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EBASCO SERVICES INCORPORATED

EPA WORK ASSIGNMENT NO. 19-40RR.0-34
UNDER
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EBASCO SERVICES INCORPORATED

INTERIM RCRA FACILITY ASSESSMENT OF USN CHARLESTON NAVAL SHIPYARD CHARLESTON, SOUTH CAROLINA

AUGUST 1987

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INTERIM RCRA FACILITY ASSESSMENT
OF USN CHARLESTON NAVAL SHIPYARD
CHARLESTON, SOUTH CAROLINA

AUGUST 1987

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TABLE 5-1
RECOMMENDATIONS FOR FURTHER ACTION
CHARLESTON NAVAL SHIPYARD

SWMU	ACTION	COMMENTS
1. DRMO (Formerly DPDO) Staging Area	No Action	This unit is being closed out
2. Lead Contamination Area	Continue with the NACIP program	The unit has been documented to be a potential health risk.
3. Pesticide Mixing Area	Continue with the NACIP program	Pesticides and PCBs were detected in the soils.
4. Pesticide Storage Building	None	
5. Battery Electrolyte Treatment Area	Continue with RFI/ICM	NSY is in the process of phasing out this unit
6. Public Works Storage Yard (Old Corral)	None	NSY is in the process of closing out this unit
7. PCB Transformer Storage Area	Continue with the NACIP program	This unit is currently being studied under the NACIP program
8. Oil Sludge Pit Area	Continue with the NACIP program	This unit is currently being studied under the NACIP program
9. Closed Landfill	Continue with the NACIP program	
10. Hazardous Waste Storage Facility	None	
11. Caustic Pond	Continue with the NACIP program	
12. Old Fire Fighting Training Area	None	
13. Current Fire Fighting Training Area	None	

1.0 INTRODUCTION

The RCRA Facility Assessment (RFA) is designed to evaluate releases of hazardous waste or hazardous constituents to the environment and to implement corrective actions, as necessary, under the broad authorities of the 1984 Hazardous Solid Waste Amendment (HSWA). The RFA identifies information on solid wastes management units (SWMUs) at RCRA facilities, evaluates the potential for release to the environment, and determines the need for further investigation.

The Interim RFA begins with a desktop exercise to review existing U.S. Environmental Protection Agency (EPA) files and gather data from appropriate state environmental agencies regarding SWMUs and potential releases at the RCRA Facility. Additional information is obtained through a trip to the facility to identify SWMUs, provide visual confirmation of SWMU characteristics and releases, and develop locations and rationale for onsite sampling, if required at a later date.

The Charleston Naval Shipyard SWMU response letter, file information from South Carolina state regulatory agencies, and Charleston Naval Shipyard environmental-related files have been reviewed and pertinent information is summarized herein. Information obtained during the site trip conducted on July 22-24, 1987 and documented in the Site Trip Report (See Appendix A) is discussed in this report.

This report includes recommendations concerning the need for further action at each SWMU at the Charleston Naval Shipyard Facility. Potential recommendations under the RFA process include the following:

1. No further action

2. Conduct a sampling investigation (SI)

3. Skip the SI and proceed directly to a RCRA Facility Investigation (RFI)

4. Begin planning and implementing interim corrective measures (ICM)

5. Refer potential releases to other environmental program offices for further assessment as appropriate

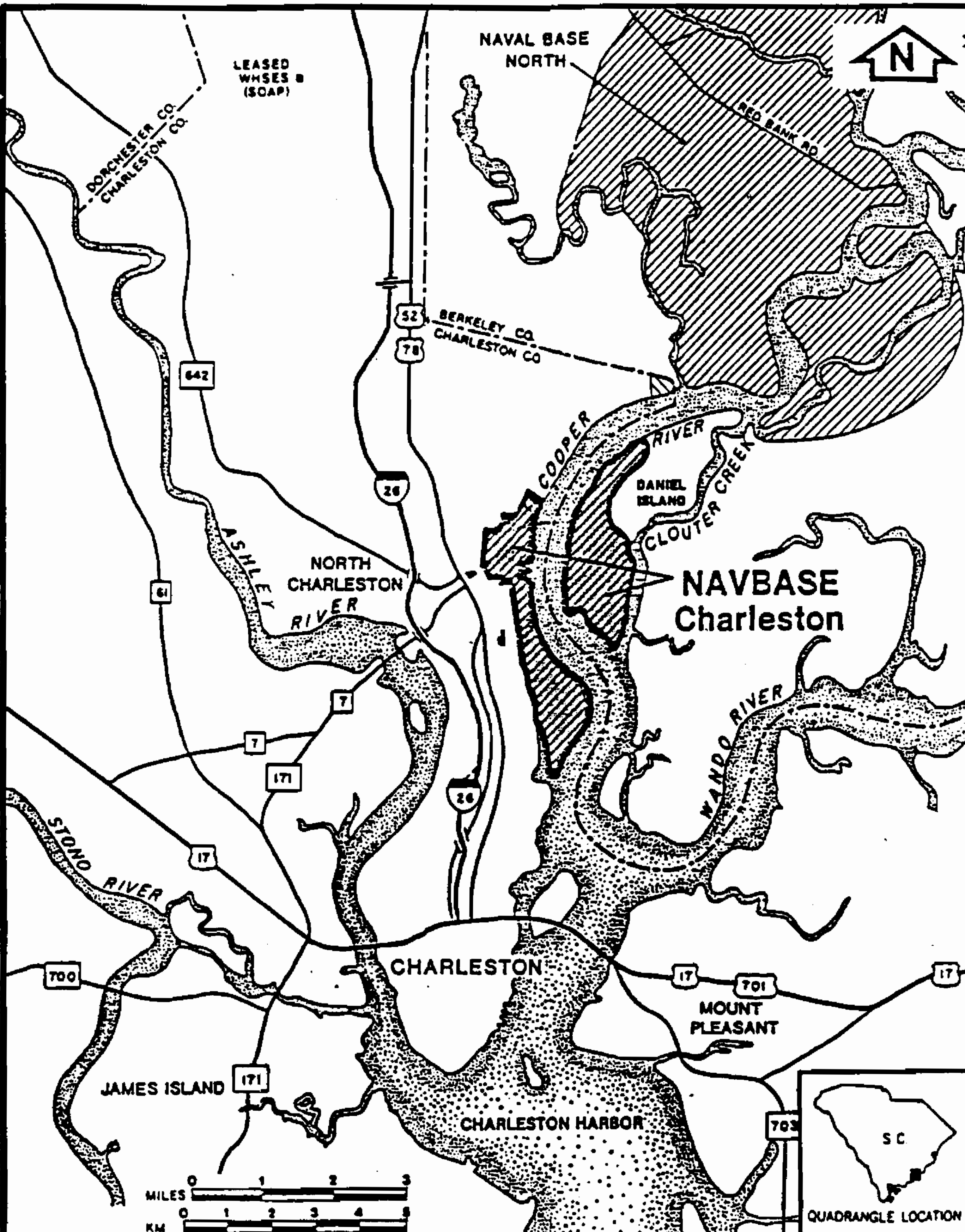
2.0 DESCRIPTION OF FACILITY OPERATIONS AND WASTE GENERATION

2.1 FACILITY DESCRIPTION (REF. 1)

Charleston Naval Shipyard (NSY) is located within the Charleston Naval Base, South Complex (NAVBASE). Figure 2-1 shows NAVBASE Charleston which is located on the banks of the Cooper River in Charleston County, approximately five miles north of the City of Charleston, South Carolina. The NSY Charleston covers approximately 1,908 acres and is divided into two major areas: an undeveloped spoil area on the east bank of the Cooper River on Daniel Island in Berkeley County, and a developed area on the west bank of the Cooper River (see Figure 2-2). The developed area lies on a peninsula, bounded on the west by the Ashley River and the east by the Cooper River. The shipyard controls the spoil area and the majority of the central third of the developed area on the west bank of the river.

The shipyard has been in operation since August 31, 1901 when the U.S. Navy took possession of 2,250 acres and established the U.S. Naval Yard. The mission of the Yard was to make repairs to the smaller vessels of the fleet and supply them with stores. In 1948, NSY was designated a submarine repair and overhaul yard including, by 1958, radiological decontamination. A research, development, and testing function was also added at that time. In addition, NSY became the east coast center for mine warfare ship support. In 1961, NSY was given design support responsibilities for the Polaris submarines. Since that time, shops at NSY have been expanded to include a drydock designed to service the Fleet Ballistic Missile (FBM) submarines and other nuclear-powered ships.

Today, NSY is a highly industrialized installation providing logistical support and performing work in conversion, overhaul, repair, alteration, dry docking and outfitting of ships, submarines and service crafts. The shipyard is responsible for the maintenance of shore facilities and for the operation and maintenance of all utility systems on the Charleston Naval Base Complex. The NSY has a current work force of approximately 8,500 civilian and 60 military personnel.



SCALE AS SHOWN	CHARLESTON NAVAL SHIPYARD, CHARLESTON, S.C.	FIGURE
DATE AUG 1987	LOCATION MAP SOURCE: REF. 1	2-1

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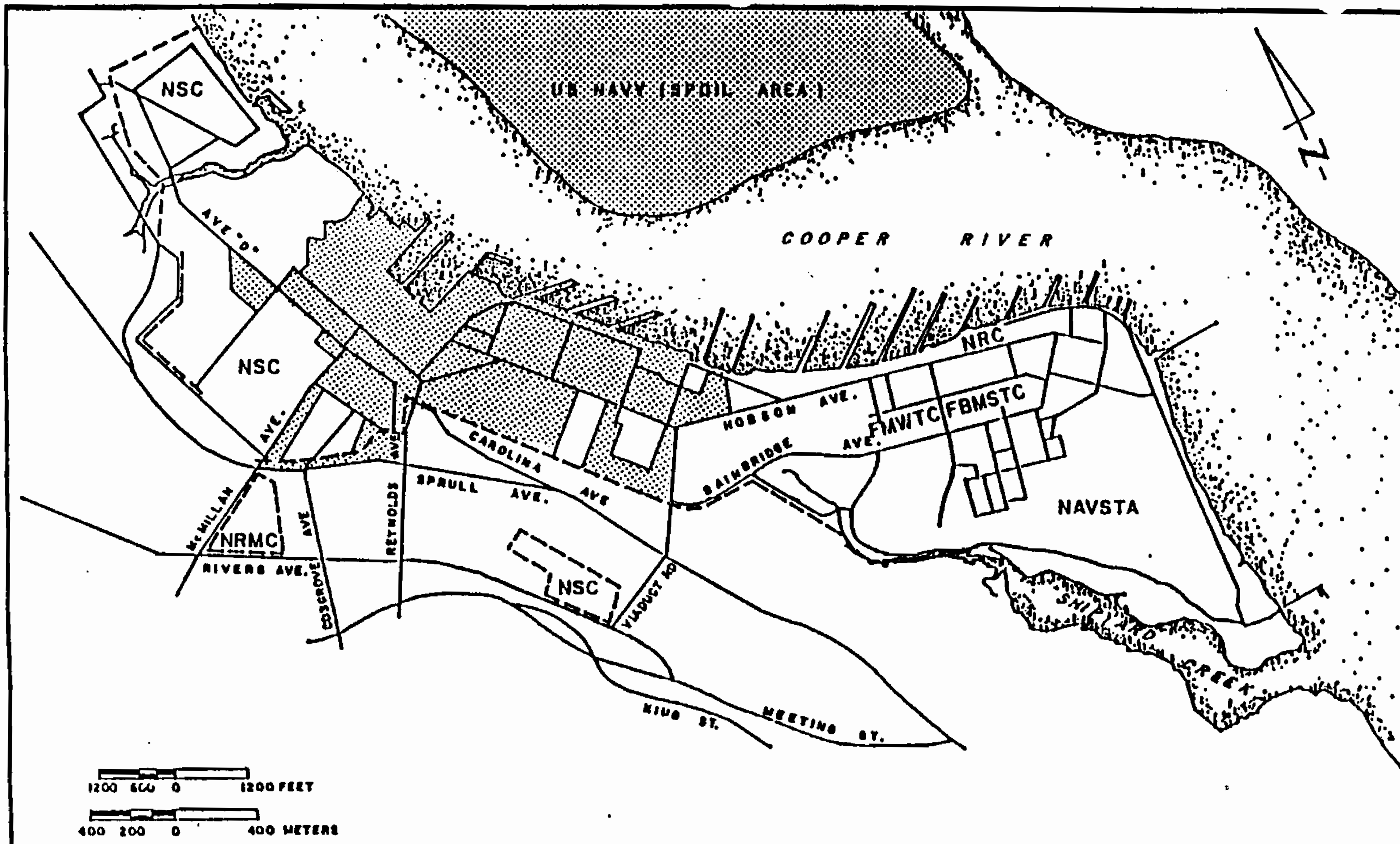


SCALE 1" = 1200'	CHARLESTON NAVAL SHIPYARD, CHARLESTON, S.C.	FIGURE
DATE AUG 1987	SITE MAP SOURCE: REF. 1	2-2

C.C.JOHNSON & MALHOTRA,P.C.

2.2 REGULATORY HISTORY (REF. 1)

On June 3, 1980, the Commander of the Charleston Naval Base was assigned the NSY lead for compliance with the Navy Hazardous Material Management Program for all commands and activities of NAVBASE. Within the shipyard, the program was assigned to the Public Works Department, Environmental Protection and Energy Conservation Division. In 1983, the department submitted two studies to the South Carolina Department of Health and Environmental Control (SCDHEC). These studies are the Naval Base Charleston Initial Assessment Study (IAS) and the Naval Shipyard Confirmation Study (CS).

The IAS and the CS are part of the Navy Assessment and Control of Installation Pollutants (NACIP) Program. The Department of the Navy developed the NACIP Program to identify, assess, and control environmental contamination from past use and disposal of chemicals and other materials. The NACIP program is part of the Department of Defense (DOD) Installation Restoration Program which satisfies requirements for DOD installations under the "Superfund" Program, authorized by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. As a result of these investigations, six sites were identified as requiring remedial action, consisting mainly of superficial clean-up and decontamination.

As "lead activity for the NAVBASE", NSY holds a valid transporter permit and a Part A hazardous waste management permit. The shipyard is seeking a Hazardous Waste Storage Permit for a new hazardous wastes container storage and transfer facility. When the new facility is permitted, the NSY hazardous waste storage and transfer operations will be consolidated, and five interim status facilities currently in operation will be closed in accordance with 40 CFR 265, Subpart G standards. Closure plans for these facilities have been prepared and are currently under review by SCDHEC.

2.3 INDUSTRIAL OPERATIONS AND WASTE GENERATION

The Naval Shipyard operates 18 major industrial shops. The operations performed by the shops at NSY and the industrial wastes generated from these operations are described in the IAS Report dated May, 1983 (REF. 1). Descriptions of these operations obtained from the IAS are provided in the following sections.

2.3.1 Foundry

Metal parts used in refitting ships are cast at the Foundry. The Foundry does not produce hazardous waste, and hazardous materials are not used in the operations. There are no records of past hazardous waste generation at the Foundry.

2.3.2 Shipfitter Shop

The industrial operations performed at the Shipfitter Shop consist of cutting and machining large metal plates used in the initial steps of building or major repair work of ships. Equipment used in this shop is capable of shearing, punching, planning, cutting, and rolling metal plates one to one and one-half inches thick. No hazardous wastes are currently generated by these operations or have been generated in the past.

2.3.3 Sheetmetal Shop

The Sheetmetal Shop performs light-gauge sheetmetal fabrication and a limited amount of degreasing. No significant quantities of industrial wastes are generated here. A minimal volume of cutting oil is used in cutting sheetmetal, and most of it adheres to the sheetmetal and metal shavings. All sheetmetal waste, including metal shavings, is periodically sold to salvage contractors under the administration of Defense Reutilization Management Organization (DRMO).

2.3.4 Boiler Shop

Boilers onboard ships are repaired by Boiler Shop personnel. In the past, when boilers were relined with asbestos, hazardous wastes were generated during "rip-out" operations in which the firebrick and asbestos lining were chipped away with air hammers. A substitute material is now being used in Navy boilers, and only about 1,000 pounds of waste asbestos is generated annually by NSY. The amount removed is expected to diminish as the older boilers are replaced. Past quantities of asbestos disposed in the base sanitary landfill (see SWMU 3) were significantly greater than 1,000 pounds per year.

Boiler tubes, preserved with Cosmoline (a grease used to prevent rust) are received at the Boiler Shop. The Cosmoline is removed by a bath of kerosene, followed by another bath of hot water, trisodiumphosphate, caustic soda, and detergents. After this second bath, the tubes are steam rinsed. This operation produces approximately 800 gallons of contaminated kerosene semiannually. This material is pumped out by the Temporary Services Shop and put into the Naval System Command (NSC) waste oil reclamation system. The contents of the second bath are discharged to the sanitary sewer. Prior to the installation of the sanitary sewer, this waste was discharged to the Cooper River via the combined sewer system.

2.3.5 Welding Shop

Welding Shop personnel perform welding operations on ships assigned to NSY for repair. This facility does not generate hazardous waste, and hazardous materials are not used in its operation.

2.3.6 Electrical Shop

Electrical Shop operations include the manufacture and repair of industrial electrical equipment used in naval vessels. Electrical Shop operations which generate waste include the following:

1. Insulation of wire for motor armatures by coating it with varnish,
2. Cleaning metal components with a solvent cleaner,
3. Salvage of spent electrical batteries from naval vessels, and
4. Battery restoration and recharge.

Both the battery salvage operation and the battery restoration and recharge operation generate an acidic waste stream. The battery salvage operation consists of draining the acid electrolyte from spent batteries removed from naval vessels, rinsing the battery casings and electrodes with water, and recovering the lead electrodes. The recovered lead is sold to salvage contractors. The combined waste stream of waste acid and wastewater is collected and routed to the acid neutralization facility. This facility also receives acidic wastewater from the battery restoration and recharge operation. Small acid spills frequently occur during battery restoration and recharge, and the acid and rinsewater drain to a sump. From the sump, the acidic wastewater is pumped to the acid neutralization facility. About 200 gallons of sludge is currently generated every six months by the neutralization process and since the mid-1970s, have been hauled off base by a contractor.

2.3.7 Electronics Shop

Electronics Shop operations consist of the repair and modification of electronic equipment. The only activity in the Electronics Shop which generates industrial waste is a water curtain spray paint booth. Water is recirculated during painting but requires disposal once every three to four months because of the buildup of fugitive paint. Prior to the installation of the separate sanitary/industrial wastewater sewer system in 1972, this wastewater was discharged to the Cooper River via the combined sewer system. Since 1972, this wastewater has been discharged to the sanitary/industrial sewer system. Approximately 50 gallons of sludge, accumulated in the water curtain recirculation system, are cleaned out following drainage of the wastewater to the sewer system. Prior to 1973, the sludge was placed in a 55-gallon drum and hauled to the base sanitary landfill for disposal. Since 1973, the sludge has been drummed and hauled off base for disposal.

2.3.8 Machine Shop 31

Industrial operations performed at this shop consist of machining, anodizing and metal electroplating using cadmium, copper, chromium, lead, nickel, and silver. Anodizing processes include coating steel piping used in hydraulic equipment with phosphate and treating aluminum with alodine.

The machining operations involve lathing, cutting, grinding, drilling, and punching of large metal components. Industrial wastes generated by this shop consist of metal waste and waste oil. The waste oil originates from machining operations and from draining metal components containing oil, such as engines. The waste oil drains to an underground storage tank. The tank is periodically pumped out, and the waste oil is hauled to the NSC waste oil reclamation facility. About 1,000 gallons of waste oil are removed from the underground storage tank annually.

The only industrial waste generated by the electroplating operation is rinsewater containing fugitive toxic metals and cyanide from the electroplating baths. Prior to 1972, untreated rinsewater was discharged to the Cooper River via the combined sewer system. In late 1971 or early 1972, the rinsewater was segregated from stormwater and sanitary wastewater into two waste streams, and a pretreatment system was installed.

The current and past rates of discharge for the cyanide-bearing waste stream are unknown. However, volumes discharged are known to be less than that of the non-cyanide-bearing waste stream.

2.3.9 Machine Shop 38

The primary function of Machine Shop 38 is light machine work, including the repair of machinery such as turbines and engines.

Industrial wastes currently generated by this shop, as well as waste generation rates, are presented in Table 2-1. The source of the waste oil is a gravity oil-water separator, which receives waste oil from engines and other machinery, and oily wastewater from cleanup operations. The separator effluent is currently discharged to the sanitary sewer system, and the recovered oil is periodically pumped into a tank truck which transports it to the NSC waste oil reclamation facility. Prior to the installation of the separate sanitary/industrial wastewater sewer system in 1972, the waste oil and oily wastewater were disposed in the combined sewer system without prior oil-water separation. Since 1972, this waste stream has been discharged to the sanitary/industrial sewer system; however, the oil-water separator was not installed until sometime in the mid-1970s.

Solvents, primarily 1,1,1,-trichloroethane and freon, are used as degreasers and other types of cleaners from which wastes are generated. Potassium hydroxide solution originates in oxygen generators used on naval submarines which have been assigned to NAVBASE Charleston since 1948. Hydraulic fluids containing chlorinated organic substances are recovered during the repair of hydraulic equipment used in naval vessels. Prior to 1972, these liquid wastes were discharged to the Cooper River via the combined sewer system. When this disposal practice was discontinued, these wastes were placed in 55-gallon drums and hauled off base.

2.3.10 Pipe Shop

Operations at the Pipe Shop include the bending, cutting, and connection of pipes. Degreasing of pipes and other metal components is performed in the Pickling Shop, which is under the supervision of the Pipe Shop. No hazardous wastes are generated by Pipe Shop operations. There are no records indicating past generation of hazardous waste by the Pipe Shop.

TABLE 2-1

POTENTIALLY HAZARDOUS WASTE GENERATION RATES
MACHINE SHOP 38

Waste	Generation Rate (gal/yr)
Waste oil	500
Solvents (primarily 1,1,1-trichloroethane and freon)	200
Potassium hydroxide solution	40
Hydraulic fluid	15

Source: REF. 1.

2.3.11 Pickling Shop

Current operations at the Pickling Shop include degreasing with a "dry cleaning fluid" (Stoddard solvent), hydrochloric acid bath, iridite bath, nitric acid bath, paint stripper bath, bright dip (sodium dichromate), sulfuric acid bath, trisodium phosphate bath, and deoxyisoprep bath. The tanks used for these baths range in size from approximately 1,500 gallons to 2,400 gallons. The baths are changed every three to six months, depending on the amount of use, and the spent pickling baths are hauled off base by a contractor. The quantities of waste currently generated in the Pickling Shop on an annual basis are: spent pickling acids and other corrosives (1,375 gallons), bright dip (275 gallons), and trisodium phosphate (1,210 gallons). Since 1974, NSY has arranged for a private contractor to dispose of spent pickling waste. Prior to that time, the contents of spent pickling baths were discharged to the Cooper River via the storm drainage system.

2.3.12 Central Tool Shop

The Central Tool Shop is primarily responsible for performing the following functions:

1. Procurement and storage of lubricants and hydraulic fluids,

2. Lubrication and maintenance of shipyard machinery, and

3. Operation and maintenance of barges and railcars used to store and transport oily waste/waste oil to the NSC waste oil reclamation facility.

The only industrial wastes currently generated by the Central Tool Shop are waste oils, solvents, and hydraulic fluids. Approximately 11,000 gallons of lubricant oil are currently used on an annual basis in lubricating NSY machinery, and as much as 35 percent, or 3,800 gallons, is recovered by draining old oil from machinery. The remaining 7,200 gallons are lost as a result of volatilization and/or spillage occurring during oil changes. Recovered oil is placed in 55-gallon drums and transported to the Naval Supply Center (NSC) waste oil reclamation facility. Prior to about 1966, the waste oil was drummed and sold to private contractors for reclamation. Past generation rates of waste oil were probably similar to current rates, except during World Wars I and II when they were much higher.

The operation and maintenance of the railcars and barges used to store and transport oily waste/waste oil to the NSC waste oil reclamation facility do not generate hazardous wastes. The oily waste/waste oil stored and transported by the railcars and barges is generated in the naval vessels docked at the shipyard piers or located in the drydocks for repairs.

A past operation of the Central Tool Shop which generated hazardous waste was the repair of electrical equipment, such as transformers, containing PCB fluids. This operation was performed until about 1976. It was reported by Central Tool Shop personnel that small PCB spills were a common occurrence during these repairs. The typical cleanup procedure consisted of placing absorbent material on the spill and depositing the saturated material in trash cans. The trash can contents were then transported to the base sanitary landfill for diposal. The amount of PCB-contaminated waste disposed in this manner is unknown.

2.3.13 Paint Shop

Sandblasting and painting of ships assigned to the NSY and ship components are performed by Paint Shop personnel. Two metallic paints are used regularly in the Paint Shop: a lead-based primer and a copper-containing bottom paint. A total of 3,000 gallons of paint is used each month. No records exist indicating past or present application of organo-tin paints at NSY. However, sandblasting operations at NSY have reportedly removed organo-tin paints applied to ship hulls at other locations. Thus, although organo-tin paints have not been applied at the NSY, sandblasting grit containing organo-tin paints has been generated at the NSY.

About 226 tons of paint wastes and solvents are currently generated on an annual basis and stored on a concrete pad adjacent to the Cooper River. Since the late 1960s, a private contractor has been hired to dispose of all paint wastes, including paints, solvents, and paint sludge. Prior to the use of a disposal contractor, painting wastes were disposed in the base sanitary landfill.

Two water curtain spray booths are operated in the Paint Shop. When the water curtain is cleaned, the paint sludge (approximately 1,000 pounds) from the booth is collected and disposed by private contractor, and the water is discharged to the sanitary sewer. Prior to the 1960s, the paint sludge was disposed in the base sanitary landfill, and the wastewater was discharged to the Cooper River prior to the installation of the sanitary sewer.

Waste from sandblasting operations has been subjected to the Extraction Procedure (EP) Toxicity Test and found to be nonhazardous. Waste sandblasting materials are disposed offsite. Prior to 1974, waste sandblasting materials were disposed in the base sanitary landfill.

2.3.14 Woodwork Shop

The Woodwork Shop performs all wood cutting, planing, finishing, and fabrication required to maintain, modify, and/or manufacture equipment and furniture for shipyard operations and naval vessels. Past Woodwork Shop activities have included the use of a 2,500-gallon dip tank to apply a fire retardant solution to wood products. The composition of the fire retardant is unknown. Fire retardants are generally formulations of salts, the principal ones being borates, phosphates, and ammonium compounds. The application of fire retardants to wood at the Woodwork Shop did not generate any waste. Fresh fire retardant was added to the dip tank to make up for losses due to evaporation and absorption into the treated wood. The application of fire retardants to wood was discontinued in February, 1981 when the practice of purchasing wood already treated with fire retardant began.

2.3.15 Supervisor of Shipbuilding Conversion and Repair (SUPSHIP)

SUPSHIP was established in June, 1950. The procurement and monitoring of contracted services for shipbuilding conversion and repairs are the sole functions of SUPSHIP personnel. No repair or production services are performed by SUPSHIP itself. Since the early 1970s, the principal contractors procured by SUPSHIP have been Metal Trades, Inc., Braswell Shipyards, and Sandblasting, Inc., all of which have facilities onbase. Records indicate that Metal Trades, Inc., and Sandblasters, Inc. were established onbase after 1975. The quantities of wastes generated by these contractors are unknown.

2.3.16 Temporary Services Shop

The Temporary Services Shop was established in 1950. The duties of Temporary Services include draining and cleaning of shipboard tanks, draining of chemical tankage, and wet layup of boilers on NAVBASE Charleston. Approximately 40,000 gallons of flushing solutions are currently generated annually by the Temporary Services Shop.

Shipboard tanks are treated in accordance with prescribed Navy methods, which vary depending on the intended use of the tank. Chemicals used to treat the various tanks are caustic soda, sulfamic acid, trisodium phosphate, nonionic detergent, and calcium and sodium hypochlorite. When these materials are removed from the treated tank, they are disposed by private contractor. Since February 1981, NSY has directed the disposal of spent tank-treatment chemicals. Prior to that time, the NSY Quality Control Laboratory directed the neutralization of these materials. After neutralization, the materials were discharged to the storm sewer, which emptied into the Cooper River.

Since February, 1981, all tank-treatment chemicals, except chlorinated water, have been hauled off base by an EPA-approved contractor. Chlorinated water, used to treat potable water holding tanks onboard ship, is stored and periodically diluted and discharged to the sanitary sewer.

Wet layup of the ship boilers require the use of chemicals such as hydrazine and morpholine. These chemicals, used as corrosion inhibitors and antioxidants while the boilers are not in use, are received and pumped out by Temporary Service Shop personnel. Hydrazine is listed as a hazardous waste under EPA hazardous waste regulations. Prior to February, 1981, wastes containing hydrazine were discharged to the Cooper River; since that time, however, wastes from boiler layup have been hauled off base by a contractor. Estimates of the volume of boiler layup water generated were not available.

Tanks involved in other operations, such as the boiler tube degreasing bath in the Boiler Shop and the oil-water separator in the Central Tool Shop, are also pumped out by Temporary Services Shop personnel. Waste oils are taken to the NSC waste oil reclamation system. This method of waste oil recovery has been used since the establishment of the Temporary Services Shop in 1950.

2.3.17 Public Works Naval Shipyard

Public Works has been located at NAVBASE Charleston since the founding of the Naval Yard in 1901. Public Works personnel provide services to NSY and, in some cases, to NAVBASE Charleston as a whole. Services include utilities, large equipment maintenance, pest control, and environmental management.

Public Works areas where hazardous wastes currently are generated include vehicle maintenance, building maintenance, and pest control. Wastes generated in the vehicle maintenance areas are cleaning solvents and waste oil. Cleaning solvents are disposed by a contractor. Waste oils are recycled through the NSC waste oil reclamation facility. The building maintenance group generates paint waste, which is disposed by a contractor along with waste from the Paint Shop (Building 223).

The environmental section of Public Works is responsible for all supervision of NAVBASE Charleston hazardous waste contracting, in addition to other duties. This group also supervises cleanup of any hazardous waste spills on NAVBASE Charleston, as well as the disposal of the spilled material.

2.3.18 Atlantic Fleet Audio Visual, Inc. (AFAV)

A tenant of NSY, AFAV provides photographic and audio visual services for the Atlantic Naval Fleet and NSY. AFAV has been in operation since 1975. Wastes generated by AFAV include waste hypo-solution, which contains silver, black fixer, and developer solution. Approximately 1,500 gallons of waste hypo-solution are generated annually, and silver recovery is provided prior to discharging this solution to the sanitary sewer. An electrolytic silver recovery process is utilized in the silver recovery unit. Cartridges containing recovered silver are reportedly sold to private contractors. In addition, approximately 72 gallons of bleach fixer and 200 gallons of developer solution are discharged to the sanitary sewer annually.

2.4 WASTEWATER TREATMENT

During the development of NAVBASE Charleston from 1901 to 1972, the sanitary, stormwater, and industrial sewer systems were established as a combined wastewater system. All industrial wastes were pretreated prior to disposal. The final discharge points for this system were several outfalls along the Cooper River. With the installation of a separate sanitary sewer system in 1972, sanitary and industrial discharges were separated from the combined system. The effluent from this separate system was discharged to North Charleston Consolidated Public Service District (NCCPSD) rather than to the Cooper River. The following sections describe the sewer systems at NAVBASE.

2.4.1 Sanitary Sewer System

A number of changes to the sanitary sewer system have occurred since its installation. In 1974 and 1976, repairs and alterations included the connection of existing buildings to the sanitary system and the installation of oil-water separators and acid neutralization facilities to pretreat industrial wastewater prior to discharge to the sanitary sewer system.

In 1975, sanitary sewer connections were installed on the piers for use by docked ships. Improvements to this system were made in 1978. Some ships were not capable of using the dock system because their onboard sanitary system was not compatible with the dock system. Modifications to the collection system and to the ships using the system have remedied this condition. Some overboard discharge of sanitary wastewater by docked ships occurred until April 1981, when Federal law prohibited such discharges.

NCCPSD required quarterly monitoring reportedly shows that effluent from NAVBASE Charleston is in compliance with NCCPSD requirements.

2.4.2 Stormwater Drainage

No single collection system exists for the disposal of stormwater runoff. Numerous local systems of inlets and pipes carry runoff by gravity to the nearest natural drainage channels or waterways. The northern NSC area has eight outfalls to the Cooper River and two to Noisette Creek. The developed portion in the center of NAVBASE Charleston is drained to the Cooper River through a variety of piping and area drainage. Stormwater discharges are permitted under NPDES permit SC 0003816.

2.4.3 Industrial Wastewater

As discussed earlier in this section, prior to 1972 a combined wastewater collection system conveyed all wastewaters generated at NAVBASE Charleston to the Cooper River. Limited industrial wastewater pretreatment was practiced prior to this date. Since 1972, industrial wastewater treatment and disposal have consisted of pretreatment and discharge to the sanitary sewer system, which conveys industrial and sanitary wastewaters to the NCCPSD. Several direct operations, such as vehicle maintenance and cleaning and blowdown from the space heating boiler, are permitted to discharge to the Cooper River under NPDES permit No. SC 0003816.

Pretreatment methods include gravity oil-water separation, acid neutralization for metals removal. Many of the oil-water separators were installed in 1974 and 1976 during alterations made to the sanitary sewer system because of oil contamination problems at the municipal treatment plant. Twelve oil-water separators are currently used in areas where the industrial operations may introduce petroleum products to the sanitary sewers. Each oil-water separator has a holding tank for the oily fraction. This tank is pumped out periodically on an "as needed" basis and the waste oil is transported to the NSC waste oil reclamation facility.

In addition to these pretreatment systems, industrial wastewater treatment systems also exist for the battery salvage and restoration and recharge operations and for the metal plating operation as described below.

2.4.3.1 Battery Waste Treatment

As discussed in Section 2.3.6, acidic wastewater generated by the battery salvage and restoration and recharge operations is collected and neutralized prior to being discharged to the sanitary sewer. The acid neutralization facility consists of a concrete underground tank with two compartments. The first compartment serves as a holding and mixing tank. Acidic wastewater from the battery salvage operation drains by gravity to the first compartment, and wastewater from the battery restoration and recharge operation is pumped to the first compartment from a sump. When a sufficient volume of wastewater collects in the first compartment, the mechnical agitator is activated, and soda ash is added to adjust the pH to approximately 6.5. Following pH adjustment, the wastewater is transferred to the second compartment, which serves as a settling tank. The suspended material in the wastewater is allowed to settle for about four hours then the clarified wastewater is discharged to the sanitary sewer. Approximately 3,000 gallons of wastewater is treated annually in the acid neutralization facility, and approximately 200 gallons of sludge is removed from both compartments of the facility about once every 6 months. The sludge is hauled off base by an EPA-approved contractor.

2.4.3.2 Metal Plating Waste Treatment

As discussed in Section 2.3.8, non-cyanide-bearing rinsewater from the electroplating operation is collected and treated for metals removal prior to being discharged to the sanitary sewer. Cyanide-bearing rinsewater is also collected; however, no pretreatment is provided for this waste stream prior to being discharged to the sanitary sewer. Figure 2-3 presents a sketch of the metal plating waste treatment facility. This facility began operation about 1983 and replaced an existing system which operated prior to 1983. The old metal plating waste treatment facility is in the process of being closed out.

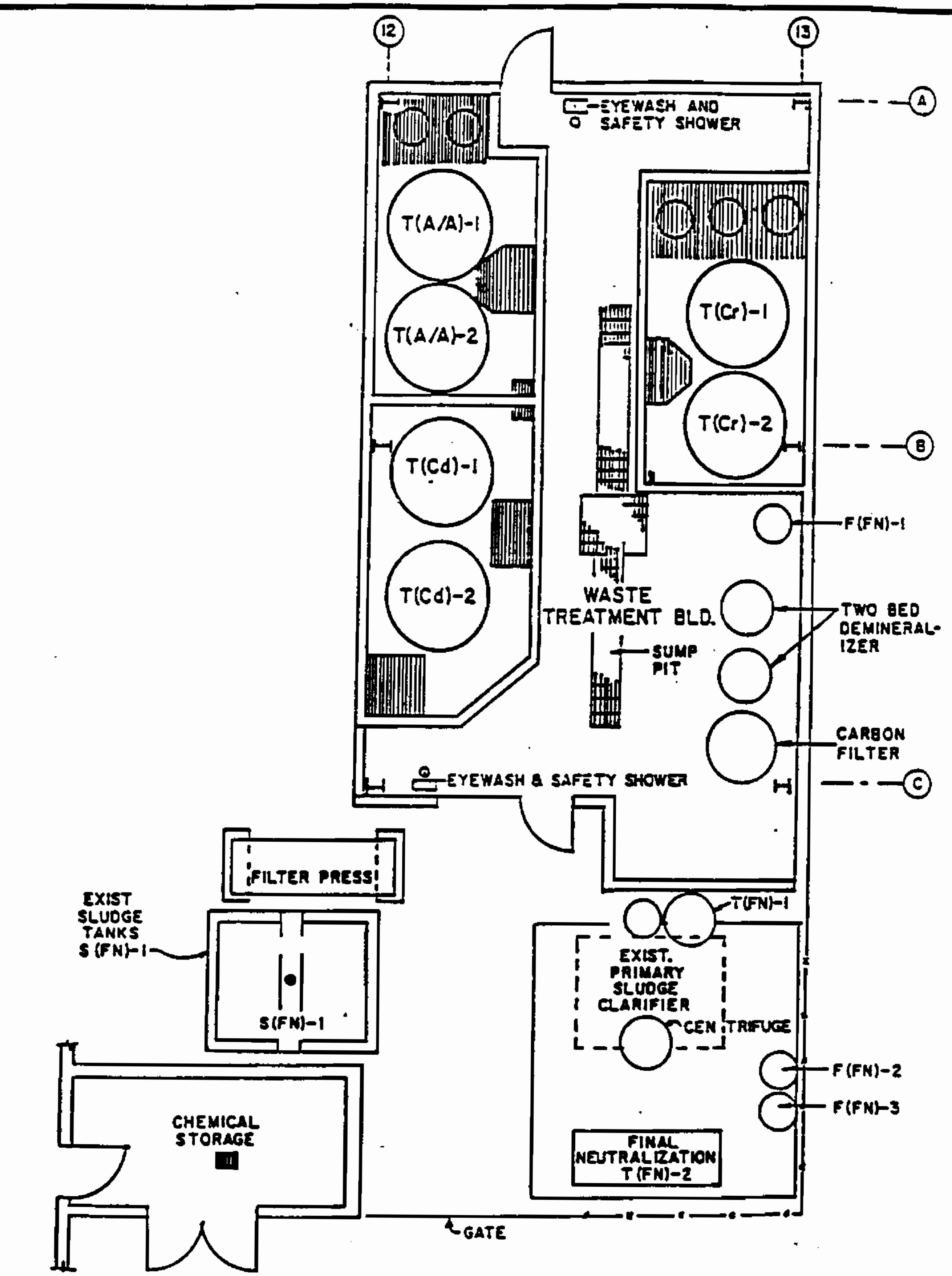
Rinse water from the chrome effluent, the acid/alkali effluent from metal plating, and the cadmium effluent are routed to separate sumps. These wastewaters are lifted from their respective sumps to two chrome effluent holding tanks (1,000 gallons each), two acid/alkali holding tanks (1,500 gallons each) and two cadmium effluent holding tanks (1,000 gallons each) respectively.

Associated with each set of batch holding tanks are chemical feed stations. These are chemical reagent containing tanks from which are dispensed, by way of metering pumps, the required quantity of chemicals to cause the chemical reactions which precipitate the potentially contaminating metal ions out of solution.

Wastewater in the chrome holding tanks is treated with sulfuric acid, sodium metabisulfite and sodium hydroxide. The acid/alkali waste is treated with sulfuric acid and sodium hydroxide while wastewater in the chrome holding tanks is treated with potassium hydroxide.

Associated transfer pumps from each set of holding tanks transfer the reacted contents of the bath holding tanks to the clarification section of the waste treatment building. The cadmium waste stream is first pH adjusted to 11, filtered to remove cadmium hydroxide and directed to the clarifier. The chromium and acid/alkali holding tanks wastes are transferred directly to the clarifier.

All treated effluents are directed from the clarifier to the holding tank S(FN)-1. The sludge from tank S(FN)-1 is pumped to a plate and frame filter press for dewatering. The filtrate issuing from the filter press and the clarified wastewater from tank S(FN)-1 are directed to the final neutralization tank T(FN)-2 for pH adjustment before being discharged to the sewer system.



SCALE NO SCALE	CHARLESTON NAVAL SHIPYARD METAL PLATING WASTE TREATMENT SYSTEM SOURCE: REF. 2	FIGURE 2-3
DATE AUG 1987		

TCA 301-885-7

3.0 ENVIRONMENTAL SETTING AND TARGET POPULATIONS

3.1 REGIONAL GEOLOGY

3.1.1 Physiography

Charleston Naval Shipyard is located in the lower South Carolina Coastal Plain Physiographic Province on the Cooper River side of the Charleston Peninsula, which is formed by the confluence of the Cooper and Ashley Rivers.

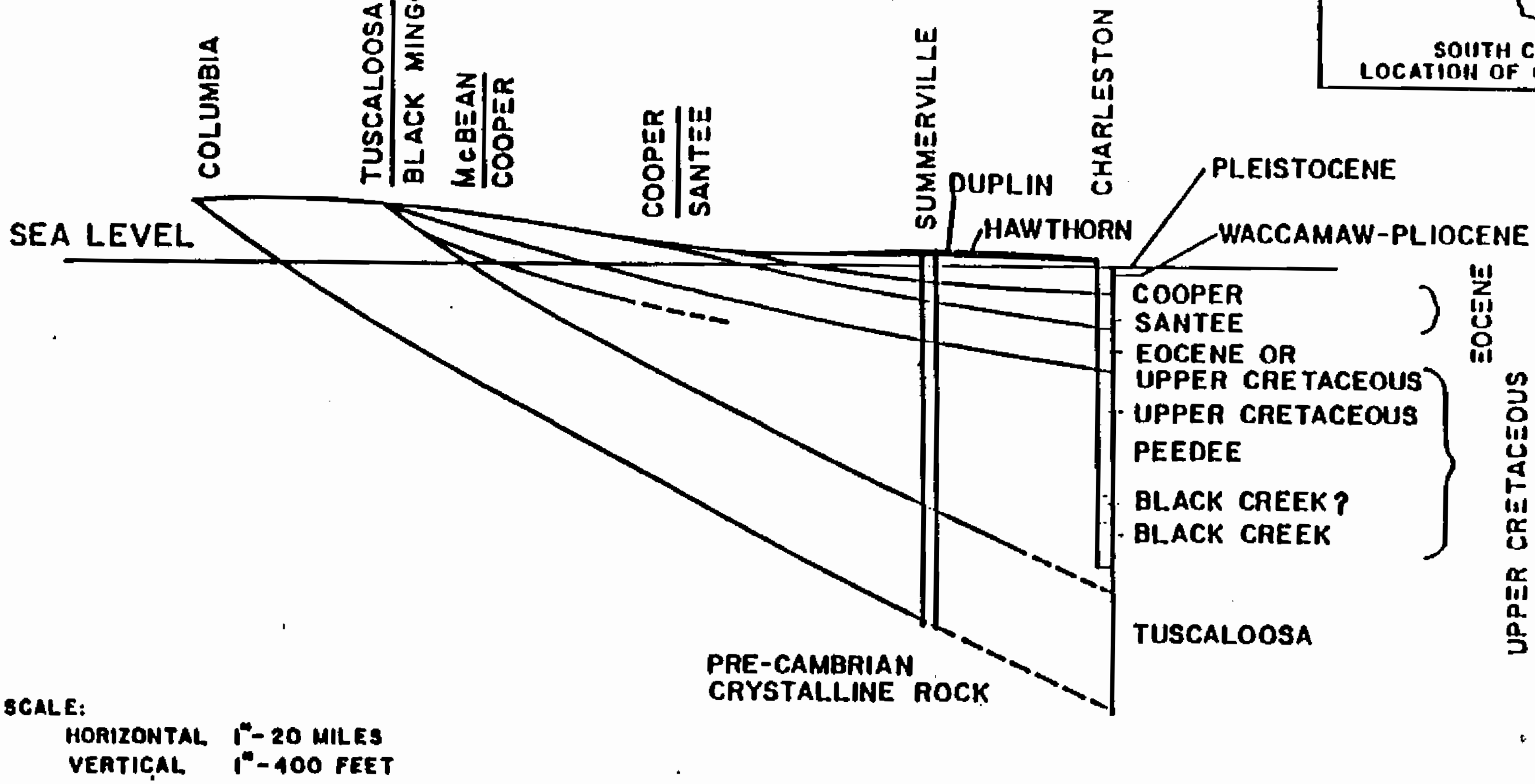
The topography of NAVBASE Charleston is typical of South Carolina's Lower Coastal Plain, with low relief plains broken only by the meandering courses of the many sluggish streams and rivers flowing toward the coast, and by an occasional marine terrace escarpment. Topography at NAVBASE Charleston is essentially flat, with elevations ranging from just over 20 feet mean sea level (msl) in the northwestern part of the base to sea level at the Cooper River. Much of the original topography of NAVBASE Charleston has been modified by man's activities. The southern end of the base originally was a tidal marsh drained by Shipyard Creek and its tributaries. Over the last 70 years, this area has been filled with both solid wastes and dredged spoil. Most of the base is within the 100-year flood zone.

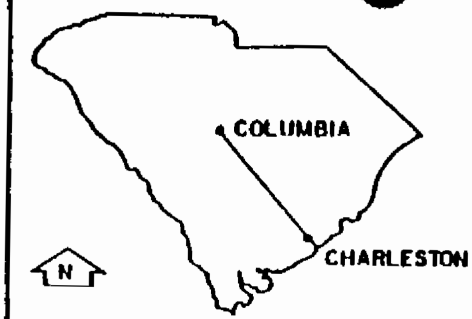
3.1.2 Stratigraphy and Structure

The geology of the Charleston area is typical of the southern part of the Atlantic Coastal Plain. A seaward-thickening wedge of Cretaceous and younger sediments is underlain by older igneous and metamorphic basement rock (see Figure 3-1).

The sedimentary formations of the Coastal Plain consist of Upper Cretaceous, Tertiary, and Pleistocene sediments that strike in a general northeast-southwest direction and dip from 12 to 30 feet per mile in a south-southeasterly direction. Table 3-1 shows the stratigraphic column of these geologic formations.

The uppermost surficial deposits in the Charleston area are composed of interbedded sand, shells, silt, and clay that are approximately 15 to 80 feet thick. The surficial deposits are underlain by the Cooper Marl Formation, which is composed primarily of calcareous clay. The Cooper Marl is underlain by the Santee Limestone Formation which is composed of poorly indurated, fossiliferous limestone. The Santee Limestone outcrops approximately 40 miles to the northwest of the NSY at Lake Marion in Orangeburg County and in southeastern Calhoun County (REF. 4).





SCALE AS SHOWN	CHARLESTON NAVAL SHIPYARD	FIGURE 3-1
DATE AUG 1987	EAST-WEST GEOLOGIC CROSS SECTION FROM THE COAST INLAND THROUGH CHARLESTON, S.C. SOURCE: REF. 1	

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TABLE 3-1

GEOLOGIC UNITS OF THE COASTAL PLAIN OF SOUTH CAROLINA

SYSTEMS	SERIES	FORMATION	THICKNESS (FEET)	CHARACTER OF MATERIAL
Quatenary	Pleistocene	Pamlico	25	Reddish-brown, orange, gray, and and white sands and clays.
		Talbot	17	
		Penholoway	28	
		Wicomico	30	
		Sunderland	70	
		Coharie	45	
		Brandywine	55	
Tertiary	Pliocene	Waccamaw	1-58	Soft limestone and loose gray to buff fine quartz sands.
	Miocene	Duplin marl	0-41	Buff granular, friable, sandy marl with numerous shells.
		Hawthorn	30-160	Limestone, marl, shale, Fuller's earth.
	Oligocene	Flint River	50	Yellow to reddish-brown sand and silicified limestone.
	Eocene	Cooper marl	1-175	Grayish-green plastic marl.
		Barnwell sand	100-200	Fine to coarse pebbly reddish sand.
		Santee lime-stone	1-230	Light-colored lime-stone and marls.
		McBean	0 to 225 (700?)	Laminated green and red clays, glau-conitic marls and sand.
		Black Mingo	1-125	Dark brittle clays or shales interbedded with red and brown sands.

TABLE 3-1 (Continued)

GEOLOGIC UNITS OF THE COASTAL PLAIN OF SOUTH CAROLINA

SYSTEMS	SERIES	FORMATION	THICKNESS (FEET)	CHARACTER OF MATERIAL
Cretaecous	Upper Cretaceous	Peedee	1-810	Dark gray sandy marl, argillaceous, micaceous sands, and limestone layers.
		Black Creek	1-570	Very dark gray shaly clays with inter-laminated thin, mica-ceous, fine-grained sands.
		Tuscaloosa	1-784	Light-gray, tan, red, and purple cross-bedded sands, clays, and kaolin.

Source: REF.7

The Charleston area has a history of seismic activity, dominated by the Great Charleston Earthquake of 1886. Approximately four hundred earthquakes have been recorded in the Charleston area during the period of 1754-1970.

3.2 REGIONAL HYDROLOGY (REF. 1)

3.2.1 Surface Water

The County of Charleston lies within the Cooper River basin of South Carolina. The Cooper River Basin comprises 722 square miles of Coastal Plain in South Carolina. The Cooper River has its origin at the confluence of its east and west branches, from which it flows 31 miles southward to its outlet in Charleston Harbor. Lake Moultrie in the upper part of the Cooper River Basin, approximately 40 miles upstream of NAVBASE Charleston, was constructed by the South Carolina Public Service Charleston Naval Base Authority in 1942 as part of the Santee-Cooper Project. This lake intercepts drainage from about 300 square miles of the Cooper River Basin and accepts overflows from Lake Marion, located in the Santee River Basin.

Prior to the completion of the Santee-Cooper Project by the State of South Carolina in 1942, Charleston Harbor was considered one of the finest natural harbors on the Atlantic Coast, with depths in many areas exceeding 65 feet. Following completion of the project, the average discharge into the Cooper River increased by a factor of greater than 200, from approximately 530 to 125,000 gallons per second. This resulted in shoaling and silt accumulation in the lower reaches of the Cooper River and in Charleston Harbor. As a result, annual maintenance dredging requirements increased from less than 500,000 cubic yards per day to more than 1 million cubic yards per day. Because of this shoaling problem, the Charleston Harbor estuary has been subject for many years to water quality changes associated with dredging operations. Most of the material creating these shoals is of Piedmont origin, and only a small amount can be attributed to bank erosion. The increased freshwater flow has resulted in the formation of density currents in the harbor which have a predominant upstream bottom flow and, consequently, trap sediment within the harbor (REF. 1).

3.2.2 Groundwater (REF. 7 and 1)

The relatively permeable rocks and the artesian conditions which exist in more than two-thirds of the Coastal Plain result in an abundant source of groundwater in the province. The Tuscaloosa, Black Creek, Peedee, and Ocala (equivalent of the Santee-Cooper unit) formations are the source of water for most of the drilled wells in the Coastal Plain. Although both the Cooper Marl and the Santee limestone function as aquifers in other areas, neither is significantly developed in the Charleston area.

In the Charleston area, the Cooper Marl is rather impermeable and acts as the upper confining bed for the Santee formation. The Santee is not as permeable in the Charleston area as in other areas of the province and is a confined aquifer. Groundwater in the Santee, which occurs at about -328 feet MSL in the Charleston area flows generally to the southeast. Some wells in the vicinity of NAVBASE Charleston are pumping from the Santee for industrial purposes. In July 1981, the water level of a well in the Santee under NAVBASE Charleston measured 15 feet MSL, indicating that the gradient across the confining bed, the Cooper Marl, is artesian. That is, water from the Santee moves upward through the Cooper to discharge into the incised river valleys (REF. 1).

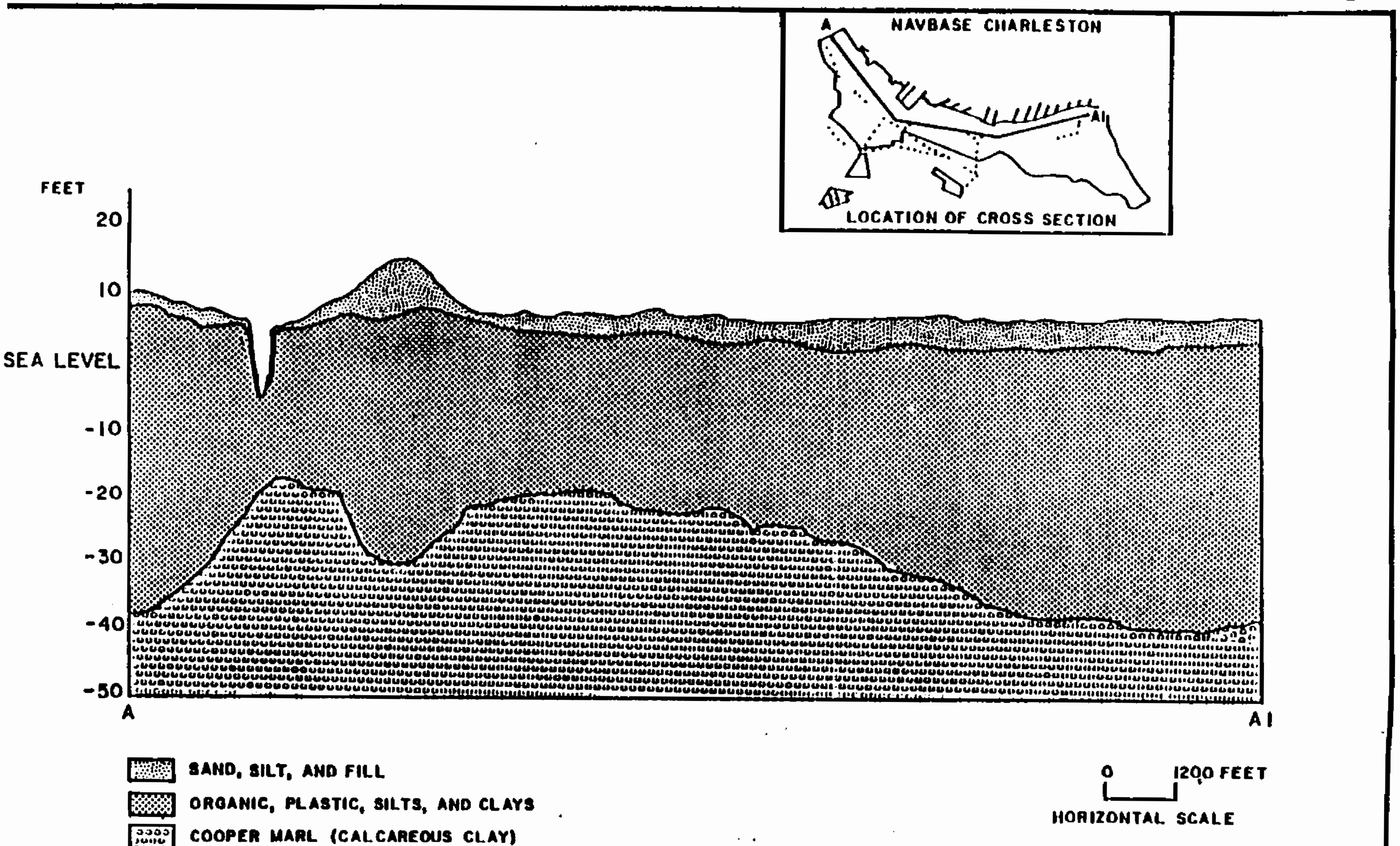
3.3 LOCAL GEOLOGY AND HYDROLOGY (REF. 1)

3.3.1 Geology

At NAVBASE Charleston, Recent and/or Pleistocene sands silts, and clays of high organic content are exposed at the surface. These materials are underlain by a 200 foot thick plastic calcareous clay known as the Cooper Marl. The Cooper Marl is underlain by the Santee Limestone and older rocks. Figure 3-2 shows a generalized north-south cross section along the approximate center of the base. As shown, the installation is underlain by several feet of sands, silts, and fill which are underlain by silts, clays, and the Cooper Marl.

During the Confirmation Study, 132 shallow borings were drilled and 29 monitoring wells were installed. The locations of these wells are shown on Figure 3-3. Appendix B presents the lithologic descriptions of soil samples. Based on the logs of these borings, the surficial deposits are composed of fine-grained sand, silt, and clay. Sand lenses are present in localized areas; however, these are generally only several feet thick. Much of the material, particularly in the southern portion, represents material dredged from Cooper River and Shipyard Creek (REF. 8).

In monitoring well DLF-1, which was drilled to a depth of 62 ft, the top of the Cooper Marl was found at a depth of 45 ft. The sediments between 45 and 62 ft consisted of a hard, calcareous, slightly sandy clay. In order to estimate the permeability of this calcareous clay,



SCALE AS SHOWN	CHARLESTON NAVAL SHIPYARD	FIGURE
DATE AUG 1987	GENERALIZED GEOLOGIC CROSS SECTION THROUGH NAVBASE CHARLESTON SOURCE: REF. 1	3-2

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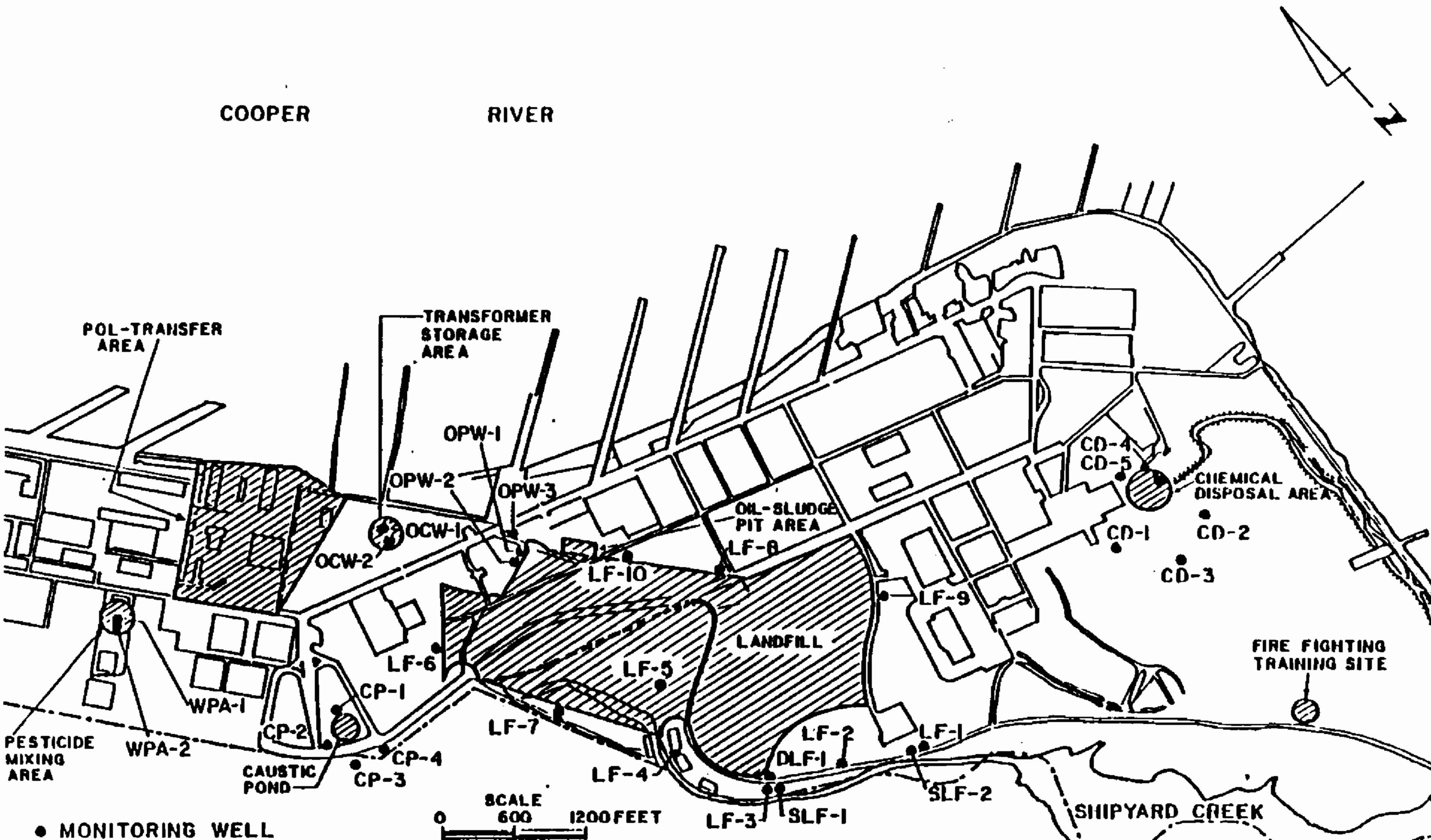

SCALE AS SHOWN	CHARLESTON NAVAL SHIPYARD	FIGURE
DATE AUG 1987	LOCATION OF MONITORING WELLS SOURCE: REF. 8	3-3

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consolidation tests were performed on two undisturbed samples. From the results of these tests, the permeabilities of these samples were calculated to be 1.3 x 10 and 3.2 x 10 centimeters per second (REF. 8).

The soils at NAVBASE Charleston are generally fine-grained and only slightly permeable. This type of soil, combined with the basically level topography, causes drainage problems at the base. The permeability of the organically rich clays underlying the surface soils is also rather low. These highly organic clays, which range in thickness from 15 feet to 50 feet, are very soft, have extremely high water contents, and cause foundation problems (REF. 1).

3.3.2 Hydrology (REF. 1)

3.3.2.1 Surface Water

The NAVBASE Charleston is located on the eastern edge of a low, narrow finger of land separating the Ashley and Cooper Rivers. The southern portion of NAVBASE Charleston is drained by Shipyard Creek and the northern portion by Noisette Creek. Both creeks drain into the Cooper River. Surface drainage in the NSY area is directly into the Cooper River, which empties into Charleston Harbor.

Shipyard Creek is a small tidal tributary, about two miles in length, extending along the southwest boundary of NAVBASE Charleston to the Cooper River, at a point opposite the southern tip of Daniel Island. Docking facilities are located along the west shore of the lower mile of channel, while the east shore is bounded by tidal marshland along its entire length.

Noisette Creek, which transects the northern portion of NAVBASE Charleston, is a tidal tributary approximately two and one-half miles long. The creek flows almost directly eastward from its headwaters in the City of North Charleston and empties into the Cooper River.

3.3.2.2 Groundwater

Water levels were measured in the monitoring wells installed during the Confirmation Study conducted at NAVBASE (see Section 3.3.1). These levels were referenced to mean low water by a topographic survey. The groundwater levels that were measured on July 28, 1981, and February 10, 1982, are shown in Table 3-2. On February 10, the highest water level recorded, 11.75 ft mlw (mean low

TABLE 3-2

GROUNDWATER ELEVATIONS AT NAVBASE
JULY 28, 1981, AND FEBRUARY 10, 1982(1)

Well No. and Location	Ground Surface Elevation (ft)	Measuring Point Elevation (ft)	Elevation of Water Table 7/28/81 (ft)	Elevation of Water Table 2/10/82 (ft)
Chemical-Disposal Area				
CD-1	14.7	18.22	9.24	11.75
CD-2	14.0	17.55	8.93	10.25
CD-3	13.0	16.45	9.49	10.66
CD-4	12.8	16.25	7.08	8.91
CD-5	12.1	15.63	8.47	10.39
Caustic-Pond Area				
CP-1	11.61	14.06	5.81	6.41
CP-2	11.63	14.95	6.81	7.65
CP-3	9.84	12.74	7.39	-
CP-4	8.74	11.39	7.64	7.90
Electrical Transformer Storage Area				
WOC-1	9.46	12.13	-	6.31
WOC-2	9.31	12.32	-	6.80
Landfill Area				
LF-1	6.4	8.88	8.22	8.17
LF-2	6.9	9.42	5.89	5.71
LF-3	8.9	11.35	4.39	5.33

TABLE 3-2 (Continued)

GROUNDWATER ELEVATIONS AT NAVBASE
JULY 28, 1981, AND FEBRUARY 10, 1982(1)

LF-4	8.7	11.22	5.61	5.56
LF-5	10.7	12.66	9.36	10.95
LF-6	7.91	10.92	-	7.06
LF-7	16.44	19.49	-	10.21
LF-8	9.05	11.44	-	8.58
LF-9	12.55	15.75	-	11.20
LF-10	8.21	10.54	-	6.77
SLF-1	8.69	11.19	6.01	5.51
SLF-2	6.50	9.00	5.62	5.48
DLF-1	9.17	11.67	6.98	5.69
Pesticide-Mixing Area				
WPA-1	15.22	17.81	-	9.85
WPA-2	15.22	16.98	-	10.00

1) Referenced to mean low water (mlw).

Source: REF. 8

water), was in well CD-1 near the chemical disposal area, and the lowest recorded, 5.33 ft mlw, was in well LF-3, next to Shipyard Creek downgradient of the landfill. The horizontal hydraulic gradient is very low at the site and, as expected, groundwater in the water table aquifer is moving laterally from the central portions of the shipyard toward the Cooper River and Shipyard Creek. The water table is generally within three to seven feet of the ground surface.

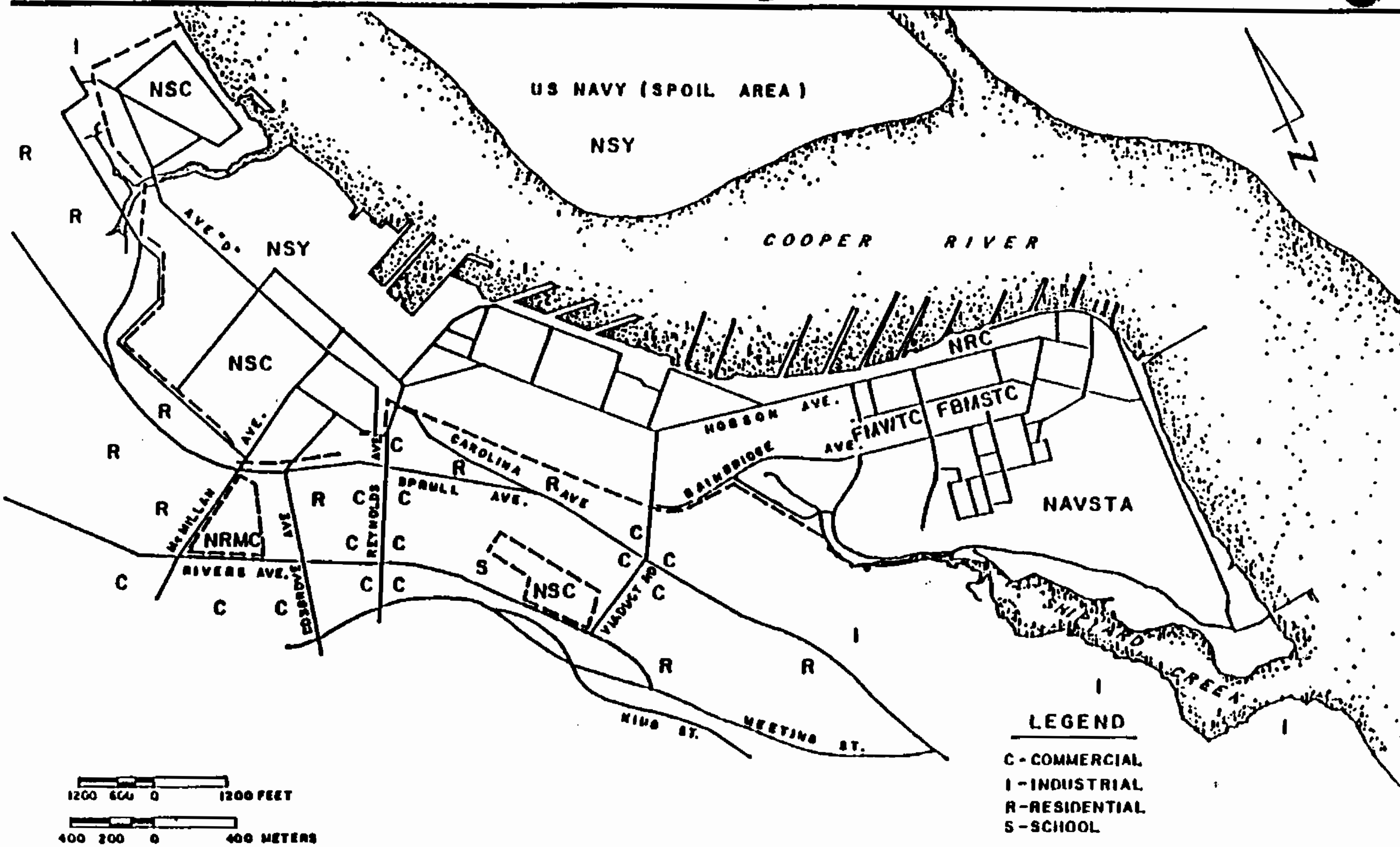
Several wells were installed at different depths to determine the vertical head relationships. The data collected from wells SLF-1, LF-3, and DLF-1 as concluded by Geraghty & Miller, Inc. indicate that, overall, an upward hydraulic gradient exists at the site between the top of the Cooper Marl and the base of the surficial deposits. This suggests that there is little or no potential for downward movement of groundwater from the surficial deposits into the Santee Limestone. The hydraulic relationship could be reversed if pumping of groundwater from the Santee Limestone resulted in a significant lowering of the potentiometric surface of the Santee Limestone at the NSY (REF. 8).

3.4 LAND USE IN THE VICINITY OF THE FACILITY (REF. 1)

As illustrated by Figure 3-4, the areas surrounding NAVBASE Charleston are highly developed and characterized by commercial, industrial, residential, and school land uses. Commercial areas are located primarily west of NAVBASE Charleston; industrial areas lie to the north and along the west bank of Shipyard Creek.

The western bank of Shipyard Creek is now, and has been for many years, an area of high industrial concentration. Maps dating from early 1900s show the presence of railways in this area, a feature, when combined with nearby waterways, makes the area ideal for heavy industry. Although ownership changes from time to time, the land adjacent to NAVBASE remains under the control of chemical, fertilizer, oil refining, metallurgical, and lumber operations.

The eastern bank of the Ashley River is also dotted with industries. The east bank of the Cooper River is undeveloped and contains extensive wetlands along Clouter Creek and Thomas Island. Active dredge spoil disposal areas are located on U.S. Naval Reservation property between the Cooper River and Clouter Creek, offsite on the southern portion of Daniel Island, and on Drum Island (REF. 1).



SCALE 1" = 1200'	CHARLESTON NAVAL SHIPYARD, CHARLESTON, S.C.	FIGURE
DATE AUG 1987	LAND USE/ZONING IN THE VICINITY OF NAVBASE CHARLESTON SOURCE: REF. I	3-4

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3.5 ENVIRONMENTAL MONITORING

Based on the findings of an Initial Assessment Study conducted at NAVBASE, a Confirmation Study was performed to assess the potential for oil and hazardous waste contamination of soil and groundwater from abandoned oil sludge pits, a chemical disposal area, a caustic settling pond, the solid waste landfill, the old pesticide mixing area, the old fire fighting training site, the petroleum, oil, and lubricant (POL) transfer area, and the electrical transformer storage area. During the investigation, twenty-nine monitoring wells were installed (see Figure 3-3).

Analytical results for groundwater samples taken from these wells are discussed in appropriate sections in Chapter 4. Additionally, twenty-six soil samples were collected for chemical analyses. Analytical results from these analyses are also discussed in appropriate sections in Chapter 4 of this report.

3.6 TARGET POPULATIONS AND DRINKING WATER SOURCES (REF. 1)

All the shallow groundwater at the NSY eventually discharges to the Cooper River either directly or indirectly via its tributaries. Contaminants, if present, in the shallow groundwater system would eventually discharge to the Cooper River if not attenuated by subsurface soils. However, the flow rate in the shallow system is expected to be rather slow due to the fine-grained nature of the sediments and the low gradient. Some contaminants, particularly metals, are likely to be attenuated by adsorption onto clay minerals. Furthermore, no potable use is made of the shallow groundwater downgradient of the NSY, since the Cooper River and Shipyard Creek are the base boundaries and also the downgradient boundaries of the shallow groundwater system. It is possible that residential wells in the shallow aquifer exist upgradient of the NSY Charleston. However, these wells are not threatened by contaminant migration from the NSY, since they are upgradient and reversal of the natural gradient by pumpage from any shallow residential wells would be extremely unlikely. The shallow groundwater system is not used for potable supply at the NSY.

Potential contaminants emanating from SWMUs at NSY and entering the shallow groundwater system do not threaten the health of NSY personnel, since the shallow system is not developed for potable use at NAVBASE Charleston. Likewise, contaminant migration via the shallow groundwater system does not threaten human health off the installation, since shallow groundwater flow is intercepted by surface waters at the installation boundaries and since the shallow system is not developed in the vicinity of the NSY. Contaminants entering the shallow groundwater system at the NSY do, however, represent a potential threat to the environment, since contaminants have the potential to migrate via the shallow groundwater system to adjacent surface waters.

Although aquatic habitats in the Cooper River, Noisette Creek, and Shipyard Creek may be threatened, human health by contaminant migration, exposure through consumption by humans would be minimal since these surface bodies are not used as potable water supplies. However, the Cooper River is used for recreational boating and other water sports. During the site visit, many boats were seen on the Cooper River in the vicinity of the NSY, and residents were observed fishing in the river. Recreational users of the Cooper River may be considered a potential target population.

The deeper aquifer (Santee Limestone) is not threatened by potential contamination in the shallow groundwater system because the Santee has a hydraulic head above its confining bed (the Cooper Marl) at the NSY (REF. 1). Consequently, water flows upward through the Cooper, thus preventing the movement of contaminants into the Santee. Furthermore, water in the Santee is not of good quality in the vicinity of the NSY and the aquifer is not significantly developed for potable water.

Pathways also exist for any surface contaminants emanating from SWMUs to migrate beyond installation boundaries via stormwater drainage. Stormwater is conveyed by natural and manmade drainage channels to the Cooper River or its tributaries. The heavily industrialized central portion of the base, which includes NSY, drains to the Cooper River. Thus, surface contaminants at the NSY have the potential to migrate off the installation into the Cooper River either directly or through its tributaries.

Vegetation and wildlife that come in contact with contaminated groundwater, surface water or soils are potential future and possible past receptors. No stressed vegetation was noted at the facility.

4.0 SWMU DESCRIPTIONS

This section describes the unit characteristics, waste chracteristics, pollutant migration pathways and evidence of release to the environment of each SWMU identified at the site. Data gaps and recommendations regarding the need for further action at each SWMU are presented in Section 5.0.

Twenty-three SWMUs were identified during the records review and visual site inspection. Additionally, one SWMU (PCB Spill Area) was subsequently reported by NSY. Table 4-1 summarizes the wastes reportedly stored, disposed or spilled at these SWMUs. Figure 4-1 shows the locations of SWMUs identified at the NSY. The units are identified on the figure as follows:

1. DRMO (formerly DPDO) Staging Area
2. Lead Contamination Area
3. Pesticide Mixing Area
4. Pesticide Storage Building
5. Battery Electrolyte Treatment Area
6. Public Works Storage Yard (Old Corral)
7. PCB Transformer Storage Area
8. Oil Sludge Pits
9. Closed Landfill
10. Hazardous Waste Storage Facility
11. Caustic Pond
12. Old Fire Fighting Training Area
13. Current Fire Fighting Training Area
14. Chemical Disposal Area
15. Incinerator
16. Paint Storage Bunker
17. Oil Spill Area
18. PCB Spill Area
19. Solid Waste Transfer Station
20. Waste Disposal Area
21. Old Paint Storage Area
22. Old Plating Shop WWTS
23. New Plating Shop WWTS
24. Waste Oil Reclamation Facility

4.1 SWMU NO. 1: DRMO (formerly DPDO) STAGING AREA (REF. 12)

4.1.1 Unit Characteristics

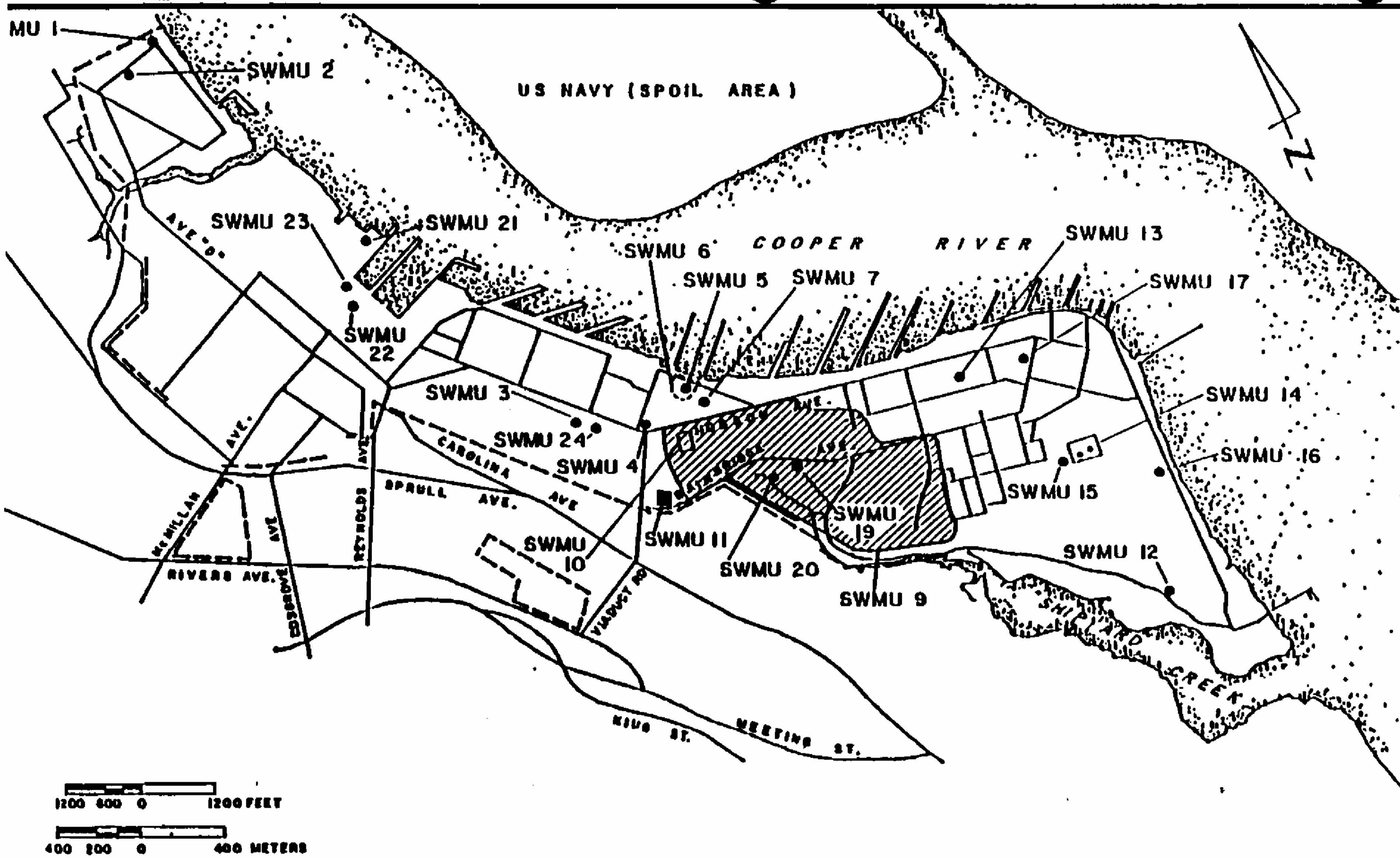
This warehouse is used by the existing Defense Reutilization Management Organization (DRMO). The DRMO conducts a large-scale operation for receiving property turned in by the Armed Forces branches within the region of

TABLE 4-1
SOLID WASTE MANAGEMENT UNITS
Charleston Naval Shipyard
Charleston, South Carolina

AREA OF CONCERN	PERIOD OF OPERATION	TYPES OF WASTES STORED, DISPOSED OR SPILLED
SWMU 1 DRMO (formerly DPDO) Staging Area	About 1974-Present	Excess government materials, chemicals including freon, used drums
SWMU 2 Lead Contamination Area	Mid-to-late-1960's to 1984	Lead
SWMU 3 Pesticide Mixing Area	Prior to 1971	Pesticide rinse
SWMU 4 Pesticide Storage Building	About 1980-1985	Miscellaneous materials
SWMU 5 Battery Electrolyte Treatment Area	About 1984-1986	Internal battery components
SWMU 6 Public Works Storage Yard (Old Corral)	Unknown-Present	Containerized hazardous wastes
SWMU 7 PCB Transformer Storage Area	About 1970-1976	Electrical equipment, including transformers
SWMU 8 Oil Sludge Pit Area	1944-1974	Oil from industrial activities
SWMU 9 Closed Landfill	1930-1973	Sanitary wastes & various inorganic & organic chemicals
SWMU 10 Hazardous Waste Storage Facility	1985-Present	Containerized hazardous wastes
SWMU 11 Caustic Pond	Early 1940s-Early 1970s	Calcium hydroxide sludge
SWMU 12 Old Fire Fighting Training Area	1966-1971	Oil, gasoline and alcohol
SWMU 13 Current Fire Fighting Training Area	About 1973-Present	No. 2 diesel oil, and gasoline

TABLE 4-1 cont.
SOLID WASTE MANAGEMENT UNITS
Charleston Naval Shipyard
Charleston, South Carolina

AREA OF CONCERN	PERIOD OF OPERATION	TYPES OF WASTES STORED, DISPOSED OR SPILLED
SWMU 14 Chemical Disposal Area	Prior to 1972-1977	Warfare decontaminating agents DANC-DS-2 & DANC-N4
SWMU 15 Incinerator	Unknown-Present	Paper
SWMU 16 Paint Storage Bunker	At least June 1987 Present	Paint, Paint Thinner
SWMU 17 Oil Spill Area	June 1987-Present	Oil
SWMU 18 PCB Spill Area	June 1987-Present	PCB
MU 19 olid Waste Transfer tation	1982-Present	Dry trash, tires, used drums
SWMU 20 Waste Disposal Area	1985-Present	Cardboard boxes, batteries, toilet utilities, wood, concrete blocks, tree stumps
SWMU 21 Old Paint Storage Area	1980-1986	Paint, Paint Thinner
SWMU 22 Old Plating Shop WWTS	Unknown - 1982	Chromium & other acidic wastewaters, cyanide & other alkaline wastewaters
SWMU 23 New Plating Shop WWTS	About 1982-Present	Cadmium, acid/alkali & chrome waste
SWMU 24 Waste Oil Reclamation Facility	1979-Present	Waste oil, Bunker C Diesel fuel



SCALE AS SHOWN	CHARLESTON NAVAL SHIPYARD, CHARLESTON, S.C.	FIGURE
DATE AUG 1987	LOCATION OF SWMUS (SEE FIGURE 4-2 FOR KEY) SOURCE: REF. I	4-1

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SOLID WASTE MANAGEMENT UNITS (SWMU)

SWMU NO. 1. DRMO (formerly DPDO) Staging Area
SWMU NO. 2. Lead Contaminated Area
SWMU NO. 3. Pesticide Mixing Area
SWMU NO. 4. Pesticide Storage Building
SWMU NO. 5. Battery Electrolyte Treatment Area
SWMU NO. 6. Public Works Storage Yard (Old Corral)
SWMU NO. 7. PCB Transformer Storage Area
SWMU NO. 8. Oil Sludge Pit Area
SWMU NO. 9. Closed Landfill
SWMU NO. 10. Hazardous Waste Storage Facility
SWMU NO. 11. Caustic Pond
SWMU NO. 12. Old Fire Fighting Training Area
SWMU NO. 13. Current Fire Fighting Training Area
SWMU NO. 14. Chemical Disposal Area
SWMU NO. 15. Incinerator
SWMU NO. 16. Paint Storage Bunker
SWMU NO. 17. Oil Spill Area
SWMU NO. 18. PCB Spill Area
SWMU NO. 19. Solid Waste Transfer Station
SWMU NO. 20. Waste Disposal Area
SWMU NO. 21. Old Paint Storage Area
SWMU NO. 22. Old Plating Shop WWTS
SWMU NO. 23. New Plating Shop WWTS
SWMU NO. 24. Waste Oil Reclamation Facility

SCALE NO SCALE	CHARLESTON NAVAL SHIPYARD	FIGURE
DATE AUG 1987	KEY FOR FIGURE 4-1	4-2

NAVBASE. This building is located adjacent to the northern boundary of the base (see Figure 4-1) and near an offsite industrial area. If attempts by DRMO to transfer the property to other service branches, state governmental agencies or academic institutions for subsequent use are unsuccessful, the property is declared waste and appropriately disposed. The turned-in property handled by DRMO includes products that, when they become waste, are classified as hazardous wastes. The DRMO currently stores property that has become hazardous waste at the rear of a covered storage shed.

The storage shed is a wood framed and roofed structure with no exterior walls (except in one corner of the building where 675 square feet are enclosed by sheet metal walls). Part of the floor has an asphalt pad; however, the remainder of the floor is unpaved. This building is adjacent to a private industrial (petroleum storage tanks) site just north of the shipyard boundary. Hazardous wastes are stored segregated according to type (in racks as high as 20 feet); however, no spill control facilities (i.e., berms) are available to keep them segregatd in the event of a spill.

The storage shed is occasionally used to store chemicals. The maximum inventory of wastes stored within the storage shed is estimated at 30,000 gallons. The amount stored at the shed has never approached the maximum capacity.

During the site visit a barrel containing freon was leaking through a small hole in the top of the barrel. This barrel along with three other barrels were originally offered for sale in July, 1987. However, the barrels were found to be leaking and were later considered to be wastes.

Upon completion of the new hazardous waste container storage unit (Building 665), the Naval Base plans to continue to allow the DRMO to store declared hazardous wastes within their storage shed for less than 90 days prior to transfer to the new storage building or transport off site as hazardous waste; therefore, this accumulation point will be closed and may revert to a staging area.

4.1.2 Waste Characteristics

During the site visit, about 50 empty 55-gallon drums were observed stored on wooden pallets. The cleaning of these drums is to be contracted out so that the drums can be reused on base.

Excess chemicals (out-of-shelf date) generated by the Naval Supply Center (NSC), a navy activity at NAVBASE, are turned over to DRMO for disposal. A list of chemicals and other materials which DRMO will take physical custody of are provided in Appendix C. These items provided by the NSY include coating compounds, acids, insulating compounds and bases.

4.1.3 Groundwater

4.1.3.1 Pollutant Migration Pathways

Part of the floor has an asphalt pad; however, the remainder of the floor is unpaved. The potential for migration of hazardous constituents from this unit is possible since part of the floor is unpaved. There was no evidence of spills on the ground or on the asphalt pad.

4.1.3.2 Evidence of Release

There was no evidence of release to groundwater in the site records, nor was there evidence of release noted during the visual site inspection.

4.1.4 Surface Water

4.1.4.1 Pollutant Migration Pathways

The staging area is an open area with a tin roof and a partial asphalt floor with the remainder of the floor unpaved. There are no surface water controls around this SWMU. The Cooper River is approximately 500 feet from the staging area. If a spill occurred stormwater runoff could carry contaminants to the Cooper River.

4.1.4.2 Evidence of Release

No evidence of release to surface water was found in the site records or observed during the visual site inspection.

4.1.5 Air

4.1.5.1 Pollutant Migration Pathways

Pollutants present in unsealed units or units which are damaged, could volatilize and migrate to the atmosphere.

4.1.5.2 Evidence of Release

During the visual site inspection a drum containing freon was leaking through a small hole in its top.

4.1.6 Soil

4.1.6.1 Pollutant Migration Pathways

Since this unit is only partially paved, there is a possibility of release of hazardous constituents to the soil.

4.1.6.2 Evidence of Release

No evidence of release to the soil was found in the site records or observed during the visual site inspection.

4.1.7 Subsurface Gas

4.1.7.1 Pollutant Migration Pathways

Because of the waste characteristics, the generation or migration of subsurface gas is not expected.

4.1.7.2 Evidence of Release

There is no evidence of a release of subsurface gas from this unit.

4.2 SWMU NO. 2: LEAD CONTAMINATION AREA (REF. 2)

4.2.1 Unit Characteristics

This unit consists of a salvage bin (Bin No. 03) and the ground surface adjacent to the bin. The bin was used from mid- to late - 1960's until 1984 to store lead-acid batteries from submarines. The batteries were transported to the bin by railcar from the battery salvaging operation. SWMU No. 2 is located on Naval Supply Center property on the northwest part of NAVBASE (see Figure 4-1) adjacent to the DRMO storage yard.

After the electrodes and associated internal metallic components were removed from the battery jars as described in section 4.5.1 (SWMU No. 5), the batteries were placed on a railcar for transfer to DRMO for pickup by a salvage contractor. Approximately 400 to 700 pounds of batteries were stored in this area two to three months at a time before they were sold to a contractor.

Evidence of a reddish-brown dust in and around the area was noted during the visual site inspection. NSY staff explained that rainwater falling on top of the batteries caused a chemical reaction resulting in the formation of lead oxide. The dust was spread over the area by rain splashing against the batteries.

This bin is located on a concrete foundation, while the area in front of the bin consists of asphalt paving or concrete. An open drainage ditch is located immediately behind the bin and transmits surface runoff in a westerly direction to an underground catch basin and storm sewer system. The NSY intends to clean up the area.

4.2.2 Waste Characteristics

The primary waste stored in this area is lead.

4.2.3 Groundwater

4.2.3.1 Pollutant Migration Pathway

The batteries were placed in an area with a concrete foundation. If cracks develop in the concrete there is a potential for pollutants to migrate to the water table from this unit. Pollutants could also enter the groundwater via surface water runoff.

4.2.3.2 Evidence of Release

There was no evidence of a release of contaminants to the groundwater from this unit found in the records or observed during the site visit.

4.2.4 Surface Water

4.2.4.1 Pollutant Migration Pathways

Drainage from this area flows to an open drainage ditch located immediately behind the bin, which transmits surface runoff to an underground catch basin and storm sewer system. Stormwater runoff could carry contaminants to Shipyard Creek.

4.2.4.2 Evidence of Release

No evidence of release to surface water was found in site records or during the visual site inspection.

4.2.5 Air

4.2.5.1 Pollutant Migration Pathways

Activity in the DRMO yard area, which is located adjacent to SWMU No. 2, generates fugitive dust, thus creating a potential for lead transport via atmospheric routes.

4.2.5.2 Evidence of Release

Ambient air sampling was conducted during the contamination and exposure assessment for lead contamination within DRMO (December 9-12, 1985). Samples were taken outdoors, in the materials storage area, and indoors, within seven buildings located within the DRMO site.

The results of the ambient air sampling are given in Table 4-2. The lead concentrations are expressed in units of micrograms of lead per cubic meter of air. As shown by the data in Table 4-2, the measured ambient air lead levels did not exceed OSHA, NIOSH, or ACGIH recommended occupational criteria (30 to 50 ug/m). One outdoor Hi-Vol sample (HVD2-1) did exhibit a lead level (2 ug/m) slightly above the National Ambient Air Quality Standard (1.5 ug/m). Apparently, lead contaminated dust is being dispersed from the primary contamination source (Bin No. 3) and is accumulating in dust in the adjacent buildings. The levels in the air, however, were (at the time of sampling) within occupational criteria (REF. 2).

4.2.6 <u>Soils</u>

4.2.6.1 Pollutant Migration Pathways

Hazardous constituents could migrate to the soil from this unit via runoff and subsequent sediment transport.

4.2.6.2 Evidence of Release

During the visual site inspection a reddish material was noted in and around the area. A soil sampling investigation was conducted during the Contamination and Exposure Assessment for the lead contamination within DRMO. Seventy-one soil samples were collected from the DRMO site; 35 samples consisted of surficial soils (surface to 0.5 ft. depth) and the remaining 36 samples were collected at various depth intervals from 10 individual soil borings (total depths of 7.5 to 10 ft. below land surface). The surficial soil samples were collected across a grid pattern to characterize the areal extent of lead contamination and the soil boring samples were collected to yield information on the extent to which lead had penetrated (migrated) vertically in the soils (REF. 2).

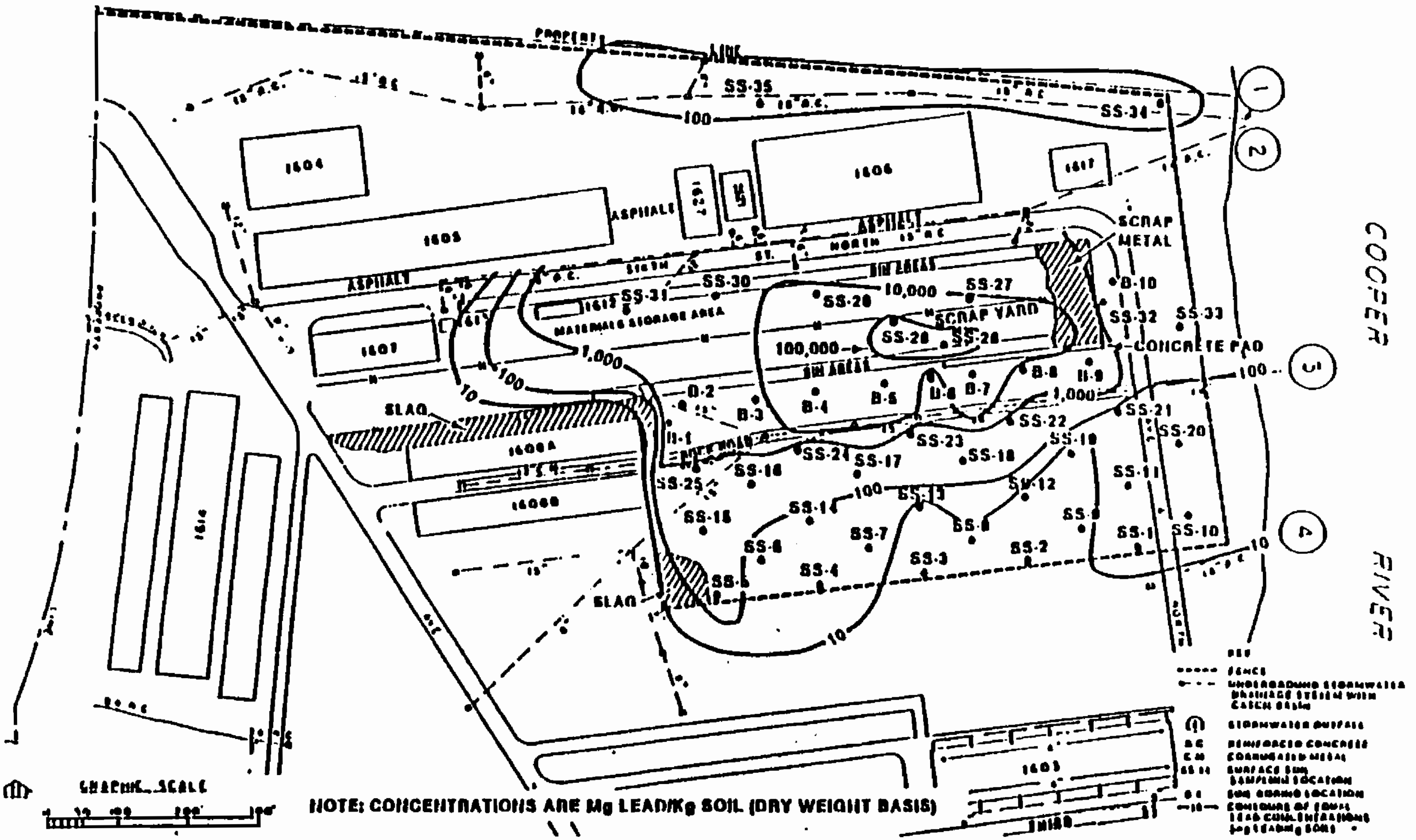
The locations of the soil sampling points in the DRMO Area are shown in Figure 4-3 and analytical results are given in Table 4-3. Lead concentrations vary widely from <1.3 to 371,000 mg of lead per Kg of soil.

TABLE 4-2

LEAD CONCENTRATIONS IN INDOOR AND
OUTDOOR AMBIENT AIR
DRMO AREA

Sample Matrix	Sample No.	Lead Concentration (ug/m^3)
Outside-Air	HVD1-1	<1
Outside-Air	HVD1-2	<1
Outside-Air	HVD2-1	2
Outside-Air	HVD2-2	1
Building-Air	AA1606 (Office)	<20
Building-Air	AA1606 (Warehouse)	<20
Building-Air	AA1607	<20
Building-Air	AA1608A	<20
Building-Air	AA1612	<20
Building-Air	AA1613	<20
Building-Air	AA1627	<20
Building-Air	AA2521	<20

Source: REF. 2.



SCALE AS SHOWN	CHARLESTON NAVAL SHIPYARD	FIGURE
DATE AUG 1987	SURFACE SOIL LEAD CONCENTRATION ISOPLETHS, SWMU NO. 2 SOURCE: REF. 2	4-3

.C.JOHNSON & MALHOTRA,P.C.

TABLE 4-3

LEAD CONCENTRATIONS IN SURFICIAL
(SURFACE TO 0.5 FT.)
SOILS IN THE DRMO AREA

Sample Matrix	Soil Sampling Locations	Lead Concentration (mg lead/kg soil)*
Surficial Soil	SS1	69.2
Surficial Soil	SS2	2.72
Surficial Soil	SS3	<1.3
Surficial Soil	SS4	28.5
Surficial Soil	SS5	137
Surficial Soil	SS6	<1.3
Surficial Soil	SS7	20.7
Surficial Soil	SS8	6.70
Surficial Soil	SS9	8.17
Surficial Soil	SS10	68.7
Surficial Soil	SS11	126
Surficial Soil	SS12	<1.3
Surficial Soil	SS13	<1.3
Surficial Soil	SS14	43
Surficial Soil	SS15	371
Surficial Soil	SS16	286
Surficial Soil	SS17	266
Surficial Soil	SS18	424
Surficial Soil	SS19	<1.3
Surficial Soil	SS20	40.4
Surficial Soil	SS21	54
Surficial Soil	SS22	328
Surficial Soil	SS23	717
Surficial Soil	SS24	488
Surficial Soil	SS25	32.7
Surficial Soil	SS26	371,000
Surficial Soil	SS27	10,500
Surficial Soil	SS28	107,000
Surficial Soil	SS29	1,260
Surficial Soil	SS30	9,320
Surficial Soil	SS31	2,810
Surficial Soil	SS32	907
Surficial Soil	SS33	298
Surficial Soil	SS34	533
Surficial Soil	SS35	411

Source: REF. 2

*Dry-weight basis

The lead data in Table 4-3 were plotted on a site map (shown in Figure 4-3) to visually depict the areal distribution of the lead contamination and to facilitate estimation of the area of contamination. As shown, lead concentrations are greatest in the area adjacent to and in front (north) of the former battery storage bin (sampling location Nos. SS26 to SS31). Lead concentrations decrease to background levels (10 to 100 mg/kg) over a distance of several hundred feet south of the bin area. The current activity (vehicles, etc.) in the materials storage area north of the bin has apparently spread the lead contaminated soil over a large area. The area encompassed by the 1,000 mg/kg isopleth shown in Figure 4-3 is estimated at 6 acres. Additionally, stormwater runoff of contaminated soil from the immediate vicinity of the former storage bin has spread the lead contamination along a surface drainage way located immediately south of the bin area and toward the stormwater catch basin at the eastern end of Bldg. 1608A (see Figure 4-3).

Soil borings were made in order to characterize the vertical extent of lead contamination in the soils. The results of lead analysis of the soil boring samples show the lead contamination is principally confined to the surface soils (surface to 0.5 ft. depth interval) (REF. 2). The lead concentration for each sample depth interval averaged over all 10 soil borings is as follows:

Depth Interval	Lead Concentration (mg/kg)
Surface to 0.5 ft.	16,103
3 to 4.5 ft.	255
6 to 7.5 ft.	274
8.5 to 10 ft.	509

These results indicate that, while there are very high lead levels in the surficial soils, the lead apparently is not migrating vertically through the soil column. Due to its ionic nature, lead is strongly adsorbed to soils, especially soils exhibiting a high clay content (REF. 2).

EP Toxicity tests conducted on two soil samples with the highest lead concentrations revealed that these soil samples are hazardous (greater than 5 mg/l).

4.2.7 Subsurface Gas

4.2.7.1 Polutant Migration Pathways

Because of the waste characteristics, there is little chance for the formation of subsurface gas.

4.2.7.2 Evidence of Release

There is no evidence of a release or formation of subsurface gas at this unit.

4.3 SWMU NO. 3: PESTICIDE MIXING AREA (REF. 1)

4.3.1 Unit Characteristics

The pesticide mixing area is located in the central portion of the shipyard due west of and adjacent to storage tank 39-D and north of the Recreational Storage Building (see Figure 4-1). The area is approximately 50 ft x 25 ft in size. An area measuring approximately 20 square yards remains completely devoid of vegetation, indicating that the soils in this area may be contaminated by unknown quantities of various pesticides (REF. 1) Prior to 1971, pesticides were mixed in the small shed south of the denuded area, and equipment used for spraying and mixing was rinsed in this area and the rinse water was allowed to drain into the soils.

4.3.2 Waste Characteristics

This area was used in the past to wash off equipment used in the spraying and mixing of pesticides. Pesticides (insecticides, herbicides, fungicides, and rodenticides) have been and are currently being used throughout NAVBASE Charleston to maintain grounds and structures and to prevent pest related health problems. Table 4-4 presents a list of pesticides which have been used and are currently in use at NAVBASE Charleston.

4.3.3 Groundwater

4.3.3.1 Pollutant Migration Pathways

Since pesticide containing rinse water was poured directly on the ground, there is a possibility of pollutant migration downward through the soil to the groundwater.

4.3.3.2 Evidence of Release

During the Confirmation Study conducted at NAVBASE, water quality analyses were performed at the Pesticide Mixing Area. Water samples were collected from monitoring wells WPA-1 and WPA-2 (see Figure 4-4) to determine whether past practices of pesticide mixing and equipment rinsing had affected the shallow groundwater. The samples were analyzed for pesticides, herbicides, PCBs, and arsenic. The laboratory results, which are presented in Appendix D,

TABLE 4-4

PESTICIDES USED AT NAVBASE CHARLESTON

Item

Insecticides (Bldg. 381)

Carbaryl, 80 percent WP
Chlordane, 72 percent EC
Diazinon, 2 percent
Diazinon, 47.5 percent EC
Dichlorvos, 5 percent
Dimethoate (Cygon), 23.4 percent EC1
Dursban, 41.2 percent EC1
Malathion, 57 percent EC
Malathion, 95 percent
Propoxur (Baygon), 2 percent
Propoxur (Baygon), 15.9 percent EC
Pyrethrin, 6 percent
Pyrethrin, 3 percent
Pentokel
Repellant, 71 percent (2-oz bottles)tles

Rodenticides (Bldg. 381)

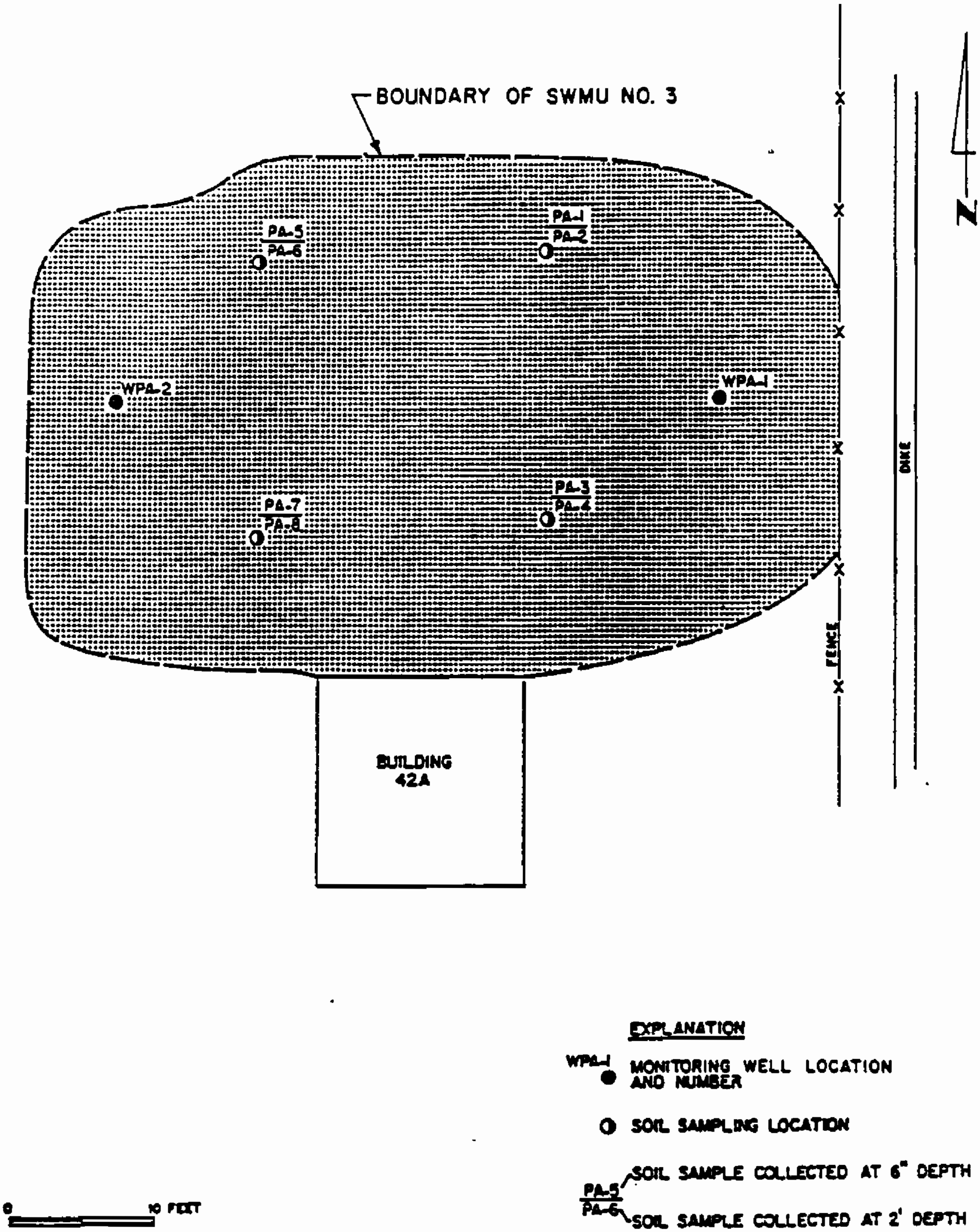
Anticogaulant, 5 percent
Anticoagulant, 3 percent
Calcium cyanide, 42 percent
Zinc phosphide, 80 percent

Herbicides (Bldg. 1316)

Bromacil, 80 percent WP
Dalapon, 85 percent
Diquat, 35.3 percent EC
Spike
2,4-D, 4 lb/gal
2,4,5-T, 6 lb/gal

Note: WP = Wettable powder.
lbs = pounds.
EC = Emulsifiable concentrate.
gal = gallons.
oz = ounce.
lb/gal = pounds per gallon.

Source: REF. 1.



SCALE 1" = 10'	CHARLESTON NAVAL SHIPYARD	FIGURE
DATE AUG 1987	SWMU NO. 3 MONITORING WELL AND SOIL SAMPLE LOCATIONS SOURCE: REF. 8	4-4

show that the concentrations of all of the above parameters were below their detection limits and that the pH of the groundwater is about 6 (REF. 8).

4.3.4 Surface Water

4.3.4.1 Pollutant Migration Pathways

Stormwater runoff from this unit could potentially carry contaminated sediment to Shipyard Creek via the storm drainage system.

4.3.4.2 Evidence of Release

There was no evidence of release to surface water from this unit found in the file information or observed during the site visit.

4.3.5 Air

4.3.5.1 Pollutant Migration Pathways

Pollutant migration to the air from this unit is not expected to occur.

4.3.5.2 Evidence of Release

There is no evidence of release to the atmosphere from this unit.

4.3.6 Soils

4.3.6.1 Pollutant Migration Pathways

Since contaminants were spilled directly onto the ground, localized soil contamination has probably occurred. Hazardous constituents could migrate to soil away from the unit via runoff and subsequent sediment transport.

4.3.6.2 Evidence of Release (REF. 8)

A soil sampling program was conducted at the pesticide mixing area in February, 1982. A total of eight samples were collected at the four locations shown in Figure 4-4 and analyzed for arsenic, herbicides, pesticides, and PCBs. The results of the analyses are presented in Appendix D. Odd numbered samples were collected at a depth of six inches, and even numbered samples were collected at a depth of two feet.

Concentrations of arsenic in the soil ranged from 1.1 ug/gm (micrograms per gram) in PA-4 to a high of 6.3 ug/gm in PA-1, and analyses for herbicides 2,4-D and 2,4,5-TP indicated that the levels of these constituents in the soil were less than the detection limit.

The eight soil samples were each analyzed for 18 pesticides, and up to six pesticides were detected. Three of the six pesticides are interrelated in that DDD and DDE are metabolites of DDT and are formed during the biodegradation of DDT. The fact that these were found in all eight samples is significant since DDT has not been in general use for about 15 years; therefore, they represent compounds that may have been present in the soil for a long period of time. Three other pesticides were found in samples PA-3 and PA-7, including heptachlor, beta BHC, and delta BHC.

The eight soil samples were also analyzed for seven PCB compounds, and six of the samples were found to contain one of these compounds, Aroclor 1260.

In May 1982, personnel from the Navy collected two samples of the uppermost soil within the pesticide mixing area. The results, which are presented in Appendix F, indicate that the greatest concentration of DDT in the soil is at land surface, at 1.48 and 5.3 ug/gm. These data, along with the previous data collected at the pesticide mixing area, show that the concentration of DDT in the soil is highest at land surface and decreases rapidly at depth (REF. 8).

4.3.7 Subsurface Gas

4.3.7.1 Pollutant Migration Pathways

Based on unit and waste characteristics, subsurface gas formation is not expected.

4.3.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from this unit found in the files or observed during the site visit.

4.4 SWMU NO. 4: PESTICIDE STORAGE BUILDING (REF. 1)

4.4.1 Unit Characteristics

The Pesticide Storage Building has been used to store insecticides and rodenticides since 1980. The unit is located in the central portion of NAVBASE on NSY property.

This is a steel building approximately 40 ft. by 30 ft. with a concrete floor. The building is equipped with a formulation and mixing room. Sink and floor drains are connected to the sanitary sewer system. An equipment rinse area is provided at a wash rack adjacent to the Storage Administration Facility. Prior to 1980, all pesticides were stored in the NAVSTA Recreational Storage Building. Since 1985 this building has been inactive and is currently used for miscellaneous storage only.

4.4.2 Waste Characteristics

The Pesticide Storage Building stored insecticides and rodenticides prior to 1980. A listing of the types of chemicals used at the building can be found in Table 4-4.

4.4.3 Groundwater

4.4.3.1 Pollutant Migration Pathways

This unit is constructed of concrete with floor drainage to the sanitary sewer system. There was no evidence of cracks in the structure. Migration of hazardous constituents from this unit to groundwater is not expected.

4.4.3.2 Evidence of Release

There was no evidence of release to groundwater in the site records, nor was evidence of release noted during the visual site inspection.

4.4.4 Surface Water

4.4.4.1 Pollutant Migration Pathways

This unit is in an enclosed building. The floor is made of concrete and contains floor drainage that is connected to the sanitary sewer system. There was no evidence of leaks in the structure or in the floor.

4.4.4.2 Evidence of Release

No evidence of release to surface water was found in the site records or observed during the visual site inspection.

4.4.5 Air

4.4.5.1 Pollutant Migration Pathways

This unit is in an enclosed building. Volatilization of pollutants and migration to the air are unlikely.

4.4.5.2 Evidence of Release

There is no evidence of a release of hazardous constituents to the atmosphere from this unit.

4.4.6 Soils

4.4.6.1 Pollutant Migration Pathways

Since this unit is an enclosed building with a concrete floor, pollutant migration to the soil is unlikely.

4.4.6.2 Evidence of Release

There was no evidence of a release of hazardous constituents to the soil from this unit found in the files or observed during the visual site inspection.

4.4.7 Subsurface Gas

4.4.7.1 Pollutant Migration Pathways

Because of unit and waste characteristics, subsurface gas migration is not expected to be a problem.

4.4.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from this unit found in the files or observed during the visual site inspection.

4.5 SWMU NO. 5: BATTERY ELECTROLYTE TREATMENT AREA (REF. 12)

4.5.1 Unit Characteristics

Prior to 1984 The Battery Electrolyte Treatment Area was used for the neutralization of submarine battery acid. The battery electrolyte treatment unit is associated with the battery salvaging and restoring and recharging operations. This unit is located in the central portion of the shipyard adjacent to drydock No. 4 (see Figure 4-1). The primary components of the unit are:

- o an elevated, curbed, concrete, battery disassembly platform;
- o two in-ground, brick-lined, concrete treatment tanks; and
- o two customized railcars for transferring internal battery components within the Shipyard.

The tanks are nominally 7 feet, 4 inches deep, although the bottoms slope laterally to the centerline; the initial pH adjustment tank is 10 feet wide by 12 feet long, and the settling tank is 10 feet wide by 20 feet long. The acid-resistant brick lining covers the bottom and extends 4 feet, 6 inches up the walls of each tank.

Each railcar has been customized to contain liquids that may drain from the internal battery components after disassembly. The deck forms a shallow trough and is surrounded by a raised lip. The trough drains through a valve which is connected through a hose to the treatment tank during disassembly operations. The continuous deck is constructed of two by eight inch lumber, laid flat and overlain by plywood sheeting. The entire surface is covered by a continuous layer of lead sheeting.

Historically, the submarine battery cells have been dumped and rinsed on the curbed concrete pad which drains to the treatment tank. The electrodes and associated internal metallic components were removed from the battery jar, and placed on a railcar for transfer to the DRMO storage compound (SWMU 1) for subsequent transport to an off site metal recovery facility. After the rinsewater was drained, the jar was placed upright on an adjacent concrete slab (No. 1278) to await transfer to the Shipyard battery rework facility, where the jar was reformed, tested and reused.

In the treatment tank, the pH was adjusted to 7.5 using soda ash. The neutralized waste then flowed by gravity through a pipe penetrating the intermediate wall into the settling tank where additional mixing and settling occurred. The treated supernatant was decanted through a standpipe to a POTW through a sanitary sewer. A detailed description of the acid neutralization treatment system is prsented in Section 2.4.

Management practices for used batteries at the Shipyard are under revision. Instead of returning empty used batteries to the DRMO warehouse, batteries will be turned in while still containing electrolyte. As a result, the treatment unit is being phased out of service. However, the Shipyard wishes to retain the structure, should a future need for electrolyte treatment arise.

Final closure activities consist of removing the final volume of treated electrolyte, decontaminating the pad, railcars and tanks and removing any residual contaminated soil surrounding or beneath the structure. Final closure will be initiated after the new hazardous waste storage and transfer facility is fully permitted.

Also included in this area were about sixty 55 gallon drums marked as hazardous waste. These drums are used to segregate and store spill residue from paint solvents (paint and paint related spills) from the NAVBASE. Once the drums are full (or 90 days expires) the drums are taken to the Hazardous Waste Storage Building. These drums were observed siting on the concrete pad on wooden pallets during the site visit. In the future paint solvents will be segregated where they are generated. During the site visit, a reddish-brown color was noticed on the ground just beyond the battery disassembly platform.

4.5.2 Waste Characteristics

This unit handles electrodes and associated internal metallic components removed from battery jars. This unit also contains 55-gallon drums which were used to segregrate and store spill residue from paint solvents (paint and paint related spills).

4.5.3 Groundwater

4.5.3.1 Pollutant Migration Pathway

This unit is on a concrete platform with two underground treatment tanks (constructed of concrete). If cracks develop on the concrete platform or treatment tanks, pollutants could migrate downward to the groundwater.

4.5.3.2 Evidence of Release

There was no evidence of release to the groundwater in the site records nor was there evidence of release noted during the visual site inspection.

4.5.4 Surface Water

4.5.4.1 Pollutant Migration Pathways

There is the possibility for stormwater runoff to carry contaminants from the concrete platform to Shipyard Creek . Since the treatment tanks are covered there is little chance of migration by this pathway from the tanks.

4.5.4.2 Evidence of Release

No evidence of release to surface water was found in the facility records or observed during the visual site inspection.

4.5.5 Air

4.5.5.1 Pollutant Migration Pathways

Based on waste characteristics, volatilization of pollutants and migration to the air are likely.

4.5.5.2 Evidence of Release

There was no evidence of a release of hazardous constituents to the atmosphere from this unit found in the files or observed during the visual site inspection.

4.5.6 Soils

4.5.6.1 Pollutant Migration Pathways

Soil in areas receiving runoff may become contaminated via sediment transport.

4.5.6.2 Evidence of Release

During the visual site inspection a reddish brown color was noticed on the ground next to the battery disassembly platform. No further evidence of release to soils was observed during the site inspection.

4.5.7 Subsurface Gas

4.5.7.1 Pollutant Migration Pathways

Because of waste management practices at this unit occur above ground, the generation or migration of subsurface gas is not expected.

4.5.7.2 Evidence of Release

There was no evidence of release of subsurface gas from this unit found in the files or observed during the visual site inspection.

4.6 SWMU NO. 6: PUBLIC WORKS STORAGE YARD (OLD CORRAL) (REF. 12)

4.6.1 Unit Characteristics

The Public Works Storage Yard is a large, open, unpaved, fenced compound where routinely-generated, containerized hazardous wastes are currently stored prior to shipment from the Shipyard. When the new hazardous waste storage and transfer facility is permitted, the storage yard will be permanently closed as a hazardous waste unit.

The capacity of the storage compound is estimated at 132,000 gallons (2400 55-gallon drums). Although the inventory of wastes stored at the compound has never approached that quantity, it is the basis for estimating the maximum waste inventory.

Final closure will consist of transfering all containers stored in the compound to the hazardous waste storage facility (SWMU No. 10) or transported offsite as hazardous waste. After the waste has been removed, all papers, pallets, empty containers, and debris will be removed, papers and debris will be containerized for transport offsite as hazardous wastes, and pallets and empty containers will be transferred to the storage building for use there.

4.6.2 Waste Characteristics

The Public Works Storage Yard has three areas where hazardous waste is currently generated; they include the vehicle maintenance, building maintenance and pest control.

Wastes generated in the vehicle maintenance areas are cleaning solvents and waste oil. Cleaning solvents are disposed by a contractor. Waste oils are recycled through the NSC waste oil reclamation facility. The building maintenance group generates paint waste, which is disposed by the contractor along with waste from the Paint Shop.

A June 24, 1986 site inspection conducted by EPA noted that there were a few drums (<5 drums) with loose covers and or damaged containers. However, no leakage was observed (REF. 10).

4.6.3 Groundwater

4.6.3.1 Pollutant Migration Pathways

Since drums of hazardous waste are placed directly on the ground any leaks or spills could result in contaminants migrating downward into the water table aquifer.

4.6.3.2 Evidence of Release

There was no evidence of release to the groundwater from this unit found in the files or observed during the visual site inspection.

4.6.4 Surface Water

4.6.4.1 Pollutant Migration Pathways

Hazardous constituents from this unit could possibly migrate to surface waters (Cooper River) via runoff.

4.6.4.2 Evidence of Release

There was no evidence of a release to surface water from this unit found in the files or observed during the visual site inspection.

4.6.5 Air

4.6.5.1 Pollutant Migration Pathways

A wide variety of hazardous wastes are stored at this unit including solvents. Volatilization of pollutants and migration to the air are possible.

4.6.5.2 Evidence of Release

There was no evidence of a release to the atmosphere from this unit found in the files or observed during the visual site inspection.

4.6.6 Soils

4.6.6.1 Pollutant Migration Pathways

Drums of hazardous wastes are stored directly on the ground in some areas of this unit. Percolation of contaminants into the soil is possible. Also pollutants could migrate to soil away from this unit via runoff and subsequent sediment transport.

4.6.6.2 Evidence of Release

A soil sampling program was completed in March, 1987 as part of the requirements for the closure of this unit. Because of the wide variety of hazardous wastes stored within the compound during interim status, it was necessary to perform a screening analysis of each soil sample to identify any contaminants present and to define the extent of soil contamination. The soil sampling program described in the NSY, Closure Plans for Interim Status Facilities dated May 27, 1986 (REF. 12) was approved by SCDHEC on October 22, 1986. Results of the analyses (attached as Appendix E) indicate that soils in the Public Works Storage Yard area is contaminated with metals including barium, cadmium, chromium and lead. Concentrations of PCBs were found to be less than 1 ppm.

4.6.7 Subsurface Gas

4.6.7.1 Pollutant Migration Pathways

This unit handles solvents, therefore some subsurface gas formation is likely if solvent drums were to leak.

4.6.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from this unit found in the files or observed during the visual site inspection.

4.7 SWMU NO. 7: PCB TRANSFORMER STORAGE AREA (REF. 1)

4.7.1 Unit Characteristics

The PCB Transformer Storage area includes Building 3902, the adjacent concrete slab (located outside the building), and the surrounding areas that were used for the storage of electrical equipment, including transformers. The unit is located at the north-central boundary of NAVBASE adjacent to the Cooper River (see Figure 4-1). Between 1970 and 1976 out-of-service transformers were brought to the concrete pad on the south side of the building prior to transportation off base. Transformers were either sold intact or drained prior to sale. The area around this concrete pad shows evidence of past oil spills. Due to the intermittent drainage of transformer oil and the unknown concentrations of PCBs therein, it is not possible to estimate the total amount of PCBs released to the soil. Since 1986, transformers have been stored in the new hazardous waste storage and transfer facility.

During the visual site inspection, 50 empty drums marked "Salvage Drums" were noted in Building 3902. Reportedly these drums are used to replace drums with leaks.

4.7.2 Waste Characteristics

This unit reportedly received only electrical transformers containing PCBs.

4.7.3 Groundwater

4.7.3.1 Pollutant Migration Pathways

There is a possibility that hazardous constituents could have migrated to the groundwater as a results of accidental spills on the ground.

4.7.3.2 Evidence of Release

As part of the Confirmation Study two groundwater monitoring wells were installed during early 1982 in order to verify groundwater contamination. Water samples were collected from wells WOC-1 and WOC-2 (Figure 4-5) on February 12, 1982, and were analyzed for arsenic, pesticides, and PCBs (see Appendix F). Water from well WOC-1 contained 19 ug/l of arsenic, 0.2 ug/l of DDT, and 0.2 ug/l of PCB (Arcolor 1260). Water from well WOC-2 contained 13 ug/l of arsenic, 0.1 ug/l of DDT, 1 ug/l each of alpha, beta, and gamma benzene hexachloride (BHC) and 0.6 ug/l of PCB (Aroclor 1260).

4.7.4 Surface Water

4.7.4.1 Pollutant Migration Pathways

Hazardous constituents from this unit could possibly migrate to surface waters (Cooper River) via runoff or flooding.

4.7.4.2 Evidence of Release

There was no evidence of a release to surface waters from this unit found in the files or observed during the visual site inspection.

4.7.5 Air

4.7.5.1 Pollutant Migration Pathways

Based on waste characteristics, volatilization of pollutants and migration to the air is unlikely.

4.7.5.2 Evidence of Release

There was no evidence of a release of hazardous constituents to the atmosphere from this unit found in the files or observed during the visual site inspection.

4.7.6 Soils

4.7.6.1 Pollutant Migration Pathways

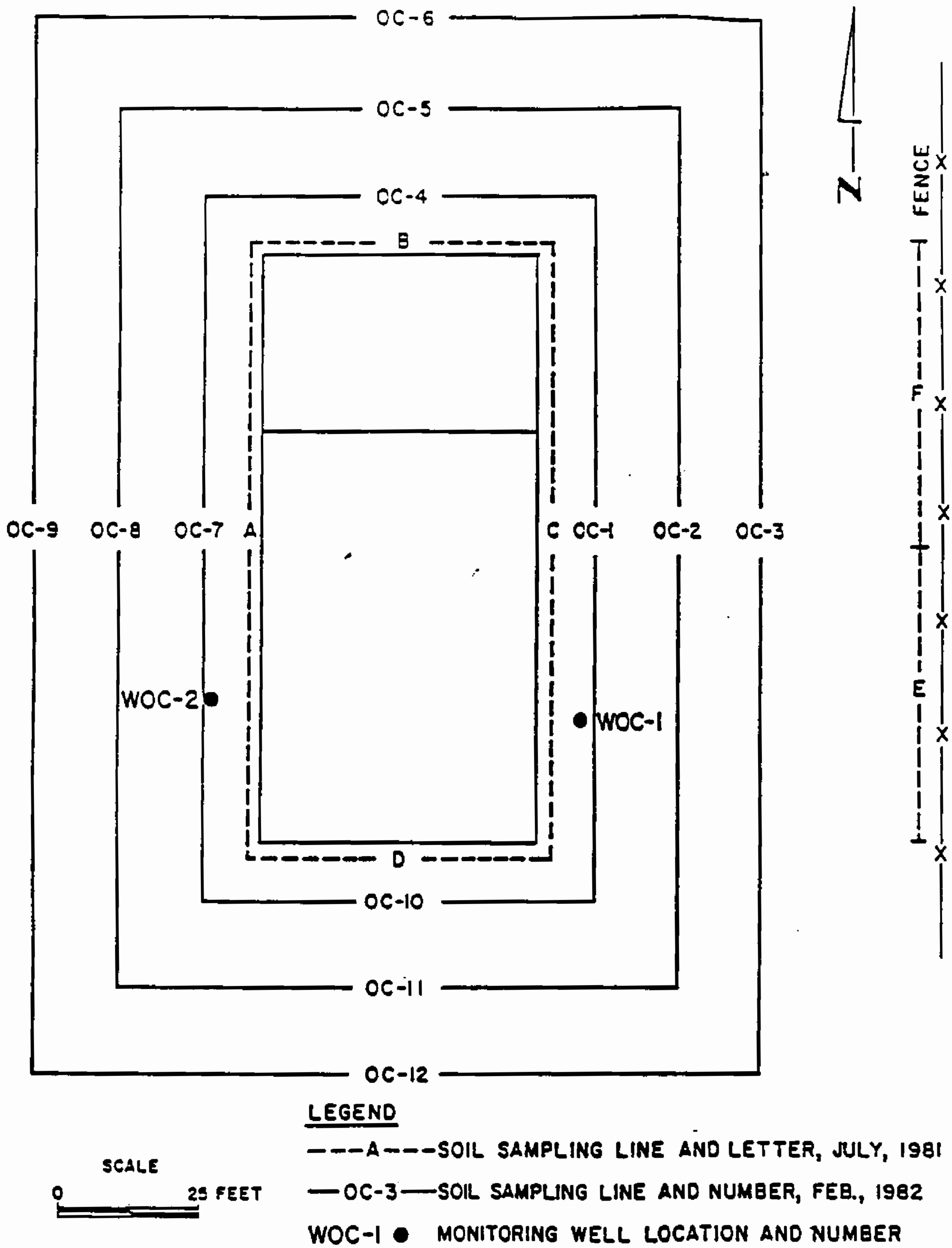
Because of past waste handling practices, there is a possibility of subsurface soil contamination and percolation of contaminated water through the soil.

4.7.6.2 Evidence of Release (REF. 8)

During the Confirmation Study conducted at NAVBASE, a soil sampling program was conducted at the electrical transformer storage area to determine the effects of past storage practices in the area. The sampling program was carried out in two phases. The first phase was conducted in July, 1981 and consisted of collecting composite samples along lines running parallel to the sides of Building 3902 and the attached concrete slab (Figure 4-5). Four composite samples, A through D, were collected at a depth of six inches, one from each side of the building.

The second sampling phase was conducted in February, 1982 to better define the horizontal distribution of PCBs in the soil. Composite soil samples, OC-1 through OC-12, were collected on sampling lines paralleling each side of the building and attached slab at distances of 10 ft, 25 ft, and 40 ft away from the building and slab (Figure 4-5). As in Phase I, these samples were collected every 3 ft at a depth of six inches. A total of 12 composite soil samples, OC-1 through OC-12, were collected in the electrical transformer storage area during Phase II. These samples were analyzed for pesticide content, PCBs, and arsenic by ERCO. The results are presented in Appendix F.

The arsenic concentrations in the composite soil samples ranged from 1.3 ug/gm in sample OC-12 to 15.5 ug/gm in sample OC-3. The concentrations of PCBs in samples immediately adjacent to the building and slab, and the fence line (Phase I sampling lines A through F) were estimated to be less than 10 ug/gm. Ten of the other 12 composite samples were found to contain one of the seven PCB compounds, Aroclor 1260. Samples OC-2, OC-3, and OC-11 contained the greatest concentrations of Aroclor 1260, 62.0, 37.0, and 11.0 ug/gm, respectively. Samples OC-6, OC-7, and OC-8 contained 3.2, 3.0, and 1.1 ug/gm. No Aroclor 1260 was detected in sample OC-1 or OC-12, and the other samples, OC-4, OC-5, OC-9, and OC-10, contained 0.675 ug/gm or less. In general, the greatest concentrations of Aroclor 1260, were found east of Building 3902 at distances of 25 and 40 ft away.



SCALE AS SHOWN	CHARLESTON NAVAL SHIPYARD	FIGURE
DATE AUG 1987	SWMU NO. 7 MONITORING WELLS AND SOIL SAMPLE LOCATIONS SOURCE: REF. 8	4-5

4.7.7 Subsurface Gas

4.7.7.1 Pollutant Migration Pathways

Because of waste characteristics, subsurface gas generation is not expected.

4.7.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from this unit found in the files or observed during the site inspection.

4.8 SWMU NO. 8: OIL SLUDGE PIT AREA (REF. 1)

4.8.1 Unit Characteristics

During the period 1944-71, oil sludges produced from the industrial activities at the shipyard installation were disposed in three unlined pits near the Warehouse Administrative building. During the period of use, heavy rains would occasionally cause the pits to overflow, creating oil spills in the low areas adjacent to the pits. The pits were subsequently covered with fill, trapping the oil in the subsoil. Two of the pits were covered by 1956. From 1971 to 1974, the remaining pit was open but was not used for the disposal of oil or sludge. In 1974, this pit was pumped to remove the oil and filled with clean, compacted fill. Portions of the area have now been converted into a parking lot (Photo No. 8).

A ditch which drains into the Cooper River was observed to run through the oil sludge pit area. At the time of the site inspection, there was standing water in the ditch. No oil slicks were observed in the ditch.

4.8.2 Waste Characteristics

Oil sludges produced from the industrial activities at the shipyard were the only wastes reportedly disposed in this unit.

4.8.3 Groundwater

4.8.3.1 Pollutant Migration Pathways

Migration of hazardous constituents from this unit is possible since the unit is unlined.

4.8.3.2 Evidence of Release (REF. 8)

Water samples were collected from two wells (Figure 4-6) installed in the area, wells OPW-1 and OPW-3 (well OPW-2 contained oil) and analyzed for sulfate content, 14 volatile organic compounds, and PCBs (see Appendix G). Wells OPW-1 and OPW-3 contained <1 and 780 mg/l of sulfate and 0.84 and 0.17 mg/l of methylene chloride, respectively. PCBs were not detected in the water sampled from OPW-3; however, well OPW-1 contained 0.04 ug/l of PCB (Aroclor 1260).

4.8.4 Surface Water

4.8.4.1 Pollutant Migration Pathways

This SWMU has been covered with fill and a portion of the area is currently being used for a parking lot. However, oil is reportedly trapped in the subsoil and can potentially migrate towards the Cooper River or Shipyard Creek.

4.8.4.2 Evidence of Release

Several oil slicks of undetermined origin have been reported in the Cooper River near the oil pit area. These may be the result of oil which has migrated from the sludge pit area.

4.8.5 Air

4.8.5.1 Pollutant Migration Pathways

Volatilization of pollutants and migration to the air is unlikely.

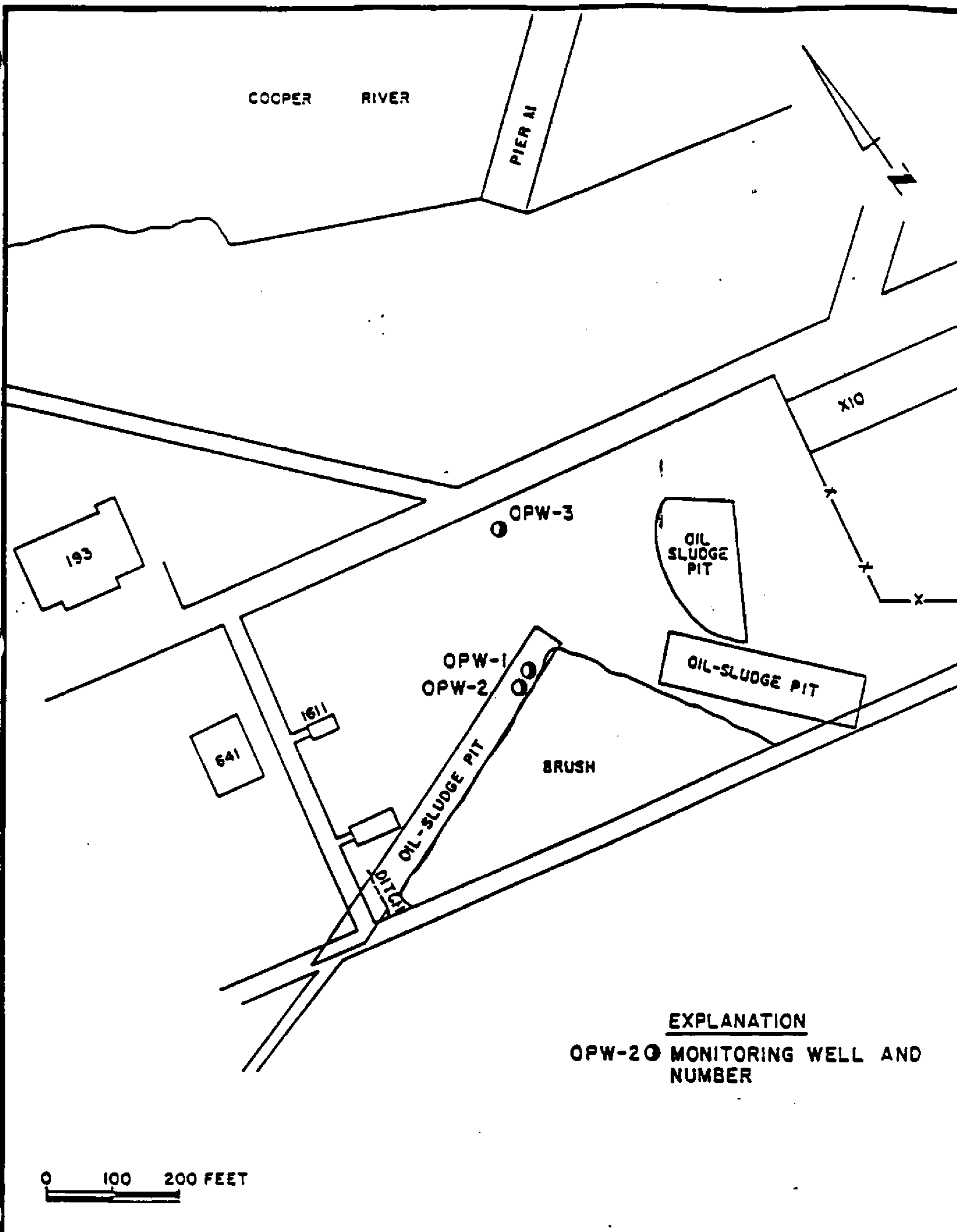
4.8.5.2 Evidence of Release

There was no evidence of a release of hazardous constituents to the atmosphere from this unit found in the files or observed during the visual site inspection.

4.8.6 Soils

4.8.6.1 Pollutant Migration Pathways

Since these oil pits were unlined during their operation, there is a possibility of subsurface soil contamination via infiltration. Surface soil contamination could have occurred on areas adjacent to the pits.



SCALE AS SHOWN	CHARLESTON NAVAL SHIPYARD SWMU NO. 8 MONITORING WELL LOCATION SOURCE: REF. 8	FIGURE 4-6
DATE AUG 1987		

CA 301-885-3

4.8.6.2 Evidence of Release (REF. 8)

During the Confirmation Study, two soil boring investigations were conducted. During Phase I, shallow borings were installed in the reported vicinity of the abandoned oil-sludge pits. The field investigation was expanded during Phase II after oil was discovered in a section of a newly-dug ditch located as shown in Figure 4-6.

Within the area of the abandoned oil-sludge pits, a total of 87 shallow borings were drilled to determine the areal extent of oil in the ground. Six borings were also drilled along the Cooper River to determine if oil seeping from these pits had moved toward the river. Because oil floats on top of the water table, the borings were drilled to the top of the water table at an average depth of about 4 feet.

The results of the boring program determined a long, narrow body of oil exists in the southwestern portion of the oil-sludge area. The oil body is approximately 50 ft wide by 600 ft long and trends in a northeast-southwest direction. Measurements taken in borings and in well OPW-2 indicate that the oil ranges in thickness from about two to four inches. East of the oil body is a small area of oily residue; however, the remaining portions of the oil-sludge area were found to be free of oil (REF. 8).

4.8.7 Subsurface Gas

4.8.7.1 Pollutant Migration Pathways

Because of waste characteristics, subsurface gas migration is likely to occur.

4.8.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from this unit found in the files or observed during the visual site inspection.

4.9. SWMU NO. 9: CLOSED LANDFILL (REF. 1)

4.9.1 Unit Characteristics

From the 1930s to 1973, all solid waste generated at NAVBASE reportedly was disposed onsite in a landfill. Most wastes from the industrial shops in NSY were disposed in the landfill. The landfill was operated as an area fill (i.e., no trenches were dug), and, to reduce the volume, most wastes were burned. The landfill site is located along the western edge of NAVBASE Charleston, south of Viaduct Rd (see Figure 4-1). Before landfilling, this area was a tidal marsh bordering Shipyard Creek. Wastes were deposited directly into the marsh and were often flooded by high tides. Materials which would not burn (such as concrete rubble, drums, and metal scrap) were placed on the leading edge of the fill, sometimes in the tidal waters. Combustible waste materials were burned daily, and the burned residue was pushed into the marsh with a bulldozer. Cover material was applied on an irregular, "as-available" basis. Soils from onsite building excavations, spoil dredged from the river, and bottom ash from the power plant were all used as cover materials.

In the past, boiler rebuilding operations ("rip-out" operations) resulted in a mixture of firebrick and asbestos, which was placed in a trash receptacle and taken to the base landfill. Around 1968, a special procedure involving double bagging of asbestos material was instituted in an attempt to control the disposal of asbestos. The asbestos continued to be disposed in the base landfill until it was closed in 1973. Currently, special handling procedures are required, and the asbestos is disposed by an EPA-approved contractor. After final closure, a two feet thick soil cover was applied to the entire fill area.

Most solid wastes currently generated at NAVBASE Charleston are hauled off base. A small amount of bottom ash from the coal-fired power plant is retained and spread on roads to enhance traction. A portion of the landfill is covered with residue from sand blasting operations.

4.9.2 Waste Characteristics

The waste from this unit included sanitary waste and various inorganic and organic chemicals. Most of the waste came from the industrial shops in NSY. Table 4-5 lists industrial wastes that were disposed in the landfill.

4.9.3 Groundwater

4.9.3.1 Pollutant Migration Pathways

There is a possibility that hazardous constituents could have migrated through the unlined landfill into the groundwater.

TABLE 4-5

INDUSTRIAL WASTES DISPOSED IN THE CLOSED LANDFILL

Waste	Origin	Current Annual Generation Rate	Years of Disposal
Asbestos	Boiler Shop	1,000 lbs	70
Asbestos	SIMA	2 yds	15
Varnish Sludge	Electrical Shop	300 gal	70
Mercury	Electrical Shop	25 lbs	70
Acid Neutralization Sludge	Electrical Shop	400 gal	70
Paint Sludge	Electronics Shop	200 gal	70
Metal Sludge	Machine Shop 31	50,000 lbs	70
PCB Fluids	Central Tool Shop	None	40
Paint Wastes	Paint Shop	226 tons	70
Toxic NRP Water Chemicals	NSC	1,330 lbs	10

Source: REF. 1.

4.9.3.2 Evidence of Release

NAVBASE has installed groundwater monitoring wells around the landfill to characterize the chemical quality of the groundwater in the vicinity of the landfill. These wells were initially sampled during July, 1981, and the samples were analyzed for several physical and chemical parameters. Additional sampling was performed in February, 1982, and analyses were conducted for inorganic and organic priority pollutants. The complete results of these sampling efforts are reported in Appendix H. Table 4-6 summarizes the data for constituents reported above analytical detection limits. As shown, several trace metals and chlorinated organics are present in the groundwater in the vicinity of the landfill. These constituents likely reflect past disposal of metal plating sludges, waste chemicals, and industrial degreasing solvents disposed in the landfill. Groundwater in the vicinity of the landfill is expected to flow toward Shipyard Creek or the Cooper River. It is expected that the soils would provide some degree of attenuation of these pollutants. Additionally substantial dilution would occur upon entering the river systems (REF. 1).

4.9.4 <u>Surface Water</u>

4.9.4.1 Pollutant Migration Pathways

Hazardous constituents from this unit can potentially leach through the soil and seep into Shipyard Creek or the Cooper River.

4.9.4.2 Evidence of Release

There was no evidence of a direct release of hazardous constituents to surface water from this unit found in the files or observed during the visual site inspection.

4.9.5 <u>Air</u>

4.9.5.1 Pollutant Migration Pathways

Volatile constituents used at this unit could volatilize from the landfill and enter the atmosphere.

4.9.5.2 Evidence of Release

No evidence of release to the air was found in the site records, nor was evidence of release noted during the site inspection.

TABLE 4-6

SUMMARY OF TRACE METAL AND ORGANICS DATA FOR THE CLOSED LANDFILL MONITORING WELLS

Constituent	Concentration Range (ug/l)
Metals	
Arsenic (As)	<10-70
Barium (Ba)	370-4,620
Chromium (Cr)	<5-8.2
Mercury (Hg)	<0.1-0.4
Lead (Pb)	<5-22
Acid Organics	
Pentachlorophenol	ND-15
Phenol	--
2,4,6-Trichlorophenol	--
2,4-Dichlorophenol	--
4,6-Dinitro-o-cresol	--
Base/Neutral Organics	
1,4 Dichlorobenzene	--
2,4 Dinitrotoluene	--
N-nitrosodiphenylamine	--
Bis(2-ethylhexyl) phthalate	ND-90
Diethyl phthalate	--
Di-n-butyl phthalate	--
Naphthalene	--
Acenaphthene	--
Anthracene/Phenanthrene	--
Indeno(1,2,3-cd)pyrene	--
Volatile Organics	
Methylene chloride	ND-1,600
Chlorobenzene	ND-50
Chloroform	ND-5.4
Dibromochloromethane	ND-3.4

ug/l = micrograms per liter.
ND = Not detected.
-- = 1 to 9 ug/l.

Source: REF. 1.

4.9.6 Soil

4.9.6.1 Pollutant Migration Pathways

After final closure, two feet of soil cover was applied to the entire fill area, so erosion of contaminated soil is unlikely. The landfill is unlined and soils in contact with the wastes are expected to be contaminated. Contaminants may leach from the wastes into soils underlying the landfill.

4.9.6.2 Evidence of Release

There was no evidence of a release of hazardous constituents to soil from this unit found in the site records or observed during the visual site inspection.

4.9.7 Subsurface Gas

4.9.7.1 Pollutant Migration Pathways

Because of the waste characteristics, the generation of subsurface gas is likely.

4.9.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from this unit found in the file information or observed during the visual site inspection.

4.10 SWMU NO. 10: HAZARDOUS WASTE STORAGE FACILITY (REF. 13)

4.10.1 Unit Characteristics

The Naval Shipyard has constructed a new hazardous waste (HW) container storage and transfer facility to service the entire base. This facility is managed by DRMO. Approval was given to construct the facility prior to receiving an approved Part B permit with the understanding that any required changes to the facility would be made by the shipyard to conform to the final permit requirements. This facility has been in operation from about March, 1987. The facility currently operates as a temporary storage facility with permission to store wastes for 90 days maximum.

Construction was completed on October 15, 1986. The 6,500 square foot building contains seven storage bays, a work area, a personnel decontamination area, safety and emergency equipment, a laboratory, a restroom, and an office. Each bay has a separate spill containment structure, which allows maximum flexibility in segregating incompatible wastes. This building allows for a maximum inventory of 1,032 palletized 55-gallon drums, double-stacked. The maximum capacity reflects the storage of only nonflammable liquids in the storage facility and allows 3-foot aisles between rows of drums. Flammable liquids are stored in group of 1,100 gallons (20 drums) or less with 5-foot aisles between groups.

The DRMO Hazardous Waste Storage Facility is designed to store hazardous materials/wastes until time of proper disposal. A 6-inch high concrete ramp is located at the entrance to each storage bay for spill containment. Storage bays are separated by interior partition walls. A catch basin for spill containment and storm drainage is located in the exterior load/unload area. The catch basin has a slide gate valve, which is closed during loading and unloading operations and open at other times for storm drainage. A rollover type curb is provided to isolate the load/unload area.

4.10.2 Waste Characteristics

The wastes stored at the building are grouped into the following general classifications:

- Flammable liquids
- Acids
- Alkalies
- Chlorinated hydrocarbons
- Oxidizers
- Reactives
- General wastes (compatible)
- PCBs

These general classifications are reflected on signs used to identify the contents of each storage bay.

4.10.3 Groundwater

4.10.3.1 Pollutant Migration Pathways

This recently constructed unit is made of concrete with a sloped floor, bounded by curbs in order to isolate any leaks or spills within one storage bay. There was no evidence of cracks in the structure. Migration of hazardous constituents to groundwater is not expected.

4.10.3.2 Evidence of Release

There was no evidence of release to groundwater in the site records, nor was evidence of release noted during the visual site inspection.

4.10.4 Surface Water

4.10.4.1 Pollutant Migration Pathways

This unit is a concrete enclosed building. The floor is made of concrete and has a 6-inch high concrete ramp located at the entrance to each storage bay for spill containment. There are no floor drains leaving the storage area. There was no evidence of cracks in the structure.

4.10.4.2 Evidence of Release

No evidence of release to surface water was found in the site records or observed during the visual site inspection.

4.10.5 Air

4.10.5.1 Pollutant Migration Pathways

Since waste are stored in an enclosed building, no significant pathways for migration of pollutants to the air are expected.

4.10.5.2 Evidence of Release

No evidence of release to the air was found in the site records, or noted during the site inspection.

4.10.6 Soils

4.10.6.1 Pollutant Migration Pathways

Hazardous wastes are stored in 55-gallon drums and placed on wooden pallets on a concrete floor. These drums are currently stored for 90 days maximum. The possibility of localized soil contamination is minimal.

4.10.6.2 Evidence of Release

There was no evidence of a release of hazardous constituents to soil from this unit found in the file information or observed during the visual site inspection.

4.10.7 Subsurface Gas

4.10.7.1 Pollutant Migration Pathways

Since all operations are above ground, subsurface gas generation from this unit is not expected to occur.

4.10.7.2 Evidence of Release

No evidence of subsurface gas releases were found in the facility records or observed during the visual site inspection.

4.11 SWMU NO.11: CAUSTIC POND (REF. 1)

4.11.1 Unit Characteristics

The caustic pond, located near the junction of Bainbridge Ave. and Viaduct Rd. (see Figure 4-1), was used for the disposal of calcium hydroxide from the early 1940s through the early 1970s. The calcium hydroxide was generated as a byproduct of the reaction of water with calcium carbide to produce acetylene gas. During operation, water saturated with calcium hydroxide (a white sludge) was allowed to settle in the pond, while excess water was discharged to Shipyard Creek. Although part of this pond was filled during the construction of Bainbridge Ave., a section of the pond was filled three years ago. The amount and areal extent of the calcium hydroxide is unknown; however, soil borings conducted during the IAS indicate sludge to a depth of one foot.

4.11.2 Waste Characteristics

This unit was used for the disposal of calcium hydroxide. The calcium hydroxide was generated as a byproduct of the reaction of water with calcium carbide to produce acetylene gas.

4.11.3 Groundwater

4.11.3.1 Pollutant Migration Pathways

There is a possibility that hazardous constituents could have migrated through the unlined pond into the groundwater.

4.11.3.2 Evidence of Release

Four monitor wells were installed in the area of the caustic pond during the Confirmation Study conducted at NAVBASE. Water samples were collected from each of the four monitoring wells (see Figure 4-1) to assess the impact of the disposal of calcium hydroxide on the shallow groundwater environment. The samples collected were analyzed in the field for pH and specific conductance and, in a water quality laboratory, for calcium, chloride and sulfate content. The results indicate that the pH is slightly acid to slightly basic, ranging from 6.3 to 7.3; the calcium and chloride contents and specific conductance are somewhat elevated, ranging, respectively, from 101 to 490 mg/l, from 423 to 823 mg/l, and from 1,970 to 7,400 umhos/cm (micromhos per centimeter). The relatively neutral pH values suggest that the normally high pH of the caustic water infiltrating from the pond has been lowered due to the naturally-occurring acidic soils at the site (REF. 8).

4.11.4 Surface Water

4.11.4.1 Pollutant Migration Pathways

This unit has been filled therefore, the migration of hazardous constituents from this unit to surface water is not expected.

4.11.4.2 Evidence of Release

No evidence of release to the surface water was found in the site records or observed during the visual site inspection.

4.11.5 Air

4.11.5.1 Pollutant Migration Pathways

Volatilization of pollutants and migration to the air from this unit are unlikely due to the nature of the contaminants.

4.11.5.2 Evidence of Release

There was no evidence of a release of hazardous constituents to the atmosphere from this unit found in the site records or observed during the visual site inspection.

4.11.6 Soils

4.11.6.1 Pollutant Migration Pathways

Since this unit was unlined during its operation, there is a possibility of subsurface soil contamination via percolation of contaminated water through the soil. Surface soil contamination could have occurred on areas adjacent to the pond. The pond was filled and vegetation now covers the area. Further soil contamination from this unit is therefore not expected.

4.11.6.2 Evidence of Release

All contaminated soils have been reportedly covered with fill. There is no evidence of a release of hazardous constituents to the soil in the site records, nor was evidence of release noted during the visual site inspection.

4.11.7 Subsurface Gas

4.11.7.1 Pollutant Migration Pathways

Because of the waste characteristics, subsurface gas generation is not expected.

4.11.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from this unit found in the file information or observed during the visual site inspection.

4.12 SWMU NO. 12: OLD FIRE FIGHTING TRAINING AREA (REF. 1)

4.12.1 Unit Characteristics

The old fire fighting training area consists of a pit located at the southern end of the NSY and is no longer in use. It reportedly ranged between 30 to 50 feet in diameter and was used between 1966 and 1971 for training purposes. Oil, gasoline, and alcohol were poured into this pit, ignited, and subsequently extinguished during fire fighting training exercises.

The pit area is not readily discernible from the ground, but its location is reportedly apparent when viewed from the air. The pit was closed in 1972 by leveling and covering with bottom ash, and 4 inches of sludge reportedly laid at its bottom. The amount of oil which may have leached into the subsoil and the areal extent of the pit are unknown. Currently, the pit is separated from Shipyard Creek by a dense zone of shrubs and hardwoods, as well as a roadbed.

4.12.2 Waste Characteristics

The unit was reportedly used to contain waste oil, gasoline, and alchol burned during fire fighting training exercises.

4.12.3 Groundwater

4.12.3.1 Pollutant Migration Pathways

Pollutants remaining in the soil could migrate downward and enter the water-table aquifer. The water table ranges between 3 and 7 feet below ground surface at the facility.

4.12.3.2 Evidence of Release

There was no evidence of a release of hazardous constituents to the groundwater from this unit found in the site records or observed during the visual site inspection.

4.12.4 Surface Water

4.12.4.1 Pollutant Migration Pathways

Any oil currently remaining in the soil could leach into Shipyard Creek with a resulting potential for surface water degradation.

4.12.4.2 Evidence of Release

In 1971, the pit was cited by the U.S. Coast Guard for an oil spill following a heavy rainfall which caused the oil in the pit to overflow into Shipyard Creek. No evidence of a release to surface water from this unit was identified during the visual site inspection.

4.12.5 Air

4.12.5.1 Pollutant Migration Pathways

Volatilization of contaminants is expected to be minimal because of the reported waste characteristics.

4.12.5.2 Evidence of Release

There was no evidence of a release of hazardous constituents to the atmosphere from this unit found in the file information reviewed or observed during the visual site inspection.

4.12.6 Soils

4.12.6.1 Pollutant Migration Pathways

Pollutants could migrate to soil away from the training pit area via surface water runoff and subsequent sediment transport and deposition. Pollutants could also migrate via groundwater transportation and bind to underlying and downgradient soils.

4.12.6.2 Evidence of Release

During the Confirmation Study conducted at NAVBASE, three soil borings were drilled at the fire fighting pit, one in the center of the pit, and the other two along the road bordering Shipyard Creek. No oil nor any trace of oil was found in any of the borings (REF. 8). During the site inspection, there was no evidence of a release to soil of hazardous constituents from the area pointed out by the NSY personnel as the Old Fire Fighting Training Unit.

4.12.7 Subsurface Gas

4.12.7.1 Pollutant Migration Pathways

This pathway is not a concern for this SWMU because of the unit and waste characteristics.

4.12.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from the fire fighting unit found in the file information reviewed or observed during the visual site inspection.

4.13 SWMU NO. 13: CURRENT FIRE FIGHTING TRAINING AREA

4.13.1 Unit Characteristics

Fire fighting training for both surface and submarine fleet personnel is currently conducted at Fleet and Mine Warfare Training Center located on the north eastern part of NAVBASE. The fire fighting training uses approximately 20,000 gallons of No. 2 diesel oil per year and 2,000 gallons of gasoline per year in training operations. Training exercises include extinguishing ignited diesel oil and gasoline. Diesel oil floating on water in tanks is burned in enclosed, paved areas. Gasoline is burned directly on the ground in a bermed area (REF. 1).

Oily wastewater is periodically removed from the tanks used for diesel fuel-on-water burning and passed through a gravity oil-water separator prior to being discharged to the sanitary sewer leading to the North Charleston Consolidated Public Service Department (NCCPSD). Prior to 1972, the wastewater was reportedly discharged to the Cooper River via the combined sewer system (REF. 1). Less than 50 gallons of waste oil per month accumulates in the oil-water separator. This waste oil is periodically removed and transported to the NSC waste oil reclamation facility. In the past, the waste oil was transported offsite by private contractors for reclamation.

The facility indicated that this unit is not required to be permitted. However, if a spill or a discharge occurs on the ground, it will be regulated by SCDHEC.

4.13.2 Waste Characteristics

The materials currently applied to the fire fighting training operations are No. 2 diesel oil and gasoline. The effluent from the operations contains Aqueous Film Forming Foam (AFFF) used in fire fighting exercises. It was reported that the quantity of AFFF used (less than 50 gallons/week) is well below the discharge limitations imposed by NCCPSD (REF. 1).

4.13.3 Groundwater

4.13.3.1 Pollution Migration Pathways

There is a possibility of migration of hazardous constituents in the diesel oil to the water table if there are any leaks (cracks) in the concrete pad. It is unlikely that significant amounts of gasoline seep into the ground because most of the gasoline burns or evaporates.

4.13.3.2 Evidence of Release

There was no evidence of a release to groundwater from the fire fighting training area found in the file information reviewed or observed during the visual site inspection.

4.13.4 Surface Water

4.13.4.1 Pollutant Migration Pathways

Surface runoff from the fire fighting training unit could enter the NSY storm drainage system. Discharges from the drainage system eventually reach the Cooper River.

4.13.4.2 Evidence of Release

There was no evidence of a release of contaminants to surface water from this unit found in the file information reviewed or observed during the visual site inspection.

4.13.5 Air

4.13.5.1 Pollutant Migration Pathways

Pollutants present in units opened to the atmosphere could volatilize and migrate through the air.

4.13.5.2 Evidence of Release

There was no evidence of a release of hazardous constituents to the atmosphere from the fire fighting training unit found in the file information reviewed or observed in the visual site inspection.

4.13.6 Soils

4.13.6.1 Pollutant Migration Pathways

Since burning operations occur in enclosed, paved areas or directly on the ground in a bermed area, limited soil contact with hazardous constituents from SWMU No. 13 is likely. Burning operations are expected to result in the destruction of most hazardous contaminants. Only minor quantities of residual inert ash would remain.

4.13.6.2 Evidence of Release

No evidence of any soils investigations in this area was found in the site records nor was evidence of release noted during the site investigation.

4.13.7 Subsurface Gas

4.13.7.1 Pollutant Migration Pathways

The generation of subsurface gas is not expected.

4.13.7.2 Evidence of Release

No evidence of subsurface gas release was found in the file information reviewed or observed in the visual site inspection.

4.14 SWMU NO. 14: CHEMICAL DISPOSAL AREA

4.14.1 Unit Characteristics

The chemical disposal area is located at the southern end of the NSY in the vicinity of the skeet and pistol ranges. The precise location(s) of these burial areas is unknown. The area was designated as the chemical disposal area because in the past small quantities of warfare decontaminating agents, non-corrosive (DANC)-DS-2 and DANC-M4 have been buried in the area. During the construction of bunkers at the skeet range in 1972 and 1974, construction workers suffered chemical burns when drums of these chemicals were unearthed (REF. 8). It was reported that these chemicals were also buried in the berm behind the pistol range. In 1977, ten 5-gallon cannisters of DS-2 were reportedly buried at the skeet range and behind the dike at the pistol range (REF. 1).

During the visual site inspection, 7 storage batteries and 25 empty 55-gallon drums were observed at this unit.

4.14.2 Waste Characteristics

DANC-DS-2 is a strongly alkaline, water-soluble material that contains diethylene triamine and ethyl cellosolve. Although in pure form ethyl cellosolve forms peroxide, it will not form a peroxide in water, but may hydrolize or decompose to other products. DANC-DS-2 components are so water soluble that they are difficult to analyze for in water samples. DANC-M4 contains 1,1,2,2-tetrachloroethane (acetylene tetrachloride), which is a volatile, relatively water soluble, chlorinated hydrocarbon. DANC-M4 also contains a substance that is strongly irritating and releases free chlorine (nascent chlorine) when contacted with water. Chloride ion, 1,1,2,2-tetrachlorethane, and elevated pH are the only indicators of these decontaminating agents anticipated to be residual in groundwater (REF. 8).

4.14.3 Groundwater

4.14.3.1 Pollutant Migration Pathways

Toxic materials were reportedly buried at this unit. Pollutants could migrate downward through the soil and enter the water-table aquifer.

4.14.3.2 Evidence of Release (REF. 8)

During the Confirmation Study conducted at NAVBASE, five groundwater monitoring wells were installed in the vicinity of the chemical disposal area (see Figure 3-3).

Water samples collected from these wells were analyzed for pH, cadmium, iron, lead, magnesium, mercury, sodium, fluoride, nitrate, sulfate, total organic carbon, specific conductance, chloride, base-neutral compounds and volatile organic compounds. The results of these analyses are presented in Appendix I.

The data show that shallow groundwater in the chemical-disposal area has conductivities ranging from 1,900 to 27,000 umhos/cm, a pH of from 6.68 to 8.63, and the water is mineralized. The levels of cadmium, lead, and mercury were below their detection limits, the iron content was less than 1.2 mg/l, and the fluoride content was less than 1 mg/l. No quantifiable amounts of base-neutral compounds were found except for 15 and 34 ug/l of bis(2-ethylhexyl) phthalate in wells CD-4 and CD-2, respectively (REF. 8). This compound is common around industrial areas and is present in sediments of all rivers receiving municipal or industrial effluent. Either Navy industrial activity or the presence of dredged material could account for its presence (REF. 8)

The water samples analyzed for volatile organic compounds indicated that chlorobenzene was present at levels of 0.14 and 10.68 mg/l in wells CD-3 and CD-5, respectively. During a second sampling episode, well CD-3 contained 1.5. ug/l of chloroform and methylene chloride was found in all five wells at levels up to 2.0 mg/l. Methylene chloride is frequently used as a degreasing agent, and the data suggest that waste materials containing methylene chloride may have also been deposited in the chemical disposal area (REF. 8).

The water samples were also analyzed for 1,1,2,2-tetrachloroethane during the scan for volatile organic compounds. The results show that 1,1,2,2-tetrachloroethane was not present in any of the five monitoring wells.

4.14.4 Surface Water

4.14.4.1 Pollutant Migration Pathways

Drainage from the disposal area could flow into an unnamed ditch leading to surface water discharge points.

4.14.4.2 Evidence of Release

No evidence of a release to surface water from this unit was found in the file information reviewed or observed during the visual site inspection.

4.14.5 Air

4.14.5.1 Pollutant Migration Pathways

Because of some of the waste constituents (acetylene tetrachloride) the potential exists for volatilization of contaminants.

4.14.5.2 Evidence of Release

There was no evidence of a release to the atmosphere from this unit found in the file information reviewed or observed during the visual site inspection.

4.14.6 Soils

4.14.6.1 Pollutant Migration Pathways

The soil in contact with wastes buried in SWMU No. 14 is expected to be contaminated.

4.14.6.2 Evidence of Release

There is no direct evidence of a release to the soil from this unit. A soil sampling investigation was not undertaken during the Confirmation Study.

4.14.7 Subsurface Gas

4.14.7.1 Pollutant Migration Pathways

The generation of subsurface gas is possible. Volatile organics were found in groundwater samples analyzed from the site.

4.14.7.2 Evidence of Release

No evidence of subsurface gas release was found in the review of file information or observed during the site inspection.

4.15 SWMU NO. 15: INCINERATOR

4.15.1 Unit Characteristics

The incinerator is located on the Naval Station property in the east central part of NAVBASE (see Figure 4-1). The unit consists of a primary chamber and a stack approximately 30 feet high. SWMU No. 15 is permitted to burn classified documents. Twice per week on an average, documents placed in paper bags designated to be burned, are destroyed in the incinerator.

Once incineration begins, the unit operates for approximately three hours. Residue from the operation is placed in waste disposal containers for disposal with other NSY solid waste. The unit is partially surrounded by a concrete pad. The incinerator area is surrounded by a chain linked fence approximately ten feet high.

4.15.2 Waste Characteristics

The incinerator reportedly burns only paper related items. These items are considered non-hazardous.

4.15.3 Groundwater

4.15.3.1 Pollutant Migration Pathways

Based on the design layout of this unit and waste characteristics, migration of hazardous constituents to groundwater is not expected.

4.15.3.2 Evidence of Release

There was no evidence of release to groundwater found in the file information reviewed, nor was evidence of release noted during the visual site inspection.

4.15.4 Surface Water

4.15.4.1 Pollutant Migration Pathways

Apparently no hazardous materials are incinerated, so no hazardous releases are expected from this unit.

4.15.4.2 Evidence of Release

There was no evidence of continuing release of hazardous constituents to surface water in the file information reviewed, nor was evidence of release noted during the visual site inspection.

4.15.5 Air

4.15.5.1 Pollutant Migration Pathways

Volatilization of pollutants and migration to the air are unlikely because no hazardous materials are incinerated.

4.15.5.2 Evidence of Release

The incinerator has an operating SCDHEC permit. There was no evidence of releases to the air other than the permitted point-source discharge.

4.15.6 Soils

4.15.6.1 Pollutant Migration Pathways

Apparently no hazardous materials are incinerated therefore migration of hazardous constituents to soils is not expected.

4.15.6.2 Evidence of Release

There was no evidence of release to soils in the site records, nor was evidence of release noted during the visual site inspection.

4.15.7 Subsurface Gas

4.15.7.1 Pollutant Migration Pathways

Based on the unit characteristics, the generation of subsurface gas is not expected.

4.15.7.2 Evidence of Release

No evidence of subsurface gas was in the records.

4.16 SWMU NO. 16: PAINT STORAGE BUNKER

4.16.1 Unit Characteristics

SWMU No. 16 consists of a storage pile located on top of an ammunition storage (bunker) on the northeastern portion of NSY adjacent to Cooper River. During the site inspection a number of miscellaneous materials were observed piled on the ground at this site including paint, paint thinner, an oil containment boom, crates and buoys (see Photos 15 and 16).

Facility personnel claimed no knowledge of the pile's existence or the source(s) of the materials. They speculated that it could have been clean-up materials from a ship. Two paint cans were observed to be upturned with yellow paint spilled on the ground.

Less than twelve hours following the initial inspection of this unit, another inspection was made to verify cleanup reportedly taken place at the site. The paint cans were removed and returned to storage; the area containing the spilled paint was excavated and the drummed waste turned over to Environmental Protection and Energy Conservation Division (EPECD). The EPECD confirmed its initial suspicion that the materials originated from a ship.

A 10-foot chain-linked fence surrounds the unit and the area is sparsely vegetated. During the site visit, there were no signs of contaminated run-off from the area or of stressed vegetation. The area surrounding the site is heavily vegetated.

4.16.2 Waste Characteristics

During the site visit, the following wastes were observed at this site: paint, paint thinner, wooden crates, buoys and an oil containment spill boom.

4.16.3 Groundwater

4.16.3.1 Pollutant Migration Pathway

Groundwater is relatively close to the surface at the NSY (3 to 7 feet). Paint was observed spilled directly on the ground. The potential exists for pollutants to migrate downward to the water table.

4.16.3.2 Evidence of Release

There was no evidence of a release to the groundwater from this unit found in the file information reviewed or observed during the visual site inspection.

4.16.4 Surface Water

4.16.4.1 Pollutant Migration Pathways

The unit has no runoff protection, so pollutants, when present, could migrate via surface water. Runoff could flow to a drainage ditch which flows across Juneau Avenue with a possible discharge to the Cooper River.

4.16.4.2 Evidence of Release

There was no evidence of a release of hazardous constituents to surface water from this unit found in the site records or observed during the visual site inspection.

4.16.5 Air

4.16.5.1 Pollutant Migration Pathways

Volatilization of pollutants and migration to the air are likely because of some of the waste characteristics (paint and paint thinner).

4.16.5.2 Evidence of Release

There was no evidence of a release of hazardous constituents to air from SWMU No. 16 in the file information reviewed or observed during the visual site inspection.

4.16.6 Soils

4.16.6.1 Pollutant Migration Pathways

Soil in contact with paint or paint thinner would have been contaminated with hazardous constituents. Reportedly, all contaminated soils have been excavated and turned over to the EPECD for offsite disposal. The potential for further release of hazardous constituents to soils is therefore minimal.

4.16.6.2 Evidence of Release

During the site visit, paint was observed spilled on the ground, but subsequently removed. There is no other evidence of a release to soil from this unit.

4.16.7 Subsurface Gas

4.16.7.1 Pollutant Migration Pathways

Because of the removal of the waste from the SWMU subsurface gas migration is not expected to be a problem.

4.16.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from this unit found in the file information reviewed or observed during the visual site inspection.

4.17 SWMU NO. 17: OIL SPILL AREA

4.17.1 Unit Characteristics

This spill occurred in June 1987 when an underground pipe supplying No. 2 diesel fuel oil from a storage tank to the boiler in Building No. FBM 61 ruptured. FBM 61 was built in 1961 as a Submarine Training Center. At that time, electrical transformers were already installed in the area (see Figure 4-7).

The spilled oil flowed under Building FMB 61 and a small quantity entered the basement of the building. Oil flowing underground entered drainage sumps and the oil was pumped through the storm drainage system to the Cooper River.

Samples taken of the spilled area and analyzed contained Aroclor 1260, a PCB normally associated with electric transformers. Base personnel could not say exactly how the PCB entered the oil. They theorized that PCB may have leaked from the transformers and is now contained underground in the area adjacent to FBM 61. Base personnel indicated that several spills from the transformers reportedly occurred many years ago.

During the visual site inspection, waste oil was observed being pumped through one of four 55-gallon drums opened on both ends and installed in the ground (see Photo No. 17). The drum simulates a well. The oil was being pumped to a storage tank from which it will be emptied into 55-gallon drums for disposal offsite by the base waste disposal contractor.

It is unknown how much oil was spilled but facility personnel indicated that, based on the volume of the storage tank, approximately 2,000 to 4,000 gallons of oil are still to be recovered.

A July 7th telephone conversation with the facility indicated that most of the oil is now recovered and the unit will be turned over to the Navy Assessment and Control of Installation Pollutants (NACIP) program for further action. This action may include soil boring and testing followed by an appropriate remedial response (REF. 9).

4.17.2 Waste Characteristics

The spill resulted in the discharge of No. 2 diesel fuel oil containing PCB. The type of PCB is reportedly Aroclor 1260.

4.17.3 Groundwater

4.17.3.1 Pollutant Migration Pathways

Based on observations during the visual site inspection and the large volume of oil leaked underground, pollutant migration to groundwater is possible.

4.17.3.2 Evidence of Release

There was no reported evidence of a release of hazardous constituents to groundwater from this oil spill.

4.17.4 Surface Water

4.17.4.1 Pollutant Migration Pathways

Oil flowing underground could reach storm drainage sumps located in the area. The sumps are pumped to the storm drainage system which discharges to the Cooper River.

4.17.4.2 Evidence of Release

According to facility personnel, the oil spill was discovered after oil was observed in the Cooper River. The oil was traced back to the oil storage tank located in the FBM 61 building. Table 4-7 presents analytical results of samples taken from the Cooper River (samples 81-95).

4.17.5 Air

4.17.5.1 Pollutant Migration Pathways

The oil spill occurred underground and pollutant migration to the atmosphere is not expected.

4.17.5.2 Evidence of Release

There was no evidence of a release to the atmosphere from this unit found in the file information reviewed or observed during the visual site inspection.

4.17.6 Soils

4.17.6.1 Pollutant Migration Pathways

Pollutants could migrate underground and contaminate the soil beneath FBM 61 and adjacent areas.

4.17.6.2 Evidence of Release

Analytical results from three soil samples taken in the vicinity of the oil spill show PCB levels of 1 ppm, 6 ppm and 139 ppm (see Table 4-7). Sample locations are shown in Figure 4-7.

4.17.7 Subsurface Gas

4.17.7.1 Pollutant Migration Pathways

Based on the waste characteristics (oil containing PCB), th formation of subsurface gas is not anticipated.

TABLE 4-7

SAMPLING POINTS AND PCB CONCENTRATIONS
AT FBM-61
OIL SPILL AREA, NSY

Sample Point		PCB Concentration (ppm)
#65	Tank 25B	<10
#66	NS 600	<10
#67	19B	T 118 B <1
#68	Unknown tank (NSC700)	T 306 B <1
#69	TV north side (soil)	139
#70	Dirt pile southside from diging	1
#71	Drummed dirt from south side digging	6
#72	5800 gal tank car	<1
#73	NSC 700	T 476 B <1
#74	North sump	T 639 B <1
#75	Southeast sump	T <1 B <1
#76	South center sump	T <1 B <1
#77	Southwest sump	T <1 B <1
#78	19B	T 146 B <1
#79	25B	T <1 B <1
#80	NS 600	<1
#81	Drum #1	<1
#82	Drum #2	<1
#83	Drum #3	<1
#84	Drum #4	<1
#85	Drum #5	<1
#86	Drum #6	<1
#87	Drum #7	<1
#88	Drum #8	<1
#89	Drum #9	<1
#90	Drum #10	<1
#91	Drum #11	<1
#92	Drum #12	<1
#93	Drum #13	<1
#94	Drum #14	<1
#95	Drum #15	<1
#96	Chase inside FBM-61	78

*T = Top layer
B = Bottom layer

Source: REF. 11.

SAMPLING POINTS AT FBM-61

Soil

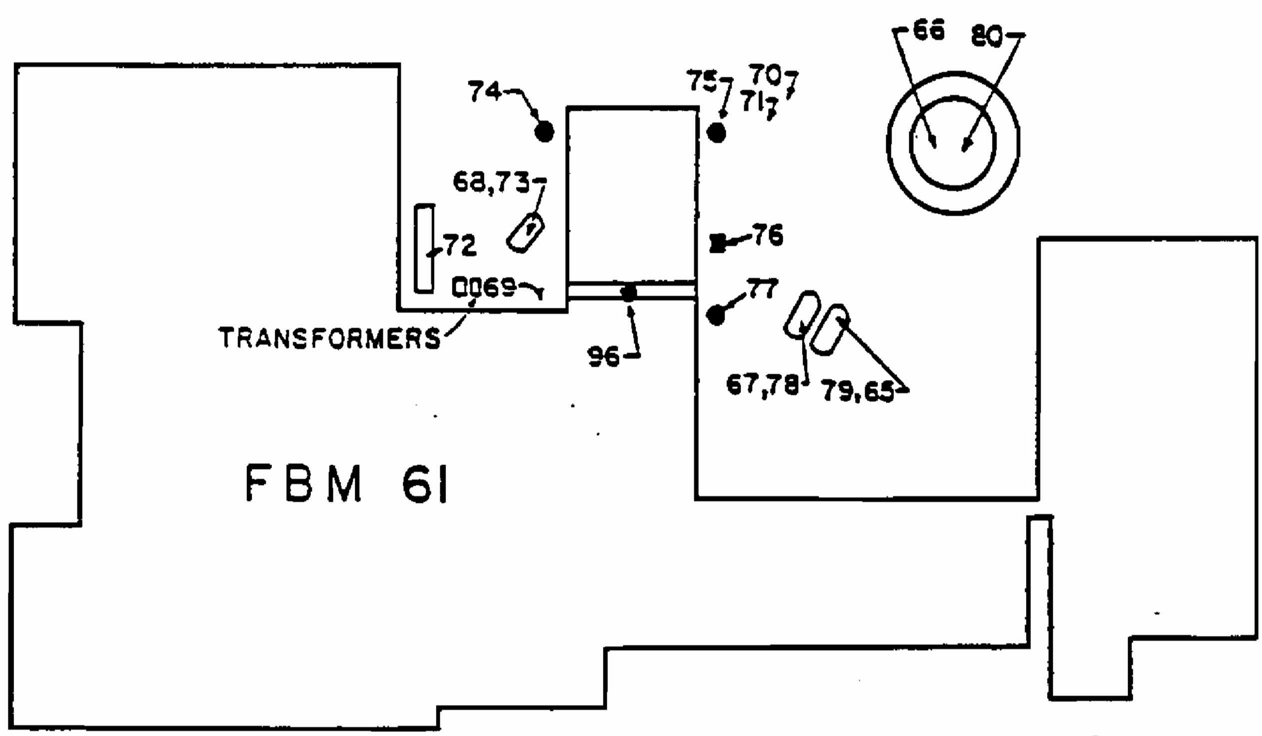
- #69 TV Northside
- #70 Dirt Pile Southside from diging
- #71 Drummed dirt from Southside diging

Oil Recovered From River

#81 - 95

Oil Sampling Point

- 65 - Tank 25B
- 66 - NS 600
- 67 - 19B
- 68 - Unknown (NSC 700)
- 72 - 5800 gal tank car
- 73 - NSC 700
- 74 - North sump
- 75 - Southeast sump
- 76 - South center sump
- 77 - Southwest sump
- 78 - 19B
- 79 - 25B
- 80 - NS 600
- 96 - Inside sump



SCALE	CHARLESTON NAVAL SHIPYARD	FIGURE
NO SCALE	SWMU NO. 17 OIL SPILL AREA	4-7
DATE AUG 1987	SOURCE: REF. 11	

TCA 301-165-3'

4.17.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from this unit found in the file information reviewed or observed during the visual site inspection.

4.18 SWMU NO. 18: PCB SPILL AREA (REF. 10)

4.18.1 Unit Characteristics

On Friday, June 12, 1987 a PCB spill occurred at the Public Works Resource Recovery Facility Storage Area. As a contractor was in the process of loading the first and largest of a group of PCB items destined for disposal, the PCB transformer shifted and broke one of the ceramic insulators on the unit. The break resulted in the discharge of Pyranol insulating fluid from the unit. The transformer was placed into a drip pan. However, the PCB containing liquid flowed over the top of the pan on to unprotected ground. The spill was contained with the assistance of shipyard personnel. The site was trenched to contain the PCB materials (REF. 10).

After containing the spill, the contaminated soil was excavated. Twenty-two drums of material were removed from the spill site and hauled offsite for disposal. The transformer and spill site were secured so as not to pose additional threats to the environment. The liquid volume was reduced to below the damaged area of the transformer by placing a 60 gallon drip pan under the transformer to catch the fluid. The spill site was covered with plastic after visible contamination had been excavated so rain would not cause the migration of undetected PCBs (REF. 10).

A decision was made to: (1) pump the remaining liquid from the transformer, (2) load the transformer onto the contractor's truck, (3) re-inspect the site to ensure all contaminated debris was properly controlled, and (4) sample the site to determine if residual contamination was present and if so, the extent of the contamination.

A total of thirteen drums of transformer oil were removed from the transformer. The capacity of the transformer according to the name plate was 665 gallons. Approximately 75 gallons of Pyranol fluid was spilled on the ground (REF. 12). The transformer and oil involved in the spill were transported offsite for disposal. All known contaminated materials were thought to have been contained or removed for management by the contractor.

Subsequently, the area was sampled and the analytical results indicated the need for additional remedial action at the spill site.

An additional 45,600 pounds of soil from the spill site were excavated on June 29, 1987. The material was shipped to SCA Chemical Services, Inc. in Emelle, Alabama for disposal. After excavation, the site was resampled. On August 5, 1987 additional soil from contaminated sampling points was removed and the points resampled. According to facility personnel, based on the analytical results no additional excavation is required.

The spill was brought to the attention of the site investigators after the scheduled site visit. As a result, the unit was not inspected.

4.18.2 Waste Characteristics

The waste spilled at this unit is Pyranol insulating fluid from a PCB transformer. The type of material contaminated included soil, a portion of an asphalt pad, steel plate material and the exterior of the transformer (REF. 10).

4.18.3 Groundwater

4.18.3.1 Pollutant Migration Pathways

Pollutants could migrate through cracks in the asphalt paved area or directly through the contaminated soil area downward to the water table.

4.18.3.2 Evidence of Release

There are no groundwater monitoring wells in the vicinity of this unit; therefore, evidence of a release to groundwater could not be determined.

4.18.4 Surface Water

4.18.4.1 Pollutant Migration Pathways

Since the site was not inspected, no release determination has been made.

4.18.4.2 Evidence of Release

No surface water analyses were available in the records.

4.18.5 Air

4.18.5.1 Pollutant Migration Pathways

Since the site was not inspected, no release determination has been made.

4.18.5.2 Evidence of Release

There was no evidence of continuing release of hazardous constituents to air in the file information reviewed or observed during the visual site inspection.

4.18.6 Soils

4.18.6.1 Pollutant Migration Pathways

Some of the waste was spilled directly on the ground.

4.18.6.2 Evidence of Release

All areas of the 20 foot by 20 foot spill site were sampled. A thirteen point grid sampling system was used during the clean-up process. Soil samples were taken following three soil excavation episodes. Analytical results of the sampling efforts are given on Tables 4-8, 4-9, and 4-10.

4.18.7 Subsurface Gas

4.18.7.1 Pollutant Migration Pathways

The generation of subsurface gas is not expected.

4.18.7.2 Evidence of Release

No evidence of subsurface gas was in the records.

4.19 SWMU NO. 19: SOLID WASTE TRANSFER STATION

4.19.1 Unit Characteristics

The solid waste transfer station consists of a staging area for the temporary holding of solid waste from NAVBASE prior to loading for transport off base and disposal. The unit occupies a small, unpaved, opened area approximately in the middle of a closed landfill (SWMU No. 10). The unit is completely fenced and is bordered on one side by Plate Street.

TABLE 4-8

PCB CONCENTRATION IN SOIL
PCB SPILL AREA
Sampling Date - June 16, 1987

Sample No.	PCB Concentration (mg/kg)
SC 0687 01	* 7
SC 0687 02	2,105
SC 0687 03	3,542
SC 0687 04	7
SC 0687 05	2,497
SC 0687 06	9,506
SC 0687 07	4,653
SC 0687 08	5,598
SC 0687 09	268
SC 0687 10	58
SC 0687 11	1
SC 0687 12	**32,634**
SC 0687 13	* **72,154**
SC 0687 14	**73,353**
SC 0687 15	**None Detected**

* Replicate Samples
Results reported in Bold type are suspect.
Source REF.10

TABLE 4-9

PCB CONCENTRATION IN SOIL
PCB SPILL AREA
Sampling Date - June 29, 1987

Sample No.	PCB Concentration (mg/kg) AmerEco/Shipyard
CH 0687 01	1 / <10
CH 0687 02	<1 / <10
CH 0687 03	68 / <10
CH 0687 04	<1 / <10
CH 0687 05	2 / <10
CH 0687 06	<1 / <10
CH 0687 07	6 / 15
CH 0687 08	94 / 9285
CH 0687 09	5 / 4
CH 0687 10	<1 / <10
CH 0687 11	7 / 29
CH 0687 12	169 / <10
CH 0687 13	* <1 / 38
CH 0687 14	* 3 / #
CH 0687 15	<1 / #

* Replicate Samples
# Samples not analyzed by the Shipyard
Source: REF. 10.

TABLE 4-10

PCB CONCENTRATION IN SOIL
PCB SPILL AREA
Sampling Date - August 12, 1987

PCB	Concentration (mg/kg)				
AROCLOR 1016	<10	<10	<10	<10	<10
AROCLOR 1221	<10	<10	<10	<10	<10
AROCLOR 1232	<10	<10	<10	<10	<10
AROCLOR 1242	<10	<10	<10	<10	<10
AROCLOR 1248	<10	<10	<10	<10	<10
AROCLOR 1254	<10	<10	<10	<10	<10
AROCLOR 1260	<10	<10	<10	<10	<10
AROCLOR 1262	<10	<10	<10	<10	<10

Source: REF. 12

SWMU No. 19 reportedly receives dry trash from all around NAVBASE. After collection, the trash is compacted and stored for disposal off base by a private waste disposal contractor. During the site inspection, rubber tires and empty 55-gallon drums were observed among the trash. The trash is stored directly on the ground. There were no signs of leaks or spills observed at the site during the visual site inspection.

4.19.2 Waste Characteristics

The wastes reportedly handled and observed during the site inspection are dry trash, tires and empty 55-gallon drums.

4.19.3 Groundwater

4.19.3.1 Pollutant Migration Pathways

Since no hazardous materials were observed in the waste pile, migration of hazardous constituents from the pile into the groundwater is not expected.

4.19.3.2 Evidence of Release

No evidence of release to groundwater was found in the site records, nor was any evidence of release noted during the visual site inspection.

4.19.4 Surface Water

4.19.4.1 Pollutant Migration Pathways

No hazardous materials were observed at the site. Surface water migration of hazardous constituents from the pile is, therefore, not expected.

4.19.4.2 Evidence of Release

No evidence of contaminant release to surface water was found in the site records, nor was evidence of release noted during the visual site inspection.

4.19.5 Air

4.19.5.1 Pollutant Migration Pathways

Based on the non-hazardous nature of wastes in the pile, air emissions of hazardous constituents are not expected.

4.19.5.2 Evidence of Release

No evidence of release to the air was found in the site records, nor was evidence of release noted during the visual site inspection.

4.19.6 Soils

4.19.6.1 Pollutant Migration Pathways

The waste temporarily stored in SWMU No. 19 is in contact with the soil. However, because the wastes do not contain hazardous constituents, soils beneath the waste pile are not expected to become contaminated.

4.19.6.2 Evidence of Release

No evidence of release to soil was found in the site records, nor was evidence of release noted during the visual site inspection.

4.19.7 Subsurface Gas

4.19.7.1 Pollutant Migration Pathways

The waste pile contains general household garbage and food wastes. However, these wastes are not stored long enough to generate subsurface gases.

4.19.7.2 Evidence of Release

No evidence of subsurface gas release was found in the site records or noted during the visual site inspection.

4.20 SWMU NO. 20: WASTE DISPOSAL AREA

4.20.1 Unit Characteristics

This unit occupies an area on the closed landfill and is located adjacent to the solid waste transfer station (SWMU No. 19). The waste disposal area has been in operation for approximately two years.

The site is an open area on which cardboard boxes, batteries, wood, concrete blocks, and tree stumps are disposed directly on the ground. Black diamond (MgO), a residue from sandblasting operations, was also observed disposed in areas on the site. No chemicals or paints were reportedly disposed nor was there evidence of such disposal during the site visit. The NSY is currently filling the site with clean soil from other areas of NAVBASE and plan to grade the area. No surface run-on diversion were observed at this unit during the site visit.

4.20.2 Waste Characteristics

The wastes reportedly disposed at this unit or observed during the site inspection are empty trash bags, cardboard boxes, batteries, wood, concrete blocks, tree stumps and residue from sandblasting operations.

4.20.3 Groundwater

4.20.3.1 Pollutant Migration Pathways

If residue from the batteries is spilled on the ground or residue from sandblasting operations is allowed to remain at the site, the potential exists for migration of contaminants to the groundwater.

4.20.3.2 Evidence of Release

There was no evidence of migration of hazardous constituents into the groundwater in the site records, nor was evidence of release noted during the site inspection.

4.20.4 Surface Water

4.20.4.1 Pollutant Migration Pathways

SWMU No. 20 contains some materials with hazardous constituents which are disposed directly on the soil. The unit has no runoff protection, so pollutants could migrate via surface water toward Shipyard Creek.

4.20.4.2 Evidence of Release

There was no evidence of a release of hazardous constituents to surface water from this unit documented in the file information or observed during the visual site inspection.

4.20.5 Air

4.20.5.1 Pollutant Migration Pathways

Because of the nature of the waste, migration to the atmosphere is minimal.

4.20.5.2 Evidence of Release

There was no evidence of a release to the atmosphere from this unit found in the site records or observed during the visual site inspection.

4.20.6 Soils

4.20.6.1 Pollutant Migration Pathways

Wastes are disposed directly on the ground. The contents from inside the batteries could leak or spill on the surface of the unit. Soil in contact with these wastes could become contaminated. Contaminants could also migrate via surface runoff and subsequent sediment transport.

4.20.6.2 Evidence of Release

Wastes were disposed directly on the ground. There was additional evidence of a release to soil from this unit.

4.20.7 Subsurface Gas

4.20.7.1 Pollutant Migration Pathways

Based on the unit characteristics (located above ground) and waste characteristics (no volatiles or household garbage), the formation of subsurface gas is anticipated to be minimal.

4.20.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from this unit found in the file information or observed during the visual site inspection.

4.21 SWMU NO. 21: OLD PAINT STORAGE AREA (REF. 1)

4.21.1 Unit Characteristics

This unit has been used since 1973 for containerized waste paints from chips returning to NAVBASE and from ship repair and overhaul operations near the waterfront. These wastes are stored on an uncovered concrete pad measuring approximately 20 feet wide by 180 feet long, located near the Sand Hoppers building, and adjacent to the Cooper River. NSY personnel would pour waste paint into 55-gallon drums and store them on the concrete pad until a contractor picked them up. The paint cans were crushed and put into 55-gallon drums for offsite disposal by a contractor. About 226 tons of paint wastes and solvents are currently generated annually.

Since the late 1960s, a private contractor has been hired to dispose of all paint wastes, including paints, solvents, and paint sludge. Prior to the use of a disposal contractor, painting wastes were disposed in the base sanitary landfill (SWMU No. 9).

Sandblasting operations are also conducted in this area. Waste sandblasting materials are currently disposed off site. Prior to 1974, waste sandblasting materials were disposed in the base sanitary landfill (SWMU No. 9).

The paint waste storage area is operated by Public Works NSY. This unit is under interim status and will complete final closure activities after the Hazardous Waste Storage Facility has an approved Part B permit.

During the visual site inspection paint was noted on the concrete pad and on the ground around the pad. Sandblasting operations were being conducted at the south end of the concrete pad during the time of inspection. Pictures were not taken in this area due to security reasons.

4.21.2 Waste Characteristics

The paint wastes stored at this unit may contain cadmium, chromium, lead, cyanide, toluene, or tetrachloroethylene. Sandblasting grit containing organo-tin paints have also been generated at this unit.

4.21.3 Groundwater

4.21.3.1 Pollutant Migration Pathways

Since this unit is unlined and waste is disposed directly on the ground, there is a possibility of pollutant migration downward through the soil to the groundwater.

4.21.3.2 Evidence of Release

Paint and sandblasting wastes were noted on the ground during the site inspection. No monitoring wells are located near this area, so potential pollution release to the groundwater from this unit could not be evaluated.

4.21.4 Surface Water

4.21.4.1 Pollutant Migration Pathways

This unit is an open area with an uncovered concrete pad. The Cooper River is approximately 100 feet from the storage area. If a spill occurred stormwater runoff could-carry contaminants to the Cooper River.

4.21.4.2 Evidence of Release

No evidence of release to surface water was found in the site records, however, paint and sandblasting materials were noted on the ground during the visual site inspection.

4.21.5 Air

4.21.5.1 Pollutant Migration Pathways

Based on some of the waste constituents (paint solvents), the potential exists for volatilization of hazardous substances.

4.21.5.2 Evidence of Release

There was no evidence of release to the atmosphere from this unit found in the file information reviewed or observed during the visual site inspection.

4.21.6 Soils

4.21.6.1 Pollutant Migration Pathways

Since paint was spilled directly onto the ground,and sandblasting is conducted in the area, localized soil contamination has probably occurred. Hazardous constituents could migrate to soil away from the unit via runoff and subsequent sediment transport.

4.21.6.2 Evidence of Release

Waste from sandblasting operations have been subjected to the Extraction Procedure (EP) Toxicity Test and found to be nonhazardous. Soils containing spilled paint were not analyzed.

4.21.7 Subsurface Gas

4.21.7.1 Pollutant Migration Pathways

Based on the waste characteristics, the generation of migration or subsurface gas is possible.

4.21.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from this unit found in the file information reviewed or observed during the visual site inspection.

4.22 SWMU NO. 22: OLD PLATING SHOP WWTS (REF. 1)

4.22.1 Unit Characteristics

The Old Wastewater Treatment System (WWTS) was originally constructed around 1972 to treat process wastewater from the metal plating shop. Treated effluent from this unit was discharged to a publicly owned treatment works (POTW) through the North Charleston Sewer District sanitary sewerage system (REF. 12).

The treatment facility consisted of two underground concrete holding tanks, one for chromic acid wastewater and one for cyanide wastewater, and a clarifier. Chromic acid wastewater drains to the chromic acid holding tank, which has a working capacity of 1,200 gallons. Approximately once every 2 weeks, the chromic acid holding tank becomes full, at which time the wastewater is pumped from the holding tank to the clarifier. After pumping the wastewater to the clarifier, soda ash is added and manually mixed with the wastewater to adjust the pH to approximately 8.5 to chemically precipitate chromium and other metals. Following pH adjustment, the suspended material in the wastewater is allowed to settle for approximately 48 hours and then the clarified wastewater is discharged to the sanitary sewer. Sludge accumulating in the bottom of the clarifier is removed. The sludge generated from 1972, when the metals removal pretreatment system was installed, until 1973 was disposed in the base sanitary landfill (SWMU No. 9). Since 1973, the sludge has been contract hauled off base. Approximately 31,200 gallons of chromic acid wastewater was treated annually in the metal waste treatment facility, and approximately 6,500 gallons of sludge was removed from the facility per year.

The cyanide wastewater drains to the cyanide waste holding tank, which also has a working capacity of 1,200 gallons. When the holding tank becomes full, the cyanide wastewater is pumped directly to the sanitary sewer. The rate of discharge of cyanide wastewater to the holding tank is extremely variable, such that pumping of the wastewater to the sewer is not performed on a regular basis but rather on an "as-needed" basis. Due to the variability of the cyanide wastewater discharge, the volume of wastewater discharged annually is unknown. However, the cyanide wastewater discharge is known to be less than the annual chromic acid wastewater discharge of 31,200 gallons (REF. 1).

This unit became inactive around 1983 when the new metal plating waste treatment facility began operation. The Old WWTS is currently under interim status until the Closure Plan has been approved. Final Closure activities for this unit have already begun. The wastewater from the treatment unit vessels has already been removed.

4.22.2 Waste Characteristics (REF. 1)

This unit treated wastewater from metal plating processes which included chromic acid, cadmium, copper, chromium, lead, nickel and silver.

4.22.3 Groundwater

4.22.3.1 Pollutant Migration Pathways

The tanks were observed empty and no cracks were visible during the site visit. The unit will be closed, therefore, no future leaks are likely. However, during operation, wastewaters may have leaked into the underlying groundwater.

4.22.3.2 Evidence of Release

There was no direct evidence of release to the groundwater in the site records nor was there evidence of release noted during the visual site inspection.

4.22.4 Surface Water

4.22.4.1 Pollutant Migration Pathways

Because this unit is no longer in use and empty, the migration of hazardous constituents from this unit to surface waters is not likely.

4.22.4.2 Evidence of Release

No evidence of releases to surface water was found in the facility records or observed during the visual site inspection.

4.22.5 Air

4.22.5.1 Pollutant Migration Pathways

Because of the unit characteristics, migration to the atmosphere is not expected.

4.22.5.2 Evidence of Release

No evidence of release to the air was found in the file information or noted during the visual site inspection.

4.22.6 Soils

4.22.6.1 Pollutant Migration Pathways

Although no cracks were observed during the site visit, hazardous constituents may have leaked into soils under the tanks when this unit was in operation. Future releases are unlikely since the unit is shut-down and empty.

4.22.6.2 Evidence of Release

There was no evidence of a release of hazardous constituents to soil from this unit in the records reviewed or observed during the site inspection.

4.22.7 Subsurface Gas

4.22.7.1 Pollutant Migration Pathways

Since no volatile contaminants were reported at the SWMU subsurface gas generation is unlikely.

4.22.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from this unit found in the file information reviewed or observed during the visual site inspection.

4.23 SWMU NO. 23: NEW PLATING SHOP WWTS

4.23.1 Unit Characteristics

The following waste streams flow to the treatment system: rinse water from the chrome plating operation, acid/alkali effluent from metal plating, and cadmium effluent. The treatment system consists of rinse water sumps, holding tanks, transfer pumps, a clarifier, a neutralization tank, and a plate and frame filter press. Wastewater effluent from the clarifier is discharged to the sewer system. Sludge from the filter press is disposed off base.

Rinse water from the chrome effluent, the acid/alkali effluent from metal plating, and the cadmium effluent are routed to separate sumps. These wastewaters are lifted from their respective sumps to two chrome effluent holding tanks (1,000 gallons each), two acid/alkali holding tanks (1,500 gallons each) and two cadmium effluent holding tanks (1,000 gallons each) respectively. The holding tanks are constructed above ground. The tanks and associated sumps are located inside a concrete structure used as the waste treatment building. Chemical feed stations are associated with each set of batch holding tanks.

Wastewater in the chrome holding tanks is treated with sulfuric acid, sodium metabisulfite and sodium hydroxide. The acid/alkali waste is treated with sulfuric acid and sodium hydroxide while wastewater in the chrome holding tanks is treated with potassium hydroxide.

Associated transfer pumps from each set of holding tanks transfer the reacted contents of the batch holding tanks to the clarification section of the waste treatment building. The cadmium waste stream is first pH adjusted to 11, filtered to remove cadmium hydroxide and directed to the clarifier. The chromium and acid/alkali holding tanks wastes are transferred directly to the clarifier.

All treated effluents are directed from the clarifier to a holding tank for filtration prior to being discharged to the sewer system. Underflow from the clarifier is directed to a centrifuge for sludge thickening and then to a plate and frame filter press for dewatering. The sludge is hauled off base.

The holding tanks and associated sumps are located within the waste treatment building. The clarification, filtration, and neutralization systems are located immediately outside the waste treatment building. The treatment building is a concrete structure built around 1983. The new WWTS replaced an existing system (SWMU No. 22).

4.23.2 Waste Characteristics

The new WWTS handles chrome effluent, acid/alkali effluent from metal plating and cadmium effluent.

4.23.3 Groudwater

4.23.3.1 Pollutant Migration Pathways

A leak (crack) in any of the processing units could cause pollutants to migrate downward to the water table. The units are above ground, but have no containment dike, so there is a remote possibility of a release to groundwater.

4.23.3.2 Evidence of Release

There was no evidence of a release to groundwater from the WWTS found in the file information reviewed or observed during the visual site inspection.

4.23.4 Surface Water

4.23.4.1 Pollutant Migration Pathways

A trench is located along the full width of the sump pits, directly in front of the sumps sunk in the floor. This trench is connected to the chromium sump. If a spill or leak were to occur from units outside the waste treatment building, materials could potentially enter the storm drainage system and eventually reach surface waters.

4.23.4.2 Evidence of Release

There was no evidence of a release to surface water from this unit found in the file information reviewed or observed during the site visit. No cracks or leaks were observed in any of the treatment units.

4.23.5 Air

4.23.5.1 Pollutant Migration Pathways

Due to the nature of the contaminants, volatilization to the atmosphere is unlikely.

4.23.5.2 Evidence of Release

There was no evidence of a release of hazardous constituents to the atmosphere from the WWTS found in the file information reviewed or observed during the visual site inspection.

4.23.6 Soil

4.23.6.1 Pollutant Migration Pathways

Since the units are built on concrete foundation pads, there is only a remote possibility of a release to soil. A spill or leak from units located outside the treatment building would result in soil contamination in the vicinity of these structures and possibly in the path of surface runoff.

4.23.6.2 Evidence of Release

No evidence of release of hazardous constituents to soils was found in the site records or observed during the visual site inspection.

4.23.7 Subsurface Gas

4.23.7.1 Pollutant Migration Pathways

Due to the waste characteristics, the formation of subsurface gas is unlikely.

4.23.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from the new WWTS found in the file information reviewed or observed during the visual site inspection.

4.24 SWMU NO. 24: WASTE OIL RECLAMATION FACILITY (REF. 1)

4.24.1 Unit Characteristics

The waste oil reclamation facility is located in the central portion of the shipyard on NSC property and was in operation since 1950. This unit consists of two storage tanks (tanks 39A and 39D). In 1979 an induced air flotation (IAF) unit was installed. The IAF unit is, however, no longer in use.

Currently, waste oils unloaded at pier K, the railroad tank car unloading facility, or at the tank truck unloading facility are pumped to this facility via underground pipelines. The waste oil first enters one of two 740,880-gallon storage tanks (tank 39A or 39D), where gravity oil-water separation occurs. Following gravity oil-water separation, the water phase is drawn off, visually inspected and discharged to the sanitary sewer system. Prior to about 1983, the water from the oil-water separation process was pumped to the IAF unit for additional oil removal. A synthetic polymer coagulant may have been manually added in the IAF unit influent to promote removal of emulsified oils. Although the discharge of the effluent to the Cooper River was covered under the NAVBASE National Pollutant Discharge Elimination System (NPDES) permit, the effluent is discharged to the sanitary sewer. This disposal method is practiced because the NCCPSD maximum daily oil and grease limitation of 100 mg/l for discharge to the North Charleston Sewer District could be met. The oil is skimmed off into a pit awaiting discharge to one of the two storage tanks.

Oil which is separated by gravity separation in the two surge tanks was pumped to tank 3906-0 in the Chicora Tank Farm for storage. The oil stored in tank 3906-0 is blended with Buncker C Diesel fuel and converted into a Navy special. This Navy Special is stored in another storage tank prior to being reused on NAVBASE.

During the visual site inspection waste oil was observed in the air flotation oil pit.

4.24.2 Waste Characteristics

Waste oil may consist of either oil, which has become contaminated but is still predominantly oil, or oily wastewater such as that pumped from bilges. Some waste oil generated by industrial operations become contaminated with waste solvents, especially in cases where oil-water separators receive spillage from degreasing operations which use solvents. However, the volume of solvent compared to the total volume of waste oil is minimal. Other waste oils include waste from diesel fuel, oily waste generated from the cleaning of oil storage tanks, lubricating oils removed from ships that are below minimum specifications, ship bilge water, and oil generated during ship maintenance and overhaul.

4.24.3 Groundwater

4.24.3.1 Pollutant Migration Pathways

If leaks or cracks develop in the pipelines, storage tanks or in the unused IAF unit, pollutants could migrate downward to the groundwater.

4.24.3.2 Evidence of Release

There was no evidence of a release to groundwater found in the site records or observed during the visual site inspection.

4.24.4 Surface Water

4.24.4.1 Pollutant Migration Pathways

There is the possibility that the flotation unit tank (containing waste oil) may overflow.

4.24.4.2 Evidence of Release

No evidence of releases to surface water were found in the file information or observed during the visual site inspection.

4.24.5 Air

4.24.5.1 Pollutant Migration Pathways

Solvents present in uncovered units could volatilize and migrate to the atmosphere.

4.24.5.2 Evidence of Release

No evidence of a release to the air was found in the file information reviewed or observed during the visual site inspection.

4.24.6 Soils

4.24.6.1 Pollutant Migration Pathways

There is a remote possibility that the IAF unit will overflow or leak onto surrounding soils.

4.24.6.2 Evidence of Release

No evidence of releases to the soil was found in the file information reviewed or observed during the visual site inspection.

4.24.7 Subsurface Gas

4.24.7.1 Pollutant Migration Pathways

Because of the waste characteristics, the generation of subsurface gas is not likely.

4.24.7.2 Evidence of Release

There was no evidence of a release of subsurface gas from this unit found in the file information reviewed or observed during the visual site inspection.

5.0 CONCLUSIONS AND RECOMMENDATIONS

This section summarizes releases from individual SWMUs, and recommendations for further action at the NSY facility. The recommendations are presented in Table 5-1.

5.1 SWMU NO. 1 DRMO (Formerly DPDO) STAGING AREA

The storage shed is a wood framed and roofed structure with exterior walls used to store chemicals and other materials including coating compounds, acids, insulating compounds and bases. The base intends to close this accumulation point and may revert to using it as a staging area.

Apart from the leaking freon drum, no other direct evidence of a release to the environment was found in the data reviewed nor was release noted during the site visit. The leaking freon drum has been removed from the unit. It is recommended that the base continue with its plan of closing the unit.

5.2 SWMU NO. 2 LEAD CONTAMINATION AREA

This unit is a salvage bin that was used to store lead-acid batteries from submarines. The contamination investigation and exposure assessment (REF. 2) conducted for this SWMU has resulted in a determination that existing lead contamination in soils and dust present a potential risk to human health and/or the environment.

Since this SWMU has been studied extensively under the NACIP program, it is recommended that remediation efforts continue under this program. The Confirmation Study recommedation of conducting a focused feasibility study to determine the most effective and economical remedial action should therefore be implemented.

5.3 SWMU NO. 3 PESTICIDE MIXING AREA

This unit was used in the past to wash off equipment used in spraying and mixing of pesticides. During the Confirmation Study conducted at NAVBASE, no pesticides, herbicides, or PCBs were detected in the shallow groundwater at this unit. However, pesticides and PCBs were detected in the soil with the highest concentrations occurring near the ground surface.

TABLE 5-1 (cont.)

RECOMMENDATIONS FOR FURTHER ACTION
CHARLESTON NAVAL SHIPYARD

SWMU	ACTION	COMMENTS
14. Chemical Disposal Area	Continue with the NACIP program	This unit is currently being studied under the NACIP program
15. Incinerator	None	
16. Paint Storage Bunker	None	The unit has apparently been cleaned up
17. Oil Spill Area	Implement RFI/ICM	Conduct a soil boring and sampling program
18. PCB Spill Area	None	
19. Solid Waste Transfer Station	None	
20. Waste Disposal Area	None	
21. Old Paint Storage Area	Continue with closure activities	
22. Old Plating Shop WWTS	Continue with closure activities	
23. New Plating Shop WWTS	None	
24. Waste Oil Reclamation Facility	None	

NOTE:

NACIP - Navy Assessment and Control of Installation Pollutants
ICM - Interim Corrective Measures
RFI - Remedial Facility Investigation

Corrective measures have been recommended for this unit as part of the Confirmation Study. It is recommended that the NACIP process continue, including appropriate EPA reviews, to determine the most effective and economical remedial action.

5.4 SWMU NO. 4 PESTICIDE STORAGE BUILDING

This unit was used to store insecticides and rodenticides. The unit has been inactive since 1985 and is currently used for miscellaneous storage only. No direct evidence of a release to the environment was found in the data reviewed nor was release noted during the site visit. Therefore, no further action is recommended.

5.5 SWMU NO. 5 BATTERY ELECTROLYTE TREATMENT AREA

Prior to 1984 this unit was used for the neutralization of submarine battery acid. The unit also contains drums which were used to segregrate and store spill residue from paint solvents (paint and paint related spills).

This unit is being phased out of service. However, the NSY plans to retain the structure, should a future need for electrolyte treatment arise. No evidence of a release to the environment was found in the data reviewed nor was evidence of a release noted during the site visit. It is recommended the NSY proceed with phasing this unit out of service.

5.6 SWMU NO. 6 PUBLIC WORKS STORAGE YARD

This is a large open, fenced compound where routinely-generated, containerized hazardous wastes are currently stored prior to shipment from the NSY. This unit is an interim status facility and is planned to be permanently closed as a hazardous waste unit. No evidence of a release to the environment was found in the data reviewed nor was evidence of a release noted during the site visit. Therefore, no further action is recommended.

5.7 SWMU NO. 7: PCB TRANSFORMER STORAGE AREA

This unit was used to store electrical equipment including transformers. Areas of the unit show evidence of past oil spills. The data collected at this unit during the Confirmation Study conducted at NAVBASE (REF. 8) shows that the shallow groundwater contains very low levels of PCBs, pesticides, and arsenic, although the soils in this area contain relatively high levels of these contaminants.

The Confirmation Study recommended a more detailed sampling program prior to selecting a remedial action. This course of action should be followed and remedial action pursued through the NACIP program.

5.8 SWMU NO. 8 OIL SLUDGE PIT AREA

This unit was used between 1944 and 1971 for disposing of oil sludges produced from industrial activities at NSY. The pits were later abandoned and filled with gravel and sand. During the Confirmation Study conducted at NAVBASE, a ditch was dug at this site that intercepted the oil body, and the ditch had to be dammed immediately to prevent migration of the oil into Shipyard Creek (REF. 8).

Corrective measures have been recommended for this unit as part of the Confirmation Study. It is recommended that the NACIP process continue, including appropriate EPA reviews, to determine the most effective and economical remedial action.

5.9 SWMU NO. 9 CLOSED LANDFILL

Prior to 1973, all solid waste generated at NAVBASE reportedly was disposed onsite in a landfill. Wastes included household garbage, asbestos, drummed industrial liquid wastes, waste solvents, waste paints, paint sludge, PCBs, metal sludge, acid neutralization sludge, mercury, and other waste chemicals. Most wastes from the industrial shops in NSY were disposed in the landfill.

The area has since been covered with soil and graded to prevent ponding. The results of chemical analyses of water samples collected from monitoring wells along the edge of the landfill revealed the presence of low levels of dissolved metals and volatile organics. The Confirmation Study recommended that a feasibility study be performed to determine the most effective and economical method of remediation. This course of action should be followed and remedial action pursued through the NACIP program.

5.10 SWMU NO. 10 HAZARDOUS WASTE STORAGE FACILITY

This unit is designed to store hazardous waste materials until time of proper disposal. The facility currently operates as a temporary storage facility with permission to store wastes for 90 days maximum. No evidence of a release to the environment was found in the data reviewed or noted during the site visit.

All wastes and hazardous constituents started at this unit are disposed off base. Therefore, no further action is recommended.

5.11 SWMU NO. 11 CAUSTIC POND

This unit was used for the disposal of calcium hydroxide. The Initial Assessment Study (see REF. 1) identified the Caustic Pond as a potential hazardous waste site. The water quality data collected from the wells installed around the Caustic Pond indicate that the shallow groundwater has been mineralized by wastes in the pond.

Corrective measures have been recommended for this unit as part of the Confirmation Study. It is recommended that the NACIP process continue, including appropriate EPA reviews, to determine the most effective and economical remedial action.

5.12 SWMU NO. 12 OLD FIRE FIGHTING TRAINING AREA

Between 1966 and 1971 oil, gasoline, and alcohol were poured into this unit, ignited and subsequently extinguished during fire fighting training exercises. The unit was closed in 1972 by leveling and covering with bottom ash, and four inches of sludge. Soil borings at the fire fighting pit revealed no oil or traces of oil. No further action is recommended at this SWMU.

5.13 SWMU NO. 13 CURRENT FIRE FIGHTING TRAINING AREA

This unit is used for extinguishing ignited diesel oil and gasoline during fire fighting training exercies. Diesel oil burning operations occur in enclosed, paved areas and gasoline is burned directly on the ground in a bermed area. Most of the gasoline burns or evaporates. No action is recommended for this unit.

5.14 SWMU NO. 14 CHEMICAL DISPOSAL AREA

Small quantities of warfare decontaminating agents DANC-DS-2 and DANC-N4 were buried at unknown locations in the chemical disposal area. These chemicals are strongly alkaline and can cause chemical burns if contact with the skin or eyes occurs. Analyses of water samples from five monitoring wells in the area did not detect the presence of chemical constituents associated with these decontaminating agents. However, several other industrial chemicals such as methylene chloride and chlorobenzene were detected in water samples collected from these monitoring wells. Presumably waste products containing these materials have also been disposed in this area. The presence of these compounds in the groundwater poses a safety hazard to personnel excavating in this area.

Corrective measures have been recommended for this unit as part of the Confirmation Study. It is recommended that the NACIP process continue, including appropriate EPA reviews, to determine the most effective and economical remedial action.

5.15 SWMU NO. 15 INCINERATOR

This unit is permitted by SCDHEC to burn classified paper materials. Residue from the burning operation is disposed with other NSY solid waste. Since no hazardous waste is handled at this SWMU, no further action is recommended.

5.16 SWMU NO. 16 PAINT STORAGE BUNKER

This unit consists of a pile in which miscellaneous materials including paint, paint thinner, oil containment booms, wooden crates and buoys were observed. The paints and thinners have since been removed and returned to storage. Also, an area, where paint was observed spilled on the ground, has been excavated and the contaminated material turned over to EPECD for disposal. No further action is recommended for this unit since the paint and paint thinners have been removed from the SWMU and the paint spill has apparently been cleaned up.

5.17 SWMU NO. 17 OIL SPILL AREA

This unit consists of an oil spill which supposedly came in contact with PCBs in the soil. Most of the oil has reportedly been recovered but soil samples taken in the vicinity of the spill show PCB levels of 1 ppm, 6 ppm and 130 ppm. Remedial action is recommended for this unit.

A soil boring and sampling program should be implemented for this unit to determine the extent of contamination. A groundwater investigation should also be conducted to determine the extent of PCB contamination at SWMU No. 17.

5.18 SWMU NO. 18 PCB SPILL AREA

This spill occurred when a contractor was attempting to load a transformer onto a flatbed truck. The weight of the transformer shifted against the forklift, breaking the ceramic insulators located about 24 inches from the top of the transformer tank. Approximately 75 gallons of Pyranol fluid was spilled. The SCDHEC District Office is currently investigating the spill but has indicated to NSY that they are satisfied with the remedial action reportedly taken (Ref. 12). It is recommended that SCDHEC continue with its investigation of the cleanup action reportedly taken at the spill site.

5.19 SWMU NO. 19: SOLID WASTE TRANSFER STATION

The solid waste transfer station consists of a staging area for the temporary holding of nonhazardous solid waste from NAVBASE prior to loading for transport off base for disposal. No hazardous wastes are handled at this unit. Therefore, no further action is recommended for this unit.

5.20 SWMU NO. 20: WASTE DISPOSAL AREA

The site is an open area on which cardboard boxes, batteries, wood, concrete blocks and tree stumps are disposed directly on the ground. Black diamond (MgO), a residue from sandblasting operations, was also observed disposed in areas on the site. No chemicals or paints were reportedly disposed or was there evidence of such disposal during the site visit. The NSY is currently filling the site with clean soil from other areas of NAVBASE before grading the area. The site occupies an area above the closed landfill (SWMU No. 9).

Since this site is located on the closed landfill, and the volume of hazardous wastes known to have been disposed at the site is small, no specific recommendations are made for this unit. The feasibility study for the closed landfill (SWMU No. 9) should consider the presence of this unit in evaluating alternatives.

5.21 SWMU NO. 21: OLD PAINT STORAGE AREA

This unit has been used for storage of containerized waste paints from ships returning to NAVBASE and from ship repair and overhaul operations. The unit is under interim status and will be closed after the new hazardous waste storage facility is permitted. The closure plan (REF. 12) has been submitted to SCDHEC for approval. It is therefore recommended that the NSY continue with closure activities for this unit under SCDHEC supervision.

5.22 SWMU NO. 22: OLD PLATING SHOP WWTS

This unit was used to treat process wastewater from the metal plating shops. The plating shop supported by the treatment unit was recently replaced by a new noncyanide plating shop and treatment system, thereby eliminating the need for this unit. SWMU No. 22 is an Interim Status facility and final closure will be initiated when the new hazardous waste facility (SWMU No. 10) is permitted. It is, therefore, recommended that the NSY continue with closure activities as described in the Closure Plan (see REF. 12) under SCDHEC supervision.

5.23 SWMU NO. 23 NEW PLATING SHOP WWTS

This unit is a permitted wastewater treatment facility used to treat chrome cadmium, and acid/alkali effluents from metal plating operations. Treated wastewater is stored prior to being discharged to the sewer system. No evidence of releases to any media, except the normal discharge of clarifier effluent to the sewer system, was noted during the site visit. Therefore, no further action is recommended for this SWMU.

5.24 SWMU NO. 24: WASTE OIL RECLAMATION FACILITY

This unit is used to treat waste oil obtained from NAVBASE. Oil recovered from this operation is blended with fuel and used in various operations at NAVBASE. Sludge from the reclamation process is disposed off base by a contractor. Treated wastewater effluent is discharged directly to the sewer system. No evidence of a release to the environment was found in the data reviewed nor was evidence of a release noted during the site visit. Therefore, no further action is recommended for this unit.

LIST OF REFERENCES

1. Environmental Science and Engineering, Inc., May 1983. Initial Assessment Study for the Charleston Naval Base . ESE, Gainsville, Florida.

2. Environmental Science and Engineering, Inc. 1986. Contamination and Exposure Assessment for the Lead Contamination within the Defense Reutilization and Management Office. ESE, Tampa, Florida.

3. Davidoff, C., MCHE. 1982. Extracts From Plating Facility, Building 226, Manual III Waste Treatment. Charles Davidoff, Port Washington, NY.

4. South Carolina Water Resources Commission, 1972. ACE Framework Study. Ashley-Combahee, Edisto River Basin.

5. Mald, H.E. 1959. Geology of the Charleston Phosphate Area, South Carolina Geological Survey Bulletin 1079. U.S. Government Printing Office, Washington, D.C.

6. Billingsley, G.A. 1956. Chemical Character of Surface Waters of South Carolina Bulletin No. 168. South Carolina State Development Board, Columbia, SC.

7. Siple, G.E. 1946. Groundwater Investigation in South Carolina Bulletin No. 15. U.S.G.S. Columbia, South Carolina.

8. Geraghty & Miller, Inc. 1982. Confirmation Study - Assessment of Potential Oil and Hazardous - Waste Contamination of Soil and Groundwater at the Charleston Naval Shipyard. Geraghty & Miller, Inc. Tampa, Florida.

9. July 7, 1987. Personal communication between I. Noel (CCJM) and A. Shoultz (NSY).

10. AmerEco Environmental Services, Inc. June 25, 1987. PCB Spill Report.

11. Memorandum on Environmental Incident Report of PCB Spill. June 25, 1987.

12. Environmental and Safety Designs, Inc., April 30, 1985. Closure Plans for Interim Status Facilities, Charleston Naval Shipyard. Charleston, South Carolina.