE 14-1

PMSB I SAMPLING AND ANALYTICAL REQUIREMENTS-GROUP E

SITE 30

Medium	No. of Samples	Duplicates	Total	Analytical Suite[a,b]
Surface Water	12	1	13	A
Sediment	21	1	22	A
Soil	22	1	23	A
Groundwater	5	1	6	A
TOTAL	60	4	64	

[a]Analytical suite designations are as follows:

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

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

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

retrieved will be recorded in the field notebook. All sediment sampling and equipment decontamination activities will be conducted in accordance with sections 6.9.2 and 6.10, respectively, of the GQAPP.

Soil -- Twenty-two soil samples will be collected at the locations shown on Figure 14-1. The soil samples will be collected from each boring at composite intervals of 5 feet (surface to 5 feet, 5 feet to 10 feet, etc.) continuing to the depth of the water table. For the purpose of estimating sample requirements, it is assumed that the water table will be encountered at 10 feet and will therefore require two samples per each boring. The borings will be conducted manually with a bucket auger. All soil sampling and equipment decontamination activities will be conducted in accordance with sections 6.7 and 6.10, respectively, of the GQAPP.

Groundvater -- Five groundvater samples will be collected from shallow temporary stainless steel monitoring vells at the locations shown in Figure 14-1. The locations shown are tentative. The interpreted results of the field reconnaissance and geophysical investigations will enable the refining of the Phase I groundwater sampling strategy. The temporary monitoring wells will be 2-inch diameter and will be installed in such a manner that 5 feet of 0.010-inch screen will bracket the water table.

The collection of groundwater samples from the wells will be in accordance with sections 6.8 and 6.10, respectively, of the GQAPP.

14.1.4 Hydrologic Assessment

The goal of the Phase I hydrologic assessment will be to achieve an understanding of the basic characteristics of the creek/paved ditch drainage system (including storm sewer outfalls) and to assess the general physical characteristics of shallow groundwater in the vicinity of buildings 649 and 755 and the swamp.

The velocity and discharge volume of the creek will be estiaated at the time of sampling. Tvo stream staff gauges will be installed and

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

Each temporary monitoring well installed during Phase I will be surveyed to determine the wellhead elevation, and static water levels will be measured to determine shallow groundwater flow directions and hydraulic gradient. Elevations will be referenced to USGS datum or to a suitably established benchmark located within the vicinity of Site 30.

The hydrologic data collected in Phase I will be evaluated alongside geophysical and analytical screening data, and potential lateral migration of contamination will be assessed. Conclusions drawn from these evaluations will form the basis for permanent monitoring well installations and additional sampling in phases II and 111.

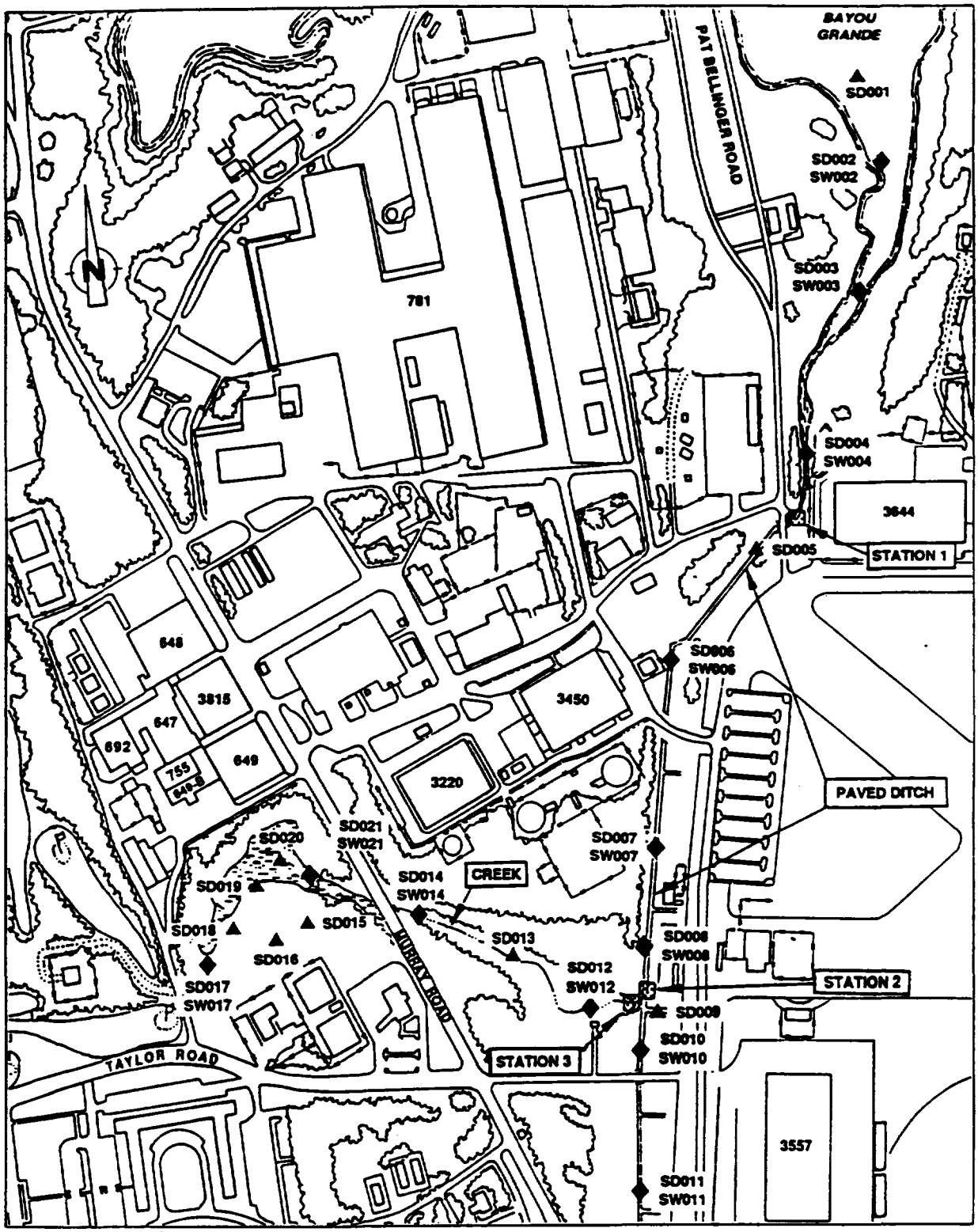
14.2 Phase II--Characterization/Extent Delineation

This section of the Contamination Assessment/Remedial Activities Investigation Work Plan--Group E (Site 30, Buildings 649 and 755), 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 14-2 and 14-3 shows the actual Phase I sampling locations and location designations. The results of the Phase I investigation of Site 30 are presented in E 6 E's Final Interim Data Report, Contamination Assessment/Remedial Activities Investigation, Buildings 649 and 755 (Site 30), Naval Air Station Pensacola, Pensacola, Florida, October 1991.

In general, the results of E 6 E's Phase I investigation of Site 30, reviewed in combination with those of previous investigations of the site (NEESA 1983 and G&M 1984), indicated the following:

- Two major areas of surface water (primarily metals) and sediment (metals, total recoverable petroleum hydrocarbons [TRPHs], polynuclear aromatic hydrocarbons [PAHs], and

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



SOURCE: Ecology and Environment, Inc., 1991

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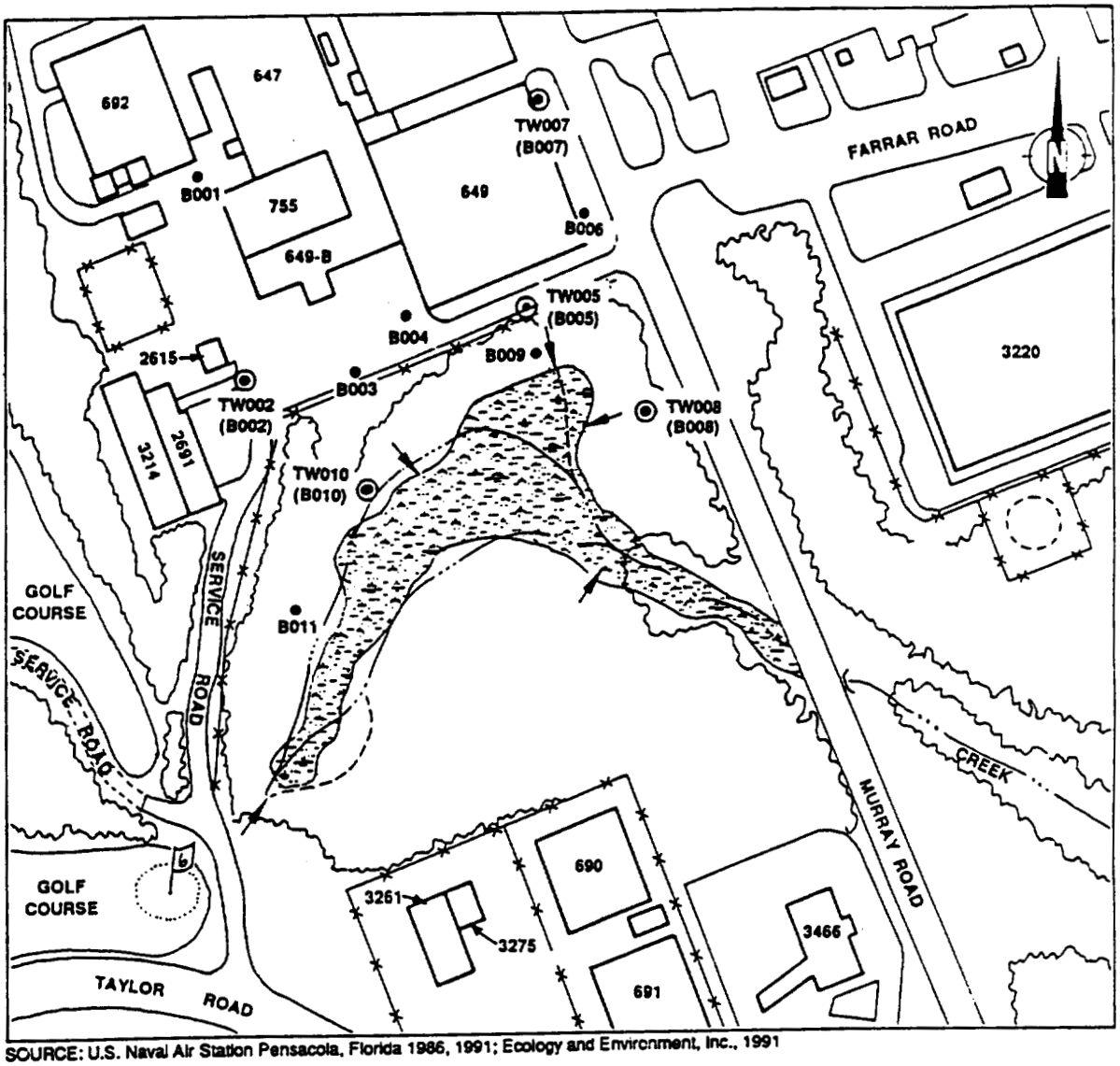
KEY:

▲	Sediment Sample Location	⊠	Stream Flow Station
◆	Surface Water and Sediment Sample Location	SD002	Sediment Sample 002
		SW002	Surface Water Sample 002

Figure 14-2 SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS NAS PENSACOLA SITE 30 — PHASE I



SOURCE: U.S. Naval Air Station Pensacola, Florida 1986, 1991; Ecology and Environment, Inc., 1991

SCALE

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KEY:

- Emergent Marsh
- Soil Boring
- Temporary Monitoring Well
- Outfall
- TW005 Temporary Well 005
- B005 Boring 005

Figure 14-3 SOIL BORING AND TEMPORARY MONITORING WELL LOCATIONS NAS PENSACOLA SITE 30 — PHASE I

phenols) contamination appear to be present at Site 30. Surface waters and sediments upstream of the creek/ditch confluence near buildings 649 and 755 have apparently been contaminated with metals and/or volatile organic compounds [VOCs] from the former metal-plating activities in this area. Surface waters and sediments downstream of the confluence have apparently been contaminated with metals, TRPHs, PAHs, and phenols by leachate migration from Site 11, a former landfill located at the distal end of Site 30 where the creek enters Bayou Grande. Surface water metals concentrations at Site 30 exceed Florida standards. However, it is not known vhether the detected surface water and sediment contamination are sufficient to constitute an environmental threat and thereby varrant remediation.

- Several areas of soil contamination appear to be present on Site 30. A limited area of metals Contamination appears associated with the former metal-plating activities. In contrast, TRPH, PAH, and phenol contamination are widespread and could reflect multiple sources. In particular, very high levels of PAH and phenol contamination near Building 692 suggest a source in this area.

- Several areas of groundwater contamination are also present. Xetals concentrations exceeding Florida standards were widespread, but this widespread occurrence could reflect the fact that the turbid groundwater samples were not filtered prior to acid preservation. Groundwater metals contamination, of a more limited extent, appears to have occurred as a result of the former metal-plating activities. 1,1,1-Trichloroethane contamination greatly exceeding the Florida standard was detected near the northeast corner of Building 649. The source and extent of this contaminate plume are unknown. VOC, PAE, and phenol contamination greatly exceeding Florida standards was detected southwest of Building 649-B. This contaminant plume, the extent of which is unknovn, may be associated with the area of soil contamination detected near Building 692.

In light of the Phase I results summarized above, the objectives of the 'PhaseII investigation of Site 30 will be as follows:

- Determine the source, nature, magnitude, and extent of potential surface water and sediment contamination in Bayou Grande near Site 11, the paved ditch and creek, and the marsh area south of Building 649.

- Determine the source, nature, magnitude, and lateral/vertical extents of known/suspected areas of soil and groundwater contamination;

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

- Identify to the greatest extent possible any sources of contamination that appear to be unrelated to the previous metal-plating activities at buildings 649 and 755.

- Initiate the Risk Assessment and Feasibility Study for the site.

In order to meet the above objectives, the Phase II investigation of Site 30 will include the following elements:

- Contaminant source survey;

- Surface water, sediment, and soil sampling;

- Installation of shallow and intermediate monitoring wells;

- Collection of groundwater samples from all newly installed wells;

- Hydrologic assessment; and

- Engineering survey.

The specific scope of work associated with each of the above elements is described in sections 14.2.1 through 14.2.4. In developing the specific scopes of work, the Phase I analytical results and other previous analytical results have both been evaluated regarding all requirements of the CERCLA and Superfund Amendments and Reauthorization Act (SARA), as well as all other *ARARs.* For Site 30, these *ARARs* include:

- Resource Conservation and Recovery Act (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 Hazardous Waste Management Facilities; Proposed Rule);

- Chapter 17-3, Florida Administrative Code (FAC; Water Quality Standards);

- Chapter 17-301, FAC (Surface Waters of the State);

- Chapter 17-302, FAC (Surface Water Quality Standards);

- Chapter 17-550, PAC (Drinking Water Standards, Monitoring, and Reporting); and
- Chapter 17-770, PAC (State Underground Petroleum Environmental Response).

P o d , quantitative air sampling will not be conducted during Phase II at Site 30 because no evidence that Site 30 represents a potential source of airborne volatile or particulate contaminants vas revealed by the Phase I surface emissions survey, particulate air [screening], or fieldwork air monitoring activities. Biota sampling also will not be conducted during Phase II because the potential contaminants of concern have not been sufficiently characterized. [However, basewide biota sampling will be conducted in conjunction vith the investigation of operable units (OUs) 15, 16, and 17 (Bayou Grande Area, NAS Pensacola Wetlands, and Pensacola Bay Area, respectively).

Every effort vill be made to complete the investigation of Site 30 during Phase II. To the greatest extent possible, the results of the Phase I investigation, as vell as field data and/or observations generated during the Phase II investigation, will be utilized to adjust and/or redirect the Phase II efforts to maximize the amount of information obtained regarding the horizontal and vertical atents of possible contamination at the site. Adjustments to the Phase II scope of vork may include, but may not be limited to: 1) sampling of .additionalmedia which are not already included in this vork plan; 2) installation of additional and/or deeper (i.e., intermediate and/or deep) permanent monitoring wells; 3) collection and analysis of additional samples from amy 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 vill 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 became available prior to or during the completion of Phase II activities at Site 30. This could varrant either an increase or decrease in the scope of work proposed in this work plan.]

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

Based on the results of the activities identified above, during Phase II, E & E will initiate the appropriate Risk Assessment and Feasibility Study activities. Risk Assessment activities will be directed toward identification of contaminants of concern, as well as identification of data gaps that must be eliminated to support the eventual completion of a Baseline Risk Assessment for the site. [If no data gaps are identified, the Baseline Risk Assessment will be complete during Phase II.]

Feasibility Study activities, which will be required for Site 30, will be directed toward identification of data gaps that must be eliminated to support the eventual completion of a comprehensive Feasibility Study for the site. [If no data gaps are identified, the Feasibility Study will be completed during Phase II.]

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

All Phase II investigation activities and results will be discussed in an Interim Data Report structured in the required format of a formal draft Remedial Investigation report. This Phase II Interim Data Report will provide a complete data synthesis incorporating the results of E 6 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 of the site can be prepared.

All Phase I investigation activities were completed in accordance with E & E's 1990 GQAPP for Contamination Assessments and Remedial Activities at NAS Pensacola. All Phase II investigation activities will be completed in accordance with the newly revised, updated 199[2] version of this document, subject to its approval. [In this section (14.2),] all references apply to the 199[2] version of the GQAPP.

14.2.1 Contaminant Source Survey

A detailed contaminant source survey will be performed at Site 30 in order to obtain a comprehensive understanding of potential contaminant source(s) at the site. The survey will focus on existing information in NAS Pensacola files, previous investigative reports, and interviews vith 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 vaste streams, including volumes, disposal methods, and/or any leaks, that ray have occurred at or impacted the site will be based on a review of the Phase I historical aerial photograph analyses and Phase I and Phase II on-site field observations. The compilation of a list of former and existing on-site buildings/structures and delineation of all associated activities will include the development of a detailed summary table and the provision of former and existing building/structure plans, if available. The evaluation of former and existing underground utilities at the site will include determining the former and current use of each utility structure. All former and existing utilities will be shovn graphically on a site map (see Engineering Survey, Section 14.2.4), based on the detail available in the data base. Finally, the identification of potential former and existing ambient contaminant sources will involve an evaluation of existing files and literature to determine whether any normal daily activities at each facility, such as the aircraft operations that are conducted in the on-site building complex, may have created potential, low-level ambient contaminant source(s).

At Site 30, specific tasks associated with the contaminant source survey will also include:

- Identification of the points of origin and the nature of the discharge of all outfalls identified during Phase I, and in particular those located in and around the emergent marsh wetland areas south of Building 649 and the creek and paved ditch west of Chevalier Field;

- Identification of the location of past and/or existing underground storage tanks and associated service piping in the vicinity of Building 649 and the nature of the substances that they contain(ed);

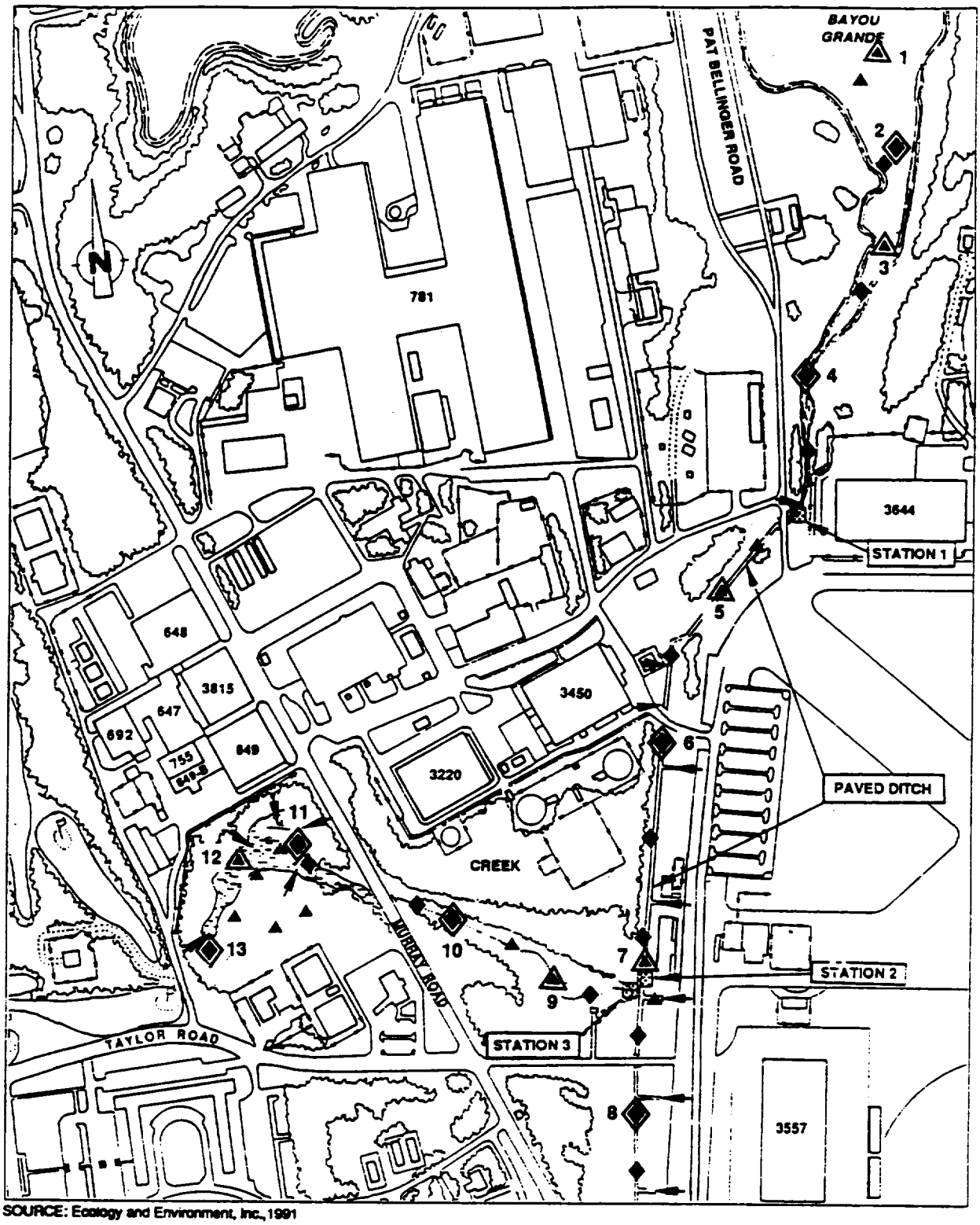
- Identification of the location of the industrial wastewater sewer system and consideration of the potential effects it may have on the distribution of site contamination; and

- Identification of the specific nature of other past and/or present activities in buildings 649 and 755 and how these activities might have contributed to site contamination (e.g., type of substances used and waste disposal practices).

14.2.2 Sampling and Analysis

Figures 14-4 and 14-5 show the proposed Phase II surface water and sediment sampling locations for Site 30. Figure 14-5 shows the proposed soil boring and monitoring well locations. Table 14-2 summarizes the sampling and analytical requirements, including QA/QC samples, for the Phase II investigation of Site 30. Tables 14-3, 14-4, and 14-5 provide the specific rationale for each proposed Phase II Site 30 surface water and sediment sample, soil boring, and monitoring well location, respectively, and for the analytical suite associated with each proposed Phase II Site 30 sampling location.

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



SOURCE: Ecology and Environment, Inc., 1991

SCALE
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KEY:

A Phase I Sediment Sample Location

Phase I Surface Water and Sediment Sample Location

Proposed Phase II Sediment Sample

Proposed Phase II Surface Water and Sediment Sample

1 Location Reference Number

Outfall

Figure 14-4 PROPOSED SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS NAS PENSACOLA SITE 30 — PHASE II

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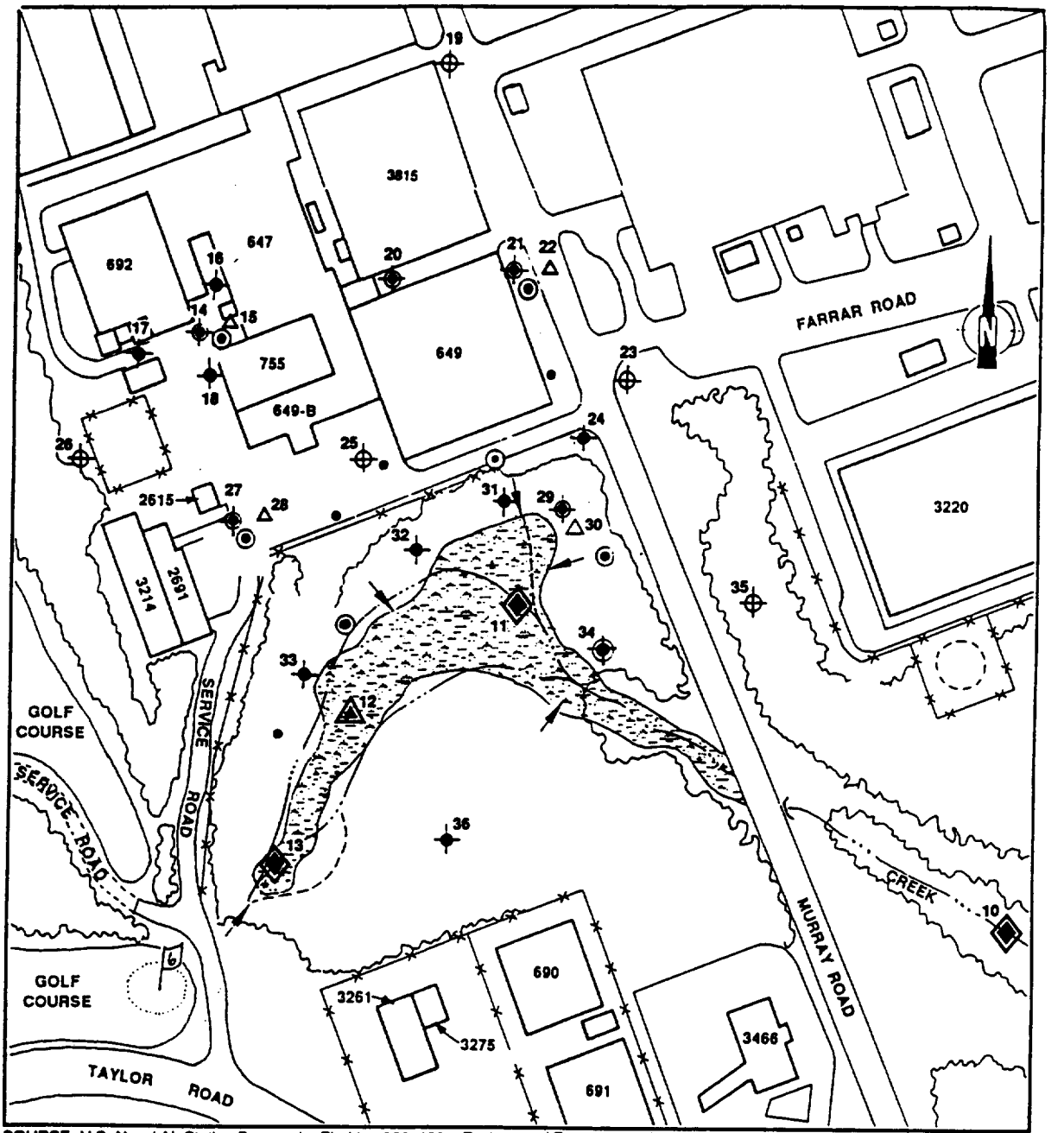

SOURCE: U.S. Naval Air Station Pensacola, Florida 1986, 1991; Ecology and Environment, Inc., 1991

SCALE

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KEY:

- Emergent Marsh
- Phase I Soil Boring
- Phase I Temporary Monitoring Well
- Outfall
- Proposed Phase II Sediment Sample
- Proposed Phase II Surface Water and Sediment Sample
- Proposed Phase II Soil Boring
- Proposed Phase II Shallow Monitoring Well
- Proposed Phase II Soil Boring and Shallow Monitoring Well
- A Proposed Phase II Intermediate Monitoring Well

Figure 14-5 PROPOSED SOIL BORING AND MONITORING WELL LOCATIONS AND PROPOSED SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS IN THE WETLAND AREA — NAS PENSACOLA SITE 30 — PHASE II

Table 14-2

PHASE II SAMPLING AND ANALYTICAL REQUIREMENTS
NAS PENSACOLA SITE *30*

Medium	No. of Samples[a]	Dupli-cates	Trip Blanks[b]	Preservative Blanks[b]	Field Blanks	Rinsate Blanks	Total	Analytical suite[c,d]
Surface Water	7	1	—	—	1	1	10	A
	(1)	—	1	—	—	—	(1),1	B
	(4)	NR[e]	NR	NR	NR	NR	(4)	D
Sediment[f]	26	3	—	NR	NR	1	30	A
	(1)	—	1	NR	NR	—	(1),1	B
	(12)	NR	n	NR	NR	NR	(12)	E
Soil[g]	75	7	—	NR	NR	3	85	A
	(1)	—	3	NR	NR	—	(1),3	B
	2	1	NR	NR	NR	—	3	C
	(16)	NR	NR	NR	NR	NR	(16)	E
Groundwater[h]	15	2	—	1	2	2	22	A
	(1)	—	2	—	—	—	(1),2	B
	(6)	NR	NR	NR	NR	NR	(6)	D
TOTAL	129	14	7	1	3	7	161	
	(38)	NR	NR	NR	NR	NR	(38)	

14[NASP]UN1105:T0397/878/10

Key:

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

[b]Trip blanks will be 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)metals, and cyanide.

[c]Analytical suite designations are as follows:

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

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

C = *TAL* metals only.

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

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

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

[e]NR = Not required.

[f]Samples collected at two depth intervals.

[g]Total of 6 boring locations x 4 dopth intervals = 24 samples, plus 7 boring locations x 7 dopth intervals = 49 samples, plus 1 boring location x 2 dopth intervals = 2 samples.

[h]Total of 11 now shallow wells + 4 now intermediate wells = 15 samples.

Source: Ecology and Environment, Inc., 1992.

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

Table 14-3

RATIONALE FOR PROPOSED PHASE II SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS AND ANALYSES NAS PENSACOLA SITE 30

Location Reference Number(s)	Sample Type(s)[a]	Location Rationale	Analytical Suite(s)[b]	Analytical Rationale
1-4	SW SD	Distal end of Site 30 creek and pavod ditch. Confirm Site 11 as potential source of sediment contamination in this area. Hydraulically downgradient of Site 11. Metals, PAHs, phenols and PCBs detected in nearby Phase I sediment samples. Metals, PAHs, and phenols, detected in nearby Phase I soil samples on Site 11. Metals, VOCs, PAHs, phenols, and PCBs detected in nearby Phase I groundwater samples on Site 11.	A	Characterize full spectrum of potential contaminants. Confirm relative absence of surface water contamination in this area.
			B (Location 3, SD 0-0.4' interval only)	Meet RCRA requirements.
			D (Locations 2 and 4, SW only)	support potential site remediation planning activities.
			E (Locations 1, 3, and 4, SD only)	Support potential site remediation planning activities.
5-1	SW SD	Characterize nature and extent of contamination in pavod ditch. PAHs and phenols detected in nearby Phase I sediment sample SD007.	A	Characterize full spectrum of potential contaminants. Confirm relative absence of surface water contamination in this area.
8	SW SD	Evaluate impact of upstream, off-site portion of pavod ditch. PAHs and/or phenols detected in Phase I sediment samples SD009, SD010, and SD011.	A	Characterize full spectrum of potential contaminants. Confirm the relative absence of surface water contamination in this area.

14[NASP]UH1105:T0397/1043/7

Key at end of table

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

Table 14-3 (Cont.)

Location Reference Number(s)	Sample Type(s)[a]	Location Rationale	Analytical Suite(s)[b]	Analytical Rationale
9, 10	SW SD	Characterise tho portion of crook between tho marsh area and paved ditch. Hydraulically domgradiont of metals, VOCs, PAHs and phenols detected in Phase I roil and groundwater samples near Bldg. 649. **PAHs** dotoctod in nearby Phase I sediment sample SD013. TCE dotoctod in Phase I surface wator sample SW014.	A	confirm full spectrum of potontial contaminants.
			B,D (Location 10, SW only)	Meet **RCRA** requirements. Support potontial site remediation planning activities.
			E (Location 9 SD only)	Support potontial rito remediation planning activities.
11-13	SW SD	Charactoriro marsh area. Potentially hydraulically domqradiont and downslope of **metals**, VOCs, PAHs, and phenols detected in Phase I soil and groundwater near Bldg. 649. Phenols dotoctod in **Phase** I sediment **samples** SD016, SD018, and SD020. Pesticides dotoctod in sediment **samples SD015**, SD016, and SD018. PCB dotoctod in sediment sample SD017.	A	Confirm full rpoctrum of potontial contaminants. Confirm relative absence of surface wator contamination in thir **area.**
			D (Location 13, SW only)	Support potontial site remediation **planning activities.**
			E (Locations 11 and 13, SD only)	Support potontial site remediation planning activities.

14[MASP]UH1105:T0397/1043/7

Key:

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

PAHs = Polynuclear aromatic hydrocarbons.
PCBs = Polychlorinated biphenyls.
TCE = Trichloroethene.
VOCs = Volatile organic compounds.
RCRA = Resource Conservations and Recovery Act.

Source: lcoloqy and Environment, Inc., 1992.

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

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Table 14-4

RATIONALE FOR PROPOSED PHASE II SOIL
SAMPLE LOCATIONS AND ANALYSES
NAS PENSACOLA SITE 30

Location Reference Number(s)	Sample Type(s)[a]	Location Rationale	Analytical Suite(s)[b]	Analytical Rationale
14, 16-10	AWT	Identify nature and extent of high levels of contamination, detected in Phase I soil sample from boring B001A (PAHs and phenols).	A	Characterize full spectrum of potential contaminants.
			E (Location 14 only)	Support potential site remediation planning activities.
20	AWT	Identify the nature and extent of potential soil contamination between Phase I soil samples from borings B001 and B002 (PAHs and/or phenols).	A	Characterize full spectrum of potential contaminants.
21	AWT	Confirm presence of elevated concentrations of phenols detected in Phase I soil samples from boring 6007.	A	Characterize full spectrum of potential contaminants.
			E	Support potential site remediation planning activities.
24	AWT	Identify the nature and extent of potential soil contamination detected in Phase I soil samples from borings B005, B007, B008, and B009 (metals, PAHs, and/or phenols).	A	Characterize full spectrum of potential contaminants.
27	AWT	Confirm the relative absence of contaminants detected in Phase I soil samples from boring B002.	A	Confirm the relative absence of soil contamination at this location or characterize full spectrum of potential contaminants.

14[NASP]UH1105:T0397/1042/7

Key at end of table.

(sold 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 Rationale	Analytical Suite(s)[b]	Analytical Rationale
29	BWT	Evaluate potential presence of aquifer matrix soils contamination by motalr based on high concentrations of metals in Phase I temporary well samples.	C	Metals are tho primary concern below tho water tablo.
31	AWT	Confirm presence of contaminants dotoctod in Phase I soil samples from boringq B009 (motalr, PAH, and phenols)	A	Characterise full spectrum of potential contaminants.
			B (Interval 0-[1.0]' only)	Moot RCRA requirements.
			E	Support potential site remediation planning activities.
32	AWT	Identify tho naturo and extent of contaminants detected in Phase I soil samples from borings B004, BOOS, B008-B010 (metals, PAHs and/or phenols).	A	Characterise full spectrum of potential contaminants.
33	AWT	Identify the nature and extent of contaminantr dotoctod in Phase I roil samples from borings B003, B010, and B011 (PAHs and/or phenols).	A	Characterise full spectrum of potential contaminantr.
34 35 36	AWT	Determine the presence and naturo of potential soil contamination dotoctod in Phase I sediment samples SD015-SD018 and SD020 (metals, VOCs, phenols, and/or pesticides and PCBs) and roil sample from boring B008 (PAHs and phonolr).	A	Characterise Cull rpoctrum of potential contaminants.

14[NASP]UN1105:T0397/1042/7

Key:

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

TRPHs = Total recoverable petroleum hydrocarbons.
VOCs = Volatile organic compounds.
PAHs = Polynuclear aromatic hydrocarbons.
RCRAs = Resource Conservation and Recovery Act.

Source: Lcoloqy and Environment, Inc., 1992.

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

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Table 14-5

RATIONALE FOR PROPOSED PHASE II MONITORING WELL LOCATIONS AND GROUNDWATER SAMPLE ANALYSES[a]
NAS PENSACOLA SITE 30

Location Reference Number(s)	Sample Type(s)[b]	Location Rationale	Analytical Suite(s)[c]	Analytical Rationale
14	SGW(14)	Determine presence and nature of potential groundwater contamination associated with Phase I soil contamination in boring B001 (metals, PAHs, and phenols).	A	Characterize full spectrum of potential contaminants.
			D	Support potential site remediation planning activities.
19 20	SGW	Determine the source and upgradient extent of groundwater VOC contamination detected at Phase I temporary monitoring well TW007.	A	Determine absence of contamination in this area or characterize full spectrum of potential contaminants.
21	SGW	Confirm high levels of metals and VOCs detected in Phase I temporary monitoring well TW007.	A	Characterize full spectrum of potential contaminants.
			D	Support potential site remediation planning activities.
23	SGW	Determine the upgradient extent of metals and VOC groundwater contamination detected in Phase I temporary monitoring well TW007. Determine the cross-gradient extent of metals contamination detected in Phase I temporary monitoring wells TW005 and TW008.	A	Determine absence of contamination in this area or characterize full spectrum of potential contaminants.
25	SGW	Determine the potential nature and upgradient extent of metals detected in Phase I monitoring wells TW005 and TW008.	A	Determine absence of contamination in this area or characterize full spectrum of potential contaminants.
26	SGW	Determine the potential source, nature, and upgradient extent of metals, VOC, PAH, and phenols contamination detected in Phase I temporary monitoring well TW002.	A	Determine absence of contamination in this area or characterize full spectrum of potential contaminants.

Key at end of table.

14[NASP]UH1105:T0397/1041/7

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Table 14-5 (Cont.)

Location Reference Number(s)	Sample Type(s)[b]	Location Rationale	Analytical Suite(s)[c]	Analytical Rationale
27	SOW	Confirm high levels of metals, VOCs, PAHs, and phenols detected in Phase I temporary monitoring well TW002. Determine upgradient and/or cross-gradient extent of metals in Phase I temporary monitoring wells TW005, TW008, and TW010.	A	Determine absence of contamination in this area or characterize full spectrum of potential contaminants.
			D	Support potential site remediation planning activities.
29	SGW	**Confirm high levels of metals detected in Phase I temporary monitoring wells TW005 and TW008.**	**A**	**Characterize full spectrum of potential contaminants.**
			B	**Meet RCRA requirements.**
			D	**Support potential site remediation planning activities.**
34	Saw	Determine the downgradient extent of temporary monitoring wells.	A	Determine the absence of contamination in **these areas or characterize** full spectrum of potential contaminants.
15 22 20 30 35	IGW	Determine the presence and nature of potential intermediate depth contamination; proposed wells are located within or downgradient of **areas** of **shallow** contaminations and are clustered with proposed **shallow** wells.	A	Determine the absence of contamination **at this depth or characterize** full spectrum of potential contaminants.
			D (28 and 30 only)	Support potential site remediation planning activities.

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Key:

[a]All 15 existing wells will also be sampled during Phase II for analytical suite A (see Table 14-2).
[b]SGW = Groundwater sample from shallow monitoring well; IGW = groundwater sample from intermediate monitoring well.
[c]Specific parameters included within each analytical suite are given in Table 14-2.
PAHs = Polynuclear aromatic hydrocarbons.
VOCs = Volatile organic compounds.
RCRA = Resource Conservation and Recovery Act.

Source: Ecology and Environment, Inc., 1992.

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

It is proposed to sample all newly installed wells for analytical suite A during Phase II to provide a uniform, time synchronous perspective on Site 30 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 with 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) at these background locations will be analyzed for [Target Analyte List (TAL)] metals. These background locations will help provide perspective on the on-site occurrences of potential contaminants, as well as aid in evaluating the impact of potential basewide ambient contaminant sources. These background soil and groundwater samples have been included only in the sampling and analytical requirements for [Group A--]Site 1 [(E & E 1992a)].

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

As noted above, tables 14-3, 14-4, and 14-5 provide specific rationales for proposed Phase II sampling locations and analyses. Sampling locations were selected based on the Phase I results in accordance with one of the following criteria:

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

Sampling locations selected pccording to the first criterion are required to allow identification of the full spectrum of potential on-site contaminants, as well as the maximum levels of occurrence. Locations selected according to the second criterion are required to delineate the distribution of contamination on site and in the site vicinity. Locations selected according to the third criterion are required to confirm that the extent of contamination has been completely delineated. The specific, detailed rationales provided in tables 14-3, 14-4, and 14-5 for each sampling location or group of locations clearly meet one or more of the three general criteria defined above.

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

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

14.2.2.1 Surface Water and Sediment Sampling

During the Phase II sampling, surface water samples will be collected at seven locations, and sediment samples will be collected at 13 locations. As shown on figures 14-4 and 14-5, combined surface water and sediment sampling locations are as follows: one in Bayou Grande adjacent to Site

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11, one where the paved ditch/creek widens into Bayou Grande, two in the paved ditch, one in the creek between the emergent marsh and the paved ditch, and two in the marsh area. As shown in figures 14-4 and 14-5, additional sediment samples will be collected at locations as follows: two in Bayou Grande adjacent to Site 11, two in the paved ditch, one in the creek between the marsh and the paved ditch, and one in the marsh. Given that the relatively rapid mixing of surface waters would tend to distribute contaminants in a more homogenous fashion than that typically found in sediments, surface water samples have not been included at every sediment sampling location.

Surface water samples will be collected in accordance with Section 6.9.1 of the GQAPP. Surface water samples collected at locations in surface water bodies shallower than 1 foot will be collected at the surface [and, whenever possible, directly into the sampling container. If not possible,] a glass or stainless steel beaker or similar sampling device [will be used]. Samples collected from water deeper than 1 foot will be collected within 1 foot of the bottom using a Kemmerer or similar sampling device. During collection of surface water samples, the surface water pH, temperature, specific conductance, dissolved oxygen, and turbidity will be measured and recorded in the field notebook. In addition, the water depth and tidal stage for each sample will be recorded in the field logbook.

Sediment samples will be collected in accordance with Section 6.9.2 of the GQAPP. Sediment samples will be collected from two depth intervals at each location: from the surface to 0.4 foot below the surface (BS) and from 0.4 to 2.0 feet BS. Sediment samples will be collected using either a stainless steel trowel, a bucket-type mud auger, an Eckman dredge, or other coring device. The composition of sediment materials retrieved will be recorded in the field notebook.

Equipment decontamination activities will be conducted in accordance with Section 6.10 of the GQAPP, and the number and types of [surface water and] sediment field QA/QC samples to be collected were determined in accordance with Section 11.1 of the GQAPP.

All seven surface water and all 26 sediment samples will be analyzed for the analytical parameters included in analytical suite A (see Table 14-2). In addition, one of the seven surface water samples and one of the 26 sediment samples will be analyzed also for the Appendix IX parameters included in analytical suite B (sample location 10 [surface water] and sample location 3 [sediment]; see Figure 14-4 and tables 14-2 and 14-3), and four of the seven surface water samples will be analyzed also for the parameters included in analytical suite D (sample locations 2, 4, 10, and 13; see Figure 14-4 and tables 14-2 and 14-3). Twelve of the 26 sediment samples will be analyzed for the parameters included in analytical suite E (sample locations 1, 3, 4, 9, 11, and 13; see Figure 14-4 and tables 14-2 and 14-3).

14.2.2.2 Soil Sampling

During the Phase II soil boring and monitoring well installation (sections 14.2.[2].3 and 14.2.[2].4), soil samples will be collected at 14 locations across Site 30 (see Figure 14-5). At soil boring locations where a monitoring well will not be installed, soil borings will be completed using hollow-stem auger methods, and soil samples will be collected using split-spoon samplers in accordance with Section 6.6.2 of the GQAPP. At each location, except as noted below, composite samples will be collected from each of the following depth intervals: 0 to [1.0] foot BLS, [1.0] foot to 2.5 feet BLS, 2.5 to 5 feet BLS, and then every 5-foot interval to the water table. For the purpose of estimating sample numbers, the depth to the water table is assumed to be 2.5 feet BLS in the vicinity of the marsh south of Building 649, 5 feet BLS on the slope between the marsh and Building 649, and 25 feet BLS near Building 649. At soil boring location 29 (see Figure 14-5), soil samples will be collected from two depth intervals BUT: 0 to 5 feet BWT and 5 to 10 feet BWT.

All soil sampling, compositing, and lithologic logging activities will be performed in accordance with Section 6.6 of the GQAPP, and equipment decontamination will be performed in accordance with Section 6.10 of the GQAPP. [The number and types of soil field QA/QC samples to be collected vere determined in accordance with Section 11.1 of the GQAPP.]

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Seventy-five of the 77 soil samples will be analyzed for the parameters included in analytical suite A (14 sample locations; see Figure 14-5 and tables 14-2 and 14-4). Two of the 77 soil saaples (not of the 75 discussed above) will be analyzed for metals only (analytical suite C, sample location 29 [sample intervals BUT only]). In addition, one soil sample (sample location 31) will be analyzed for analytical suite B (Appendix IX parameters), and 16 of 77 soil samples will be analyzed also for the remediation parameters included in analytical suite E.

14.2.2.3 Soil Boring and Permanent Monitoring Well Installation and Development

A total of 15 permanent monitoring wells will be installed at Site 30. wells will be located and designed to supplement the Phase I investigation results regarding the lateral and vertical extents of groundwater contamination. The number and target completion depths of these wells are as follows:

- 11 shallow wells, eight of which will be approximately 30 feet deep and three of which will be approximately 15 deep.
- four intermediate wells, three of which will be approximately 50 feet deep and one of which will be approximately 35 feet deep.

  Note: All shallow and intermediate wells topographically downslope of Building 649 (see Figure 14-5) are the ones expected to be approximately 15 feet shallower than those located around the building complex.

Figure 14-5 shows the locations of the proposed monitoring wells for each of the depth intervals at Site 30, and Table 14-5 provides the detailed rationale for the selection of each of the monitoring well locations and target depths.

In order to detect the presence of any floating product at Site 30, the 11 shallow wells will be completed into the upper portion of the surficial zone of the Sand-and-Gravel Aquifer such that the well screen brackets the water table. The intermediate wells will be installed to investigate the vertical extent of possible groundwater contaminants,

particularly any dense non-aqueous phase liquids (DNAPLs) at Site 30. The four intermediate vells will be completed into the lover portion of the surficial zone immediately above the first confining/semi-confining unit. Each of the four intermediate vells will be clustered with one shallov vell to assist in delineating the vertical extent of any contamination at that location, as vell as to determine the vertical hydraulic gradients between the monitored zones (see Figure 12-5).

The shallow vells will be installed using hollow-stem auger methods and will be constructed of 4-inch-diameter,, flush-threaded, polyvinyl chloride (PVC) casing terminating in 10 feet of 0.015-inch, factory-slotted screen.

In order to prevent the dovnvard migration of possible shallov contaminants during drilling, the intermediate vells will be installed using either hollov-stem auger or hydraulic rotary methods through 8-inch-diameter, PVC surface casings. The surface casing will be grouted in place and alloved to set 24 hours prior to drilling of the vell borehole to the target depth, in accordance vith Section *6.7.4* of the GQAPP. The intermediate vells installed through the surface casings will be constructed in the same manner as the shallov vells. All drilling and finished monitoring vell construction will be conducted in accordance vith sections 6.7.2 and *6.7.3* of the GQAPP. In addition, all Site *30* newly installed vells will either be protected above surface grade vith a steel surface casing and locking wellhead cover, or, in heavily traveled or paved areas, will be protected at surface grade vith a flush-mount security cover and locking cap. In conjunction vith the drilling of the vell boreholes, continuous split-spoon samples will be collected to the target completion depth of the vells, in accordance with Section *6.7.2.3* of the GOAPP. Where wells are constructed in clusters, split-spoon samples will only be collected during drilling of the deepest vell.

After installation, each of the new monitoring vells will be developed using a submersible pump and/or bailer, in accordance vith Section 6.7.5

of the GQAPP. Development waste will be contained in 55-gallon drums, labeled, and moved to a storage area on NAS Pensacola, as directed by the Navy (see also Section 14.[6].2).

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

14.2.2.4 Groundwater Sampling

During Phase 11, groundwater samples will be collected from the 15 newly installed monitoring wells on Site 30 (see Figure 14-5). Purging and sampling of each well will be conducted in accordance with sections 6.8.2 and 6.8.3 of the GQAPP, respectively, and equipment decontamination activities will be conducted in accordance with Section 6.10 of the GQAPP. The number and types of groundwater field QA/QC samples to be collected were determined in accordance with Section 11.1 of the GQAPP.

All 15 groundwater samples will be analyzed for the parameters included in analytical suite A. In addition, one of the 15 samples (location 29) will be analyzed also for the Appendix IX parameters included in analytical suite B, and six of the 15 samples (14, 15, 21, 22, 27 and 28) will be analyzed also for the parameters included in analytical suite D (see Figure 14-5 and tables 14-2 and 14-5).

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

14.2.3 Eydrologic Assessment

The main objective of the Phase II hydrologic assessment is to further delineate the [hydrogeologic character] of the underlying aquifer at Site 30. 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 Site 30 will include a vellhead elevation survey of all the nevly installed permanent monitoring wells; static vater level measurements in all the on-site vells and on-site and/or adjacent surface vater bodies; short-term specific capacity and/or slug tests on all the nevly installed permanent vells; and measurement of currents, wind, and/or stream flow at appropriate surface vater locations.

All of the nevly installed monitoring wells vill 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 vater bodies on site and will be surveyed relative to the same datum as the vells.

At Site 30, static vater levels will be measured in all the proposed on-site wells and in the vater bodies on at least four occasions: once during the sampling of the nevly installed vells; once approximately tvo to four weeks after sampling to obtain an estimate of the short-term temporal variability in vater levels; once during a low tidal phase; and once during a high tidal phase. The measurements taken during opposing tidal phases vill be collected on the same day in order to accurately evaluate tidal influences on vater level elevations at Site 30.

Limited aquifer testing will be conducted at Site 30 on all newly installed monitoring wells. This testing will consist primarily of performing short-term specific capacity tests on vells that are capable of sustaining a measurable yield. The specific capacity testing at Site 30 will be conducted during the development of the nevly installed wells. The procedure for specific capacity testing involves measuring the initial static water level in the vell and then vithdraving groundwater from the vell at a constant rate for a designated period. The vater levels during pumping are noted, and the pump is turned off. The water level recovery in the vell is then recorded continuously over

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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.

At each surface water sampling location in Bayou Grande, the prevailing current direction and velocity, wind direction and velocity, water depth, and tidal phase will be recorded during the time of sampling. In addition, in order to evaluate tidal effects on nearshore areas, these measurements will be recorded at these same locations during high tide, low tide, and mid tide. For all inland surface water bodies on Site 30 in which a flow is noted, velocity, discharge, and stream elevation data will be recorded at the same time that water levels are measured in the on-site monitoring wells. A rain gauge will be installed at or near the site and monitored regularly over the course of the fieldwork.

14.2 .4 Engineering Survey

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

All engineering survey information will be integrated with any existing computer-aided design (CAD) base maps so that all updated, site-related information can be precisely and efficiently added to the base map. The development of a CAD base map will include the addition of previous data point locations (i.e., coordinates of latitude and longitude). The survey draving will be produced in mylar and blueline copies; the CAD file for the draving 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 BPA approval.] Rapid response will be emphasized. An IRM could involve the installation of security fences and varning signs; construction of berms, caps, and/or recovery and treatment systems; and removal of soil, sediment, and/or drums. If an IRM is conducted, a detailed, explanatory report of the IRM will be developed by E 6 E and provided to the Navy [and EPA].

14.2.6 Report

Refer to Section 20 of this vork plan (revised [July 1992]) for a description of the Phase II report.

14.3 Phase III--Extent Delineation

Phase III tasks will be conducted based on the results of phases I and 11, [if deemed necessary]. Where the earlier phases are intended to

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identify and characterize areas and contaminants of primary concern as they extend laterally from source areas, Phase III activities are intended to delineate the horizontal and vertical extents of contamination.

14.3.1 Soil Sampling

Depending on the findings of phases I and II, the collection of soil samples in Phase III may be required. Additional soil borings or soil sampling will be conducted in conjunction with new well installation,

14.3.2 Shallow Monitoring Well Installation and Development

The need for additional shallow monitoring wells may be required to determine the horizontal limits of shallow groundwater contamination.

14.3.3 Intermediate and Deep Honitoring Well Installation and Development

The installation of monitoring wells into deeper zones of the aquifer will be required to assess horizontal and vertical flow 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 Groundwater Sampling

All wells installed in Phase III will be sampled, and analytical requirements for the samples will be developed based on the results of previous phases. Monitoring wells installed prior to phase III will be sampled as required. It is anticipated that a select number of wells will not be sampled as part of this extent delineation phase.

14.3.5 Hydrologic Assessment

All wells installed during Phase III will require a wellhead survey to obtain top of casing elevations. Water level measurements will be made for all site monitoring wells and nearby surface water bodies. Horizontal and vertical flow gradients will be determined. Aquifer testing will be performed to ascertain aquifer physical characteristics. On sites where contamination is found in the surficial zone during

phases I and/or II, the low permeability zone will be further characterized during Phase III and any subsequent phases. It is intended that soil sample results, lithologic logs, isopach maps, permeability testing, aquifer testing, and other information 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 vill be conducted to accurately identify all nev site sampling locations. All sampling and monitoring vell locations vill be identified both horizontally and vertically. In addition, *any* improvements (such as pavement) will be located. All engineering survey information vill be integrated vith the existing Phase II CAD base maps so that ill updated, site-related information can be precisely and efficiently added to the base map. The survey draving will be produced in mylar and blueline copies; the CAD file for the draving vill 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 Phase I, and any sampling performed in Phase 11.

14.3.[8] Biota Sampling

If deemed appropriate based on the findings of phases I and II, biota sampling may be conducted in Phase III. [If required,) a separate biological sampling plan will be prepared. Biota Sampling for Site 30 may potentially include the collection of aquatic vegetation and fauna from the swamp, creek, paved ditch, and/or Bayou Grande. [Basevide biota sampling will be conducted as part of the investigation of OUs 15, 16, and 17.]

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14.4 Phase IV--Extent Delineation

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

- Surface water and sediment sampling;
- Soil sampling;
- Shallow monitoring well installation and development;
- Intermediate and deep monitoring well installation and development;
- Groundwater sampling;
- Hydrologic assessment; [and
- Engineering survey.]

14.[5] Field Quality Assurance/Quality Control

14.[5].1 Documentation

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

14.[5].2 Field QA/QC Samples

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

14.[6] Decontamination and Waste Management Procedures

14.[6].1 Decontamination Procedures

All equipment decontamination procedures for Site 30 will be performed in accordance with Section 6.10 of the GQAPP.

14.[6].2 Waste Management Procedures

[All investigation-derived waste handling will be performed in accordance with Section 6.11 of the GQAPP and EPA's guidance for investigation-derived waste.] All water generated during monitoring well purging and development activities on Site 30 will be discharged onto the ground surface avay 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 well installation activities will be disposed of on the site or will be containerized, labeled, and moved to a storage area on NAS Pensacola, as directed by the Navy.

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

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is. LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

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

16. GROUNDWATER MODELING

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

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

E 6 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 6 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.

17. TREATABILITY STUDY

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

18. BASELINE RISK ASSESSMENT

As part of the Remedial Activities Investigation, a baseline risk assessment will be conducted to determine the level of effort required in the 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 vith EPA's 1989 documents, Risk Assessment Guidance for Superfund: Volumes I and II.]

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

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

18.1 Contaminant Identification

The main purpose of this step is to screen available information on the hazardous wastes present at the site and to identify contaminants of concern to focus on in subsequent efforts in the risk assessment process. **[The identification of contaminants of concern will be conducted in accordance with the previously referenced risk assessment guidance documents (BPA 1988a, 1988b).]**

18.2 Exposure Assessment

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

1) A source mechanism of chemical release into the environment;

2) An environmental transport medium (e.g., air, groundwater, and/or biota);

3) A point of potential contact with the medium of concern; and

4) An exposure route to the population from the contact point.

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

The final step in the exposure assessment is to integrate the information and develop a 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;

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

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

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

19. FEASIBILITY STUDY

Further details on the specific tasks to be performed as part of the 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 (EPA 1988b). If any of the procedures described in this section are in conflict vith the current EPA guidance document, the methods described in the BPA guidance document will be folloved.]

19.1 Screening of Applicable Remedial Technologies

E & E will screen and develop applicable technologies for the remediation of any on-site contamination. In the process of screening applicable technologies, E & E will consider all ARARs, identify problems, and determine pathways of contamination using a receptor-oriented approach based on the threat to the public health, welfare, and

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

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

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

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

Each report will be written as an independent document, complete in its ovn right, and fully supportive of the conclusions vhich 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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[Bold items enclosed in brackets demote *changes* to the last version of document]

21. DOCUMENT REVISION

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

23. PROJECT SCHEDULE

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

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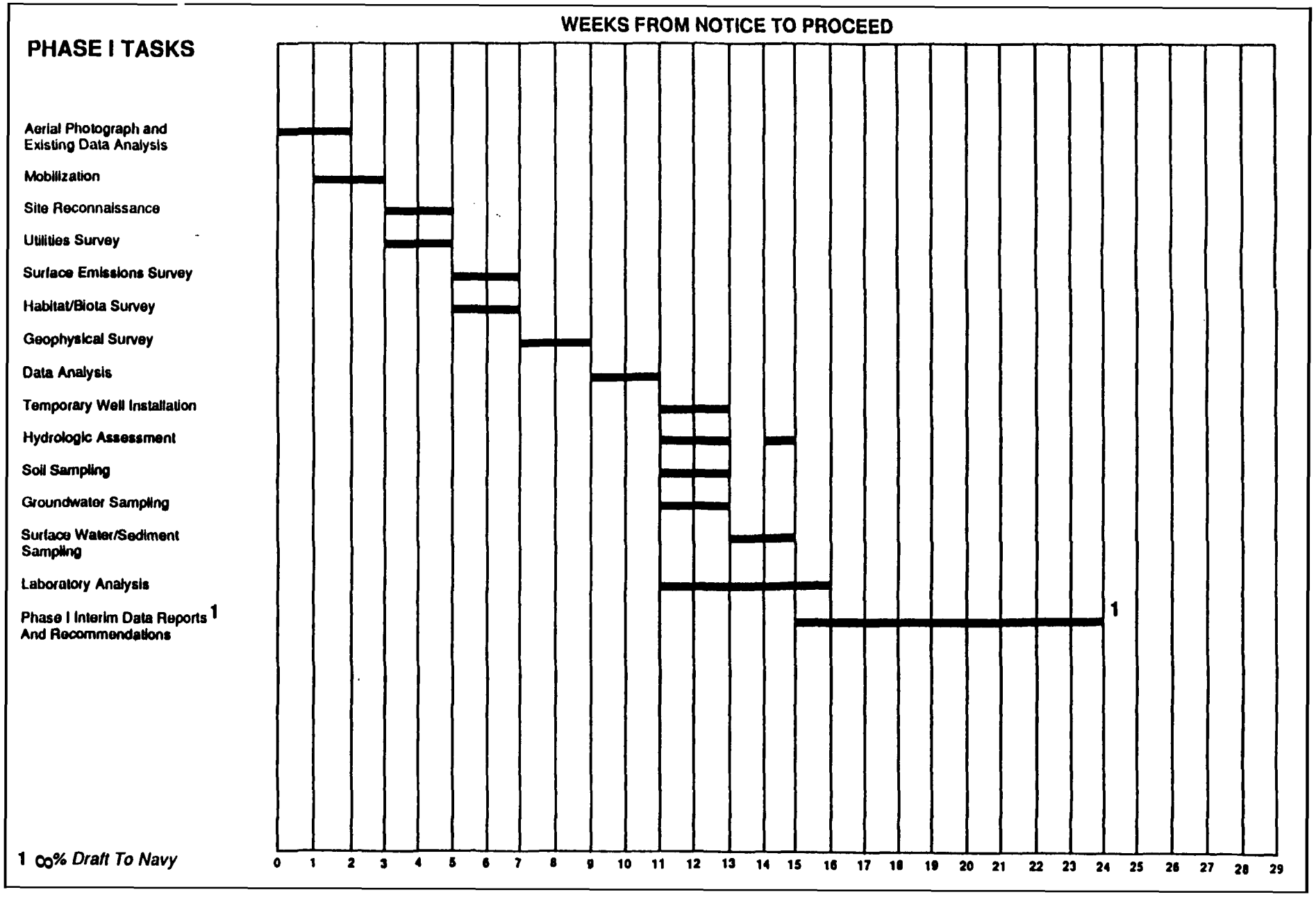

Figure 23-1 PHASE I PROJECT SCHEDULE -- GROUP ≤ (SIT ≤ 30)

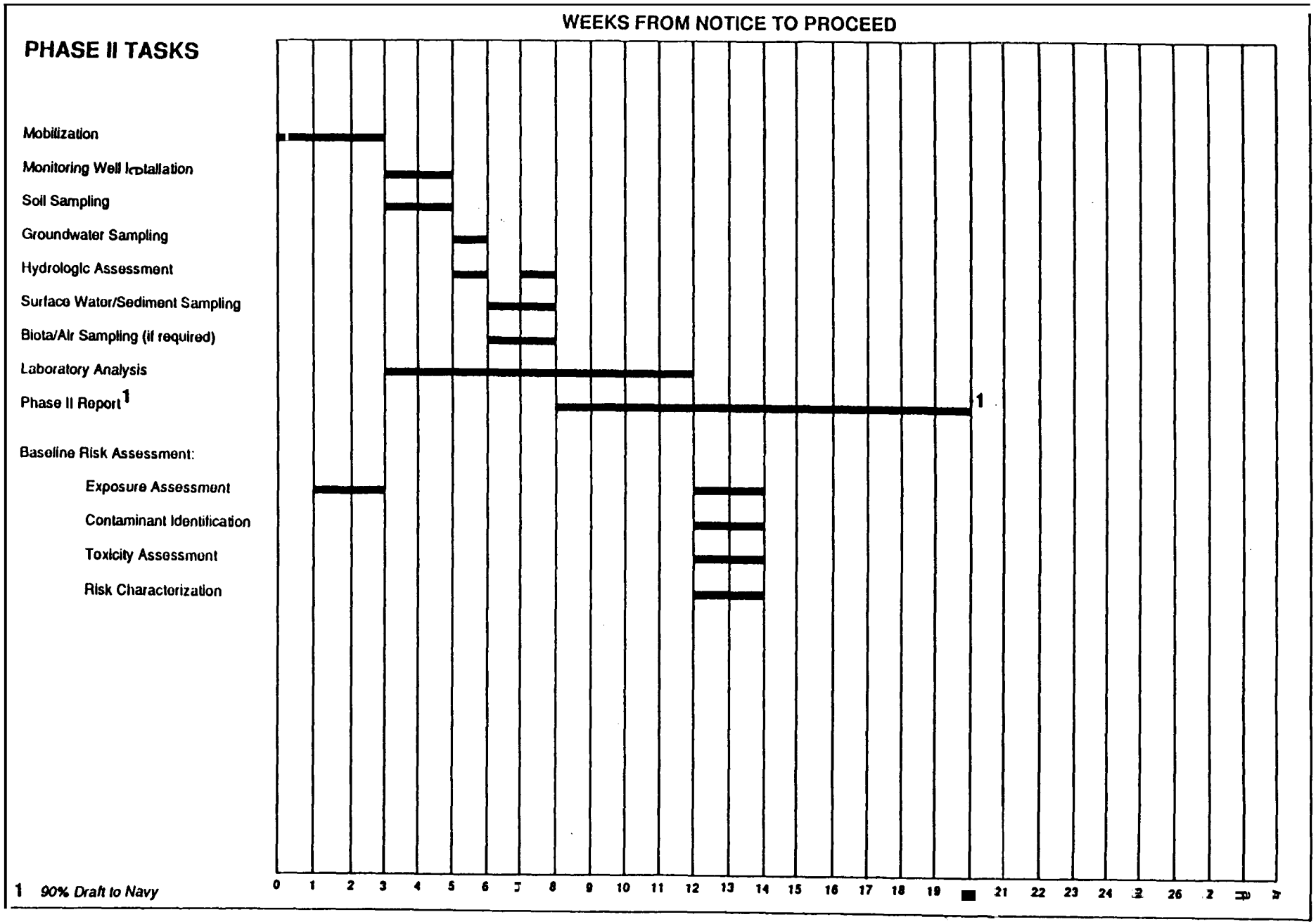

Figure 23-2 PHASE II PROJECT SCHEDULE -- GROUP E (SITE 30)

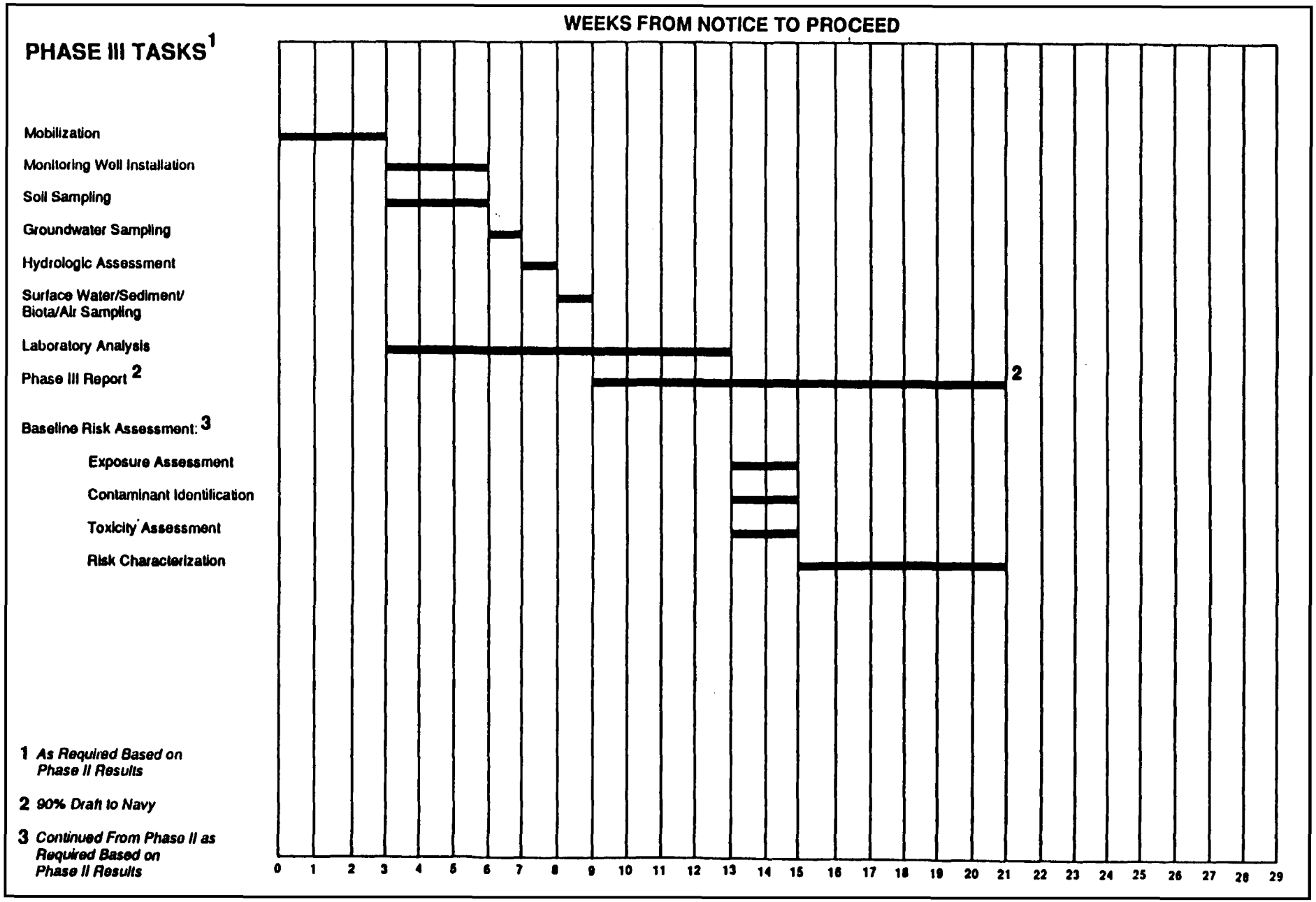

Figure 23-3 PHASE III PROJECT SCHEDULE -- GROUP E (SITE 30)

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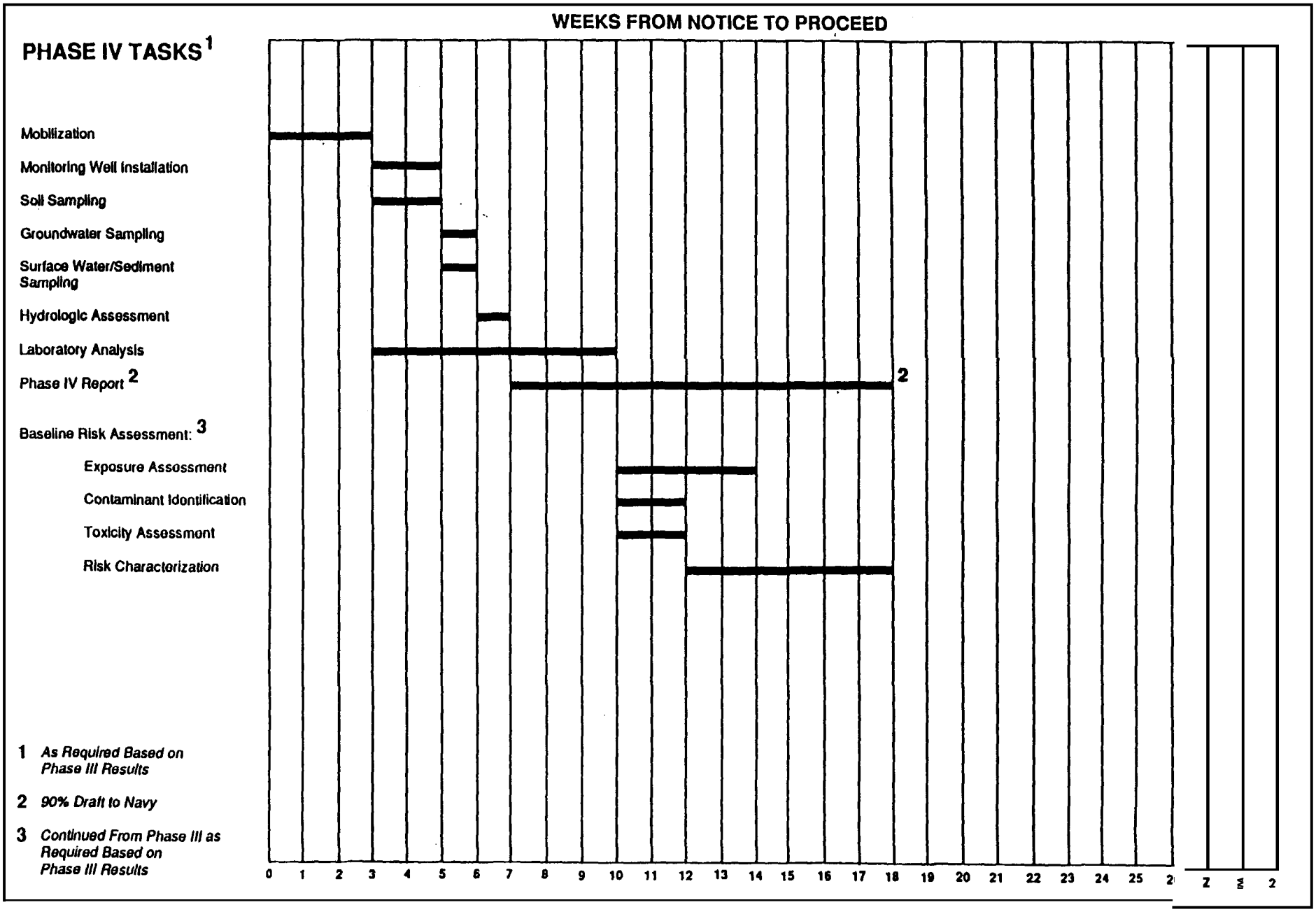

Figure 23-4 PHASE [illegible] PROJECT SCHEDULE -- GROUP E (SITE 30)

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25. **FLORIDA PROFESSIONAL** GEOLOGIST **SEAL**

I hereby affix my seal to the Contamination Assessment/Remedial Activities Investigation Work Plan, Group E, 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: John D. Barksdale

License Number: P.G. No. 1150

State: Florida

Expiration Date: July 31, 1992

John D. Barksdale

John D. Barksdale

7/6/92

Date

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

APPENDIX A

SITE-SPECIFIC SAFETY PLAN

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changes to the last version of document]

ecology and environment, inc.

SITE SAFETY PLAN

Version 988

A. GENERAL INFORMATION

Project Title: Site 30-Buildings 649 and 755

Project No.: UH1105

TDD/Pan No.:

Project Manager: John Barksdale

Project Dir.: Rick Rudy

Location(s): Buildings 649 and 755 - West of Chevalier Field

Proparod by: Jon Schmidt

Date Proparod: 4-25-89

Approval by: Mary Miller

Dato Approved:

Site Safety Officer Review:

Dato Reviewed:

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

Proposed Dato of Field Activities: September 1989

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

Documentation/Summary:

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

D. SITE/WASTE CHARACTERISTICS

Waste Type(s):

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

Characteristic(s):

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

Other:

Physical Hazards:

Overhead [X]	Confined* Space [ ]	Below Grade [ ]	Trip/Fall [X]
Puncture [ ]	Burn [ ]	Cut [ ]	Splash [X]
Noise [X]	Other: Sampling within swamp and crook associated with Site 30.		

Vehicular traffic within tho site area. Heat/cold stress.

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

Site History/Description and Unusual Features (see sampling Plan for detailed description): From tho 1940s to tho 1970's plating solutions and treatment solutions were allegedly dumped into a ditch alongside Buildings 649 and 755. This ditch loads into a swamp and crook which empty into Bayou Grande by tho way of a paved ditch. Samples have boon taken from tho ditch noxt to Building 649. low levels of cadmium, magnesium, and copper were detected. Samples for this study will bo colloctod from tho roils and groundwater around Buildings 649 and 755 as well as surface water and sediment samples from tho swamp, crook, paved ditch, and Bayou Grande.

Locations of Chemicals/Wastes: Liquid wastes were dumped on-site into a paved ditch, which empties into conduits which discharge into Bayou Grande

Estimated Volume of Chemicals/Wastes: Approximately 360,000 gallons of plating solutions and chemicals from e magnesium tretment line were dumped into tho on-site ditch every year for approximately 30 years.

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

C. HAZARD EVALUATION

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

Physical Hazard Evaluation:

1) Physical Surveys - Walking in swamps and crook;

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

3) Soil Sampling - Using portable drill rig;

4) Surface Water and Sediment Sampling - Working in confined spaces and from a boat (in some cases)

5) Groundwater Sampling - Splash.

6) Docontamination Procedures - Using solvents.

7) Hydrologic Assessment - splash.

Chemical Hazard Evaluation:

Compound	PEL/TWA	Route of Exposure	Acute Symptoms	odor Throshold	Odor Description
Cadmium	0.02 mg/m3	Inh,Ing,Abs	Pulm. Edema	varies	varies
Cyanide	5 mg/m3	" "	weak,convulsions	—	almond odor
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
Hydrochloric Acid	5 ppm	Inh, Ing, Derm	corrosive	Unknown	acrid
Sodium Hydroxide	2 mg/m^3	Inh, Ing, Derm	corrosive	N/A	odorless
Tin	2 mg/m^3	Inh, Congest	irritate eye,skin	N/A	varies
Phosphoric Acid	1 mg/m^3	Inh, Ing, Derm	corrosive	N/A	odorless
Nickel	1 mg/m^3	Inh, Ing, Derm	allergic,asthma	N/A	—
Silver	0.01 mg/m^3	Inh, Ing, Derm	irritated skin	N/A	—
Lead	0.05 mg/m^3	Inh, Ing, Derm	insomnia,hyperten.	N/A	—
Chromium	500 mg/m^3	Ing, Ing	fibrosis of lungs	N/A	—

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

ecology and environment, inc.

SITE SAFETY PLAN

Version 988

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	LOW [X]	Unknown [ ]

D. SITE/WASTE CHARACTERISTICS

Waste Type(s):

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

Characteristic(s):

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

Other:

Physical Hazards:

Overhead [X]	Confined* Space [ ]	Below Grade [ ]	Trip/Fall [X]
Puncture [ ]	Burn [ ]	Cut [ ]	Splash [X]
Noise [X]	Other: Sampling within swamp and crook associated with Site 30.		

Vehicular traffic within tho site area. Heat/cold stress.

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

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

Decon Solution Monitoring Procoduros. if Applicable: Decontamination will be 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 fieldwork activities. Personnel will exercise caution in tho vicinity of Site 30 and along tho crook, swamp, and paved ditch. If above background radiation levels are encountered team members will evacuate tho sampling area, and contact tho corporate health physics group to reassess tho site.

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

All fieldwork activities will be 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, cutting.):

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

Sample Handling Procoduros Including Protective Wear:

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

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

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

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E. EMERGENCY INFORMATION

(Use supplemental sheets, if necessary)

LOCAL RESOURCES

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

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

Hospital Emergency Room NAS Dispensary - 904-452-2733. Baptist Hospital 904-434-4811 (Life Flight)

Poison Control Center

Police (include local, county sheriff, state) 911

Fire Department 911

Airport

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

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

rod. Express 1-800-238-5355

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

Site Contact NAS Pensacola Lnvirooontal Coordinator, Ron Joyner — 904-4524515

SITE RESOURCES

Site Emergency Evacuation Alarm Method N/A

Water Supply Source On-site

Telephone Location, Number To bo determined on-aito

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 Nowchurch .....(904) 878-2336 (home)
   (904) 877-1976 (office

4. Regional Office Manager, R.Rudy..... (904) 693-7245 (home)
   (904) 877-1978 (office

MEDTOX HOTLINE

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

   What to report:

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

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

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

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

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

Directions to hospital (include map) from Site 30

NAS Dispensary - Follow Chevalier Field Service Road (west side of field) west to Murray Road. Follow Murray Road to Moffett Road. Turn right onto Moffett Road and continue to Fisher Straat. Turn laft onto Fishar Straat and continua to Turner Straat. The NAS Dispensary is located on Turner Straat in Building 3600.

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

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

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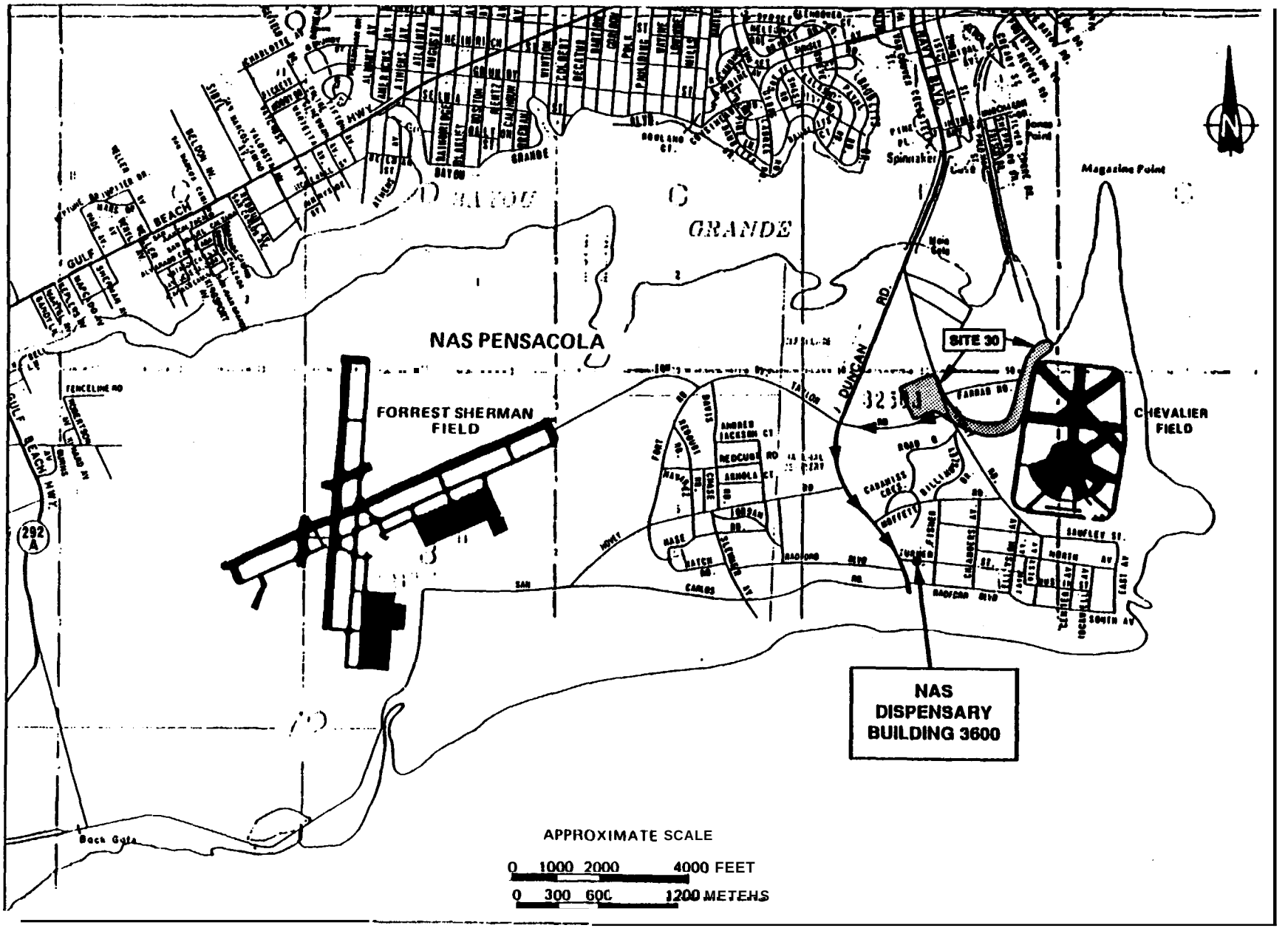
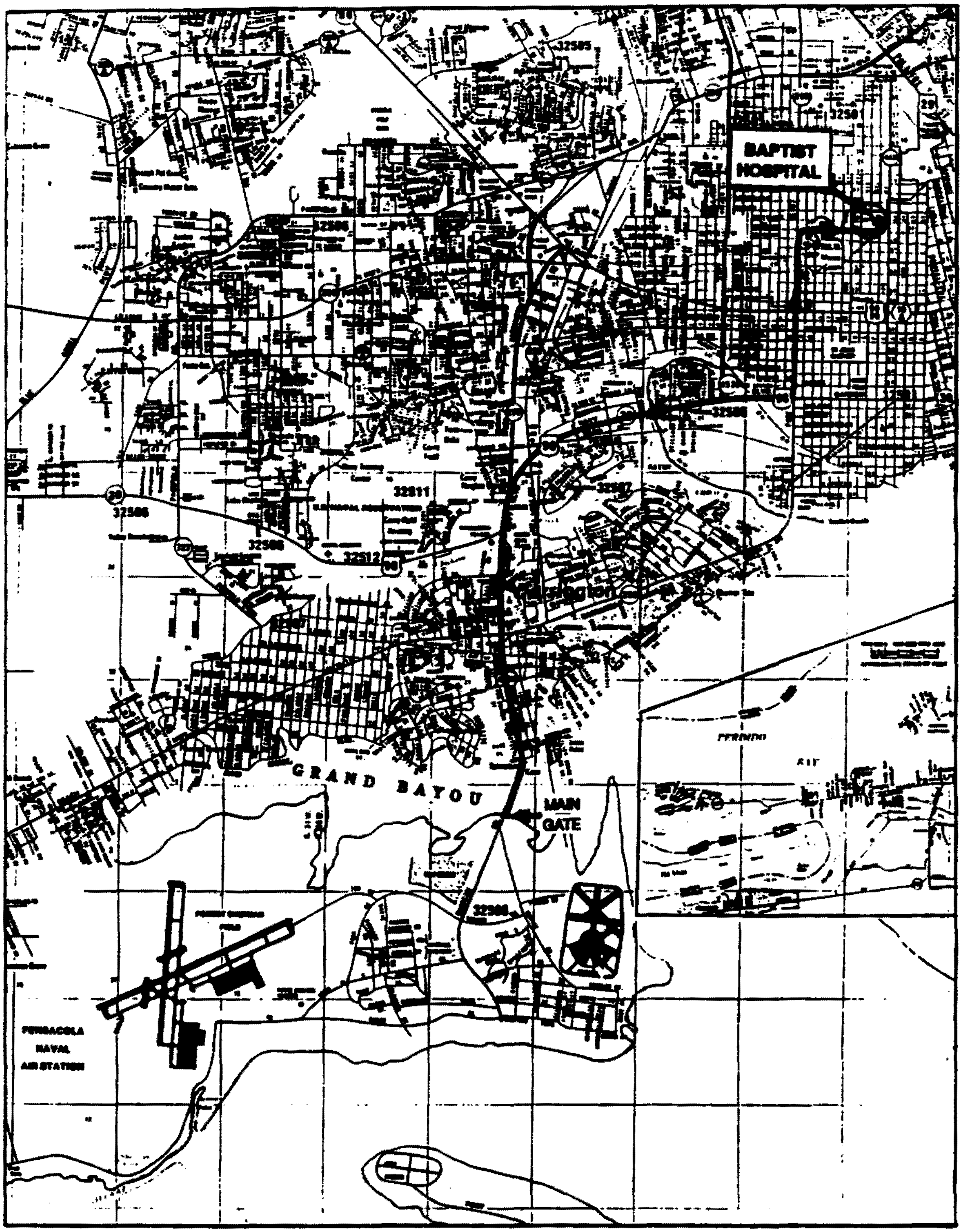


Figure A-1 LOCATION OF NAS DISPENSARY



SOURCE: Ecology and Environment, Inc., 1982

APPROXIMATE SCALE IN FEET

0 2000 4000 6000 8000

Figure A-2 LOCATION *OF* **BAPTIST HOSPITAL**

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DRILL RIG SAFETY

* Hard hats must be worn.
* All team members must be know the procedure to shut the rig off and the location of the "kill" switch.
* When moving a rig off the road, pay attention to obstacles in route of travel. Walk the intended route first.
* Have someone guide the rig driver when clearance is at a minimum or when hazards are in close proximity.
* Set rig brakes and block the wheels when rig is set up at the desired drilling location.
* The mast must be lowered when the rig is moved.
* Always consider overhead wires to be live, watch for sagging lines and do not operate rig within 15 feet of overhead lines.
* Make sure the site, platforms and walkways are free of obstructions.
* Hake 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.

	H & S, TRAINING 2.8	Revised: JANUARY 1990 Approved: H. Van Cleave

STANDARD OPERATING PROCEDURE
FOR
EMERGENCIES DUB TO HEAT AND EBAT STRESS MONITORING

REVISED JANUARY 1990

Prepared by

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1 INTRODUCTION

Field operations present a variety of hazards to the employee. During hot days or when wearing protective clothing, heat stress can be experienced and, if not remedied, can threaten the health or life of field personnel.. Therefore, it is important that all employees are able to recognize the symptoms of heat stress as well as perform first aid vithout delay.

2 SCOPE

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

In addition, this SOP recommends 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 ate followed in the field. However, each individual must be cautious vhen vorking in conditions where heat stress is possible.

3 OBJECTIVES

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

4 EFFECTS OF HEAT

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

Interference 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 which certain body processes speed up and generate additional heat. Then the body must eliminate not only the normal but also the additional quantities of heat.

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

4.1 HEAT CRAMPS

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

4.1.1 Symptoms

The symptoms of heat cramps include the following:

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

4.1.2 Emergency Care

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

4.2 HEAT EXHAUSTION

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

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

4.2.1 Symptoms

The symptom of heat exhaustion are as follovs:

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

4.2.2 Emergency Care

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

4.3 HEAT STROKE

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

4.3.1 Symptoms

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

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

4.3.2 Emergency Care

Remember that this is a true emergency, therefore, transportation to a medical facility should not be delayed. In the meantime, place the victim in a coal 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 with 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 hut cramps or heat exhaustion, Gatorade or its equivalent is suggested as part of the treatment regime. The reason for this type of liquid refreshment is that such beverages vill return much-needed electrolytes to the body's system. Vithout these electrolytes, body systems cannot function properly, and the represented health hazard vill 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:

- 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, vhen 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 vorn, especially levels A and B, the suggested guidelines for ambient temperature and maximum vearing time per excursion are as follows:

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

5.2 HEARTRATE MONITORING

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

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

If the recovery pulse rate during the last 30 seconds of the first minute is at 110 beats/minute or less and the deceleration 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 HONITORIIUG PERSONNEL BODY TEMPERATURE AND BLOOD PRESSURE

When personnel are in respiratory protective gear for extended periods, or when air temperatures are very high, the monitoring of body temperature urd-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 vorking in the hot zone.

5.4 MONITORING THE WORK AREA FOR HEAT STRESS CONDITIONS

Air temperature and relative humidity *are* the two most Important measurements for determining tha 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 vitbout 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 ovn 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

Prepared by

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1 INTRODUCTION

This document is meant to be used in conjunction with E & E SOPs for field operatiom and hazardous vaste 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 & B personnel are frequently required to vork in the field vitb 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 B & E's own drill rig by our personnel.

2 OPERATION OF DRILLING EQUIPMENT BY E & E

2.1 RESPONSIBILITIES AND AUTHORITY OF SITE SAFETY OFFICER

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

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

2.2 RESPONSIBILITIES AND AUTHORITY OF E 6 E DRILLER

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

- Kill switches tripped and operation verified;
- Chin 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, chins;
- 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 stabilized8
- 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 following safety practices will be in effect:

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

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

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

2.3 RESPONSIBILITY AND AUTHORITY OF OTHER E & B PERSONNEL

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

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

3.2 E 6 E DRILLER AND HELPER

The E & E driller and helper shall have taken and passed the basic 40-hour Health and Safety Training as prescribed by B 6 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 & B Drilling Team upon employment vith E 6 E, by performing various types of drilling. This reviev will be the basis for determining vhcther 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 Eelper on an assortment of field projects before he or she can be reviewed for advancement to the position of Driller. If a Driller is uninvolved in drilling efforts for 1 year or more, he or she will be required to act as a Driller's Helper on a project, as well as receive rig-specific training on the equipment, before being permitted to act as a Driller again. The Driller's Helper position requires prior attendance at a drilling training school program. Folloving successful completion of such a course, the Driller's Helper will be observed on sites for a period of approximately 6 months, during which time he or she will 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 B personnel shall have taken the basic 40-hour Health and Safety Training course. Field personnel must meet medical and respiratory fit test requirements established by E & E and OSHA, as well.

3.4 SUBCONTRACT DRILLER AND OTHER SUBCONTRACT DRILLING PERSONNEL

Subcontract Drillers and their support personnel must, at a minimum, have passed basic 40-hour 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 work.

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4 SUPERVISION OF SUBCONTRACT DRILLERS

4.1 RESPONSIBILITIES AND AUTHORITY OF SITE SAFETY OFFICER

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

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

- The mast must be located at least 25 feet from any overhead or underground utility lines.
- The location and operation of operational and unencumbered kill switches must be reiterated to all site personnel.
- Outriggers, stabilizers, or jacks are in place, and the rig is level.
- A geophysical survey (electromagnetic or ground-penetrating radar) or a reliable site history must be obtained to verify absence of buried obstacles, tanks, or drums.
- A first rid 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 with the cooperation of the RSC or the Corporate Health and Safety Group, from the nearest E & E office.

It is the responsibility of the SSO to ensure that all safety equipment is in good 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 & E personnel are forbidden from entering the "super exclusion zone" around the borehole while the rig is actively drilling. The SSO must not attempt to take air readings in or around the auger while in use, nor are cutting samples taken vhile 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 vith regard to whether vork practices meet the requirements of the SSP. Shutdovn of vork or restriction of personnel are options available to the SSO. The SSO should hold informal site safety briefings at the start of both field vork and daily vork shifts throughout the course of the project. Although E & E contractually requires Subcontractors to provide properly trained and outfitted staff, the SSO should verify verbally at the start-up meeting that the field staff has necessary respiratory approval and OSEA-mandated training, especially on hazardous waste sites. Site safety briefing topics, as well as attendees, will be recorded in the site safety log.

If the SSO has reason to believe either E 6 E or Subcontractor personnel are under the influence of alcohol or drugs, or are othervise ill before or during vork onsite, he or she should consider restricting those team members from site vork. Personnel arriving for vork requiring level C protection vho are not cleanly shaved may also be restricted at the discretion of the SSO.

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

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

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

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

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

No refueling operations will be performed until rig engines are shut down. Motor furls sbould 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 B & B PERSONNEL

All E & E personnel on site are required to follow the terms of the SSP and the direction of the SSO. Because the SSO cannot be in all places at all times, the crew should observe the subcontractors and condition Of their equipment at all times, and report immediately to the Team Leader and SSO any safety-related issues that are unresolved. Included are such details as drwsout, 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 set up so that E & E personnel and subcontractors share the same expendable supplies.

B & B 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 ing p n will have read and understood the terms of the B & E d 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 vork begins on day 1. All will be shown the location and operation of "kill switches," which will be operationally checked each morning.
- Fire extinguisher(s) will be staged next to the rig before drilling and refueling operations.
- Welding and cutting activities will only be performed avay 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 vithin 25 feet of overhead lines.

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

- 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 using 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 & B 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 lovered for repairs.

5.1.2 Rotary and Core Drilling

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

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

  - Rods and bit should be open and clear.

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

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

  - The capacities of hoist8 and sheaves should be checked against the anticipated veight 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 wrench from the chuck.

- Drill rods should not be braked while being lowered 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 betveen 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 work 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 dovn. As previously stated, hardhats, steel-toed boots, safety glasses, and vork gloves are to be vorn during such work, 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.

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

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

- Should the rope "grab" the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel, including the Operator, to rapidly back 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, wire rope, or cable on the drill rig) around a hand, vrist, arm, foot, ankle, leg, or any other part of the body.

- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing, or other tools vith the cathead and rope method. Be avare that the rope advances toward the cathead with 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 with 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, while staying as far away as possible from the hammer impact point.

- The cathead Operator must be able to operate the cathead standing on a level surface vitb sound, firm-footing conditions, vithout distraction or disturbance.

5.1.4 Continuous-Flight or Hollow-Stem Augers

- Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.
- Apply an adequate amount of dovn pressure before rotation to seat the auger head below the ground surface.
- Check auger flights for nicks or burrs that could catch clothing during rotation, and file them down.
- Watch the auger head vhile slovly engaging the clutch or rotation control, and start rotation. Stay clear of the auger.
- Slovly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about 1 foot or more below ground surface.
- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control, and repeat the starting process.
- An auger guide should be considered to facilitate the starting of a straight hole through hard ground or pavement.
- The Operator and tool handler should 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 wrench, or any other tool during rotation.
- Whenever possible, use tool hoists to handle auger sections.
- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.
- Never allow feet to get under the auger section that is being hoisted.

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

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

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

S. 1.5 Use of Wire Line Hoists, Wire Rope, and Hoisting Equipment

- All vire ropes and fittings should be visually inspected during we 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 Wire 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 vved for a period of 1 month or more should be thoroughly inspected before being retuned 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 svivel is used to hoist drill rods, svivel bearings should be inspected and lubricated daily to ensure that the svivel freely rotates under load.

- If a rod slipping device is wed to hoist drill rad., 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 vhile the rod column is king supported by a rod slipping device. If drill rods should slip back into the borehole, do not attempt to brake the fall of the rods vith hands or by tensioning the slipping device.

- 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 vith each sheave — if the rope is too large, the sheave will pinch the vire rope — if the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger wire ropes.

- Use tool handling hoists only for vertical lifting of tools (except vhen 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.

- When 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 vinch on the front or rear of the vehicle, and stay as far as possible away 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 vith damaged or faulty guides, rollers, sheave bearings, or latches on safety hooks.

- Clutches and brakes on hoists should be periodically tested.

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

- Always vear gloves when handling vire rope.

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

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- Never carry out hoisting operations vhen weather conditions are such that hazards to personnel, the public, or property are created.
- Never leave a load suspended in the 8ir when the hoist is unattended.
- Never hoist a load over the head, body, or feet of personnel.
- Never use a hoist line to "ride" up the mast (derrick) of a drill rig.
- Replacement of wire ropes should conform to the drill rig manufacturer's specifications.

6 REFERENCES

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

Diedrich D-SO Safety Hanual.

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

Wire Rope Users Hanual, American Iron and Steel Institute.

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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

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HYDROCHLORIC ACID, 37%

PRODUCT IDENTIFICATION:

Synonyms: Muriatic acid

Formula CAS No.: 7647010

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

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

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

Eye **Contact:**
Corrosive! Vapors arc irritating and may cause damage to the eyes. Splashes may cause severe hums and permanent eye damage.

Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion d teeth. Long term exposures seldom occur due to the corrosive properties *d* 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 Io 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 *U* 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 d water lor at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly ck an shoes before reuse. Get medical attention immediately.

Eye Exposure:
Wash eyes with plenty of water for at least I S minuter. lilting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS, 1986)

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

SECTION 6 Occupational Control Measures

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

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

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

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

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

SECTION 7 Storage and Special Information

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

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CHEMICAL INFORMATION
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Material Safety Data

Emergency Phone Number: 314-982-5000

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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 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

Printed in U.S.A.

SECTION 1 Physical Data

Appearance: Clear, colorless liquid.

Odor: Rubbing alcohol.

Solubility: Infinite in water.

Boiling Point: 82°C (180°F).

Melting Point: -89°C (-128°F).

Specific gravity: 0.79

Vapor Density (Air = 1): 2.1

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

Evaporation Rate: (n-BUAC = 1) 2.83

SECTION 2 Fire and Explosion Information

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

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

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

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

SECTION 3 Reactivity Data

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

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

Hazardous Polymerization:
Will not occur.

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

SECTION 4 Leak/Spill Disposal Information

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

Ensure compliance with local, state and federal regulations.

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

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Material Safety Data

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Emergency Phone Number: 314-982-5000

Mallinckrodt, Inc., Science Rod— Division. P.O. Boa &ll.i s . KY 43061.

ISOPROPYL ALCOHOL

PRODUCT IDENTIFICATION:

Synonyms 2-propanol; KC-propyl alcohol; isopropanol

Formula CAS No: 67-63-0

Molecular weight: 60.10

Chemical Formula: $(CH_3)_2$ CHOH

Hazardous Ingredients: Not applicable.

PR 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 lo 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 minuter. 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 – I): 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 form, or carbon dioxide. Water spray may be used lo keep fire exposed containers cool.

Special Information:
In the cvcnt 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 bc used to flush spills away from exposures and to dilute spills to non-flammable mixtures. vapors can now along surfaces lo distant ignition source and flash back.

SECTION 3 Reactivity Data

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

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

Hazardous Polymerization:
Will not occur.

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

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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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! Drink large quantities of water or milk if available. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases call a physician.
SEE SECTION 5.

DOT Hazard Class: Oxidizer

SECTION 1 Physical Data

Appearance: Clear, colorless to slightly yellow liquid.

Odor: Suffocating acrid.

Solubility: Infinite in water.

Boiling Point: 122°C (252°F)

Melting Point: -34°C (-29°F)

Specific Gravity: 1.41

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

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

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

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

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

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

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

SECTION 3 Reactivity Data

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

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

Hazardous Polymerization:
Will not occur.

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

SECTION 4 Leak/Spill Disposal Information

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

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

Ensure compliance with local, state and federal regulations.

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

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

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

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

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

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

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

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

B. FIRST AID

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

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

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

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

C. TOXICITY DATA (RTECS, 1982)

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

SECTION 6 Occupational Control Measures

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

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

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

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

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

SECTION 7 Storage and Special Information

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

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SODIUM HYDROXIDE

PRODUCT IDENTIFICATION:

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

Formula CAS No.: 1310-73-2

Molecular Weight: 40.00

Chemical Formula: NaOH

Hazardous Ingredients: None.

PRECAUTIONARY MEASURES

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

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

EMERGENCY/FIRST AID

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

DOT Hazard Class: Corrosive Material

SECTION 1 Physical Data

Appearance: White, deliquescent pellets.

Odor: Odorless.

Solubility: 111 g/100 g of water.

Boiling Point: 1390°C (2534°F)

Melting Point: 318°C (604°F)

Specific Gravity (water=1): 2.13

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

Vapor Pressure (mm Hg): Negligible.

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

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

Explosion:
Not considered to be an explosion hazard.

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

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

SECTION 3 Reactivity Data

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

Hazardous Decomposition Products:
Sodium oxide.

Hazardous Polymerization:
This substance does not polymerize.

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

SECTION 4 Leak/Spill Disposal Information

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

Ensure compliance with local, state and federal regulations.

NFPA **Ratings: Health:** | **Flammability:** | **Reactivity: 1**

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

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

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

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

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

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

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

B. FIRST AID

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

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

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

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

C. TOXICITY DATA (RTECS. 1982)

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

SECTION 6 Occupational Control Measures

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

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

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

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

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

SECTION 7 Storage and Special Information

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

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300779

SULFURIC ACID *96%*

PRODUCT IDENTIFICATION:

Synonyms: Oil of Vitriol

Formula CAS No.: 7664-93-9

Molecular Weight: 98.07

Chemical Formula: H_2SO_4

Hazardous Ingredients: Not applicable.

PRECAUTIONARY MEASURES

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

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

EMERGENCY/FIRST AID

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

DOT Hazard Class: Corrosive Material

SECTION 1 Physical Data

Appearance: Colorless, oily liquid.

Odor: Odorless.

Solubility: Infinite @ 20°C.

Boiling Point: ca. 310°C (590°F)

Melting Point: ca. -14°C (6°F).

Specific Gravity: 1.84

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

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

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

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

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

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

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

SECTION 3 Reactivity Data

Stability:
Stable under ordinary conditions of use and storage.

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

Hazardous Polymerization:
Will not occur.

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

SECTION 4 Leak/Spill Disposal Information

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

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

Ensure compliance with local, state and federal regulations.

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

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

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

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

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

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

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

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

B. FIRST AID

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

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

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

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

C. TOXICITY DATA (RTECS, 1982)

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

SECTION 6 Occupational Control Measures

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

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

Personal Respirators: (NIOSH Approved)
If the TLV is exceeded a full 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 low. 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 mar Cadmium Date 3/23/92

DOT Name/U.N. lo. 2570 Job No. UH8000

CAS Number 7440-43-9

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: _____)

Chemical Formula Cd Molecular Weight 112.4

Physical State solid Solubility (H2O) Insoluble Boiling Point 1409° F

Flash Point N/A Vapor Pressure/Density 0 mm Freezing Point 610° F

Specific Gravity 8.65 Odor Characteristic --- Flammable Limits _____

Incompatabilities Strong oxidizers

Biological Properties:

TLV-TWA --- PEL 0.2 mg/m^3 Odor/Odor Threshold Odorless

IDLH 50 mg/m^3 Human --- Aquatic --- Rat/Mouse ---

Route of Exposure Inhalation, Ingestion

Carcinogen X Teratogen _____ Mutagen _____

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Monitoring Recommendations:

Mini-Ram

Disposal/Waste Treatment:

Health Hazards and First Aid:

Large quantities of water, induce vomitiaq, medical attoation: remove to fresh air, medical attention immediately

Symptoms: Acute: irritation of nose and throat, coughing, chest pain, nausea, vomiting, dissiness, chills, stomach distress, diarrhea

Chronic: loss of smell, liver damage, kidney damage, cancer

3000780

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HAZARD EVALUATION OF CHEMICALS

Chemical Name: Cyanide Date: 5/02/92

DOT Name/U.N. No.: 1680/1689 Job No.:

CAS Number: 151-50-8/143-33-9

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 Proportiom: (Synonyms: Potassium cyanide/ sodium cyanide)

Chemical Formula: KCN/NaCN Molecular Weight: 65.1/49.0

Physical State: solid Solubility (H2O): 72/58 % Boiling Point: 7/2725°F

Flash Point: NA Vapor Pressure/Density: 0 mm Freezing Point: NA

Specific Gravity: 1.55/1.6 Odor Characteristic: Flammable Limits: Non

Incompatabilities: Acids, oxidizers, acid salts, chlorates & nitrates

Biological Proportiom:

TLV-TWA: 5 mg/m^3 PEL: 4.7 ppm Odor/Odor Threshold: bitter, almond-like

IDLH: SO ppm Human: Aquatic: Rat/Mouse:

Route of Exposure: Inhalation, Ingestion, Dermal

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

Radiological Proportiom:

Handling Recommendations: (Personal protective measures)

modified Level D with gloves and tyvek at tho miminium.

Monitoring Recommendations:

OVA/Hnu/ Mini Ram

Disposal/Waste Treatment:

Health Hazards and First Aid:

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

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

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

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Tin Date 7/06/92

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

CAS Number 7440-31-5

References Consulted (circle):

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

Toxic and Hazardous Safety Manual ACGIH Other:

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

Chemical Properties: (Synonyms: Metallic tin, tin flake, tin powder)

Chemical Formula Sn Molecular Weight 118.7

Physical State solid Solubility (H2O) insoluble Boiling Point 4545° F

Flash Point N/A Vapor Pressure/Density 0 mm Melting Point 449°F

Specific Gravity 7.28 Odor Characteristic N/A Flammable Limits N/A

Incompatabilities Chlorine, turpentine, acids, alkalis

Biological Properties:

TLV-TWA 2.0 mg/m^3 PEL 2.0 mg/m^3 Odor/Odor Threshold N/A

IDLH 400 mg/m^3 Human Aquatic Rat/Mouse

Route of Exposure Inhalation, Ingestion, Dermal

Carcinogen — Teratogen — Mutagen —

Radiological Properties:

Handling Recommendations: (Personal protective measures)

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

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

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

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

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

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HAZARD EVALUATION OF CHEMICALS

Chemical lam Phosphoric Acid Date 7/06/92

DOT Name/U.N. No. 1805 Job lo.

CAS Number 7664-38-2

References Consulted (circle):

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

Toxic and Hazardous Safety Manual ACGIH Other:

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

Chemical Properties: (Synonyms: Metaphosphoric acid, Orthophosphoric acid)

Chemical Formula H_3PO_4 Molecular Weight 98.0

Physical State Colorless Liquid Solubility (H2O) Miscible Boiling Point 415°F

Flash Point n/a Vapor Pressure/Density 0.03 mm Melting Point 111°F

Specific Gravity 1.87 Odor Characteristic Flammable Limits —

Incompatabilities Strong caustics, most metals

Biological Properties:

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

IDLH 10,000 mg/m^3 Human Aquatic Rat/Mouse

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

Carcinogen Teratogen Mutagen

Radiological Properties:

Handling Recommendations: (Personal protective measures)

Impervious clothing, Viton gloves, faceshield respirator w/organic vapor cartridge in areas with elevated readings.

Monitoring Recommendations:

OVA or HNu.

Disposal/Waste Treatment:

Concentrated: dilute discharge to municipal sewer after primary treatment,

Health Hazards and First Aid:

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

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

Chronic: Irritation to upper respiratory tract

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Nickel (metal) Date 7/02/92

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

CAS Number 7440-02-0

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: Raney alloy; nickel particles)

Chemical Formula Ni Molecular Weight 58.7

Physical State solid (powder) Solubility (H2O) insoluble Boiling Point 4946°F

Flash Point N/A Vapor Pressure/Density N/A Freezing Point 2651°F

Specific Gravity N/A Odor Characteristic none Flammable Limits N/A

Incompatabilities strong acids, sulfur, wood, potassium perchlorate

Biological Properties:

TLV-TWA 1 mg/m3 PEL 1 mg/m3 Odor/Odor Threshold odorless

IDLH _____ Human _____ Aquatic _____ Rat/Mouse _____

Route of Exposure inh, ing, derm

Carcinogen Human/animal suspected Teratogen Experimental Mutagen Experimental

Radiological Properties:

N/A

Handling Recommendations: (Personal protective measures)

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

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

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

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

Chronic: Dermatitis from skin sensitization. Cancer of lungs and nasal passages in nickel refining employees.

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HAZARD EVALUATION OF CHEMICALS

Chemical Name Silver **Date** 7/06/92

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

CAS Number 7440-22-4

References Consulted (circle):

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

Toxic **and** Hazardous Safety **Manual** **ACGIH** Other: _____

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

Chemical Properties: (Synonyms: Silver metal)

Chemical **Formula** Ag Molecular Weight 107.9

Physical State solid Solubility (H2O) insoluble **Boiling** Point 3632°F

Plash Point n/a Vapor Pressure/Density 0 mm Melting Point 1761°F

Specific Gravity 10.49 Odor Characteristic _____ **Flammable** Limits _____

Incompatabilities Acetylene, ammonia, hydrogen peroxide, bromoside, chlorine, trifluoride

Biological Properties:

TLV-TWA 0.01 mg/m^3 PEL 0.01 mg/m^3 Odor/Odor Threshold _____

IDLH _____ Human _____ Aquatic _____ Rat/Mouse _____

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

Carcinogen _____ Toratogen _____ **Mutagen** _____

Radiological Properties:

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

Impervious clothing, Viton gloves, faceshield respirator in windy/dusty areas.

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

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

Symptoms: Acute: Irritates eyes, dries skin

Chronic: _____

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HAZARD EVALUATION OF CHEMICALS

Chemical Name: Lead Date: 3/23/92

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

CAS Number: 7439-92-1

References Consulted (circle):

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

Toxic and Hazardous Safety Manual ACGIH Other:

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

Chemical Properties: (Synonyms: Plumbum)

Chemical Formula: Pb Molecular Weight: 207.2

Physical State: solid Solubility (H2O): insoluble Boiling Point: 3164 F

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

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

Incompatabilities: Strong oxidizers, hydrogen peroxide, acids

Biological Properties:

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

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

Route of Exposure: Inhalation, Ingestion, Dermal

Carcinogen: — Teratogen: — Mutagen: —

Radiological Properties:

Handling Recommendations: (Personal protective measures)

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

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

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

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

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

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HAZARD EVALUATION OF CHEMICALS

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

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

CAS Number 7440-47-3

References Consulted (circle):

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

Toxic and Hazardous Safety Manual ACGIH Other: SAX, Aldrich

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

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

Chemical Formula Cr Molecular Weight 52

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

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

Specific Gravity 7.14 Odor Characteristic Flammable Limits

Incompatabilities Strong oxidizers

Biological Properties:

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

IDLH N/A Human Aquatic Rat/Mouse

Route of Exposure Inhalation, Ingestion

Carcinogen Teratogen Mutagen

Radiological Properties:

Handling Recommendations: (Personal protective measures)

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

Monitoring Recommendations:

Disposal/Waste Treatment:

Health Hazards and First Aid:

ING: give large amounts of water, induce vomiting, immediate medical attontion. INH: move to fresh air, CPR it necessary, immediate medical attontion. DER: Rinse with largo amount. of water.

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

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

APPENDIX B

SITE-SPECIFIC **QUALITY ASSURANCE PROJECT PLAN**

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

Section 1.0 -- Title Page

Vork Plan Group: E
Site No.: 30
Site Name: Buildings 649 & 755

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

E & E ASC Director: Gary H. Hall for
~~Xxxxxxxxx~~ W.F. Hall, Ph.D

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

Section 2.0 -- Table of Contents

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Section 1.0 -- Title Page

Vork Plan Group: E
Site No.: 30
Site Name: Buildings 649 & 755

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1203 Governor's Square Boulevard, Suite 401
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K. Walker

E & E ASC Director: Gary H. Hall for
~~Xxxxxxxxx~~ W.F. Hall, Ph.D

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

Section 3.0 -- Project Summary (Continued)

Phase II -- Characterization

PLANNED NUMBER OF SAMPLES

Surface Water	7	Air	___	Duplicates	14
Sediment	26	Biota:		Trip Blanks	7
sail	77	Flora	___	Field Blanks	3
Groundwater	15	Fauna	___	Rinsate Blanks	7
				Preservative Blanks	1

CATEGORIES OF ANALYSES

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

Additional analytical categories are identified below:

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

Section 4.0 — Project Organization and Responsibility

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

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

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

Section 5.0 — QA/QC Objectives for Measurement Data

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

Analyte	Media	Method No.	A	P	C	DL
Laboratory Screening Analyses*						
Volatile Organic Compounds	S/W	--	N/M	N/M	N/M	N/M
Polynuclear Aromatic Eydrocarbons	S/W	--	N/M	N/M	N/M	N/M
Pesticides	S/W	--	N/M	N/M	N/M	N/M
Polychlorinated Biphenyls	S/W	--	N/M	N/M	N/M	N/M
Total Recoverable Petroleum Hydrocarbons	S/W	EPA 418.1	N/M	N/M	N/M	TBD
Phenols	S/W	--	N/M	N/M	N/M	N/M
Arsenic	S/W	--	N/M	N/M	N/M	N/M
Cadmium	S/W	--	N/M	N/M	N/M	N/M
Chromium	S/W	--	N/M	N/M	N/M	N/M
Copper	S/W	--	N/M	N/M	N/M	N/M
Lead	S/W	--	N/M	N/M	N/M	N/M
Nickel	S/W	--	N/M	N/M	N/M	N/M
Silver	S/W	--	N/M	N/M	N/H	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/H	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/M
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
Dioxins	S/W	EPA 8280	N/M	N/M	N/M	N/M
Organophosphorus Pesticides	S/W	EPA 8140	N/M	N/M	N/M	N/M
Eerbicides	S/W	EPA 8150 (Mod)/509B	N/H	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/H	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/H
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

Analyte	Media	Method No.	A	P	C	DL
Lead	S/W	EPA 7421	N/H	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/H	N/M	N/M
Mercury	S/W	EPA 7471/7470	N/M	N/H	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/H
Silver	S/W	EPA 6010	N/M	N/H	N/M	N/M
Sodium	S/W	EPA 6010	N/M	N/M	N/H	N/M
Tin	S/W	EPA 7870	N/M	N/M	N/H	N/H
Thallium	S/W	EPA 7841	N/H	N/M	N/M	N/H
Vanadium	S/W	EPA 6010	N/M	N/M	N/M	N/H
Zinc	S/W	EPA 6010	N/M	N/M	N/M	N/M
Cyanide	S/W	EPA 9010/335.2	N/H	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/H	N/M	N/M
Hardness	W	EPA 130.2	N/H	N/M	N/M	N/H
Alkalinity	W	EPA 310.1	N/M	N/M	N/M	N/H
Total Suspended Solids	W	EPA 160.2	N/H	N/M	N/M	N/H
Total Kjeldahl Nitrogen	S/W	EPA 351.3	N/M	N/M	N/H	N/M
Nitrogen-Ammonia	S/W	EPA 350.2	N/M	N/M	N/H	N/M
Orthophosphate Phosphorus	S/W	EPA 365.2	N/M	N/H	N/H	N/M
5-day Biological Oxygen Demand	V	SM 5210	N/H	N/M	N/M	N/M
Chemical Oxygen Demand	W	EPA 410.4	N/M	N/M	N/M	N/H
pH	W	EPA 150.1	N/M	N/M	N/H	N/H
Percent Moisture	S	ASTH D-2216-80	N/M	N/M	N/M	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/H	N/H
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	ASTH D-129-64	N/H	N/H	N/H	N/M
Ignitability	S/W	EPA 1010	N/M	N/H	N/M	N/M
Cation Exchange Capacity	S	EPA 9081	75-125	35	95%	100 mg/kg
Field Parameters						
pH	W	150.1	N/M	N/M	N/H	N/H
Specific Conductance	W	120.1	N/M	N/H	N/H	N/H
Temperature	W	170.1	N/M	N/M	N/H	N/H
Dissolved Oxygen	W	EPA 360.1	N/M	N/M	N/M	N/H

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

*
With the exception of Total Recoverable Petroleum Eydrocarbons 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. Modifications to these procedures are described belov:

No Modifications

Section 7.0 — Sample Custody

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

No Modifications

Section 9.0 — Analytical Procedures

Screening and quantitative analytical procedures are presented in Section 9.0 of the GQAPP. Site-specific accuracy, precision, completeness, and detection limit criteria are presented in Section 5.0 of this SQAPP. Modifications to any other of the analytical procedures are described belov:

No Modifications

Section 10.0 -- Data Reduction, Validation, and Reporting

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

No Modifications

Section 11.0 -- Internal Quality Control Checks

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

No Hodifications

Section 12.0 -- Performance and System Audits

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

Audit Type	Frequency/Date	Description
	To Be Determined	

Section 13.0 -- Preventive Maintenance

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

No Modifications

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

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

No Modifications

Section 15.0 -- Corrective Action

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

No Modifications

Section 16.0 — Quality Assurance Reports to Management

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

No Modifications

Appendix A -- Additional Personnel Biographies

Personnel assigned to this site investigation whose biographies do not appear in the GQAPP are listed belov; 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	M 2	Gulf coast, estuarine
Ammocrypta asprella	Crystal darter	U	T	M 2	Fresh water
Etheostoma histrio	Harlequin darter	U	SSC		Fresh water
Fundulus jenkinsi	Salt marsh topminnow	P	SSC		Salt, fresh, brackish waters
Lepisosteus spatula	Alligator gar	U	SSC		Brackish, fresh, salt water
Moxostoma carinatum	River redhorse	U	SSC		Fresh water
AMPHIBIANS AND REPTILES					
Alligator mississippiensis	American alligator	R	SSC	T(S/A)	Swamps, marshes, ponds
Caretta caretta caretta	Loggerhead turtle	M?	T	T	Marine, coastal
Chelonia mydas mydas	Green turtle	M?	E	E	Marine, coastal
Dermochelys coriacea	Leathorback turtle	M	t	E	Marine, coastal
Drymarchon corais coupori	Eastern indigo snake	P	T	T	Open areas near water
Eretmochelys imbricata	Hawksbill turtle	M?	E	E	Marine, coastal
Gopherus polyphemus	Gopher tortoise	P	SSC	UR 1	Sandy coastal plains
Graptemys pulchra	Alabama map turtle	U	SSC		Swamps, streams, marshes, ponds
Lepidochelys kempi	Atlantic ridley turtle	M?	E	E	Marine, coastal
Rana areolata aesopus	Florida gopher frog	P	SSC	UR 2	Sand hill communities
Macroclemys temmincki	Alligator snapping turtle	SR	SSC	UR 2	Swamp., marshes, ponds

14[NASP]UH1105:T0397/1886/2

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
MAMMALS					
~~Mustela vison~~ lutensis	Florida mink	U		u 1 2	Terrestrial habitats
Peromyscus polionotus trissyllopsis	Perdido Key beach mouse	N/A	T	t	Beach dunes
Trichechus manatus latirostris	West Indian manatee	M	t	E	Atlantic and Gulf coasts
BIRDS					
Charadrius melodus	Piping plover	P	T	T	Open, dry, randy beaches
Charadrius alexandrinus	Snowy plover	P	T	UR 2	Open, dry, randy beaches
Dendroida dominica stoddardi	Stoddard's yellow throated warbler	P-u		UR 2	Wooded habitats
Dendroica kirtlandii	Kirtland's warbler	U	E	t	Wooded habitat.
Haematopus palliatus	American oystercatcher	U	SSC		Coastal habitatr
Egretta rufescens	Reddish egret	P-U	SSC	UR 2	Freshwater/coastal wetlands
Egretta caerulea	Little blue heron	P-u	SSC		Freshwater/coastal wetlands
Egretta thula	Snowy egret	P-U	SSC		Freshwater/coastal wetlands
Grus canadensis pratensis	Florida sandhill crane	U	t		Freshwater wetlands
Falco peregrinus tundrius	Arctic peregrine falcon	M	E	T	Winters on coasts
Falco sparverius paulus	Southeastern kestrel	I	T	UR 2	Open pine forests, clearings
Haliaeetus leucocephalus	Bald eagle	P-U	t	E	Pine forests/coastal habitat
Pandion haliaetus	Osprey	I	SSC		Near water
Pelecanus occidentalis	Brown pelican	R	SSC	AC	Mangrove trees, coasts

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Key at end of table.

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Table Appendix C (Cont.)

Scientific Name	Common Name	Base Status[a]	Status[b] FGFWFC (or IDA)	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	L	Wooded habitat.
Campephilus principalis	Ivory-billed woodpecker	U	E	L	Wooded habitat.
Sterna antillarum	Least tern	U	T		Coastal habitats
Mycteria americana	Wood rtork	U	E	E	Freshwater/coastal wetlands
Rostrhamus sociabilis	Snail kite	U	E	L	Freshwater/coastal wotlandr
INVERTEBRATES					
Copris gopheri	Scarab beetle	P		UR 2	Associated w/gopher tortoise
Chrysopsis gossypina cruiseana	Cruise's golden-as er	P	E	UR 1	Coastal dunes
Drosera intermedia	Spoon-leaved sundew	R	T		Aquatic habitat.
Epigaea repens	Trailing arbutus	U	E		Dry, acid, randy roil
Kalmia latifolia	Mountain laurel	U	T		Rich, moirt, shady woods
Lilaeopsis carolinensis	Carolina lilaeopsis	R		UR 2	
Lilium iridollae	Panhandle lily	U	E	UR 2	Black, mucky soils
Pinguicula planifolir	Chapman's butterwort	U	RE	UR 2	
Polygonella macrophylla	Large-leaved jointweed	R	T	UR 1	Sand pino-oak scrub
Rhododendron aurtrinum	Orange azalea	U	E	V a S	Moist, woody habitat.

14[NASP]UH1105:T0397/1886/2

Key at end of table.

Table Appendix C (Cont.)

Scientific Wan	Common Wane	Base Status[a]	status[b] FGFWFC (or FDA)	status[b] USFWS	Habitat
Sarracenia leucophylla	White-top pitchorplant	R	8		Open acid boqs
Sarracenia rubra	Sweet pitchorplant	U	I	V I 2	Acid boqs/slash pine woods
Stewartia malacodnedron	Silky camellia	U	I		Slopes ot wooded ravines

14[NASP]UN1105:T0397/1886/2

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 tor listing.
UR 1 = Under review tor federal listing with substantial evidence indicating at least some degree ot bioloqical vulnerability and/or throat.
VI 2 = Under review, insufficient biological data available.
UR 5 = Candidate species but taxa has proven to bo more widespread than previously believed and/or thoro species that are not rubjoct 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 Environment, Inc., 1991 after florid. Natural Areas Inventory 1988.

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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 II--Characterization

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

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

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

Phase II investigation of Site 30 will involve the collection of surface water, sediment, soil, groundwater, and biota samples. Permanent shallow monitoring wells will be installed. The hydrologic assessment of the site will be expanded to include limited aquifer testing. The analytical requirements for Phase II are shown in Table *14-2*. Air sampling will be conducted only if warranted by the results of Phase I efforts.

During the Phase II investigation of Site 30, 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

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

TABLE 14-2

PHASE II SAMPLING AND ANALYTICAL REQUIREMENTS—GROUP E

SITE 30

Medium	No. of Samples	Dupli-cates	Trip Blanks[a]	Preservative Blanks	Field Blanks	Rinsate Blanks	Total[*]	Analytical Suite[b,c]
Surface Water	8	1	1	1	1	1	13 (2)	A B
Sediment	26	3	1	NR	NR	1	31 (6)	A C
Soil	30	3	1	NR	NR	2	36 (6)	A C
Groundwater	5	1	1	NR	NR	1	8 (1)	A B
TOTAL	69	8	4	1	1	5	88(15)	

14[NASP]UN1105:T0397/900/11

[a]Trip blanks will bo analyzed for Target Compound List (TCL) volatile organic compounds only. Preservative blanks will be analyzed for TCL volatile organic compounds, total recoverable hydrocarbons, dissolved TCL metals, and cyanide.

[b]Analytical suite designations are as follows:

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

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

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

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

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

NR = Not required.

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14.2 Phase II--Characterization

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

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

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

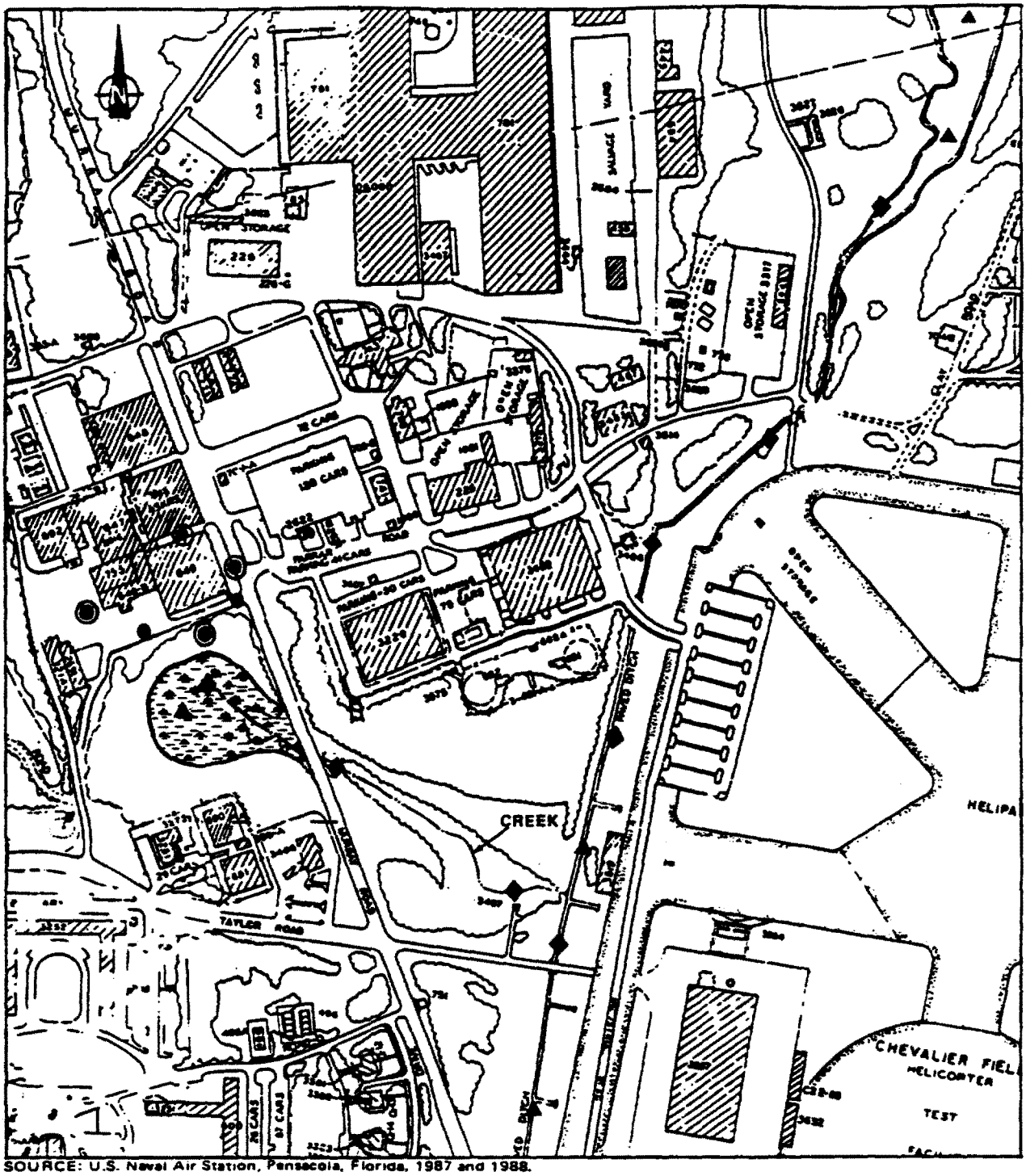
Phase II investigation of Site 30 will involve the collection of surface water, sediment, soil, groundwater, and biota samples. Permanent shallow monitoring wells will be installed. The hydrologic assessment of the site will be expanded to include limited aquifer testing. The analytical requirements for Phase II are shown in Table *14-2*. Air sampling will be conducted only if warranted by the results of Phase I efforts.

During the Phase II investigation of Site 30, 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

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



SOURCE: U.S. Naval Air Station, Pensacola, Florida, 1987 and 1988.

SCALE

0 200 400 600 800 FEET

KEY:

- ● Tentative Soil Boring
- ▲ Tentative Sediment Sample
- ◆ Tentative Surface Water and Sediment Sample
- ○ Tentative Shallow Monitoring Well
- Swamp Area

Figure 14–2 TENTATIVE SOIL BORING, SHALLOW MONITORING WELL, SEDIMENT AND SURFACE WATER SAMPLE LOCATIONS, SITE 30 – PHASE II

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wells be installed north of Building 649; however, actual installation will be contingent upon drill rig access considerations. As a measure to investigate the potential for groundwater contamination by'"sinker" solvents, one intermediate-depth, 2-inch PVC well will also be installed during Phase 11. For planning purposes it is assumed that the intermediate-depth well will be installed to a completion depth of 40 feet. Based on Phase I findings, this well will be clustered with a shallow monitoring well in order to enable determination of vertical hydraulic gradient. The wells will be installed using hollow-stem auger techniques, and in accordance with Sections 6.7 and 6.10 of the GOAPP.

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.

14.2.5 Groundwater Sampling

Groundwater samples will be collected from all newly installed monitoring wells. The total numbers of Phase II groundwater samples are assumed to be five. Groundwater sampling will be conducted in accordance with Sections 6.8 and 6.10 of the GOAPP.

14.2.6 Hydrologic Assessment

In Phase 11, the drainage basin characteristics of the creek/paved ditch will be further assessed. Velocity, discharge, and stream elevation data will be recorded during the field investigation. Rain gages will be monitored and precipitation events recorded.

Each newly installed monitoring well will be surveyed to determine the well head elevation, and water levels will be measured to determine the shallow groundwater flow direction and hydraulic gradient. In addition, limited aquifer testing will be performed consisting of short-term specific capacity testing conducted during well development and/or slug testing.

The results of Phases I and II will be evaluated enabling a reasonable assessment of lateral contaminant migration in shallow groundwater, and stream transport of contaminants and contaminant-laden sediments will be attributed to sources in the vicinity of the swamp headwater area.

14.2.7 Air Sampling

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

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

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