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Remedial Action Plan
Southern Wood Piedmont Company, City of Wilmington & North Carolina State Ports Authority Wilmington, North Carolina Facility

Prepared for

Southern Wood Piedmont Company
Spartanburg, South Carolina

Prepared By The

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REMEDIAL ACTION PLAN
SOUTHERN WOOD PIEDMONT COMPANY, CITY OF WILMINGTON, & NORTH CAROLINA STATE PORTS AUTHORITY WILMINGTON, NORTH CAROLINA FACILITY

EXECUTIVE SUMMARY

This plan describes a voluntary Remedial Action Plan (RAP) that is proposed to address groundwater contamination at the former Southern Wood Piedmont Company (SWP) facility located in Wilmington, North Carolina. This report presents a proposed plan developed in accordance with the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR), Division of Solid Waste Management, Superfund Section, Inactive Hazardous Sites Branch report titled: GUIDELINES FOR RESPONSIBLE PARTY VOLUNTARY SITE REMEDIAL ACTION dated July 1, 1995. The RAP is based on the findings of the soil, sediment, surface water, and groundwater assessment reports and the human health and ecological risk assessments completed for the facility. The proposed plan for site remediation is preliminary and subject to public and regulatory agency comment.

The North Carolina State Ports Authority is presently in negotiation with the City of Wilmington to purchase their parcel of land at the site. Following purchase of the City of Wilmington property, the North Carolina State Ports Authority plans to construct a land/sea cargo transfer facility. In order to develop the site, several feet of fill material will be required. The fill material will be capped with an impervious material to support facility operations. Sheet piling may also be installed along the Cape Fear River for pier construction and backfill support.

Observations during the remedial investigations indicate that wood-preserving constituents entered the environment from three source areas. The three source areas are the wood treatment area, the large storage tank area, and the diesel storage tank area. All three source areas have coalesced and formed a west to east trending band of organics located along the southern City of Wilmington property boundary between the Cape Fear River to the west and the on-site drainage ditch to the east. Along this band dissolved organics from the former wood treatment area migrate to the east toward the on-site drainage ditch and then turn to the south toward Greenfield Creek. The dissolved organics do not appear to migrate off site to the east. The dissolved organics in the vicinity of the former diesel storage tanks and the large storage tank area are migrating to the west toward the Cape Fear River.

The primary objective in the selection of the remedial action at this facility is to minimize the potential for site contamination to pose future threats to human health and the environment and to maintain risks at acceptable levels for reasonably expected current and future site use. A feasibility study was performed to identify and evaluate potential alternatives to remediate the contamination identified at the site. The corrective measure technologies that were technically practical, proven effective, and cost efficient, while providing adequate protection of human health and the environment, were retained for further evaluation.

The following remedial alternatives have been selected for the Wilmington facility:

(1) No action/natural attenuation;
(2) Natural attenuation, site security, and monitoring, and;
(3) Natural attenuation, site security, monitoring, and site development.

The preferred remedial action for the Wilmington facility is alternative (3)--natural attenuation, site security, monitoring, and site development. Site development will include placing several feet of fill material and an impervious surface across the site (capping). Sheet piling installation and backfilling may also be required for pier construction. Alternative 3 was selected based on being the most cost-effective corrective action that effectively protects human health and the environment.

Human health and ecological risk assessments completed for the site indicate that groundwater, soil, sediment, and surface water concentrations are at levels that future use of the site as non-residential industrial is not likely to present a significant risk. The groundwater plume does not pose a current risk to human health or the environment, and is unlikely to pose a future risk because of the low rate of plume migration to surrounding surface water bodies, natural degradation, and the absence of potential receptors (i.e. groundwater users) in the area. The preferred remedial alternative assumes that the current concentrations of wood-preserving constituents will be reduced over time through natural degradation, thereby, reducing the toxicity, volume, mobility, and associated risks to human health and the environment. Filling, paving, and sheet piling installation during site development will further decrease the mobility of the constituents and increase the time available for natural degradation. Semi-annual groundwater and surface water monitoring will occur to evaluate the natural degradation process and verify compliance with applicable or relevant and appropriate requirements (ARARs). In addition to standard indicator parameters, pH, specific conductance, and temperature, the ground water and surface water samples will be analyzed for the site constituents-of-concern including: chromium, copper, arsenic, pentachlorophenol, acenaphthene, anthracene, carbazole, fluoranthene, naphthalene, phenanthrene, benzene, ethyl benzene, toluene, and xylenes. Semi-annual reports will be prepared and submitted to NCDEHNR documenting the sampling and analysis procedures, analytical results, and a discussion on compliance with the ARARs.

In addition to natural attenuation of the wood-preserving constituents and monitoring to assure compliance with applicable ARARs, several institutional controls will be utilized to further reduce potential risks to human health and the environment. Institutional controls will include an existing city ordinance that restricts groundwater use to irrigation, the placement of a deed restriction and deed notice, sign posting, site security, and a groundwater statutory variance. The city ordinance prevents the installation of groundwater wells for drinking water purposes in the limits of the City

of Wilmington. The deed restriction will limit the property use to industrial. A notice will be placed in the deed stating that the soil and groundwater at the facility have been impacted by previous site activities and that any improvements to the site should consider these impacts. Signs will be posted that restrict unauthorized use of the property. Site inspections will be performed daily by the North Carolina State Ports Authority's security force. A locking gate at the main entrance to the facility will be provided. The NCDEHNR will be petitioned for a groundwater statutory variance for groundwater within the property boundaries at the facility.

Implementation of the selected remedial action will begin following approval from the State of North Carolina and Region IV United State Environmental Protection Agency.

REMEDIAL ACTION PLAN
SOUTHERN WOOD PIEDMONT COMPANY, CITY OF WILMINGTON & NORTH CAROLINA STATE PORTS AUTHORITY WILMINGTON, NORTH CAROLINA FACILITY

1.0 INTRODUCTION

This plan describes a voluntary remedial action that is proposed to address soil, sediment, surface water, and groundwater contamination at the former Southern Wood Piedmont (SWP) facility located in Wilmington, North Carolina. The remedial action plan meets the requirements stated in the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR), Division of Solid Waste Management, Superfund Section, Inactive Hazardous Sites Branch guidelines titled: GUIDELINES FOR RESPONSIBLE PARTY VOLUNTARY SITE REMEDIAL ACTION dated July 1, 1995. The purpose of this remedial action plan is to identify and evaluate alternatives for corrective action at the Wilmington facility and to recommend and justify selection of a risk based preferred alternative that is protective of human health and the environment.

1.1 Site Background

The former Southern Wood Piedmont (SWP) facility is located in an industrialized area adjacent to the eastern bank of the Cape Fear River in the city limits of Wilmington, North Carolina (Figure 1). The facility is bounded to the north by the Amerada Hess Corporation fuel tank farm and to the south by Greenfield Creek. Across Greenfield Creek from the facility is the PAK Tank, Inc. bulk chemical storage tank farm. CSX railroad tracks are located to the east of the facility and the Cape Fear River is located to the west. Greenfield Street, which runs in an east-west direction, terminates to the west at the SWP facility.

The facility is situated on two parcels of land that are currently leased to Southern Wood Piedmont. The southern parcel is owned by the North Carolina State Ports Authority and the northern parcel by the City of Wilmington. A topographic map for the site and adjacent properties has been prepared and is presented in Figure 2.

1.2 Site History

Early Sanborn maps indicate that Newport Shipbuilding Company was operating on site in 1921. Newport Shipbuilding Company leased the site from the United States Shipping Board Emergency Fleet Corporation. The site was deeded to the City of Wilmington in the 1920's. In 1932, North State Treating Company leased the property from the City of Wilmington. Taylor Colquitt Company leased the property in 1935 and continued to treat wood products with creosote. In 1964, Taylor Colquitt Company was purchased by Southern Wood and the name was changed to Taylor Piedmont. International Telephone & Telegraph (ITT) purchased Taylor Piedmont in 1969. Early in 1971, ITT changed the company name to Southern Wood Piedmont Company. Southern Wood Piedmont Company operated the wood preserving facility until June 1983. At that time wood treating operations ceased and closure operations commenced at the facility.

The wood-preservative constituents used during plant operations included creosote, pentachlorophenol (PCP), and copper, chromium, and arsenic (CCA). Diesel fuel was used as a carrier for the pentachlorophenol and as a heating fuel at the facility. The soil, sediment, surface water, and groundwater at the site has been sampled and analyzed for a list of inorganic, semi-volatile, and volatile constituents (Attachment A) common to creosote, PCP, CCA, and diesel fuel.

Various phases of remedial investigation have been completed at the facility. Previous site activities include: a soil and groundwater investigation completed by the City of Wilmington on their parcel of land; a site-wide near-surface soil investigation; a landfarm soil investigation; sediment and surface water investigation in Greenfield Creek and the Cape Fear River; and Phase I, II, and III groundwater quality investigations at the facility. For a complete summary and reference listing of previous site environmental activities please refer to the ViroGroup, Inc. reports titled: PHASE III GROUNDWATER QUALITY ASSESSMENT - WILMINGTON, NORTH CAROLINA FACILITY dated July 26, 1994 and the SOIL, SEDIMENT, AND SURFACE WATER ASSESSMENT - SOUTHERN WOOD PIEDMONT, CITY OF WILMINGTON, AND NORTH CAROLINA STATE PORTS AUTHORITY dated May 1996.

1.3 Planned Future Site Use

The North Carolina State Ports Authority has signed an option to purchase the City of Wilmington's parcel of land at the site. Following purchase of the City of Wilmington property, the North Carolina State Ports Authority plans to develop the site for industrial use (i.e., construct a land/sea cargo transfer facility). Current conditions at the site are such that the site sometimes floods during high tide conditions. In order to develop the site, several feet of fill material must be placed to raise the elevation of the site. The fill material will be capped with an impervious material (concrete, asphalt, etc.) to support facility operations. Sheet piling installation and backfill placement will most likely be completed along the Cape Fear River during pier construction.

2.0 SUMMARY OF REMEDIAL ACTIVITIES

Remedial investigation activities have been completed that address the various media that may have been impacted by former site activities. A human health and ecological risk assessment has been completed that includes all of the affected media. Presented below is a summary of the remedial activities completed for each media and the findings of the risk assessment.

2.1 Soil

2.1.1 Administrative Order of Consent Activities

Soil remedial action has been completed through an Administrative Order of Consent (AOC) with the NCDEHNR dated May 20, 1985. The AOC provided soil clean-up/remedial action directives that minimized the site's impact on the environment and public health in a manner consistent with State and Federal hazardous waste laws and rules.

The sludge containing organic preservative residuals from the bottom of the various wood preservative storage tanks was placed in an approved off-site landfill or burned for fuel recovery at an off-site location. Storage tank sludge and soil in the vicinity of the chromium, copper, and arsenic (CCA) treatment and storage tank area was excavated, stabilized and buried on-site, or sent off-site to a permitted land disposal facility. Soil with arsenic concentrations between 5 mg/kg and 0.5 mg/kg arsenic (determined by EP-Toxicity testing) was stabilized by mixing with Portland cement and buried on-site. Soils with arsenic concentrations of 5 mg/kg or greater and the storage tank residues were disposed in a secure landfill off-site.

The AOC allowed land treatment (landfarming) of preservative residuals in soil to reduce the residuals to an acceptable level. Soil containing preservative residuals were excavated from the covered sludge ditch, the track area in front of the treatment cylinder, the area in the vicinity of the treatment buildings, and the large storage tank containment area. The excavated soil was temporarily staged in a bermed spoil pile. From July 1984 to April 1990 the stockpiled soils were placed at regular intervals on the two landfarm areas (LF1 and LF2) in 2-inch thick lifts and tilled weekly to a depth of 6-inches below land surface. Each lift was treated by adding irrigation water, 10-10-10 fertilizer, and chicken and turkey manure to promote microbial growth and wood preserving constituent degradation. The landfarm was operated from 1984 to 1990. The areas of excavation were backfilled with sandy clay obtained from a borrow pit 10 to 15 miles away and revegetated.

Composite soil samples were collected from each landfarm area between September 1985 and October 1988. A total of 37 sets of samples were collected from LF1 and 59 sets of samples were collected from LF2. The samples were analyzed for total nitrogen, total phosphorus, chloride, total organic carbon, soil pH, polycyclic aromatic hydrocarbons (PAH's), pentachlorophenol, phenol, and microbial counts by the Mississippi State University Forest Products research Division Laboratory (MSUFPRD) in State College, Mississippi. Total PAH concentrations declined substantially from 1985 to 1990. Degradation rates varied between the different PAHs. PAHs with two aromatic rings were found to degrade more rapidly than PAHs with four or more rings. PAHs with half-lives less than 10 days were completely degraded after 3 months, whereas, PAHs with intermediate (10 to 100 days) and long (more than 100 days) half-lives persisted.

A second soil sampling investigation was completed on October 10, 1990 in the two landfarm areas (LF1 and LF2) to provide a baseline of current conditions for LF1 and LF2. Generally, there was no observable trend in constituent concentrations between the upper, middle, and lower depth samples from the landfarm areas. Concentrations of constituents in the substrate samples were significantly lower than those occurring in the overlying landfarm material, indicating minimal vertical migration of constituents.

In October 1991 soil samples were collected from the previously sampled locations in each landfarm to provide data on the presence and degradation of the wood-preserving constituents in the landfarm material since the 1990 sampling event. In order to compare the 1990 and 1991 sampling results and for risk assessment purposes, the PAHs were divided into two classes: carcinogenic (cPAHs) and total PAHs (tPAHs). The mean concentrations for both cPAHs and tPAHs showed a slight decrease from 1990 to 1991. cPAH concentrations decreased by an average of 14.5 percent and tPAH concentrations decreased by an average of 13.1 percent between 1990 and 1991. Two- and three-ring PAHs decreased from a range of 9 to 88 percent. The average decrease was about 33 percent. The concentrations of four-, five-, and six-ring PAHs was highly variable. It was predicted using constituent-specific degradation half-live values, that after 30 years most of the constituents will be degraded to less than 0.001 mg/kg. The four- and five-ring PAHs will have concentrations of 2 mg/kg or less.

To evaluate the presence and continued degradation of wood-preserving constituents in the landfarm materials between 1991 and 1996, additional soil samples were collected on February 15, 1996. The analytical results from the 1996 landfarm soil samples indicate a decreasing trend in constituent concentration levels since 1991. The results indicate that all of the organic wood-preserving constituent concentrations have decreased in both landfarm areas. Total wood-preserving constituent concentrations in LF1 have decreased from 497.85 mg/kg dw in 1991 to 107.1 mg/kg dw in 1996 and in LF2 from 1,354.7 mg/kg dw to 131.5 mg/kg dw. The PAH constituents naphthalene, 2-methylnaphthalene, 1,1-biphenyl, acenaphthylene, acenapthene, dibenzofuran, fluorene, pyrene, dibenzo(a,h)anthracene, benzo(g,h,i)perylene, and pentachlorophenol were detected in the landfarm in 1991, but were not detected in 1996. The majority of the PAHs that were not detected in 1996 are two- and three-ring molecular structures with half-lives of less than 10 days. Phenanthrene, anthracene, carbazole, benzo(a)anthracene, chrysene, benzo(a)pyrene, fluoranthene, benzo(b,k)fluoranthene, and indeno(1,2,3-cd)pyrene were detected in the landfarm during the 1996 sampling. The molecular-ring structure of the nine PAH constituents detected ranged from three-rings (phenanthrene, anthracene, and carbazole) to six-rings (indeno(1,2,3-cd)pyrene). Three of the constituents (fluoranthene, chrysene, and benzo(a)anthracene) are comprised of four-rings, while the remaining two constituents (benzo(b,k)fluoranthene, and benzo(a)pyrene) have a five-ring structure. In general, the molecular composition of the wood-preserving constituents dictate the ease in which they will degrade, their relative mobility in the environment, and their toxicity levels. The more complex molecular-ring structures will degrade slower, however, they are usually less toxic and less mobile than compounds with simple one or two molecular-ring structures.

On October 9, 1990 composite surficial polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) soil samples were collected from each landfarm. Both composite samples had detectable concentrations of PCDDs and PCDFs. The concentrations for each class of PCDDs ranged from 140/170 (LF1/LF2) picograms per kilogram (pg/kg dw; part per trillion) total tetrachlorodibenzodioxins to 621,000/932,000 (LF1/LF2) pg/kg dw total octachlorodibenzodioxins. The 2,3,7,8-tetrachlorodibenzodioxin congener was detected at a maximum estimated concentration of 4 pg/kg dw in LF1 and at 8 pg/kg dw in LF2. The concentrations for each class of PCDFs ranged from 90/100 (LF1/LF2) pg/kg dw total tetrachlorodibenzofurans to 147,000/164,000 (LF1/LF2) pg/kg dw total heptachlorodibenzofurans.

To evaluate any change in the concentrations of PCDDs and PCDFs in the landfarm material from 1990 to 1996, two additional composite surficial soil samples were collected on February 15, 1996. The concentrations for each class of PCDDs in 1996 ranged from 61.0/91.8 (LF1/LF2) pg/kg dw total tetrachlorodibenzodioxins to 583,460/496,210 (LF1/LF2) pg/kg dw total octachlorodibenzodioxins. The 2,3,7,8-tetrachlorodibenzodioxin congener was detected at a concentration of 2.4 pg/kg dw in LF1 and at 4.2 pg/kg dw in LF2. The concentrations for each class of PCDFs ranged from 68.9/96.5 (LF1/LF2) pg/kg dw total tetrachlorodibenzofurans to 154,750/155,250 (LF1/LF2) pg/kg dw total octachlorodibenzofurans. A comparison of the 1990 and 1996 results for the dioxin and furan soil samples collected in the two landfarm areas indicate that the total concentrations for the dioxin and furan constituents have remained relatively consistent. Noteworthy changes in concentration include a decrease in the 2,3,7,8-tetrachlorodibenzodioxin congener at LF1 from 4 pg/kg dw in 1990 to 2.4 pg/kg in 1996 and a decrease at LF2 from 8 pg/kg dw in 1990 to 4.2 pg/kg dw in 1996. Total tetrachlorodibenzodioxins decreased from 1990 concentrations in 1996 from 140 pg/kg dw to 61 pg/kg dw at LF1 and from 170 pg/kg dw to 91.8 pg/kg dw at LF2.

2.1.2 Site Soil Investigation

Between February 26 and March 1, 1991, 92 soil borings were completed and 48 soil samples were collected from treated (TWSA) and non-treated wood storage areas (NTA and NTB) at the facility. Each of the soil borings were completed to a depth of 18-inches below land surface and visually assessed for the degree of staining and odor. Discolored soils were observed in 2 of 12 locations at NTA, at 6 of 21 locations in NTB, and in 8 of 23 locations in TWSA. Randomly selected soil boring locations were sampled for semi-volatile organic constituents and the metals, arsenic, chromium, and copper at depth intervals of 0- to 6-inches and 12- to 18-inches below land surface. A total of 14 semi-volatile constituents were detected. Wood-preserving constituents were detected in 18 of 26 samples collected from TWSA and in 23 of 24 samples collected in NTA and NTB. Metal concentrations in TWSA, NTA, and NTB are within observed ranges for these elements in soils of the eastern United States.

The main production area (PA) and treated wood storage area B (TWSB), located in the northwest portion of the site, were not included in the 1991 assessment. To complete the site-wide soil investigation the main production area and the treated wood storage area B were assessed on February 12 through 14, 1996. A total of 78 boreholes were completed to a depth of 18-inches. Each soil boring was described for degree of staining and odor. A head-space analysis was performed to screen each sample for total volatile organic compounds (VOC's) using a photo-ionization detector/organic vapor analyzer (PID/OVA). Twenty-six of the boreholes (1/3) were randomly selected for chemical analysis. A soil sample was collected from the 0- to 6-inch and 12- to 18-inch intervals (total of 52 soil samples) and submitted to the laboratory for analysis of the Wilmington site-specific wood-preserving constituent list. In the main production area, 33 soil borings were completed and 22 soil samples were collected. Visual observations indicated that 21 of the soil borings had no staining or odor, 3 soil borings had a faint odor, and 9 soil borings were discolored. In the 22 soil samples collected, 14 semi-volatiles and 2 volatiles were detected. Eighteen of the 22 samples contained detectable concentrations of arsenic. Chromium was detected in all of the samples and 19 of the samples had detectable concentrations of copper. The mean concentration for arsenic, chromium, and copper in the former production area is 80 mg/kg dw, 91 mg/kg dw, and 111 mg/kg dw, respectively. Investigation activities in the treated wood storage area B included the completion of 45 soil borings and the collection of 30 soil samples. Visual observations indicated that 44 of the soil borings had no staining or odor and 1 of the soil borings was discolored. Out of the 30 soil samples collected, 11 semi-volatile constituents and 1 volatile constituent were detected. Arsenic was detected in 18 out of 30 samples, chromium was detected in all 30 samples, and copper was detected in 16 out of 30 samples collected from TWSB. The average concentration of arsenic is 6.7 mg/kg dw, of chromium is 7.1 mg/kg dw, of copper is 18.7 mg/kg dw. The metal concentrations in the production and TWSB areas are in the acceptable range for background concentrations.

2.1.3 Soil Targets

No residents or workers are present at the site. The property is secured by a locked gate. The nearest residence is located approximately 400 feet east of the site. The nearest workers are located at the Hess terminal north of the site. The nearest day care facility is 1,000 feet east of the site. A recreational park is located southeast of the site, but is separated from the site by a railroad grade, by vegetation, and by a ditch that drains the site.

2.2 Sediment

A sediment sample (SWP-RB-S) was collected in 1985 by NUS Corporation in the Cape Fear River at the end of the on-site jetty (former T-head) between the two site slips. A second background sediment sample (SWP-BK-51) was collected in the bed of the overflow stream from Greenfield Lake (Greenfield Creek). No arsenic, chromium, or copper was detected in the sediment samples collected by NUS. The sediment sample at the jetty indicated the presence of

14 identified organic compounds, one unidentified brominated compound, and three unidentified hydrocarbons. The Greenfield Creek sediment sample indicated the presence of eight identified organic compounds, 11 unidentified organic compounds, and one unidentified brominated compound. The pesticides 4,4'-DDE and 4,4'-DDD were detected in the Greenfield Creek sediment sample.

On December 9 and 14, 1992, 11 sediment samples (SS-1 thru SS-11) were collected along the on-site drainage ditch and along the north bank of Greenfield Creek. To evaluate the sediment in a southern tributary to Greenfield Creek and along the Cape Fear River, 13 additional sediment samples (SS-12 thru SS-24) were collected on February 15, 1996. Each sediment sample was described for degree of staining and odor. The sediment samples were collected from 0- to 6-inches below the base of the stream bed and submitted to the laboratory for analysis of the Wilmington site-specific wood-preserving constituent list. Visual observations indicated that 13 of the sediment samples had no staining or odor, 4 sediment samples had a faint odor, and 7 of the sediment samples were discolored. The discolored soils were limited to the on-site drainage ditch, Greenfield Creek, and at the background location along the Cape Fear River adjacent to the Highway 74 bridge north of the site. Out of the 24 sediment samples collected, 13 semi-volatiles and 6 volatiles were detected. Sediment sample SS-9, located at the mouth of Greenfield Creek, had the highest concentration of total organic wood-preserving constituents (TO) at 357.3 mg/kg dw. Other concentrations of total organic wood-preserving constituents were detected in the former ditch at SS-5 (167.1 mg/kg dw), SS-6 (150.4 mg/kg dw), and SS-7 (203.3 mg/kg dw), at the background Cape Fear River location adjacent to the Highway 74 bridge at SS-14 (145.06 mg/kg dw), and in the south slip at SS-19 (153.1 mg/kg dw) and SS-21 (193 mg/kg dw). Eighteen of the 24 sediment samples contained detectable concentrations of arsenic. Chromium was detected in 23 of the sediment samples and all of the sediment samples had detectable concentrations of copper. The average concentration for the metals in the sediment is 4.6 mg/kg dw arsenic, 18.9 mg/kg dw chromium, and 19.3 mg/kg dw copper. These concentrations of arsenic, chromium, and copper detected in the sediment samples are in the acceptable range for background concentrations.

Multiple sources of potential contamination to the Cape Fear River exist in the vicinity of the site due to the heavy industrialization along its banks and along the banks of tributary creeks. Urbanization along Greenfield Creek, including a City wastewater treatment facility and a chemical bulk storage tank farm present potential sources of contamination that may discharge to Greenfield Creek and to the Cape Fear River. The distribution of various constituents detected in sediment samples collected along the Cape Fear River and Greenfield Creek suggested the likelihood that multiple sources exist.

2.3 Surface Water

Based on surface topography, runoff from most of the site is in a south-southeasterly direction to wetlands and an existing on-site drainage ditch at the eastern edge of the site. The system drains to the Cape Fear River via Greenfield Creek. The main ditch, creeks, and rivers are tidal in the vicinity of the site. Runoff from the western side of the site is to the Cape Fear River.

2.3.1 Nature and Extent of Contamination

On January 7, 1985 surface water samples were collected by NUS Corporation during the site screening investigation (SSI). One surface water sample (SWP-RB-W) was collected in the Cape Fear River from the end of the jetty (former T-head) between the two site slips. A second background surface water sample (SWP-BK-51) was collected in the overflow stream from Greenfield Lake (Greenfield Creek). No wood-preserving constituents were detected in these surface water samples.

Surface water samples have been routinely collected from the Cape Fear River adjacent to the former wood treating facility since December 1985. Two upgradient and two downgradient samples are collected along the east bank of the Cape Fear River during each sampling event. The upgradient surface water samples are located near the U.S. Highway #74 bridge and near an old slip at the former wood treating facility. The downgradient surface water samples are located near the mouth of Greenfield Creek and near the North Carolina State Ports Authority. A total of 19 routine sampling events have occurred through January 1996. On February 16, 1996, one surface water sample was collected from the on-site drainage ditch (SW-3), three surface water samples were collected from Greenfield Creek (SW-1, SW-2, and SW-5), and one surface water sample (SW-4) was collected from the southern tributary to Greenfield Creek. The surface water samples were submitted to the laboratory for analysis of the Wilmington site-specific wood-preserving constituent list. All of the surface water sample have been non-detect for the Wilmington site-specific constituent list.

2.3.2 Surface Water Targets

The nearest active surface water intake is located more than 15 miles upstream of the site on the Cape Fear River. State fishery biologists report that the Cape Fear River supports a seasonal commercial fishery. Marine fishery officials report that the Cape Fear River at Wilmington is a nursery for blue crab, eel, and shrimp. Fish and wildlife personnel maintain that any accessible locations on Greenfield creek may be fished. Four animal and 2 plant species are listed as endangered or threatened in North Carolina or the United States within 15 miles upstream and downstream of the site.

2.4 Air

The site is currently inactive and vacant of employees. All above-grade structures have been removed. Unpaved areas of the site are vegetated with grass. The landfarm activity is no longer active, the landfarm is bermed to prevent runoff and grassed to prevent release of surface soils to the air. Surface soils that were visually contaminated with wood preserving constituents have been treated in the landfarm. Soil contaminated by CCA has been stabilized or disposed off-site. The property is secured by a locked gate at the entrance. The nearest residences are more than 400 feet from the site. No odors or visual evidence of wood-preserving materials or blowing particles were detected by NCDEHNR during their 1994 site reconnaissance. The predominantly non-volatile nature of the wood-preserving materials and the present surface conditions at the site do not indicate a significant vapor or particulate respiratory hazard to individuals on or near the site.

2.5 Groundwater

The Wilmington area lies in the Coastal Plain Physiographic Province. Bedrock formations in this province consist of a crystalline basement complex overlain by a thick wedge of layered sedimentary bedrock formations. The sedimentary formations are sands, clays, and limestones, most of which are from the Cretaceous Period. The sedimentary wedge, which contains all of the significant potable aquifers in the region, thickens toward the Atlantic coast measuring 1,100 feet in the Wilmington area. Overlying the sedimentary bedrock formations are unconsolidated surficial units of sediments deposited some time between the Cretaceous Period and the present.

2.5.1 Aquifer Systems

The Wilmington facility is underlain by two aquifer systems—a shallow aquifer system and a deep aquifer system (Figure 3). The two aquifer systems are separated by a silty clay of marine origin that acts as a confining unit between the two aquifer systems. This clay is approximately 2.5 to 4 feet thick, laterally continuous, tight, dry, and prevents flow between the two aquifer systems. Groundwater contamination has only been detected in the shallow aquifer system.

The shallow aquifer system is composed of a water table aquifer and a semi-confined aquifer. Both the water table aquifer and the semi-confined aquifer are a permeable fine to coarse sand. A peaty clay material separates the water table aquifer from the semi-confined aquifer. This peaty clay material consists of silt and clay with varying amounts of wood and root fragments. The peaty clay material is completely water saturated demonstrating a hydraulic connection between the water table aquifer and the semi-confined aquifer in the shallow aquifer system.

The deep aquifer system is the Pee Dee Limestone Formation. The thickness of the Pee Dee Limestone Formation on-site is unknown but, based on geologic literature, is estimated to be on

the order of 650 to 700 feet in thickness. Domestic and industrial water sources produce from this deep aquifer system.

2.5.2 Tidal Affects

Groundwater flow in the shallow aquifer system is tide controlled. As illustrated on the low tide water table map (Figure 4), an elongate water table mound exists that is at its highest elevation in the northeast corner of the site. The groundwater mound extends along the central portion of the site to the south. From this elongate groundwater mound, the groundwater flows off in all directions toward on-site drainage ditches, Greenfield Creek, and the Cape Fear River. Groundwater in the water table aquifer off-site to the east in the vicinity of Optimist Park is flowing to the west toward the on-site drainage ditch. When water elevations rise in the surrounding surface water bodies during high tide, a groundwater inflection line develops along the drainage ditches, Greenfield Creek, and the Cape Fear River as shown on the high tide water table map (Figure 5). At this tidal stage, the surface water flows into the aquifer encountering groundwater flow from the central groundwater mound. These two opposing forces encounter each other and result in an inflection of approximately 90 degrees in flow direction and an order of magnitude decrease in hydraulic gradient. As a result, the groundwater flow rate is reduced significantly and constituents are diluted as surface water migrates into and out of the aquifer materials adjacent to the surface water bodies. The inflection of the groundwater tends to spread the constituents with the direction of flow along the inflection line.

The groundwater flow direction and gradients in the semi-confined aquifer are controlled by the surface water elevation of the Cape Fear River. At low tide a central groundwater mound is present in the semi-confined aquifer (Figure 6). Groundwater along this mound is divided and flows off toward the Cape Fear River, toward the drainage ditches, and toward Greenfield Creek. Vertical hydraulic gradients are downward from the water table aquifer along the Cape Fear River and in the central portion of the site. Upward vertical hydraulic gradients toward the water table aquifer are present along Greenfield Creek and the on-site drainage ditches. During high tide conditions the potentiometric head along the Cape Fear River increases (Figure 7) and groundwater flow is to the southeast. An upward vertical hydraulic gradient to the water table aquifer develops along the Cape Fear River and remains upward along Greenfield Creek and the on-site drainage ditches.

Recharge in the unconfined aquifer occurs in upland areas (center of the site) as precipitation percolates downward to the water table. The groundwater eventually discharges to the surrounding surface water bodies, where the water table approaches the surface. For this reason, groundwater and contaminants in the water table sand are not anticipated to migrate beyond the east or south drainage system toward Wilmington, but are more likely to discharge to the surface water bodies.

2.5.3 Ambient Water Quality

Due to the site location adjacent to the brackish Cape Fear River and Greenfield Creek, the upper aquifer system contains saline groundwater. Both the Cape Fear River and Greenfield Creek have been classified by NCDEHNR as salt water. As shown on the water table aquifer salinity isoconcentration map (Figure 8), only a small mound a fresh water (salinity < 250 mg/l) is present in the northern portion of the site. Saline water is present in the water table aquifer along the Cape Fear River, Greenfield Creek, and the on-site drainage ditches. Slightly saline (200 mg/l) groundwater is also present in the semi-confined aquifer adjacent to the Cape Fear River and Greenfield Creek.

2.5.4 Nature and Extent of Contamination

Observations during the Phase I, II, and III groundwater quality assessments indicate that wood-preserving constituents entered the environment from three main source areas (Figure 9). The wood treatment source area includes the former creosote treatment area, former CCA treatment area, and the former sludge ditch. The contaminants from these areas appear to have coalesced and are following the same migration pathways in the subsurface. A second source area is the large storage tank area. Contaminants from this area are separated from the other areas and appear to be following a different migration pathway. A third source area is the diesel storage tank area. This source area is separated by its location on the site and the physical and chemical behavior of the contaminants in the subsurface.

Groundwater monitoring wells at the facility are measured for the presence of separate-phase fluids and sampled and analyzed for wood-preserving parameters. The parameters analyzed include indicators of water quality (pH, specific conductance, and temperature) and specific wood-preserving chemical constituents. The specific wood-preserving chemical constituents include the inorganic metals arsenic, chromium, and copper and organic semi-volatiles and volatile constituents (Attachment A).

From the list of constituents analyzed in 1993, only a small fraction of the constituents have been detected. Dissolved metals have not been detected in the shallow aquifer system. Total metals were detected at background concentrations. The semi-volatile organics that were detected in the groundwater included: acenaphthene, anthracene, carbazole, fluoranthene, naphthalene, and phenanthrene (6 out of 23 constituents were detected). The volatile organics that were detected in the groundwater include: benzene, ethyl benzene, m/p xylene, o-xylene, and toluene (5 out 30 constituents were detected).

Heavy separate-phase fluids (dense non-aqueous phase liquids; DNAPLS) were detected at thicknesses of 0.01 feet at MW-11, a trace at MW-12, 0.41 feet at MW-14, 0.23 feet at MW-22,

and 5.24 feet at MW-26. A trace light sheen was observed in monitoring wells MW-12, MW-13, MW-16, MW-17, and MW-28.

The areas of separate-phase fluids (DNAPLS) and dissolved constituent concentrations occur in close relation to the source areas (wood treatment area, large storage tank area, and diesel storage tank area). An east to west trending band of dissolved and separate-phase organics occurs along the southern City of Wilmington property boundary between the Cape Fear River to the west and the on-site drainage ditch to the east (Figure 10). Along this band, dissolved organics from the former wood treatment area and sludge ditch migrate to the east toward the on-site drainage ditch and then turn to the south with the groundwater flow deflection line toward Greenfield Creek. The dissolved organics do not appear to migrate off-site to the east due to the westerly direction of groundwater flow toward the on-site drainage ditch in the vicinity of Optimist Park. Segments of the dissolved plume emanating from the former wood treatment area are also migrating to the southwest toward monitoring well MW-19 and MW-24 and to the west toward MW-17. The dissolved organics in the vicinity of the former diesel storage tanks and the large storage tank area are migrating to the west.

The dissolved organic wood-preserving constituent plume has migrated vertically through the peaty clay and into the semi-confined aquifer at the facility (Figure 11). No separate-phase fluids (DNAPLS) have been detected in the semi-confined aquifer. In the vicinity of the former wood treatment area and the sludge ditch the dissolved constituents in the semi-confined aquifer have migrated to the east toward the on-site drainage ditch, then to the south toward Greenfield Creek and finally turning southwest toward the Cape Fear River. Near the large storage tank source area, the wood preserving constituents in the semi-confined aquifer are migrating to the west.

2.5.5 Groundwater Targets

No municipal water supply wells are located within 4 miles of the site. Three community wells supplying 680 residents are located within 4 miles of the site. Two of the community wells are located at 1.7 and 3.8 miles east-northeast upgradient of the site. The third community well is located 1.6 miles west of the site across the Cape Fear River. A house count within a 4-mile radius of the site indicated that approximately 1,449 people are supplied by individual domestic wells. The nearest domestic well is located 1.6 mile west of the site across the Cape Fear River. All of the domestic wells are located north and upgradient of the site across Smith Creek. A spring which supplies outdoor faucets in Greenfield Park is located approximately 0.25 to 0.5 miles southeast of the site. These springs are classified as noncommunity, transient supplies. The spring was sampled by NUS Corporation in 1985. Toluene and 11 halogenated organic solvents were detected in the groundwater from the spring. Because only one of the compounds (toluene) was detected in the site groundwater samples and the spring is most likely hydraulicly upgradient, the contamination is not considered attributable to the site. Based on the above information, the presence of subsurface contamination at the site is not believed to be a likely threat to any drinking water supplies.

2.6 Human Health and Ecological Risk Assessments

2.6.1 Landfarm Risk Assessment

At the completion of landfarming activities, a risk assessment was conducted for the landfarm treatment area by Geraghty & Miller, Inc. The purpose of the risk assessment was to evaluate the wood-preserving constituents remaining in the landfarm and any potential risk to public health and the environment. For the risk assessment it was assumed that the landfarm treatment area will be used for future development of the that the landfarm treatment area will be used for future industrial development (deed restriction) and that several feet of fill and/or pavement will cover the landfarm. Constituents of concern (COCs) included in the risk assessment were PAHs, phenol, dimethylphenol, trichlorophenol, tetrachlorophenol, pentachlorophenol, arsenic, copper, and chromium. To confirm the presence of low pentachlorodibenzodioxins/pentachlorodibenzofurans (PCDDs/PCDFs) a sample was collected from each landfarm in 1996 which, when expressed as on a 2,3,7,8-TCDD Toxicity Equivalency basis (0.002 mg/kg TEQ) are not significantly different from the EPA's clean-up criteria of 0.001 mg/kg TEQ for residential soils. Due to the intended industrial use of this land, these low PCDDs/PCDFs concentrations are insignificant. Risk estimates for the landfarm were compared to USEPA target risk criteria. The USEPA currently uses a target excess lifetime cancer risk (ELCR) range of 1×10^{-6} to 1×10^{-4} and a hazard index (HI) of 1 to indicate if further remediation is required. The total excess lifetime cancer risk for the landfarm soil was 6×10^{-6} and the HI was 0.5. These results indicate that the development of the landfarm treatment area for industrial uses can proceed without posing a significant risk to human health or the environment.

2.6.2 Site Risk Assessment

A human health and ecological risk assessment has been completed by ChemRisk for the soil, sediment, surface water, and groundwater at the site. The human health risk assessment included an adult construction/utility worker, a child trespasser, and an adult recreational angler. The surface soils, subsurface soils, sediment, surface water, and groundwater data for the facility were used in the risk assessment. Estimates of cancer risk indicate that the typical and high end exposed individuals fall within the cancer risk management benchmark range (1×10^{-6} to 1×10^{-4}) established by EPA under the National Contingency Plan. Similarly, estimates of non-cancer Hazard Indices for the typical and high end exposed individuals were within the non-cancer hazard benchmark recommended by EPA of 1.0. The results of the human health risk assessment suggest that future use of the site are not likely to present a significant risk.

The ecological risk assessment focused on the evaluation of surface water and sediment in three specific aquatic systems: (1) the drainage ditch, which transports surface water and stormwater runoff from portions of the site to Greenfield Creek; (2) Greenfield Creek, which originates at Greenfield Lake dam, and flows west along the southern boundary of the site to the Cape Fear River; and (3) the Cape Fear River, which near the site is characterized as a tidally influenced, oligohaline reach of the Cape Fear River estuary. A tidal gate separates the mouth of Greenfield Creek from the Cape Fear River, and is an important component in limiting exposure to estuarine organisms. A characterization of ecological communities was performed to evaluate the potential exposure to ecological receptors including plants, benthic invertebrates, fish, amphibians and reptiles, wildlife, and threatened and endangered species. Hazard Quotients (HQs) derived for the great blue heron, which were well below 1.0, supported literature findings and indicated no risk of harm to higher trophic level organisms.

3.0 STATEMENT OF OBJECTIVE FOR REMEDIAL ACTION

The objective of this remedial action is to maintain human health and ecological risks at acceptable levels for reasonably expected current and future site uses. The establishment of realistic and practical objectives is essential. As indicated by the above discussion, soil, sediment, surface water, and air concerns at this facility have been addressed and are considered protective of human health and the environment. Groundwater and its potential future impact to human health and the environment remains to be addressed at the facility. Because there are no current users of groundwater at the facility or adjacent to the facility, there are no current risks to human health. Therefore, the corrective action objectives established are intended to improve site conditions for development (industrial use). Presented below is a plan that will address the appropriate remedial action for groundwater that is protective of human health and the environment.

4.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Generally, cleanup levels are established by applicable or relevant and appropriate requirements (ARARs). For groundwater currently or potentially used for drinking water purposes, these levels may be Maximum Contaminant Levels (MCLs) or non-zero Maximum Contaminant Level Goals (MCLGs) established under the Safe Drinking Water Act, State MCLs or other cleanup requirements, or risk-based levels for compounds not covered by specific State or Federal MCLs or MCLGs. Other cleanup levels may be appropriate for groundwater that are not an actual or reasonably expected source of drinking water.

4.1 North Carolina Groundwater Classifications

Three groundwater classifications exist in the State of North Carolina (NCDEHNR, 1993a). The classifications are Class GA, Class GSA, and Class GC. Most groundwaters in the state receive

a Class GA designation. Class GA designation applies to all groundwater in which the chloride concentration is equal to or less than 250 mg/l, and which the groundwater is considered suitable for drinking in its natural state, but which may require treatment to improve quality related to natural conditions. Class GSA applies to saline groundwater in which the chloride concentration due to natural conditions is in excess of 250 mg/l, but which otherwise may be considered suitable for use as potable water after treatment to reduce concentrations of naturally occurring substances. Class GC applies to groundwater that does not meet the quality criteria for GA or GSA groundwater and for which efforts to improve groundwater quality would not be technologically feasible, or not in the best interest of the public. Continued consumption of waters of Class GC by humans could result in adverse health affects. The RS designation serves as a warning that groundwater so designated may not be suitable for use as a drinking water supply without treatment. RS designation is temporary and will be removed by the Director of NCDEHNR upon a determination that the quality of the groundwater has been restored to the level of applicable standards or when the groundwaters have been reclassified.

Class GA and Class GSA groundwater classifications are automatic based on the chloride concentration in the groundwater (less than 250 mg/l chloride is automatically Class GA). Class GC groundwater in North Carolina must be assigned. Groundwater in the shallow aquifer system at the Wilmington facility is automatically given a GSA classification due to the chloride concentration that exceeds 250 mg/l. However, based on the definition of the groundwater classifications, it is likely that the groundwater could be reclassified as Class GC or designated RS groundwater. Reclassification requests must be submitted to the Director (NCDEHNR). Currently, no Class GC groundwater exists in North Carolina.

The Director can designate Class GA or GSA groundwaters as RS when: (1) where, as a result of man's activities, groundwaters have been contaminated and the Director has approved a remedial action plan, or termination of remedial action, that will not result in the immediate restoration of such groundwater to established standards, or (2) where a statutory variance has been granted as provided in Rule .0113 of 15A NCAC 2L (NCDEHNR, 1993a). In areas designated RS a groundwater monitoring system must be established that is sufficient to detect changes in groundwater quality in the RS designated area. Monitoring shall be quarterly for the first year and may be reduced to semi-annually thereafter until the applicable standards have been achieved. If during the monitoring period, contaminant concentrations increase, additional remedial action or monitoring may be required.

The Wilmington facility is an ideal candidate for a statutory variance to the requirements for Class GSA groundwater due to:

(1) The groundwater does not meet the quality criteria for GA or GSA groundwater;
(2) Treatment of groundwater to established standards is not technologically feasible. The

contaminant source is located in a geologic medium (peaty clay) that will not allow the removal of the contaminant. The source of contamination would have to be removed to provide a condition for permanent groundwater restoration;

(3) At the time of groundwater classification (December 1983) the groundwater at the facility exceeded the standards applicable to Class GA or GSA groundwater;

(4) No further disposal of contaminants to or beneath the surface of the land within the boundary of the proposed groundwater variance area will occur;

(5) Planned future site use will not cause the contaminants to migrate beyond the boundary of the statutory variance, so as to violate the groundwater quality standards in adjoining waters of a different class;

(6) No groundwater supply wells exist, or are planned to exist at the facility or nearby the facility;

(7) All adjacent property owners within a 1.5 mile radius are served by an existing public water supply system;

(8) All groundwater in the shallow aquifer system at the site discharges to surrounding surface water bodies and does not possess contaminant concentrations that would result in violations to surface water standards contained in 15A NCAC 2B .0200;

(9) Tidal affects dilute and delay the release of constituents to the surrounding surface water bodies resulting in natural attenuation of the constituents on site;

(10) Natural groundwater flow prevents the spread of constituents in the groundwater beyond the surface water boundaries;

(11) Existing and available institutional controls will minimize the potential for inadvertent exposure. A locking gate, visual inspections (daily) by the North Carolina State Ports Authority's security personnel, posting of signs restricting unauthorized use of the site, and a city ordinance restricting groundwater to irrigation purposes provide existing institutional control. Available institutional controls include a deed restriction, deed notice and a groundwater statutory variance, and;

(12) Planned site improvements by the North Carolina State Ports Authority include placement of fill material across the site, paving the surface, and installation of sheet piling along the Cape Fear River. Paving the site will significantly reduce recharge to the shallow aquifer system and further reduce the potential risk to human health and the environment. The reduction in recharge to the aquifer system will increase constituent attenuation and dilution caused by the tidal fluctuations. Installation of sheet piling along the Cape Fear River will limit the discharge of constituents to the Cape Fear River.

4.2 North Carolina Groundwater Quality Standards

State water standards have been published in NCAC Title 15A, Subchapter 2L for Class GA and Class GSA groundwater (NCDEHNR, 1993a). For Class GA and Class GSA, the groundwater quality standards are listed in Attachment B except that: (1) where the established standard for

a substance is less than the practical quantitation limit (PQL), the standard becomes the PQL; (2) where two or more substances exist in combination the maximum concentrations for each substance may be established by the Director (NCDEHNR) at values less than the standards; (3) in the absence of information to the contrary, the carcinogenic risks associated with carcinogens will be considered additive and the toxic affects associated with non-carcinogens will also be considered additive; (4) when a naturally occurring substance exceeds the standard, the standard will be the naturally occurring concentration; and (5) substances which are not naturally occurring and for which no standard is specified are not permitted in detectable concentrations in Class GA or GSA groundwater.

Groundwater quality standards for substances in Class GA and Class GSA groundwaters are established as the lesser of:

(1) Systemic threshold concentration calculated as follows: [Reference Dose (mg/kg/day) x 70 kg (adult body weight) x Relative Source Contribution (.10 for inorganics; .20 for organics)]/[2 liters/day (average water consumption)];
(2) Concentration which corresponds to an incremental lifetime cancer risk of 1×10^{-6};
(3) Taste threshold limit value;
(4) Odor threshold limit value;
(5) Maximum contaminant level; or
(6) National secondary drinking water standard.

Please refer to the Class GA and Class GSA groundwater standards located in Attachment B that pertain to this site. Included with the standard is the source from which the standard was established. It was assumed that the published standards in the Classifications and Water Quality Standards Subchapter 2L (NCDEHNR, 1993a) take precedence over calculated standards. Data for determining the appropriate standard for substances not listed in the Classifications and Water Quality Standards were acquired through the USEPA Integrated Risk Information System (IRIS).

The concentration of each wood-preserving constituent analyzed at the Wilmington facility was compared to the NCDEHNR Water Quality Standards for Class GA and Class GSA groundwater (Attachment B). Of the constituents analyzed at each monitoring well sampled, only benzene, acenapthene, naphthalene, phenanthracene, carbazole, and fluoranthene exceeded the established groundwater standards (Attachment C).

4.3 North Carolina Surface Water Classifications

Surface water classifications in North Carolina are divided between freshwater and tidal saltwater. Surface water bodies adjacent to the Wilmington facility have been classified as tidal saltwater by NCDEHNR. Greenfield Creek and the on-site tributaries are classified as Class SC-Swamp. The Cape Fear River is classified as a Class SC tidal saltwater. Class SC waters are designated as

waters suitable for aquatic life propagation and maintenance of biological integrity, wildlife, and secondary recreation, and any other usage except primary recreation or shellfishing for market purposes.

4.4 North Carolina Surface Water Standards

State tidal saltwater standards are published in NCAC Title 15A, Subchapter 2B for Class SC surface water (NCDEHNR, 1993b). The tidal salt water standards that apply to the Wilmington facility are listed in Attachment D. In addition to the listed tidal salt water standards, any source of water pollution which precludes use of Class SC waters, including their functioning as primary nursery areas (PNAs), on either a short-term or a long-term basis for which the water is classified, is considered a violation of surface water quality standards. When listed surface water standards are below the PQL, the PQL becomes the standard.

Surface water samples for wood-preserving constituents have been collected from the Cape Fear River adjacent to the former wood treating facility semi-annually (19 events) since December 1985. One upgradient and three downgradient samples are collected along the east bank of the Cape Fear River during each sampling event (Figure 12). Out of 19 routine sampling events, wood-preserving constituents have been detected only on three occasions downgradient of the site. Napthalene was detected at a concentration of 0.050 mg/l in June of 1989. The PQL for napthalene is 0.010 mg/l and the NCDEHNR Class SC tidal saltwater standard is 0.0000311 mg/l. This location was resampled for napthalene and the results were below the PQL. Copper was detected at a concentration of 0.052 mg/l in July 1990. The PQL for copper is 0.025 mg/l and the Class SC standard is 0.003 mg/l . Chromium was detected at one downgradient location in July 1990 at 0.046 mg/l. The PQL for chromium is 0.010 mg/l and the Class SC standard for chromium is 0.02 mg/l. Five surface water samples were collected from Greenfield Creek in February 1996. No wood-preserving constituents were detected in the surface water in Greenfield Creek.

5.0 SCREENING AND IDENTIFICATION OF REMEDIAL ACTION ALTERNATIVES

The primary purpose in the selection of remedial action alternatives is to minimize the potential for site contamination to pose future threats to human health or the environment. This is accomplished by screening and evaluating corrective measure technologies that are technically practical, proven effective, and cost efficient while providing adequate protection of human health and the environment.

Remedial alternatives must satisfy two "threshold" criteria to be eligible for selection: 1) the remedy must be protective of human health and the environment and 2) the remedy must meet (or provide the basis for waiving) the ARARs identified for the remedial action. ARARs may be

waived by the EPA for any of the six reasons specified by CERCLA (Attachment E), including technical impracticability (TI) from an engineering perspective.

5.1 Technical Impracticability

Investigations and experience by the EPA over the past decade has shown that restoration to drinking water quality may not always be achievable due to limitations of available remediation technologies (EPA 1989, 1992a). Many factors can inhibit groundwater restoration. These factors may be grouped under three general categories (EPA, 1993a):

(1) Hydrogeologic factors;
(2) Contaminant-related factors; and
(3) Remediation system design inadequacies.

Hydrogeologic limitations to aquifer remediation include conditions such as complex sedimentary deposits, aquifers of very low permeability, certain types of fractured bedrock and other conditions that presently make extraction or in-situ treatment of contaminated groundwater extremely difficult. The low permeability and high adsorptive capacity of the aquifer material (peaty clay) at the facility makes extraction or in-situ treatment of contaminated groundwater technically impracticable.

Contaminant-related factors, while not independent of hydrogeologic constraints, are more directly related to contaminant properties that limit the success of an extraction or in-situ treatment process. These properties include a contaminant's potential to become either sorbed onto, or lodged within, the soil or rock comprising the aquifer. The EPA in 1993a reported that the contaminant characteristics (Attachment F) that are the most difficult to remediate are dense nonaqueous phase liquids (DNAPLS). The factors that present the greatest difficulty in remediation at the Wilmington facility include:

(1) Large volume of contaminants in the subsurface;
(2) Low volatility;
(3) High contaminant retardation potential (residual concentrations) and slow desorption;
(4) DNAPLS;
(5) Depth of contaminants;
(6) Low permeability and highly retarding peat deposits;
(7) High temporal variation in groundwater flow; and
(8) The quantity, distribution and properties of the DNAPL render its removal from, or destruction within, the subsurface infeasible or inordinately costly.

Most of the sites where the EPA has determined that groundwater restoration is technically impracticable have DNAPL present. As proven technologies for the removal of certain types of DNAPL contamination do not exist yet, DNAPL sites are more likely to require technical impracticability evaluations than sites with other types of contamination (EPA, 1993a).

The third factor that may limit groundwater restoration is inadequate remediation system design and technology. DNAPL occurs as "free phase" and "residual" contamination. Free-phase DNAPL is capable of flowing into a well or migrating laterally or vertically through an aquifer. Residual DNAPL is held by capillary forces within the pores of the aquifer material. Residual DNAPL, therefore, generally is not capable of migrating or being displaced by normal ground water flow. It can be expected that an estimated 20 percent of the free-phase DNAPL body will be left behind as residual during free-phase migration (EPA, 1993b). After a certain distance of migration, the free-phase DNAPL will be reduced to just residual concentrations (Kueper, 1992).

Free-phase DNAPL can be pumped from a well to the land surface for treatment/disposal. Residual DNAPL cannot be pumped because it will not flow through the aquifer materials. In order to remediate residual DNAPL, many pore volumes of groundwater must be pumped through the aquifer to reduce the residual concentration through solubilization and biodegradation. It is currently unknown how many pore volumes it would take at the Wilmington facility to remove the residual DNAPL. Most likely, the residual DNAPL at the Wilmington facility cannot be removed by groundwater flushing. It is known that preferential groundwater flow occurs through the more porous materials (sands) and that less groundwater flows through the finer-grained sediments (peaty clay) at the site. Because the DNAPL at this facility is present within the fine-grained materials it is unlikely that flushing the aquifer materials will remediate the aquifer in a reasonable amount of time or even at all. Pumping the aquifer could lead to undesirable affects, such as unwanted migration of the DNAPL pools to unaffected parts of the aquifer. The EPA has referenced (1992b) several instances in which pumping of groundwater where DNAPLS are present has worsened and increased the area affected by the DNAPLS.

It is recognized that groundwater recovery technologies are generally inefficient in removing DNAPLS from plumes in low permeability soils (i.e. peat), and it is unlikely that groundwater cleanup level target goals for the facility will be attained by means other than natural degradation.

5.2 Screening of Remedial Action Technologies

This section identifies technologies that are potentially applicable for use in corrective action at the Wilmington facility, given the groundwater contaminant characteristics and other site-specific conditions. Those technologies that are not feasible are briefly discussed, along with rationale as to why they are not being considered for implementation.

The various remedial action alternatives that exist were initially narrowed using the EPA Remediation Technologies Screening Matrix and Reference Guide (EPA, 1993c) and VISITT (EPA, 1994) to identify potentially applicable technologies for more detailed assessment and evaluation prior to remedy selection. Innovative and unproven technologies were not evaluated.

The remedial alternatives were further narrowed by including the technologies that addressed all contaminant groups present at the facility (EPA, 1993c). The identified contaminant groups at the facility include halogenated volatiles, halogenated semi-volatiles, non-halogenated semi-volatiles, and fuel hydrocarbons.

Based on the above reviews to narrow the available technologies, the groundwater remediation technologies that requires further evaluation include:

(1) No action/natural attenuation,
(2) Site security,
(3) Monitoring,
(4) Capping,
(5) Separate-phase fluid recovery,
(6) Slurry walls,
(7) Groundwater extraction (wells/drains),
(8) Bioreactors,
(9) Air stripping,
(10) Carbon adsorption,
(11) Ultraviolet-light catalyzed chemical oxidation,
(12) In-situ enhanced bioremediation, and
(13) Hot water or steam flushing/stripping with vapor extraction.

The no action/natural attenuation option for groundwater does not involve proactive corrective measures. It assumes natural degradation of contaminants in the groundwater through dilution, dispersion and biodegradation to reduce their toxicity, mobility, and volume.

Site security at the Wilmington facility will include daily site visits by trained security personnel, locked gates, and signs restricting unauthorized use of the property. Additional institutional controls available include a groundwater statutory variance, a deed modification restricting future site use to industrial activities and notice that the groundwater on site has been impacted, and a city ordinance restricting groundwater use to irrigation purposes only.

Monitoring (ground water and surface water) assumes that natural degradation of constituents at the facility will occur through dilution, biodegradation, and dispersion. Monitoring of the ground water and surface water will assure that constituent concentrations are decreasing, or are be maintained at levels that when discharged to the surrounding surface water bodies, will be at or below surface water standards. The establishment of ground water and surface water compliance points is necessary to ensure that human health and the environment are protected from the existing contamination. The groundwater and surface water monitoring program will evaluate performance of the remedial action and degradation of contaminants over time.

Capping of the areas influenced by past site activities during the development of the site will provide additional containment of the groundwater constituents by diverting precipitation and infiltration from the contaminated area, thereby, reducing the contaminant migration potential at the site. The decrease in the migration rate of the constituents by capping should also reduce the toxicity of the constituents that are released to the surface water through an increase in time available for tidal flushing, dilution, and dispersion and an overall decrease in volume of constituents released. Sheet piling and backfill placed along the Cape Fear River will limit discharge to the Cape Fear River reducing the risk to the environment and human health.

Separate-phase fluid removal involves recovery of DNAPLs by vertical wells and/or horizontal drains. Separate-phase fluid removal at the site is limited and is only achievable in the shallow sand unit along the top of the low permeability peat layer at the facility. The low hydraulic conductivity and adsorptive properties of the peat layer inhibits separate-phase fluid recovery from the peat. Recovery from the upper sand may reduce the potential toxicity of constituents released to the surface water bodies and may lower the potential for separate-phase fluid migration to the lower sand unit. However, a substantial volume of separate-phase fluid is present in the underlying peat layer and can not be addressed by separate-phase fluid recovery from the upper sand. Little additional reduction in risk would be achieved by removing separate-phase fluid from the upper sand unit. As such, separate-phase fluid recovery would be inefficient and is considered not practical at the Wilmington facility.

A slurry wall consists of a vertical excavated trench that is filled with a low permeability slurry. The slurry, usually a mixture of bentonite and water, hydraulically shores the trench to prevent collapse and forms a filter cake to reduce groundwater flow. Where possible, especially where DNAPLS are present, slurry walls should be keyed into a low permeability layer beneath DNAPL contamination. Slurry walls often are used where the waste volume is too large for practical treatment and where soluble and mobile constituents pose an imminent threat to a source of drinking water. A slurry wall is impracticable at the Wilmington facility because it will provide no additional benefit beyond the hydraulic containment offered by the surrounding surface water bodies and associated tidal affects. Surface water bodies completely surround the site preventing groundwater migration beyond the property boundaries. Past surface water sampling data have

demonstrated that the contaminant concentrations that reach the surface water bodies are reduced to acceptable levels. In order to key the slurry wall into a low permeability layer, the slurry wall would need to be constructed to the base of the semi-confined aquifer in the shallow aquifer system (45 feet below land surface). The disturbance of the peat unit, that is presently retarding the downward flow of the DNAPL, during slurry wall construction may provide an avenue for the continuation of vertical DNAPL flow to the base of the shallow aquifer system. Barrier walls have not been tested to determine their capacity for long-term impedance of DNAPL migration (EPA, 1992b). Considering the slurry walls' low potential for additional constituent containment, compatibility of slurry wall materials with subsurface chemicals, potential for inducing unwanted migration during wall construction, and changes to the hydrogeologic system affected by wall emplacement, this option is not retained for further consideration.

Traditional groundwater extraction (pump and treat) systems, which recover and treat aqueous contamination, are useful components in many remediation systems. Groundwater extraction systems are used to extract contaminated groundwater for treatment and disposal, to extract groundwater for creating a hydraulic barrier, or to inject or extract air for in-situ air stripping/bioremediation of groundwater or soil. Extraction systems may also be used to remove separate-phase liquids and residual DNAPL by solubilization, however, these systems are not efficient at removing DNAPL from the subsurface. Many pore volumes of water are needed to completely remove even residual DNAPL under the best of circumstances (EPA, 1992b). Subsurface heterogeneities at the Wilmington facility limit the ability to move water through many contaminated zones, and thereby limit the ability of an extraction system to cleanse the site. Based on hydrogeologic conditions present at the Wilmington facility, it is considered unlikely that groundwater pump-and-treat technologies will be able to effectively and efficiently remove the contamination present in the groundwater. A large volume of source material is present in the peat layer at this facility. The nature of the materials (contaminants will tend to tightly adsorb to the peat) and the low hydraulic conductivity (retardation) of the peat prevent effective groundwater extraction. These two factors--adsorption of contaminants and low hydraulic conductivity--greatly reduce the effectiveness of a groundwater recovery system at the Wilmington facility and are anticipated to be the limiting factors in achieving cleanup level target goals using groundwater extraction. Groundwater extraction is possible in the sand units underlying and overlying the peat layer. However, because no separate-phase fluids are present in the lower sand layer, pumping from the lower sand may mobilize the free-phase constituents and induce unwanted migration to the lower portion of the shallow aquifer system. Pumping from the upper sand unit is not practical because the source material is located in the underlying peat. The heavy nature of the constituents and strong adsorptive characteristics will prevent the upward movement of the contaminants to the recovery system. As a result, groundwater extraction by vertical or horizontal wells/drains is not considered an option for this facility.

Ex-situ groundwater treatment, such as, bioreactors, carbon absorption, air stripping, and ultraviolet-light catalyzed chemical oxidation rely on effective groundwater extraction systems to

remove the contaminated groundwater for ex-situ treatment. Since groundwater extraction is technically impracticable at the Wilmington facility these alternatives are also considered impractical.

In-situ enhanced bioremediation involves circulating oxygen and nutrient sources throughout a contaminated groundwater zone to enhance the rate of aerobic degradation of organic contaminants by naturally occurring microbes. The groundwater circulation system must be created so that contaminants do not escape from zones of active biodegradation. When the subsurface is heterogeneous, it is very difficult to circulate the nutrients throughout every portion of the contaminated zone. Higher permeability zones are cleaned up much faster because groundwater flow rates are greater. A surface groundwater treatment system is required to treat extracted groundwater prior to re-injection or disposal. As discussed above, groundwater extraction at this facility offers very limited ability, as does injection to remediate the site. As a result, enhanced bioremediation is not considered practical at the Wilmington facility.

Hot water or steam flushing/stripping occurs when steam is forced into an aquifer through injection wells to vaporize volatile and semi-volatile contaminants. Vaporized components rise to the unsaturated zone where they are removed by vacuum extraction and then treated. The variety of processes include Contained Recovery of Oily Waste (CROW), Steam Injection and Vacuum Extraction (SIVE), In-Situ Steam Enhanced Extraction (ISEE), and Steam Enhanced Recovery Process (SERP). Hot water or steam flushing/stripping is a pilot-scale technology and is impracticable at the Wilmington facility. Only a thin unsaturated zone exists at the facility, which is periodically completely saturated during high tide conditions and during storm events. Injected steam and hot water will have the tendency to move through the highly permeable areas and by-pass the fine grained zones. A large portion of the source material is located in the peat layer at the facility. Steam injection is not possible in the peat layer, limiting steam injection only to the overlying sand unit. Steam injection will mobilize the residual and free-phase DNAPL allowing for its recovery. However, the migration path of the mobilized DNAPL is difficult to predict and contain, which could result in migration of the DNAPL constituents to previously unaffected areas. thereby, increasing the current risk at the facility. The steam system has a high capital cost and has a low system reliability and maintainability. Steam recovery is not considered a viable option for the Wilmington facility.

5.3 Identification of Remedial Action Alternatives

The selection of applicable remediation technologies is based on several factors as previously discussed. The initial screening process has provided a list of technologies that have the highest potential for implementation at the site. These technologies are listed below:

- No action/natural attenuation,
- Site security,

- Monitoring, and
- Capping.

Although the technologies are discussed separately, the achievement of final corrective action goals may involve various combinations of the applicable technologies. The following remedial alternatives have been selected for the Wilmington facility:

(1) No action/natural attenuation;
(2) Natural attenuation, site security, and monitoring, and
(3) Natural attenuation, site security, monitoring and capping.

Each of the final remedial action alternatives was evaluated using criteria developed by the EPA and suggested by NCDEHNR (Attachment G). The evaluation criteria include:

- *Overall Protection of Human Health and the Environment.* This addresses whether a remedy provides adequate protection and describes how risk posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- *Compliance with Applicable or Relevant and Appropriate Requirements (ARARs).* This criterion addresses whether a remedy will meet the ARARs or other Federal and State environmental statutes.

- *Long-Term Effectiveness and Permanence.* This refers to the magnitude of residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals are met.

- *Reduction in Toxicity, Mobility, or Volume through Treatment.* The remedial alternatives are assessed based on the degree to which they employ treatment that reduces toxicity, mobility, or volume, including how treatment is used to address principal threats posed by media-specific operable units.

- *Short-Term Effectiveness.* This refers to the speed with which the remedy achieves protection, as well as, the potential for a remedy to create adverse affects on human health and the environment that may result during the construction and implementation period.

- *Implementability.* This refers to the technical and administrative feasibility of a remedy, including the availability of materials and services that may be used to implement the chosen solution.

- *Cost.* This includes capital, operation, and maintenance costs. Where applicable, the

estimates include total capital cost, present worth O&M cost, and net present worth. Unless otherwise indicated, the total capital cost includes construction contingencies of 10 percent, and design, engineering, and construction management costs of 10 percent. An additional 2.5 percent is included to cover the expense of site-specific health and safety training and equipment. O&M costs include a 10 percent contingency factor. All cost are presented in 1994 dollars. Estimates were obtained from hazardous waste vendors; published unit costs (Means, 1994); or costs either developed or actually incurred for similar projects.

- *Community Acceptance.* Acceptance by the surrounding community will be assessed in the Administrative Order of Consent (AOC) following a review of the public comments received on the proposed remedial action.

6.0 PREFERRED REMEDIAL ACTION ALTERNATIVE

Remedial action alternative (3)--natural attenuation, site security, monitoring, and site development--is selected as the preferred remedial action alternative for the Wilmington facility. The preferred remedial action alternative is selected based on being the most cost-effective corrective action that effectively protects human health and the environment. The groundwater plume does not pose a current risk to human health or the environment, and is unlikely to pose a future risk, because of the low rate of plume migration to the surface water bodies, natural degradation and the absence of potential receptors (i.e. groundwater users) in the area. Past surface water sampling data has indicated that current constituent concentrations that are released to the surrounding surface water bodies are present at concentrations that are protective of human health and the environment.

The preferred remedial action alternative assumes that the current concentrations of wood-preserving constituents will be reduced over time through natural degradation, thereby, reducing their toxicity, volume, mobility, and associated risks to human health and the environment. Planned site development by the North Carolina Ports Authority, including filling, paving and sheet piling installation, will decrease the mobility of the constituents and increase the time available for natural degradation. Semi-annual groundwater and surface water monitoring will be completed to evaluate the natural degradation process and verify groundwater and surface water ARAR compliance. Groundwater and surface water samples will be collected on a semi-annual frequency from selected groundwater and surface water sample locations (Figure 12). Groundwater compliance monitoring wells (15) will include MW-8A, MW-10, MW-11B, MW-16, MW-20, MW-21, MW-22A, MW-23, MW-24R, MW-24A, MW-28, MW-28A, MW-29, MW-29A, and MW-30. Surface water compliance points will include the Highway 74 Bridge, the old slip, the mouth of Greenfield Creek, the State Ports Authority, and SW-3 located at the confluence of the onsite drainage ditch and Greenfield Creek. In addition to standard indicators

parameters, pH, specific conductance and temperature, the surface water samples will be analyzed for the site constituents-of-concern including: chromium, copper, arsenic, pentachlorophenol, acenaphthene, anthracene, carbazole, fluoranthene, naphthalene, phenanthrene, benzene, ethyl benzene, toluene and xylenes. Trained groundwater/surface water sampling personnel will collect the samples. EPA approved groundwater and surface water sampling and decontamination methods will be utilized in accordance with the U.S. EPA Region IV Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual (EPA SOP Manual) dated February 1, 1991. The surface water samples will be analyzed for volatile organic compounds by U.S. EPA Method 8240, semi-volatile organic compounds by U.S. EPA Method 8270, and metals by U.S. EPA Method 6010. Field quality control will include one duplicate sample per container type per field day, an equipment rinsate blank, and a VOA trip blank. Semi-annual reports will be prepared and submitted to NCDEHNR documenting the sampling and analysis procedures, analytical results, and a discussion on compliance with the ARARs.

In addition to natural attenuation of the wood-preserving constituents and monitoring to assure compliance with applicable ARARs, several institutional controls will be utilized to further reduce potential risks to human health and the environment. Institutional controls available include an existing city ordinance, deed restriction, deed notice, sign posting, site security, and a groundwater statutory variance. The city ordinance prevents the installation of groundwater wells for drinking water purposes in the City of Wilmington. The deed restriction will limit the property use to future industrial purposes. A notice will be placed in the deed stating that the soil and groundwater at the facility have been impacted by previous site activities and that any improvements to the site should consider these impacts. Signs will be posted that restrict unauthorized use of the property. Daily site inspections will be performed by the North Carolina State Ports Authority's security, and a locking gate at the main entrance to the facility will be provided. The NCDEHNR will be petitioned for a groundwater statutory variance for the groundwater within the property boundaries at the facility. Implementation of the selected remedial action will begin following approval from the State of North Carolina. A health and safety plan that conforms to OSHA 1910.120 requirements for the proposed remedial action is included in Attachment J. A groundwater and surface water sampling and analysis plan for the facility is presented in Attachment K.

7.0 REFERENCES

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NCDEHNR, 1995, Site Inspection Prioritization, Southern Wood Piedmont Company, NCD 058 517 467, Wilmington, New Hanover County, North Carolina, Reference No. 02821, Division of Solid Waste Management, Superfund Section.

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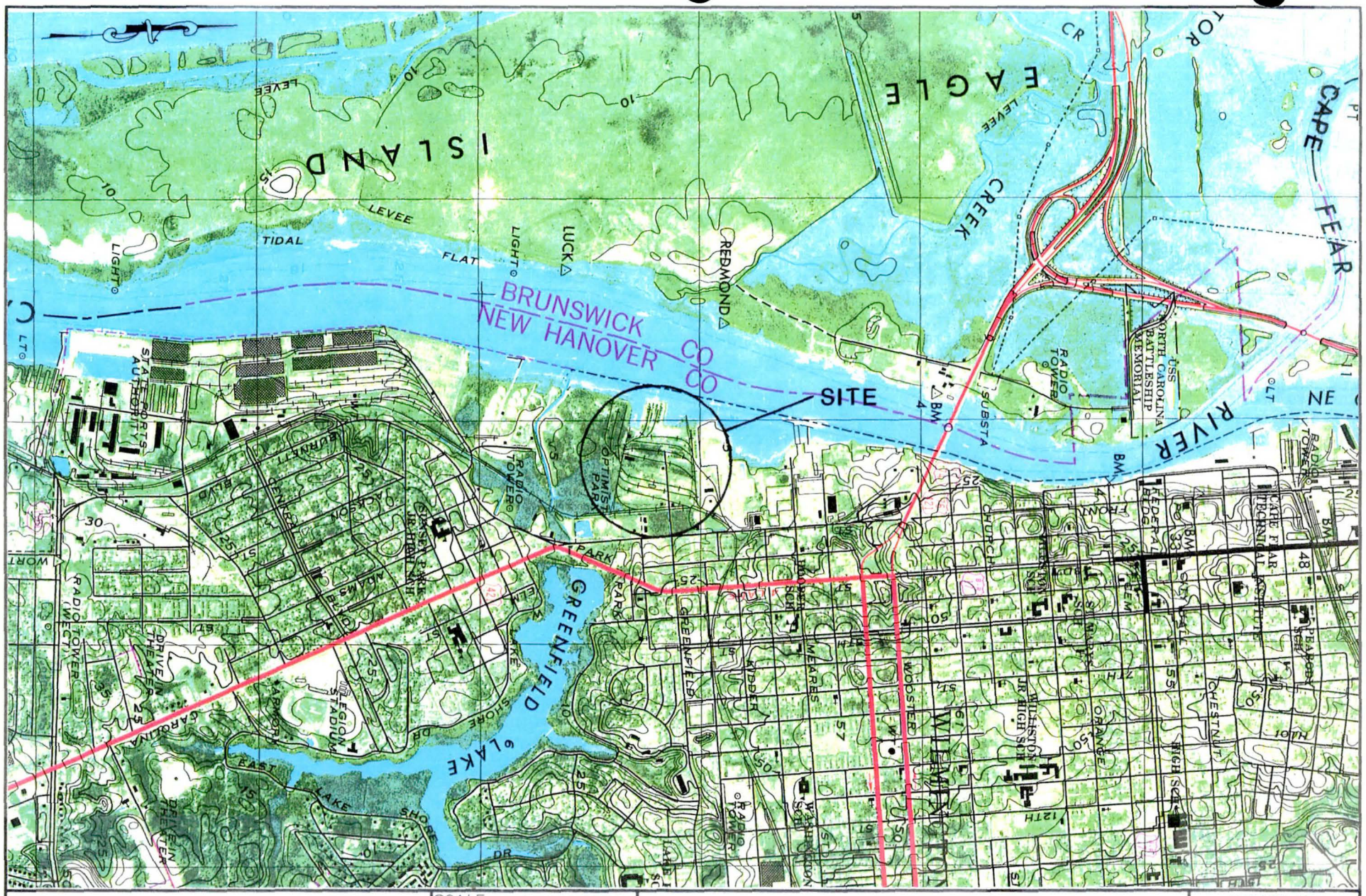
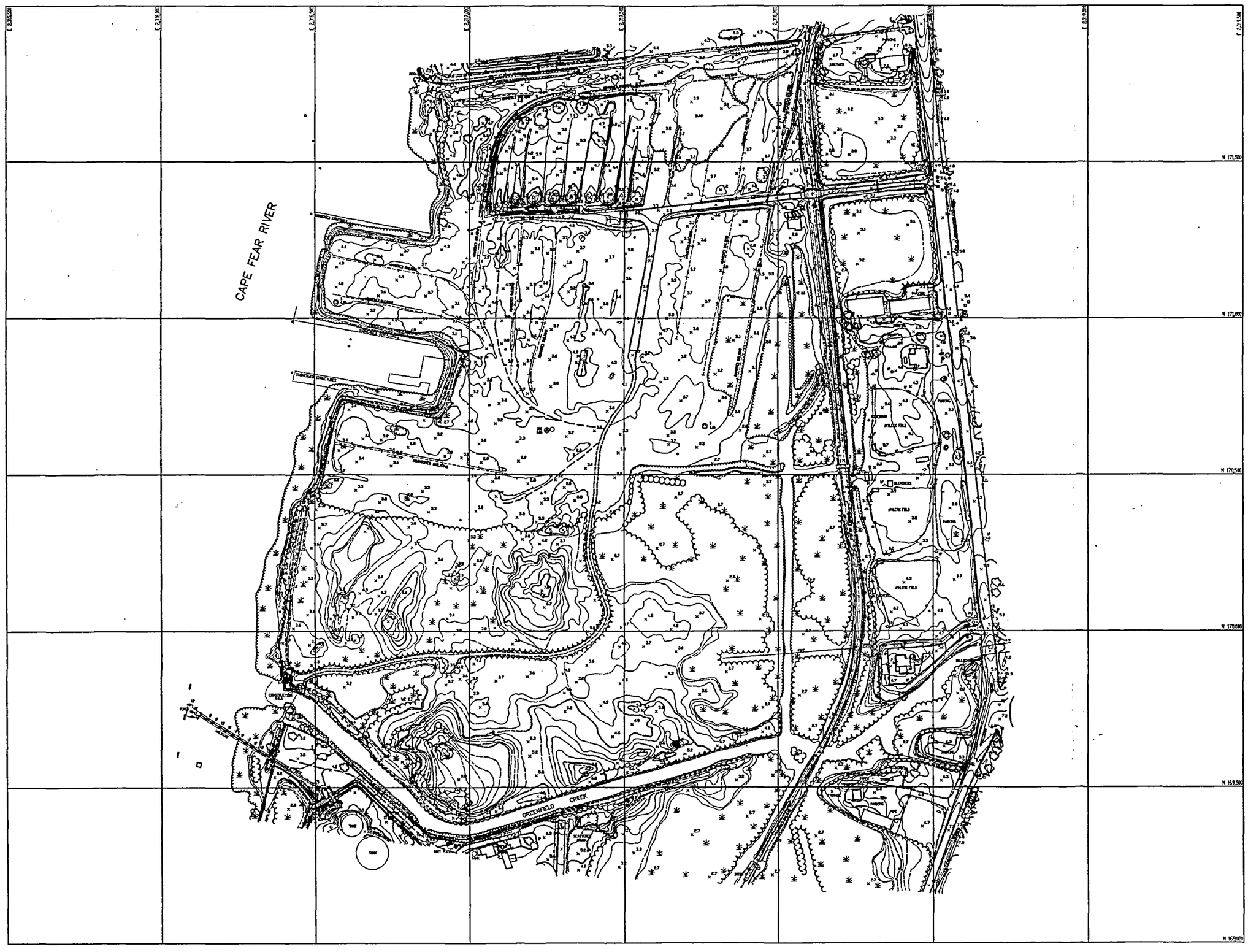
FIGURES



ViroGroup Air•Water•Soil TECHNOLOGY ETE Division ViroGroup, Inc. 1445 Pisgah Church Road Lexington, SC 29072 Phone 803-957-6270 FAX 803-957-3845 Watts 1-800-786-0654	SCALE 1:24,000 DRAWN BY CAB CHECKED BY GBK DATE 2/11/94	SITE LOCATION MAP SOUTHERN WOOD PIEDMONT/ WILMINGTON, N.C. FACILITY	FIGURE NO. 1 CADD NO. G:5301501 PROJECT NO. 12-53015.00



PSI PHOTOGRAMMETRIC SERVICES, INC
6455 E. LIVINGSTON AVENUE
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P.O. Box 1067 • 1445 Peach Church Rd. • Lexington, S.C. 29072
(803) 957-6270

0' 150' 300' 600

SCALE: 1"=300' CONTOUR INTERVAL: 1/2'
DATE OF PHOTOGRAPHY: 24-FEB-93

FIGURE 2

SITE TOPOGRAPHIC MAP

SOUTHERN WOOD PIEDMONT
WILMINGTON, N.C. FACILITY

NO.	REVISION	DATE	BY

UPPER AQUIFER

LOWER AQUIFER

SHALLOW AQUIFER SYSTEM

WATER TABLE AQUIFER

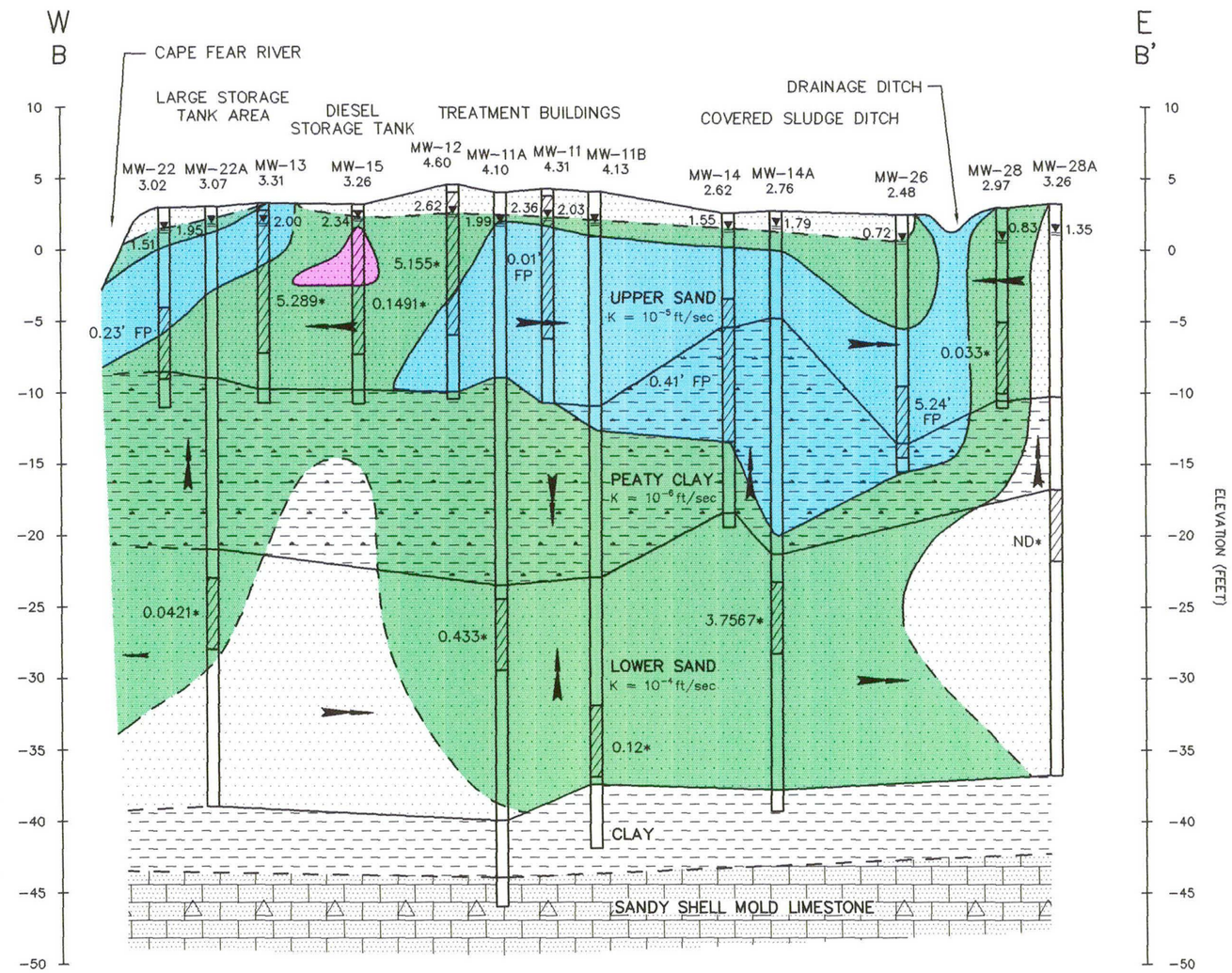
LEAKY CONFINING

SEMI-CONFINED AQUIFER

CONFINING

CONFINED AQUIFER

DEEP AQUIFER SYSTEM



LEGEND

- UPPER SAND
- PEATY CLAY
- LOWER SAND
- CLAY
- SANDY SHELL MOLD LIMESTONE
- RESIDUAL & POOLED WOOD PRESERVING CONSTITUENTS
- RESIDUAL DIESEL CONSTITUENTS
- DISSOLVED WOOD PRESERVING CONSTITUENTS ORGANIC PLUME
- SCREEN INTERVAL
- 0.98 ▼ GROUNDWATER ELEVATION
- ND* DISSOLVED ORGANICS (mg/l)
- 0.01' FP FREE PRODUCT (FT.)
- K HYDRAULIC CONDUCTIVITY
- GROUNDWATER GRADIENT

SCALE

HORIZONTAL: 1" = 300'
VERTICAL: 1" = 10'

NOTE:
HORIZONTAL SPACING BETWEEN WELLS IN THE WELL CLUSTERS ARE NOT TO SCALE, (IE: MW-11, MW-11A, & MW-11B).

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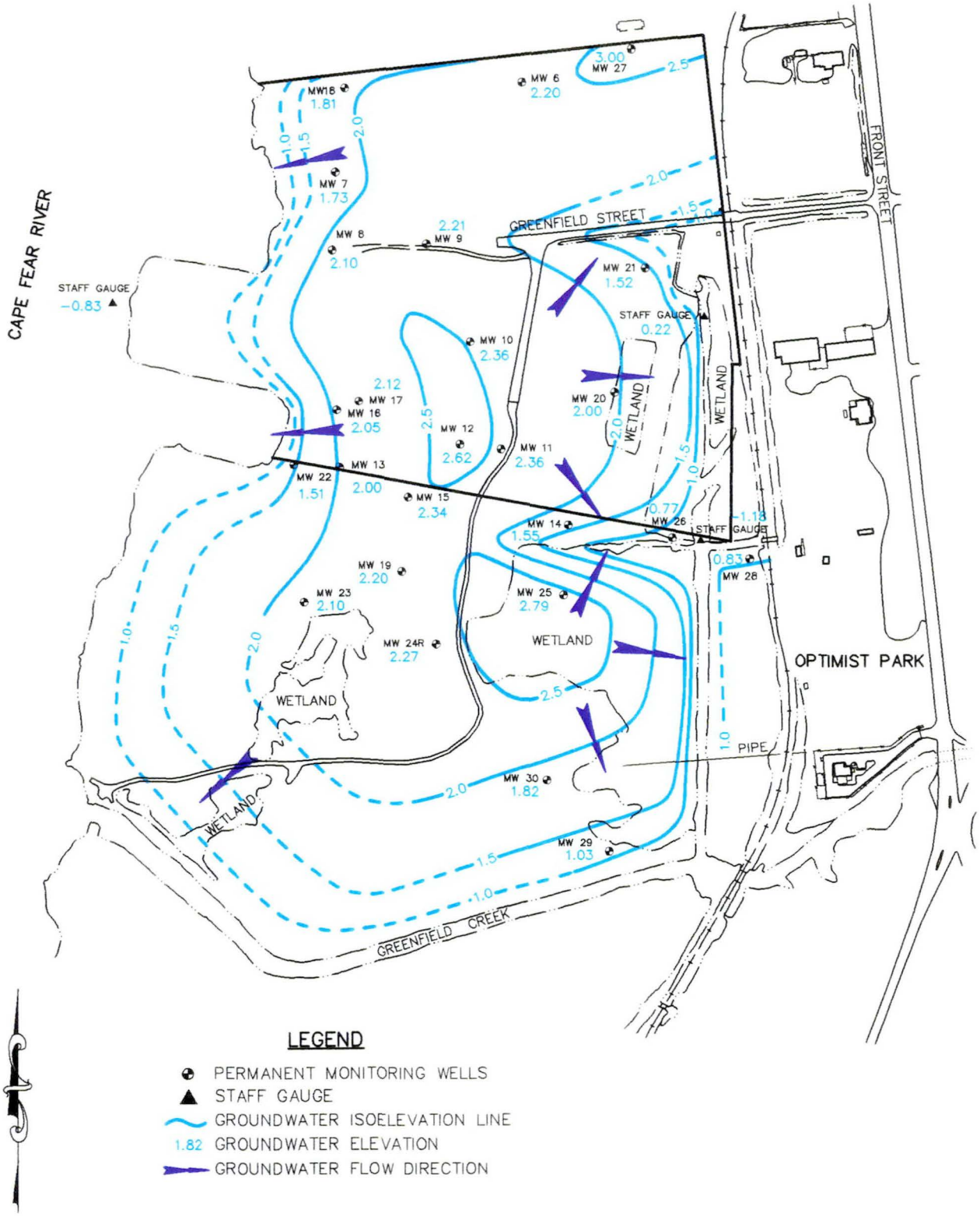
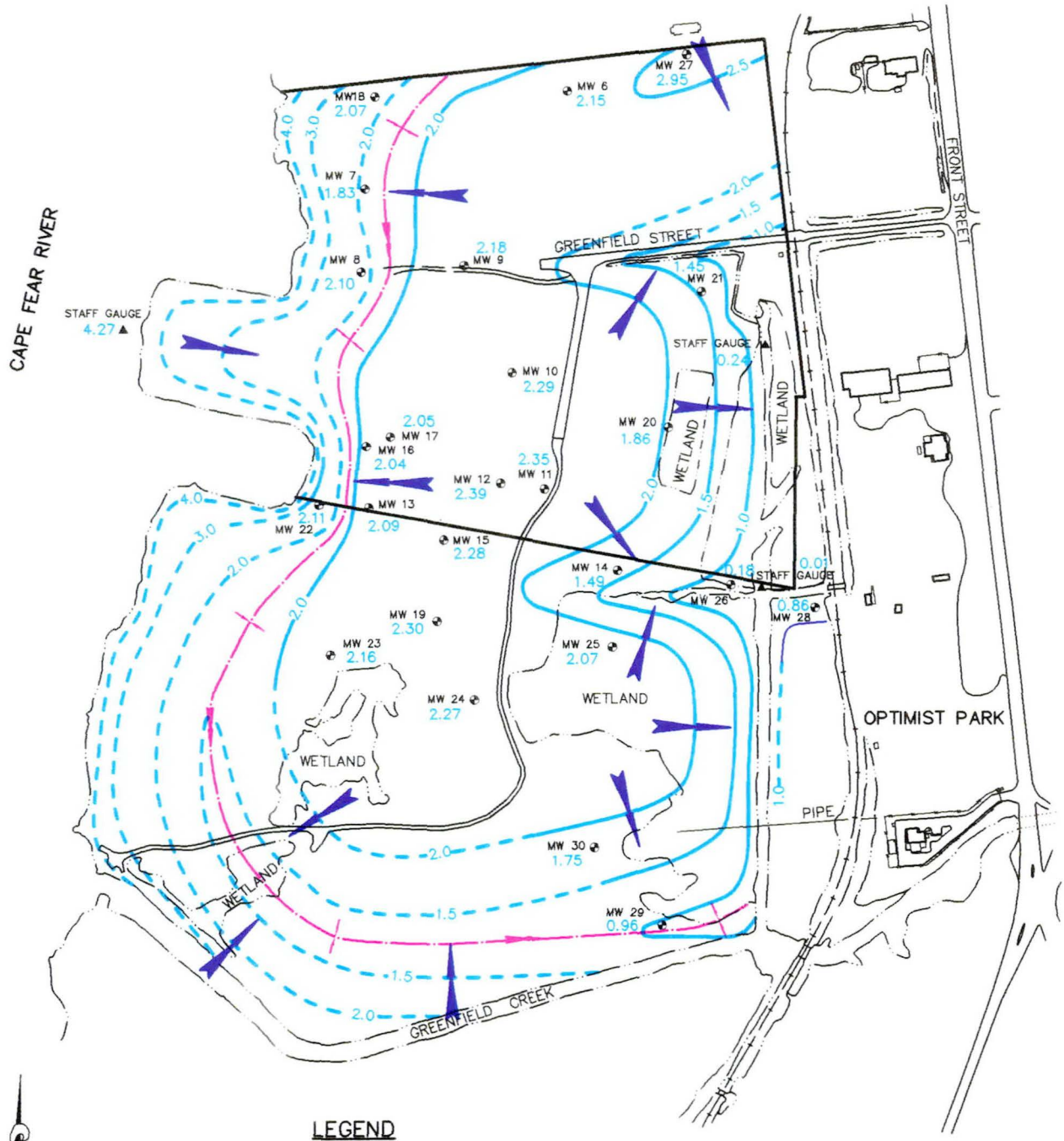
SITE AQUIFER SYSTEMS AND HYDROGEOLOGIC CROSS-SECTION MAP

SOUTHERN WOOD PIEDMONT/ WILMINGTON, N.C. FACILITY

DRAWN BY:	CAB	DATE:	3/2/94
DESIGNED BY:	GBK	CADD NO:	G:530BB
APPROVED BY:		PROJECT NO:	12-53015.00
SCALE:	AS SHOWN	FIGURE NO.	3



ViroGroup P.O. Box 1867 • 1445 Plaqah Church Rd. • Lexington, S.C. 29072 (803) 957-6270	SCALE 1"=400' DRAWN BY CAB CHECKED BY GBK DATE 2/11/94	SHALLOW AQUIFER SYSTEM LOW TIDE WATER TABLE AQUIFER POTENTIOMETRIC MAP SOUTHERN WOOD PIEDMONT/ WILMINGTON, N.C. FACILITY	FIGURE NO. 4 CADD NO. G: 5301501A PROJECT NO. 12-53015.00



LEGEND

- PERMANENT MONITORING WELLS
- STAFF GAUGE
- GROUNDWATER ISOELEVATION LINE
- 1.75 GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION
- GROUNDWATER INFLECTION LINE

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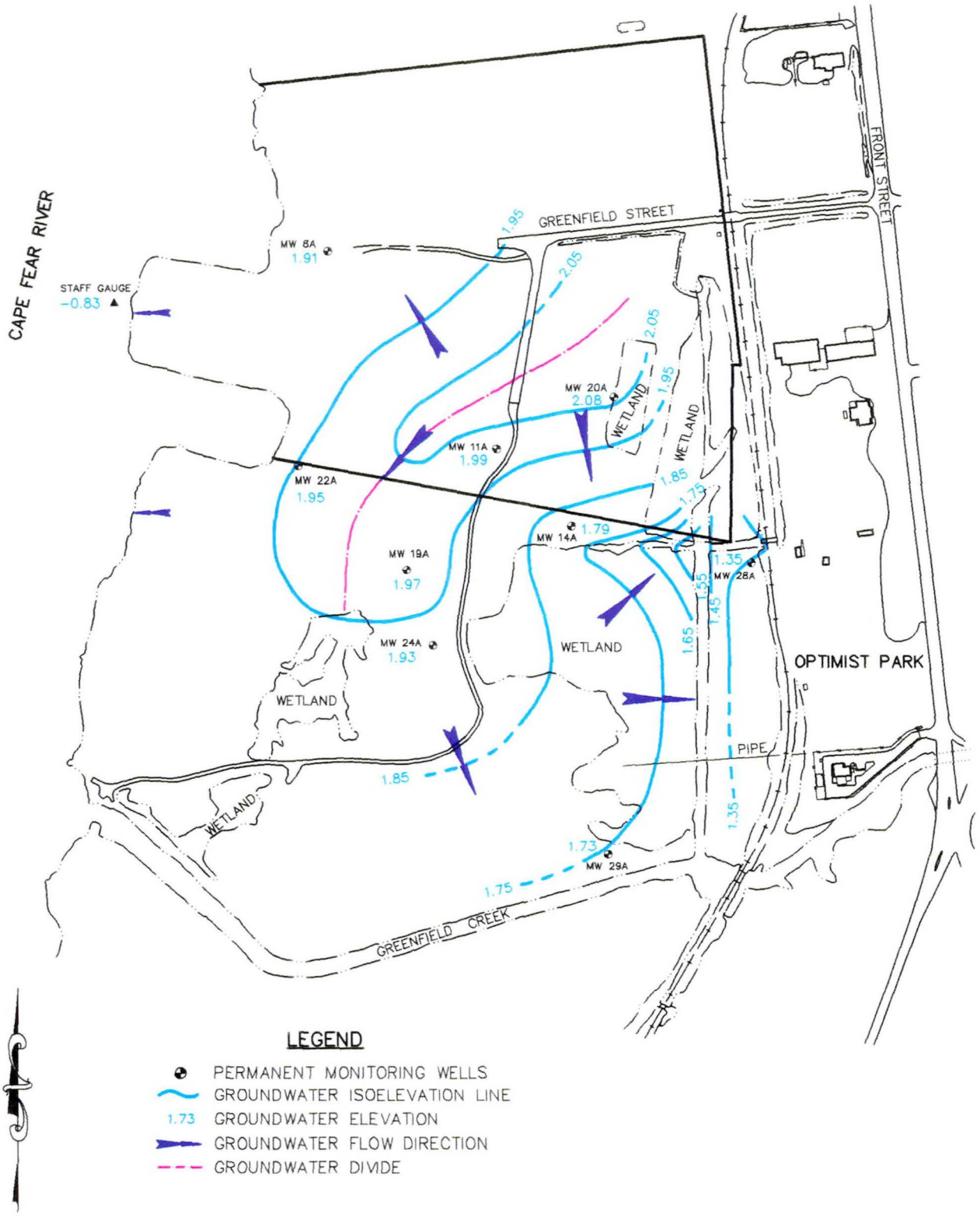
DATE	2/11/94

SHALLOW AQUIFER SYSTEM
HIGH TIDE WATER TABLE
AQUIFER POTENTIOMETRIC MAP
SOUTHERN WOOD PIEDMONT/
WILMINGTON, N.C. FACILITY

FIGURE NO.	5
CADD NO.	G:5301501A
PROJECT NO.	12-53015.00



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SCALE	1" = 400'
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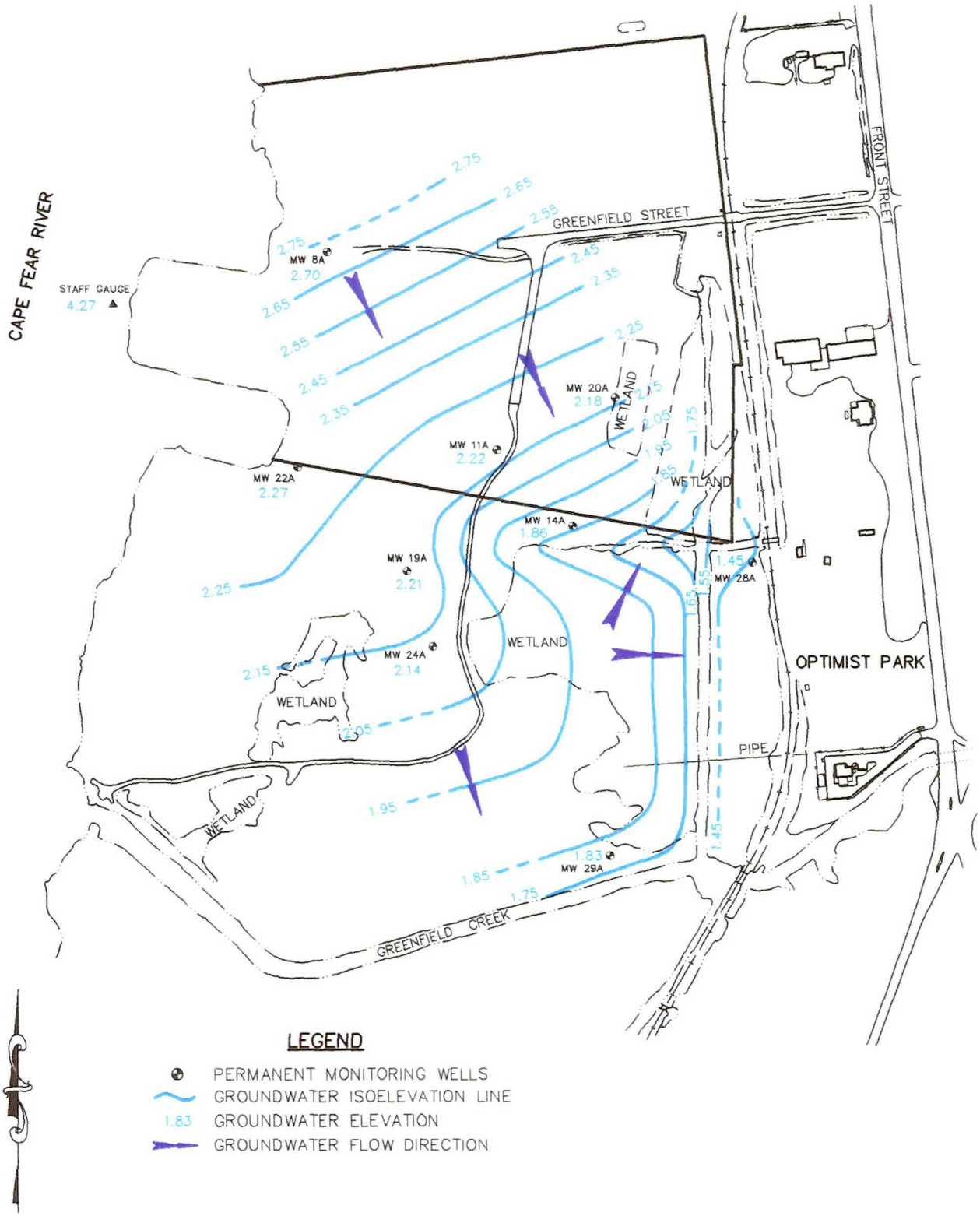
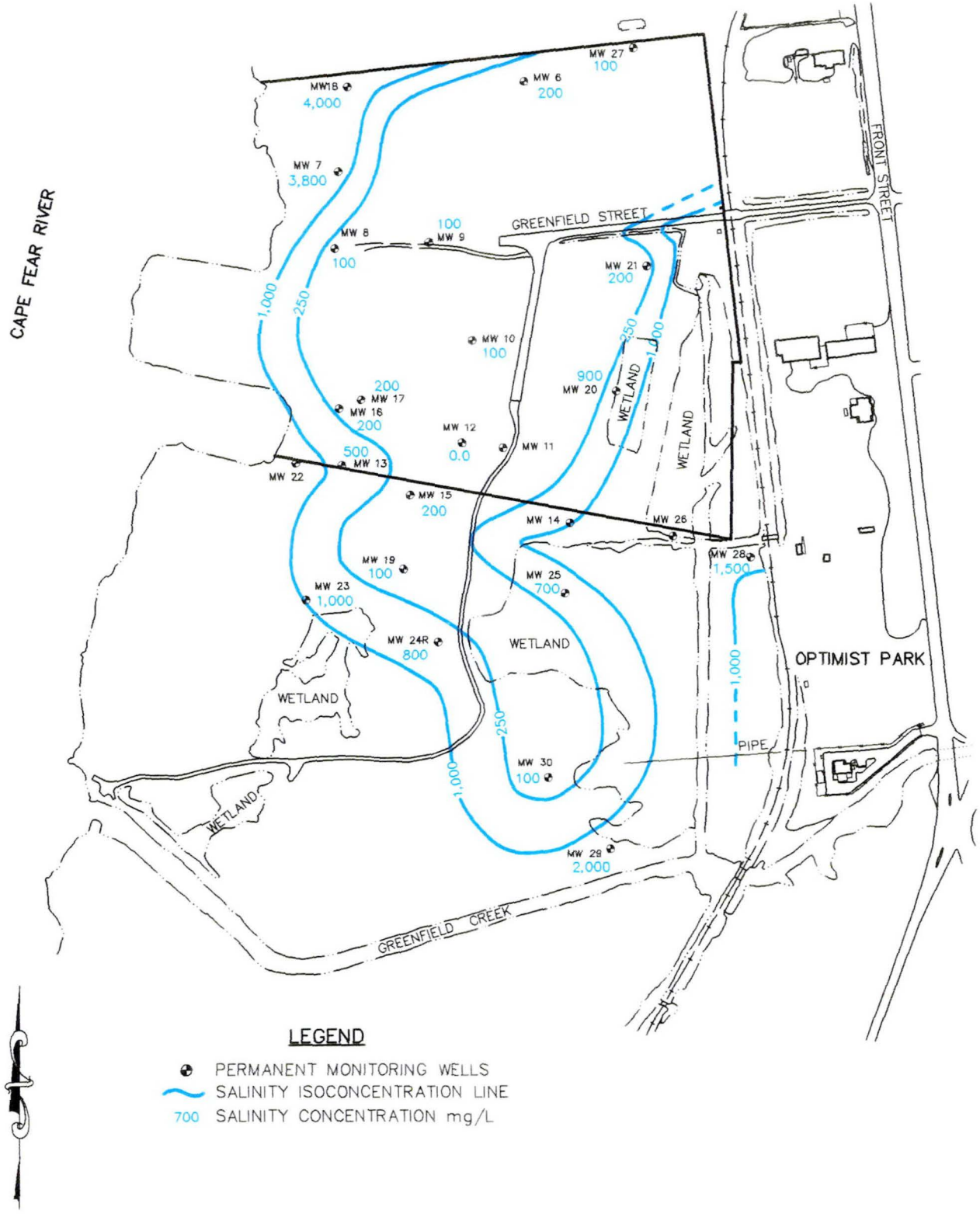
DATE	2/11/94

SHALLOW AQUIFER SYSTEM
LOW TIDE SEMI-CONFINED
AQUIFER POTENTIOMETRIC MAP
SOUTHERN WOOD PIEDMONT/
WILMINGTON, N.C. FACILITY

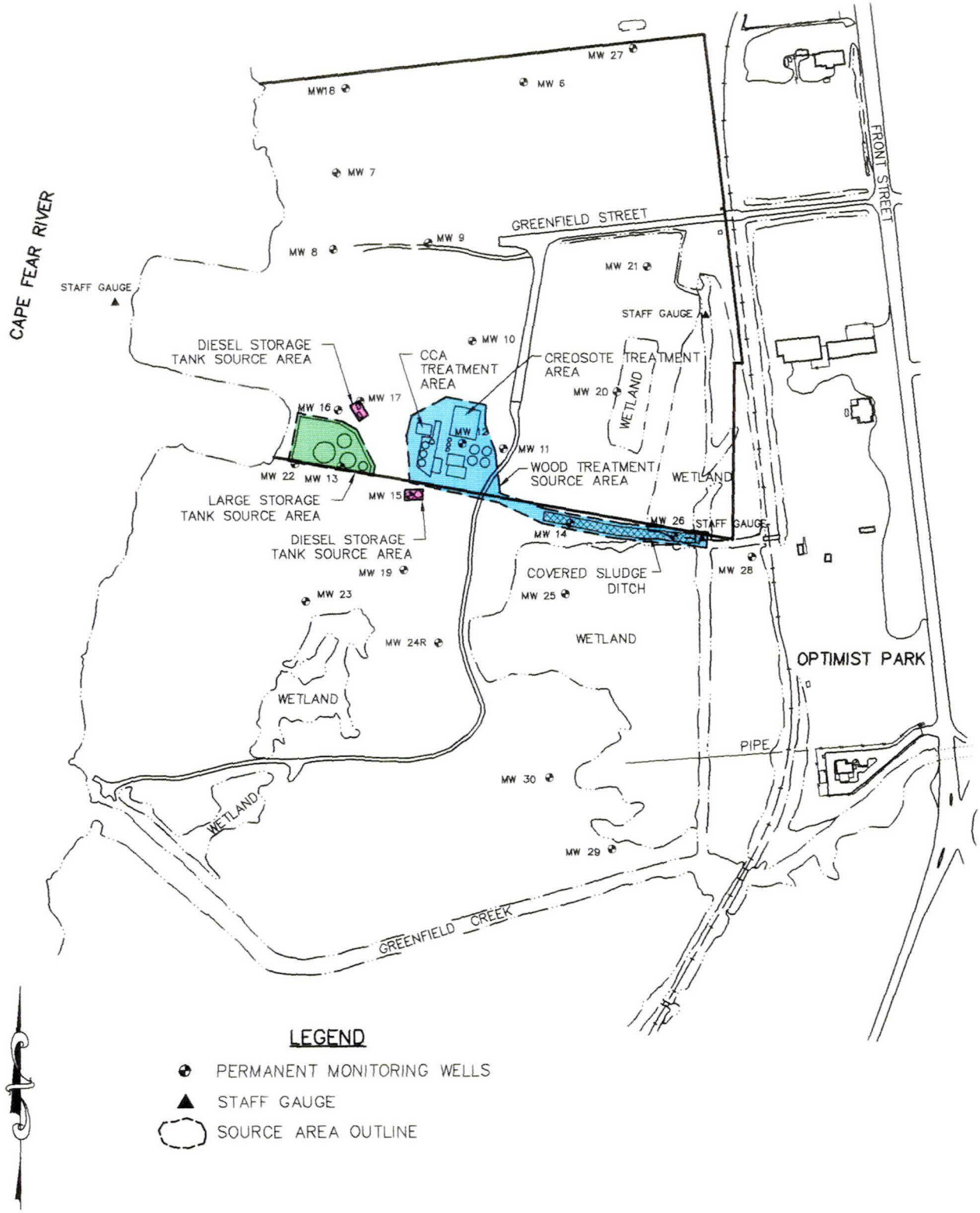
FIGURE NO.	6
CADD NO.	G: 5301501B
PROJECT NO.	12-53015.00



ViroGroup P.O. Box 1867 • 1445 Plaqah Church Rd. • Lexington, S.C. 29072 (803) 957-5270	SCALE 1"=400' DRAWN BY CAB CHECKED BY GBK DATE 2/11/94	SHALLOW AQUIFER SYSTEM HIGH TIDE SEMI-CONFINED AQUIFER POTENTIOMETRIC MAP SOUTHERN WOOD PIEDMONT/ WILMINGTON, N.C. FACILITY	FIGURE NO. 7 CADD NO. G:5301501B PROJECT NO. 12-53015.00



ViroGroup P.O. Box 1867 • 1445 Plaqah Church Rd. • Lexington, S.C. 29072 (803) 957-8270	SCALE 1"=400' DRAWN BY CAB CHECKED BY GBK DATE 2/11/94	SHALLOW AQUIFER SYSTEM WATER TABLE AQUIFER SALINITY ISOCONCENTRATION MAP SOUTHERN WOOD PIEDMONT/ WILMINGTON, N.C. FACILITY	FIGURE NO. 8 CADD NO. G:5301501A PROJECT NO. 12-53015.00



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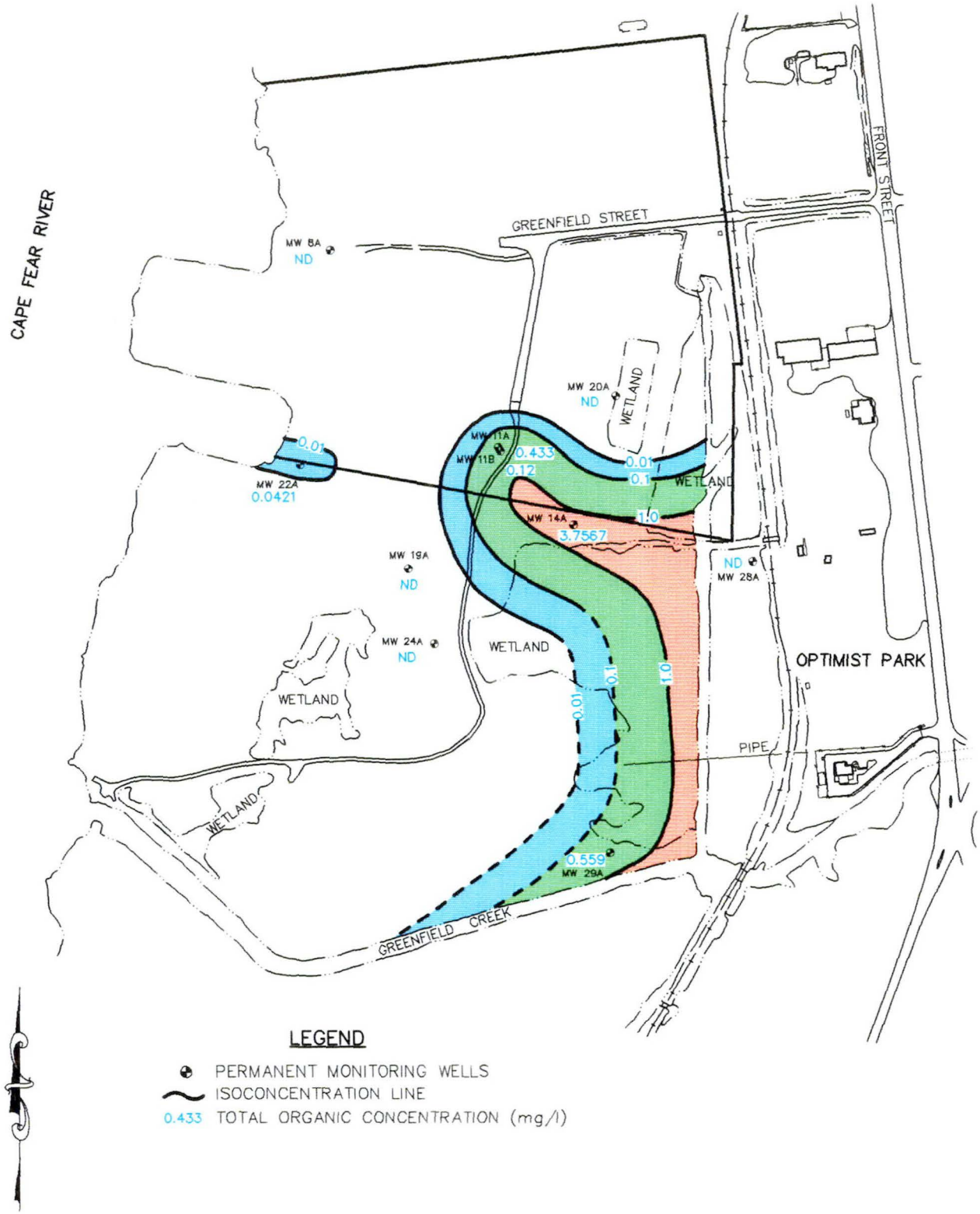
LEGEND

- PERMANENT MONITORING WELLS
- ISOCONCENTRATION LINE
- 0.164 TOTAL ORGANIC CONCENTRATION (mg/l)
- FP FREE PRODUCT (ft.)

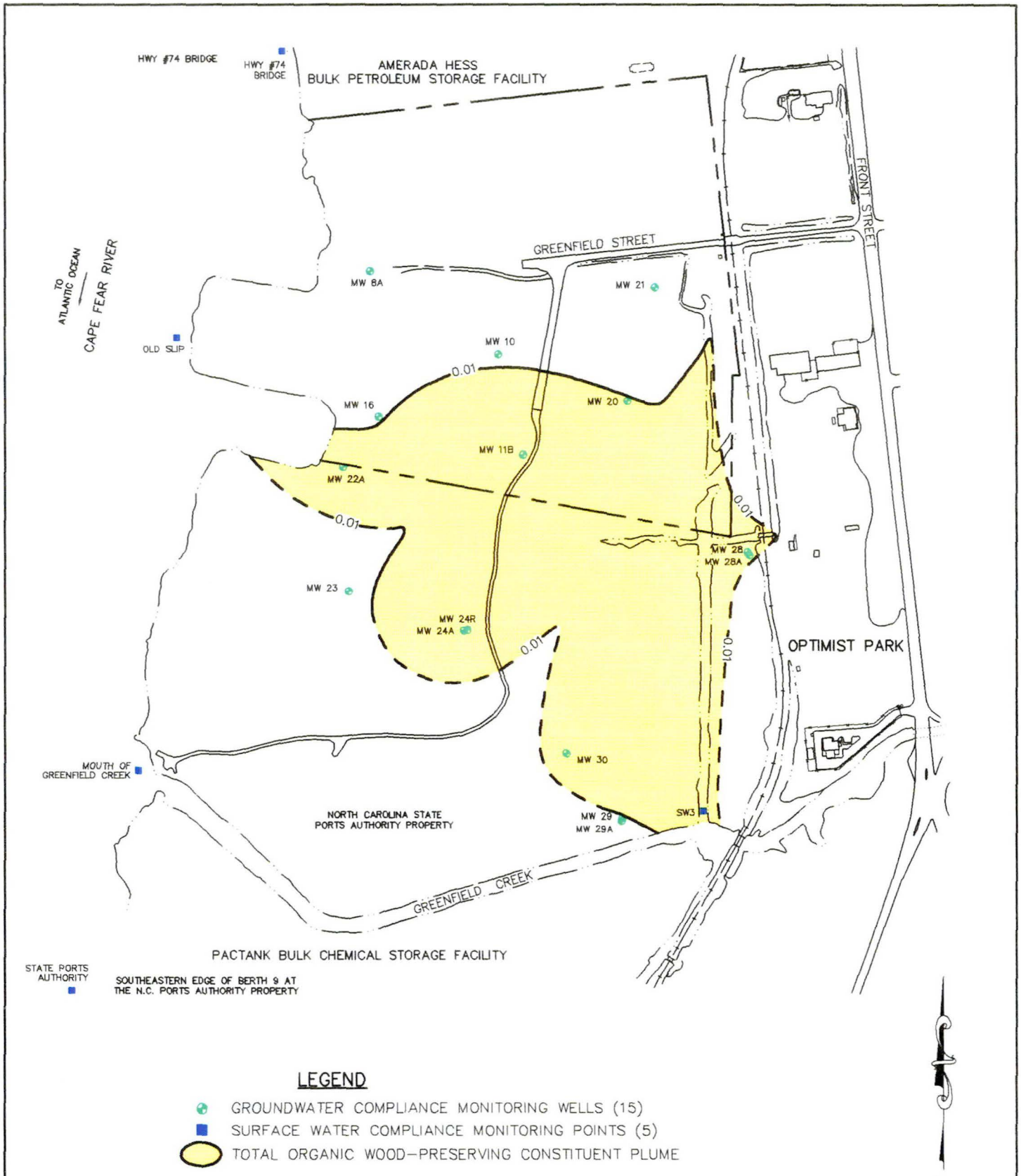
ViroGroup P.O. Box 1867 • 1445 Pisgah Church Rd. • Lexington, S.C. 29072 (803) 957-8270	SCALE 1" = 400' DRAWN BY CAB CHECKED BY GBK DATE 2/11/94	SHALLOW AQUIFER SYSTEM WATER TABLE AQUIFER ORGANIC WOOD-PRESERVING CONSTITUENTS ISOCONCENTRATION MAP SOUTHERN WOOD PIEDMONT/ WILMINGTON, N.C. FACILITY	FIGURE NO. 10 CADD NO. G:5301501A PROJECT NO. 12-53015.00



LEGEND

- PERMANENT MONITORING WELLS
- ISOCONCENTRATION LINE
- 0.433 TOTAL ORGANIC CONCENTRATION (mg/l)

ViroGroup P.O. Box 1867 • 1445 Pisgah Church Rd. • Lexington, S.C. 29072 (803) 957-6270	SCALE 1"=400' DRAWN BY CAB CHECKED BY GBK DATE 2/11/94	SHALLOW AQUIFER SYSTEM SEMI-CONFINED AQUIFER ORGANIC WOOD-PRESERVING CONSTITUENT ISOCONCENTRATION MAP SOUTHERN WOOD PIEDMONT/ WILMINGTON, N.C. FACILITY	FIGURE NO. 11 CADD NO. G:5301501B PROJECT NO. 12-53015.00



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SCALE	1" = 400'
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COMPLIANCE MONITORING LOCATION MAP
SOUTHERN WOOD PIEDMONT/
WILMINGTON, N.C. FACILITY

FIGURE NO.	12
CADD NO.	5302012
PROJECT NO.	12-53020.CO

ATTACHMENT A

WILMINGTON SITE-SPECIFIC GROUNDWATER CONSTITUENT LIST

SITE-SPECIFIC GROUNDWATER SAMPLE LIST
SOUTHERN WOOD PIEDMONT FACILITY
WILMINGTON, NORTH CAROLINA

METALS

Arsenic
Copper
Chromium

SEMI-VOLATILES

Acenaphthene
Benzo(a)anthracene
Benzo(b)fluoranthene
Bis(2-chloroethyl)ether
4-chloro-3-methylphenol
Chrysene
2,4-dimethylphenol
Fluoranthene
Naphthalene
Phenanthrene
Tetrachlorophenol
2,4,6-trichlorophenol
Anthracene
Benzo(a)pyrene
Benzo(k)fluoranthene
Carbazole
2-chlorophenol
Dibenzo(a,h)anthracene
2,4-dinitrophenol
Indeno(1,2,3-cd)pyrene
Pentachlorophenol
Phenol
2,4,5-trichlorophenol

VOLATILES

Benzene
Bromomethane
Chlorobenzene
2-chloroethylvinylether
Cis-1,3-dichloropropene
1,2-dibromomethane (Edb)
1,1-dichloroethane
1,1-dichloroethene
1,2-dichloropropane
Fluorotrichloromethane
Methyl-T-Butyl Ether (Mtbe)
1,1,2,2-tetrachloroethane
Trans-1,2-dichloroethene
1,1,2-trichloroethane
Vinyl Chloride
Bromodichloromethane
Carbon Tetrachloride
Chloroethane
Chloromethane
Dibromochloromethane
Dichlorodifluoromethane
1,2-dichloroethane
Dichloromethane
Ethyl benzene
M/P-Xylene
O-Xylene
Toluene
1,1,1-trichloroethane
Trichloroethene

ATTACHMENT B

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT, HEALTH, AND NATURAL RESOURCES GROUNDWATER CLASS GA AND CLASS GSA STANDARDS APPLICABLE TO SOUTHERN WOOD PIEDMONT, WILMINGTON, NORTH CAROLINA FACILITY

NCDEHNR GROUNDWATER CLASS GA AND GSA STANDARDS APPLICABLE TO SOUTHERN WOOD PIEDMONT, WILMINGTON, NORTH CAROLINA FACILITY

The maximum allowable concentration for substances in Class GA and Class GSA groundwaters are established as the lesser of:

(1) Systemic threshold concentration calculated as follows: [Reference Dose (mg/kg/day) x 70 kg (adult body weight) x Relative Source Contribution (.10 for inorganics; .20 for organics)]/[2 liters/day (average water consumption)];
(2) Concentration which corresponds to an incremental lifetime cancer risk of 1×10^{-6};
(3) Taste threshold limit value;
(4) Odor threshold limit value;
(5) Maximum contaminant level; or
(6) National secondary drinking water standard.

NOTE: The SOURCE category indicates how the established standard was derived (NCDEHNR Class GA/GSA or as described above).

Where no data is available for a substance or when the established standard for a substance is below the practical quantitation limit (PQL), the PQL becomes the standard.

WATER QUALITY

SUBSTANCE	STANDARD (mg/l)	SOURCE	PQL (mg/l)
pH	6.5-8.5	Class GA	NA
Chloride	250	Class GA	NA
Chloride	Naturally Occurring	Class GSA	NA
Total dissolved solids	500	Class GA	NA
Total dissolved solids	1000	Class GSA	NA

METALS

SUBSTANCE	STANDARD (mg/l)	SOURCE	PQL (mg/l)
Arsenic	0.05	Class GA	0.010
Chromium	0.05	Class GA	0.010
Copper	1.0	Class GA	0.025

NCDEHNR GROUNDWATER CLASS GA AND GSA STANDARDS APPLICABLE TO SOUTHERN WOOD PIEDMONT, WILMINGTON, NORTH CAROLINA FACILITY

SEMI-VOLATILES

SUBSTANCE	STANDARD (mg/l)	SOURCE	PQL (mg/l)
Acenaphthene	0.42	(1)	0.010
Anthracene	2.1	(1)	0.010
Benzo(a)anthracene	0.0001	(5) proposed	0.010
Benzo(a)pyrene	0.0002	(5) final	0.010
Benzo(b)fluoranthene	0.0002	(5) proposed	0.010
Benzo(k)fluoranthene	0.0002	(5) proposed	0.010
Bis (2-chloroethyl) ether	No data		0.010
Carbazole	No data		0.010
4-chloro-3-methylphenol	No data		0.010
2-chlorophenol	0.0001	Class GA	0.010
Chrysene	0.0002	(5) proposed	0.010
Dibenzo(a,h)anthracene	0.0003	(5) proposed	0.010
2,4-dimethylphenol	No data		0.010
2,4-dinitrophenol	No data		0.050
Fluoranthene	No data		0.010
Indeno(1,2,3-cd)pyrene	0.0004	(5) proposed	0.010
Naphthalene	0.021	(1) final	0.010
Pentachlorophenol	0.0003	Class GA	0.050
Phenanthrene	0.21	Class GA	0.010
Phenol	0.3	Class GA	0.010
Tetrachlorophenol	0.21	(1) draft	0.010
2,4,5-trichlorophenol	0.7	(1)	0.010
2,4,6-trichlorophenol	0.003	(2)	0.010

NCDEHNR GROUNDWATER CLASS GA AND GSA STANDARDS APPLICABLE TO SOUTHERN WOOD PIEDMONT, WILMINGTON, NORTH CAROLINA FACILITY

VOLATILES

SUBSTANCE	STANDARD (mg/l)	SOURCE	PQL (mg/l)
Benzene	0.001	Class GA	0.005
Bromodichloromethane	0.14	(1) draft	0.005
Bromomethane	0.007	(1) final	0.010
Carbon Tetrachloride	0.005	(5) final	0.005
Chlorobenzene	0.05	Class GA	0.005
Chloroethane	No data		0.010
2-chloroethylvinyl ether	No data		0.050
Chloromethane	0.028	(1) final	0.010
Cis-1,3-dichloropropene	0.0021	(1) final	0.005
Dibromochloromethane	0.1	(5) interim	0.005
1,2-dibromoethane (Edb)	4.0×10^{-7}	Class GA	0.005
Dichlorodifluoromethane	1.4	(1) final	0.005
1,1-dichloroethane	0.7	Class GA	0.005
1,2-dichloroethane	0.00038	Class GA	0.005
1,1-dichloroethene	No data		0.005
1,2-dichloropropane	0.00056	Class GA	0.005
Ethylbenzene	0.029	Class GA	0.005
Fluorotrichloromethane	2.1	(1) final	0.005
Methylene chloride	0.005	Class GA	0.005
Xylenes (total)	0.53	Class GA	0.005
Methyl-T-Butyl Ether (Mtbe)	0.2	Class GA	0.010
1,1,2,2-tetrachloroethane	0.21	(1) final	0.005
Toluene	1.0	Class GA	0.005
Trans-1,2-dichloroethylene	0.14	(1) final	0.005
1,1,1-trichloroethane	0.2	Class GA	0.005
1,1,2-trichloroethane	0.005	(5) final	0.005
Trichloroethene	No data		0.005
Vinyl Chloride	1.5×10^{-5}	Class GA	0.010

ATTACHMENT C

LIST OF CONSTITUENTS DETECTED ABOVE THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES CLASS GA AND CLASS GSA STANDARDS

LIST OF CONSTITUENTS DETECTED ABOVE THE NCDEHNR CLASS GA AND CLASS GSA GROUNDWATER STANDARD

SOUTHERN WOOD PIEDMONT FACILITY WILMINGTON, NORTH CAROLINA

Constituent	Standard*	PQL	Well	Result
Acenaphthene	0.42	0.010	MW-12 MW-13 MW-29A	0.77 0.8 0.54
Benzene	0.001	0.005	MW-13 MW-19	0.046 0.0055
Carbazole	None	0.010	MW-12 MW-13 MW-29A MW-30	0.21 0.22 0.019 0.013
Fluoranthene	None	0.010	MW-12 MW-13 MW-25 MW-30	0.31 0.30 0.034 0.016
Naphthalene	0.021	0.010	MW-11A MW-12 MW-13 MW-14A MW-15 MW-19 MW-24	0.31 3.1 3.1 3.3 0.055 0.29 0.29
Phenanthrene	0.21	0.010	MW-12 MW-13	0.74 0.77

NOTE: All values are reported in mg/l.
Standard based on NCDEHNR established standards as described in 15A NCAC 2L and Attachment A of this report. When no standard has been established, the PQL becomes the standard.

ATTACHMENT D

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT, HEALTH, AND NATURAL RESOURCES TIDAL SALTWATER CLASS SC STANDARDS APPLICABLE TO SOUTHERN WOOD PIEDMONT, WILMINGTON, NORTH CAROLINA FACILITY

NCDEHNR TIDAL SALTWATER CLASS SC STANDARDS APPLICABLE TO SOUTHERN WOOD PIEDMONT, WILMINGTON, NORTH CAROLINA FACILITY

The maximum allowable concentration for substances in Class SC tidal saltwaters are established as:

WATER QUALITY

SUBSTANCE	STANDARD	SOURCE	PQL (mg/l)
pH	6.8-8.5	Class SC	NA
pH	4.3-8.5	Class SC-Swamp	NA

METALS

SUBSTANCE	STANDARD (mg/l)	SOURCE	PQL (mg/l)
Arsenic	0.05	Class SC	0.010
Chromium	0.02	Class SC	0.010
Copper	0.003	Class SC	0.025

SEMI-VOLATILES

SUBSTANCE	STANDARD (mg/l)	SOURCE	PQL (mg/l)
Polynuclear aromatic hydrocarbons (PAHs)	0.0000311	Class SC	0.010 - 0.050

Phenolic compounds are allowed only at levels that will not result in fish-tainting or impairment of other best usage.

VOLATILES

SUBSTANCE	STANDARD (mg/l)	SOURCE	PQL (mg/l)
Benzene	0.0714	Class SC	0.005
Carbon Tetrachloride	0.00442	Class SC	0.005
1,1,2,2-tetrachloroethane	0.0108	Class SC	0.005
Vinyl Chloride	0.525	Class SC	0.010

ATTACHMENT E

CERCLA APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS WAIVERS

CERCLA ARAR Waivers

The six ARAR waivers provided by CERCLA §121(d)(4) are:

1. Interim Action Waiver;
2. Equivalent Standard of Performance Waiver;
3. Greater Risk to Health and the Environment Waiver;
4. Technical Impracticability Waiver;
5. Inconsistent Application of State Standard Waiver; and
6. Fund Balancing Waiver.

ATTACHMENT F

CONTAMINANT CHARACTERISTICS THAT AFFECT GROUNDWATER RESTORATION

Examples of Factors Affecting Ground-Water Restoration

Certain site characteristics may limit the effectiveness of subsurface remediation. The examples listed below are highly generalized. The particular factor or combination of factors that may critically limit restoration potential will be site specific.

Generalized Remediation Difficulty Scale

Increasing difficulty →

	Contaminant Characteristics		
Site Use	Nature of Release	Small Volume Short Duration Slug Release	→ Large Volume Long Duration Continual Release
Chemical Properties	Biotic/Abiotic Decay Potential	High	→ Low
	Volatility	High	→ Low
	Contaminant Retardation (Sorption) Potential	Low	→ High
Contaminant Distribution	Contaminant Phase	Aqueous, Gaseous	→ Sorbed → LNAPLs → DNAPLs
	Volume of Contaminated Media	Small	→ Large
	Contaminant Depth	Shallow	→ Deep
	Hydrogeologic Characteristics		
Geology	Stratigraphy	Simple Geology, e.g., Planar Bedding	→ Complex Geology, e.g., Interbedded and Discontinuous Strata
	Texture of Unconsolidated Deposits	Sand	→ Clay
	Degree of Heterogeneity	Homogeneous (e.g., well-sorted sand)	→ Heterogeneous (e.g., interbedded sand and silts, clays, fractured media, karst)
Hydraulics/Flow	Hydraulic conductivity	High (>10^{-2} cm/sec)	→ Low (< 10^{-4} cm/sec)
	Temporal Variation	Little/None	→ High
	Vertical Flow	Little	→ Large Downward Flow Component

ATTACHMENT G

FINAL REMEDIAL ACTION ALTERNATIVES EVALUATION CRITERIA SUMMARY TABLE

EVALUATION CRITERIA	ALTERNATIVES		
	(1) No Action/Natural Attenuation	(2) Natural Attenuation, Site Security and Monitoring	(3) Natural Attenuation, Site Security, Monitoring and Development*
Overall Protection of Human Health and the Environment	No further reduction in risk. No groundwater receptors on site or on adjacent properties. Constituents in the groundwater are diluted, dispersed and biodegraded prior to migrating off site to surrounding surface water bodies. Past surface water sampling data suggest that constituents are being reduced to acceptable levels. Contaminants are expected to degrade over time, reducing their toxicity and volume and associated risks to human health and the environment. Access to the site is restricted by a locking gate and daily site inspections by the North Carolina Ports Authority.	Same as alternative 1. In addition, a restriction and notice will be placed in the property deed that limits future site use to industrial purposes and states that the groundwater on site has been influenced by past site activities. Signs restricting unauthorized use of the property will be posted. A petition for a groundwater statutory variance will be made to NCDEHNR. Semi-annual groundwater and surface water sampling will provide for evaluation of the degradation process and compliance with ARARs.	Same as alternative 1 and 2. Fill material and an impervious surface will be placed over the site during development to support future facility operations as a land/sea cargo transfer facility. Capping will further reduce the migration rate of groundwater to the surface water bodies by preventing and diverting infiltration to the aquifer. The affect of tidal attenuation and dilution of site contaminants will be increased by decreasing the hydraulic gradient of the groundwater table.
Compliance with ARARs	Groundwater ARARs are currently exceeded on site. The groundwater on site is saline and offers no beneficial use. No groundwater users are in the vicinity of the site. Groundwater ARARs should eventually be reached through natural degradation processes. Surface water sampling has shown that a few surface water ARARs have been exceeded in the past, however, the majority of the surface water sampling events have shown that the ARARs have not been exceeded.	Monitoring will provide additional assurance that ground water and surface water ARARs will continue to be met. A statutory variance for the groundwater on site will provide alternate groundwater ARARs and restrictions on future groundwater use.	Capping will aid in reducing the migration potential of the groundwater constituents allowing greater assurance that the surface water ARARs will be met.
Long-Term Effectiveness and Permanence	Future increased risks caused by plume migration is not expected. Past surface water sampling data suggest that reasonable goals are being achieved. Residual risk will slowly be reduced through natural degradation and dilution of the contaminants to remediation goals. The time frame for complete degradation is indefinite.	Same as Alternative 1. The long-term reduction of contaminant toxicity, mobility and volume is addressed via the institutional controls and monitoring of groundwater and surface water compliance points. The useful life of an established monitoring program is indefinite because it does not involve the permanent implementation of a technology.	Same as Alternative 1 and 2. Capping is a proven and reliable technology. The long-term effectiveness of the cap can be evaluated through visual inspection of the cap materials. Necessary repairs to the cap are easily implemented.
Reduction of Toxicity, Mobility, or Volume Through Treatment	Provides no active reduction of toxicity, mobility and volume of the contaminants. All reduction occur through natural processes.	Institutional and monitoring requirements lowers potential risk. All reductions will be by natural processes.	Capping will reduce the mobility of the constituents and allow for further toxicity reduction by increased tidal flushing (dilution and dispersion).
Short-Term Effectiveness	Current and potential risks will remain under this alternative. Because the contaminants remain in the groundwater, there will be some short-term adverse environmental affects. An indefinite amount of time is required for natural degradation and dilution to decrease the contaminant concentrations in the groundwater to ARARs. No increased risk to the surrounding community is expected in the future with this alternative.	Same as alternative 1. Institutional controls will provide means for protecting the community. Groundwater and surface water monitoring will provide data for evaluating potential adverse affects to the community.	Same as Alternative 1 and 2. The cap can be installed in a short period of time. Possible exposure to site workers during site capping exists. Monitoring and personal protective equipment may be required during construction.
Implementability	This alternative is already in place. Because this alternative does not involve construction, discharge, or operation, no Federal or State permits are anticipated. Approval for no action will be necessary from NCDEHNR.	Most of the institution controls are already in place. The deed restriction and notice can be placed at a low cost. State approval of a groundwater statutory variance and the groundwater and surface water monitoring program will be required prior to implementation.	Capping and associated structures are technically feasible and widely used. Services and materials are readily available and the market is competitive. Visual inspection will determine integrity of cap and repairs can be easily implemented. City or state permits/approvals for site improvements may be required. Tasks required to implement this alternative include work plan preparation, possible state or federal consent order preparation, solicitation of bids, mobilization of equipment, site preparation, and development.
Cost (for comparison only)	Capital cost: $0.00 O&M cost: $0.00 Net Present Worth: $0.00 Months to Implement: Already in place	Capital cost: $54,000.00 (Attachment H) Present Worth O&M cost:$538,000.00 Net Present Worth:$592,000.00 Months to implement: 6	Capital cost: $925,000 (Attachment I) Present Worth O&M cost:$538,000.00 Net Present Worth:$1,462,000.00 Months to implement: 12

* Development of the site by NCSPA will include the placement of several feet of fill material and an impervious surface cap.

ATTACHMENT H

REMEDIAL ACTION ALTERNATIVE 2 COST ESTIMATE

Attachment H. Cost Estimate for Alternative 2 – Natural Attenuation, Site Security and Monitoring
Southern Wood Piedmont Company, Wilmington, North Carolina Facility

CAPITAL COSTS

DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
Deed Restriction and Notice	ls	1	$2,500.00	$2,500.00
Posting Signs	ls	1	$1,500.00	$1,500.00
Daily Site Inspection (currently no fee)				
Groundwater Statutory Variance	ls	1	$50,000.00	$50,000.00
TOTAL CAPITAL COST				$54,000.00

ANNUAL O&M COSTS

DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
Groundwater & Surface Water Sample Analysis	yr	40	$400.00	$16,000.00
Groundwater & Surface Water Sample Collection	yr	2	$4,500.00	$9,000.00
Reporting	yr	2	$2,000.00	$4,000.00
ANNUAL O&M SUBTOTAL				$29,000.00
O&M CONTINGENCY (10%)				$2,900.00
TOTAL ANNUAL O&M COST				$31,900.00
PRESENT WORTH OF O&M COSTS ($35,000/yr for 30 years @ 5% discount rate)				$538,000.00
NET PRESENT WORTH (Total Capital Cost + Present Worth O&M Cost)				**$592,000.00**

Notes: yr=year, ls=lump sum

ATTACHMENT I

REMEDIAL ACTION ALTERNATIVE 3 COST ESTIMATE

Attachment I. Cost Estimate for Alternative 3 – Natural Attenuation, Site Security, Monitoring and Development
Southern Wood Piedmont Company, Wilmington, North Carolina Facility

CAPITAL COSTS

DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
Deed Restriction and Notice	ls	1	$2,500.00	$2,500.00
Posting Signs	ls	1	$1,500.00	$1,500.00
Daily Site Inspection (currently no fee)	ls			
Groundwater Variance	ls	1	$50,000.00	$50,000.00
Mobilization/Demobilization	ls	1	$50,000.00	$50,000.00
Cap*	ls	1	$650,000.00	$650,000.00
TOTAL MATERIAL/CONSTRUCTION COSTS				$754,000.00
Health and Safety Training and Equipment (2.5%)				$18,850.00
Construction Contingencies(10%)				$75,400.00
Design, Engineering, and Construction Management(10%)				$75,400.00
TOTAL CAPITAL COSTS				$923,650.00

ANNUAL O&M COSTS

DESCRIPTION	UNIT	QTY	UNIT COST	TOTAL COST
Groundwater & Surface Water Sample Analysis	yr	46	$400.00	$18,400.00
Groundwater & Surface Water Sample Collection	yr	2	$4,500.00	$9,000.00
Reporting	yr	2	$2,000.00	$4,000.00

ANNUAL O&M SUBTOTAL	$31,400.00
O&M CONTINGENCY (10%)	$3,140.00
TOTAL ANNUAL O&M COST	$34,540.00
PRESENT WORTH OF O&M COSTS ($35,000/yr for 30 years @ 5% discount rate)	$538,000.00
NET PRESENT WORTH (Total Capital Cost + Present Worth O&M Cost)	$1,461,650.00

Notes: yr=year, ls=lump sum

*Cap costs are based on the cost determined by the North Carolina State Ports Authority to cap the site with standard fill material in preparation for site development.

ATTACHMENT J

OSHA 1910.120 HEALTH AND SAFETY PLAN FOR PREFERRED REMEDIAL ACTION ALTERNATIVE

SITE SAFETY AND ENVIRONMENTAL HEALTH PLAN

SITE SAFETY PLAN INFORMATION FORM

Rev.9/94

SITE SAFETY AND ENVIRONMENTAL HEALTH PLAN SUMMARY

The Southern Wood Piedmont Company Site Safety Environmental Health Plan is designed to identify, evaluate and control safety and health hazards, and to provide contingency planning for environmental emergencies at the site. The plan is written to conform with 29 CFR 1910.120 and 40 CFR 264 and 265 Subparts C and D.

The plan consists of two parts. The first part is a written plan of general requirements applicable at all SWP sites. The second part of the plan consists of a Site Safety Plan Information Form which, when completed, will provide specific information for the site. Most of the sections in the general requirements have a matching section in the form.

The Site Safety and Environmental Health Plan also incorporates two other Southern Wood Piedmont Company safety plans. Those plans are:

1. Safety Procedure for Entering Confined Spaces
2. Respiratory Protection Program

All other SWP safety procedures should be followed when applicable.

The Site Safety Plan Information Form will be updated at least annually. The form will also be updated whenever any change makes a portion of the existing plan obsolete.

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1. Site safety officer and other key personnel.

A Site Safety and Health Officer shall be named. This person will assure compliance with this plan and all applicable regulations prior to and during all site activity. The Site Safety and Health Officer will be responsible for completing, and keeping up to date the Site Safety Plan Information Form. In the event of an emergency, the site safety and health officer shall serve as emergency coordinator. Alternate site safety and health officers shall be named to assist the site safety and health officer if necessary and to substitute for the site safety and health officer during his absence.

The site safety and health officer will be responsible for notifying the local emergency medical facility, the nearest fire department, or other local public emergency response agencies, about the scope of site activities and any potential chemical contamination of injured employees.

2. Site characterization and analysis.

Hazardous waste sites shall be evaluated by the site safety officer and documented in the Site Safety Plan Information Form. All aspects of characterization and analysis shall be done as required by this plan, 29 CFR 1910.120 and 40 CFR Subparts C and D. Site characterization and analysis shall identify specific site hazards and determine appropriate safety and health control procedures for all employees at the site.

- Site Safety Plan Information Form

  The Site Safety Plan Information Form (form) will be filled out completely and maintained on site. The form should be updated at least annually. The form will

- Those contractor employees who are not involved with hazardous waste operations and who are not likely to encounter hazardous substances will be given general orientation training. That training will be presented prior to job startup and will inform the employees of site specific health, safety, or other hazards associated with their job scope.

4. Engineering Controls, Work Practices and Personal Protective Equipment

An appropriate combination of the following items shall be established to reduce and maintain employee exposure to, or below, the permissible exposure limits as defined by 29 CFR 1910, Subpart Z.

A. Engineering Controls are any type of specialized equipment or equipment design used to isolate workers from workplace hazards.

- Engineering Controls should be the first choice for hazard abatement.
- Engineering Controls would consist of, but not be limited to: Remotely operated material handling equipment, i.e. front end loaders, industrial vacuum and suction equipment, mechanical mixers, graders.
- Equipment should preferably have enclosed cabs
- Use of roll-off boxes or storage buildings to contain excavated materials.

B. Work Practices

- Work practices to reduce or eliminate exposure to hazardous materials should be employed where possible.
- These work practices should include, but not be limited to:
  - Removing non-essential employees from the work area.

- Chemical resistant clothing, disposable chemical resistant coveralls
- Company work uniforms
- Gloves, outer, chemical resistant
- Gloves, inner, chemical resistant
- Protective Footwear: Safety shoes or boots, steel toe and shank, chemical resistant
- Safety glasses, face shield, or goggles
- Hard Hat

Work conditions will determine the type of PPE that should be worn. All SWP site employees must wear steel toe shoes. At a minimum, working directly with hazardous substances will require wearing chemical resistant clothing, outer gloves, and steel toe shoes with a chemical resistant sole. Air monitoring which reveals air quality that exceeds the permissible exposure limit for a substance would indicate the need for respiratory protection. Respiratory protection would also be required if a sudden release of a hazardous substance required emergency response action.

Site work activities such as mowing a closed unit cap, inspecting closed containers and wells, and similar tasks would require the minimum protection of company work uniforms, safety shoes, and, where necessary, gloves.

5. Medical Surveillance

- Employees exposed to hazardous substances or health hazards above permissible exposure limits for 30 days or more a year or who must wear a respirator for 30 days or more in a year shall have an annual medical surveillance test to determine health and its relation to potential exposures.

Entering Confined Spaces. The monitor used will have combustible gas and oxygen sensors and will monitor continuously.

7. Site Control

- Site control measures for preventing contamination of employees shall be developed during the planning stages of any hazardous waste operation.
- Site control at a minimum shall include:

A. A site map. The site map will show the boundary of the entire plant site. Physical features and other points of reference will be shown. The map will show the location of any site RCRA regulated units. If the site safety plan requires the establishment of site work zones, they will be shown on the map.

B. Site work zones. Site work zones will be established and defined in the site safety plan. These zones will regulate traffic and personnel flow. The zones will be designed to reduce the spread of hazardous substances by workers and equipment to clean areas on the site. The site should be divided into as many zones as are necessary to meet operational and safety needs. The typical zones used at hazardous waste remediation sites are:

B.1 Exclusion zone - This is a zone where contamination is or could occur. Typically, exclusion zones surround areas where excavation, installation of wells, or other activities disturb the soil, or where hazardous waste is handled.

B.2 Contamination reduction zone, or decontamination zone - This zone is a transition area between the contaminated area (exclusion zone) and clean

A. Efficiently summon all personnel

B. Efficiently summon emergency response personnel

C. Efficiently maintain contact with off-site emergency response groups, corporate support and regulatory agencies.

E. Arrangements with local authorities. These arrangements should be made with local police, medical support groups, fire departments and emergency response teams. The arrangements should include providing this plan, including the site map, to the authorities whenever it is updated. The authorities should be provided with information on hazardous substances located on the site.

The purpose of these arrangements is to familiarize the authorities with present site activities, and to provide them with information on what they would likely encounter if they were required to respond to, or assist in, an emergency situation.

These general requirements and the form should be provided to the authorities. A confirmation of their receipt of the general requirements and form should be documented in writing on the enclosed receipt form. If the authorities refuse to accept the plan and form, it must also be documented in writing.

8. Decontamination Procedures

The following decontamination procedure shall be communicated to employees and implemented before entry to the site where a potential for exposure to hazardous substances exists.

- All personal protective equipment and clothing contaminated with hazardous constituents shall be removed before leaving the work site.

C. Anticipated activities (project scope) that will, or could possibly, encounter hazardous substances. In this section it is important to list the specific type of hazardous substance that may be encountered. This is important because a person who handles hazardous waste must have the 29 CFR 1910.120 training. A person who handles a hazardous substance other than a hazardous waste, on the other hand, might not be required to have the same level of training.

D. Procedures for handling, temporary storage, and location of the final destination of waste material. Guidelines for handling, storage, and location of the final destination of the waste material include:

D1. Management and handling of contaminated materials will be conducted according to project plans. These plans will be written before the startup of any project that will require excavation or withdrawal of subsurface materials.

D2. Waste material must be contained within its immediate handling area and placed in a leakproof container and covered.

D3. All waste containers will be labeled. The label will state the type of waste (physical description) and the date of generation of the oldest waste in the container.

D4. The container will be inspected weekly to assure the cover is secure, the container is not leaking, and that the label is in place. Inspections will be documented on the SWP Waste Generation/Temporary Storage Record.

D5. Hazardous waste will be disposed of only at an EPA approved disposal facility. Disposal locations will be approved by Spartanburg headquarters.

E. Location of potable water

F. Location of a first aid kit

G. General safety and health rules

G1. Removing waste by conventional means such as pouring or pumping so that no more than one inch of residue remains on the bottom of the drum, or 3% of the drums capacity is filled.

DOT requires:

G2. Purging of all residues to remove a potential hazard.

G3. Reuse of the drum is restricted to the same hazardous substance.

H. If a drum shows signs of swelling or bulging, open the drum slowly to relieve pressure. Place a barrier such as plastic sheeting between the worker and the bung to deflect any gas, liquid, or solid which may be expelled when the bung is loosened. Transfer liquid to another drum.

I. Purchase only DOT approved drums.

J. Store empty drums upside down and label "empty".

11. Contingency Plan For Emergency Response

A contingency plan shall be written to provide for effective response to possible emergencies. The plan should be written to identify and address potential risks and to halt chemical releases and respond to emergencies. The plan should prepare for situations ranging from a small release to a worst case release. It should address what to do in the event of fire or explosion at the facility and must include an evacuation procedure.

The plan specifics are located in Section X, on page 23 of the form section of this plan. An associated document, the Southern Wood Piedmont Public Relations Plan for Emergencies, contains notification and administration procedures to be followed in significant emergencies.

SOUTHERN WOOD PIEDMONT COMPANY
SITE SAFETY PLAN INFORMATION FORM

Purpose: This form shall be completed and kept up–to–date to reflect on going site activities. The form should be updated before new projects or processes begin at the site. The form should be reviewed and certified at least annually. All items in the form shall be completed and supporting documents shall be attached.

I. GENERAL SITE INFORMATION

Company Name: SOUTHERN WOOD PIEDMONT COMPANY

Site Address West Foot of Greenfield Street, Wilmington, NC

Phone No. 803 – 599–1070

Fax No. 803 – 599–1087

Pager No.

Additional Phone No's 910–791–2706; 910–328–6331 Local Manager, H.O. Phillips

Site Safety and Health Officer Bill Arrants 803–599–1078(w), 803–578–3874 (h)

Alternate Site Safety & Health Officer T.M. Davis 803–599–1075(w), 803–576–0126(h)

II. SITE CHARACTERIZATION

1. Physical Description of Site The site is located at the west termination of Greenfield Street adjacent to the Cape Fear River in Wilmington, North Carolina. Greenfield Street is the only entrance/exit to the facility. The northern portion of the site is cleared and open with access roads to all portions of the site. The southern portion of the site is wooded with one central road that leads to the confluence of Greenfield Creek and the Cape Fear River.

2. Description of Activities to be Performed (Project Scope)

Surface water sample collection

3. Duration of Activity From Present to On–going

4. Directions from nearest major highway to Site (road names and numbers)

Highway 17 North at the Cape Fear River – take first exit to right on Front Street. Travel 8 blocks to Greenfield Street. Turn west on Greenfield Street. Go 1 block on to site property.

5. A. Name, Address and Phone # of Emergency Medical Facility

Name: New Hanover Regional Medical Center

Phone: 910–343–7000

Address: 2131 South 17th Street

B. Name of person who contacted emergency medical facility about project scope and/or site activities: Gregory B. Kuntz

A copy of the Plan/Form must be submitted to the Emergency Medical Facility.

A signature sheet will be completed by the person who distributes this Plan/Form and by the person who received the Plan/Form. The signed sheet will be attached to the Form.

C. Directions from site to emergency medical facility.

East on Greenfield St. to 16th St. Right on 16th St. to 2nd signal light, (Medical Center Drive). Hospital on left – continue 1 block on 16th St. Turn left to Emergency Room Facilities.

6. A. Name, Address, and Phone # of nearest fire department that will respond to an emergency.

Name: Wilmington Fire Dept. Phone Number: 910–341–7846

Address: 20 South 4th Street, Wilmington, NC 28401

B. Name of person who contacted fire department about project scope.

Gregory B. Kuntz

A copy of the Plan/Form must be submitted to the Fire department listed in 6.A. A signature sheet will be completed by the person who distributes this Plan/Form and by the person who receives the Plan/Form. The signed sheet will be attached to the Form.

7. Hazardous Substances on Site.

Name	Hazard Type(i.e. Dermal, Inhalation, etc)	PEL	IDLH (Y or N)
Creosote	See attached MSDS Forms		
Pentachlorophenol	See attached MSDS Forms		
Chromium	See attached MSDS Forms		
Copper	See attached MSDS Forms		
Arsenic	See attached MSDS Forms		
Diesel	See attached MSDS Forms		

III. TRAINING

1. All employees who may possibly be exposed to safety or health hazards associated with hazardous substances have received the training as required by 29 CFR 1910.120 and this plan. Yes X No

2. Training Coordinator Bill Arrants – SWP Employees
PCT Services, Inc. – ViroGroup Employees

IV. ENGINEERING CONTROLS, WORK PRACTICES AND PERSONAL PROTECTIVE EQUIPMENT

1. Engineering Controls

   Describe Engineering Controls used to minimize exposure to hazardous materials.

   Not required for surface water sampling

2. Work Practices

   Describe Work Practices which will be implemented to reduce exposure to hazardous materials.

   Personal protective equipment will be worn during surface water sampling activities

3. Personal Protective Equipment (PPE)—The following list defines PPE for specific jobs.

Glove type	Latex	Job type	Surface water sampling
Glove type	Latex	Job type	Emergency response
Glove type		Job type	
Glove type		Job type	
Respirator type	Cartridge	Job type	When strong vapors present or emerg. resp.
Head and Eye Protection		Job type	
Head and Eye Protection		Job type	
Steel Toe Boots will be worn at all times	No		
Other safety shoe types	Rubber boots	Job type	Surface water sampling
Other safety shoe types		Job type	
Protective Clothing	Tyvek	Job type	Surface water sampling

Protective Clothing _____ Job type _____

Protective Clothing _____ Job type _____

Protective Clothing _____ Job type _____

Other PPE/Job type _____

_____

_____

4. Personnel requiring Personal Protective Equipment have received instruction in:

		YES	NO			YES	NO
1.	Site Hazards	X		7.	PPE Decontamination	X	
2.	PPE Selection	X		8.	Fit Testing	X	
3.	PPE Use	X		9.	Donning & Doffing	X	
4.	Work Deviation	X		10.	PPE Inspections	X	
5.	PPE Maintenance	X		11.	PPE Evaluations	X	
6.	PPE Storage	X		12.	Limits Due to Temperature	X	

V. MEDICAL SURVEILLANCE

1. Will employees be exposed to hazardous substances above PEL's for 30 days or more during a year, or will they be required to wear respirators 30 days or more during a year?

   Yes _____ No X

2. Have empolyees received medical surveillance as per the Site Safety and Environmental Health Plan?

   Yes X No _____

3. Have personnel required to wear respirators received a medical examination that determined their ability to wear respirators?

   Yes X No _____

VI. AIR MONITORING

1. Preliminary air quality monitoring has been done Yes _____ No X

   Areas monitored _____

2. Periodic air monitoring will be done Yes _____ No X

   Areas monitored _____

3. Continuous air monitoring will be done Yes _____ No X

   Areas monitored _____

4. Monitor types

   a. Explosimeter Yes _____ No X Frequency _____

   b. O2 meter Yes _____ No X Frequency _____

   c. Other _____ Frequency _____

   _____ Frequency _____

   _____ Frequency _____

5. Reasons for the above air monitoring choices:

   N/A

VII. SITE CONTROL

1. Location of Site Map — Attachment to this report
2. Are work zones defined — Yes X — No ____
3. Are work zones visibly marked — Yes ____ — No X

If yes, name the zone and its marker.

Zone:	Marker:

The zones should be marked on the site map.

4. Site Communciations
   - 4A. Internal Hand signal, verbal, horn blast
   - 4B. External Phone

VIII. DECONTAMINATION PROCEDURES

1. Location of Decontamination Area(s) Tailgate of work truck

2. Location of discarded contaminated clothing and equipment temporary storage area
   Drum on–site

3. Disposal location for contaminated clothing and equipment. Hazardous waste disposal facility

4. Location of employee showers No permanent showers

IX. SITE OPERATING PROCEDURES

1. A list of site personnel and their job titles and duties is attached. X Yes

2. A chain of command has been established and is listed with this plan. X Yes

3. 3A. In what part of the planned site activities is a hazardous substance likely to be encountered? List the location and the type of substance likely to be encountered.
   Surface water sampling
   Water

   3B. The employees authorized to work with hazardous substances/wastes are noted on the attached list of site personnel X Yes

4. Location of potable water In work truck

5. Location of first aid kit(s) In work truck

6. Location of material safety data sheets Included with this plan and at main SWP office in Spartanburg, SC

X. CONTINGENCY PLAN FOR EMERGENCIES

This plan is designed to address sudden or nonsudden release of material consisting of, or contaminated with, creosote, pentachlorophenol, or chromated copper arsenate (CCA).

1. Personnel roles

1A. The On–Site Emergency Coordinator is the Site Safety and Health Officer

Name Head Technician for ViroGroup, Inc.

Address 1445 Pisgah Church Rd., Lexington, SC 29072

Phone number 800–786–0654

1B. The Alternate On–Site Emergency Coordinator is the Assistant Site Safety and Health Officer

Name Bill Arrants

Address P.O. Box 5447, Spartanburg, SC 29304

Phone Number 803–599–1078(h), 803–578–3874

2. Possible means of release of hazardous materials to the environment. _____

Collected water could be spilled on ground.

3. Is there an explosion hazard. _____ Yes ____X____ No

If yes, describe _____

4. Is there a fire hazard. _____ Yes ___X___ No

If yes, describe _____

5. Locations affected by release, explosion and fire. _____

Greenfield Creek, Cape Fear River, and site soils

6. On–site emergency response equipment location is:

Work truck

7. List the off–site contractors and their phone numbers who can be called for emergency support:

See attached sheet

8. Do the off–site contractors listed in section 7 have the training required by 29 CFR 1910.120. X Yes

9. List the procedures which will be used to control and stop the possible releases listed in Section 2.

Will assess the need for particular equipment and/or personnel and react accordingly. Will take measures to contain any spill or spread of hazardous material. All materials will be contained, labled, properly handled, properly stored, documented and shipped.

10. List the procedures used to control a fire or explosion if they should occur:

Fire extinguisher in truck and mobile phone to call fire department.
Shovels for sand.

11. Site Security is accomplished by the following:

Daily site inspections and a locking entrance gate.

12. Evacuation.

12A. If an evacuation is necessary, describe signals used to begin evacuation and state evacuation routes.

Voice and hand signals. Exit site onto Greenfield Street.

12B. After evacuation, employees will congregate at the following location for a head count:

At the Piggly Wiggly parking lot 8 blocks east of site on Greenfield Street.

13. Release Notification.

Whenever a spill of a reportable quantity of the following material occurs:

Creosote – 1 pound, or 1 pint, or more

Pentachlorophenol – 10 pounds, or more

CCA – 2.2 pounds, or more

or if there is a fire or an explosion involving site hazardous substances, notifications must be made according to the following:

13A. Immediately notify one of the following Spartanburg personnel (if the spilled material leaves the site, or has the potential to leave the site, by land or water, call the Governmental agencies in item 4 before attempting to reach Spartanburg personnel):

	Office	Home
W.P. Arrants	599–1078	803/578–3874
M.D. Pruett	599–1077	803/579–2730
S.B. Watson	599–1082	803/472–2296
T.M. Davis	599–1075	803/576–0126
W.S. Anderson	599–1080	803/579–4099

13B. Obtain the following information regarding the spill:

1. When spill occurred
2. Time spill occurred
3. Where spill occurred
4. What was spilled
5. How much spilled
6. How was the material spilled
7. How far down stream spill reached
8. Corrective action taken on the spillage

13C. The following authorities will be notified in the event of a spill of a reportable quantity. Spartanburg office personnel can notify these agencies if available, however, in no case can this notification be delayed. If the spilled material leaves the SWP site, or will possibly leave the SWP site, by either land or water, you must contact the governmental agencies before contacting Spartanburg personnel. Fines have been levied when notification took more than four hours. Twenty–four hours is the absolute maximum for notification to the proper authorities should occur only in a case of a need to immediately stabilize the condition before making the call, or if time is needed to correctly determine the answers to questions listed in 13B to fulfill reporting requirements.

Governmental agencies that will be contacted by the On–site Emergency Coordinator or by the Spartanburg Headquarters will be as follows:

– National

National Response Center 800/424–8802(24–hr answering service)

– State

NC Division of Environmental Management

919–733–5291 (Business Hours)

919–733–3867 (After hours will forward message)

800–662–7956 (In State 24 Hrs.)

– Local

New Hanover County Emergency

Management – Dan Summers

910–341–4300 (Business Hours)

910–762–5228 (After hours will forward message)

14. The contents of this contingency plan have been explained to all site employees.

___X___ Yes

XI. CONFINED SPACE ENTRY PROCEDURE

1. Will work be performed in confined spaces? Yes _____ No __X__
2. If yes, has the confined space entry procedure been explained to all employees?

   Yes _____ No _____
3. Are all aspects of the confined space entry procedure in effect?

   Yes _____ No _____
4. Is the confined space entry procedure attached to this plan? _____ Yes
5. Emergency rescue will be provided by _____

   _____

   Telephone # _____

   Person contacted _____

Certification: The information provided above is complete, true, and current.

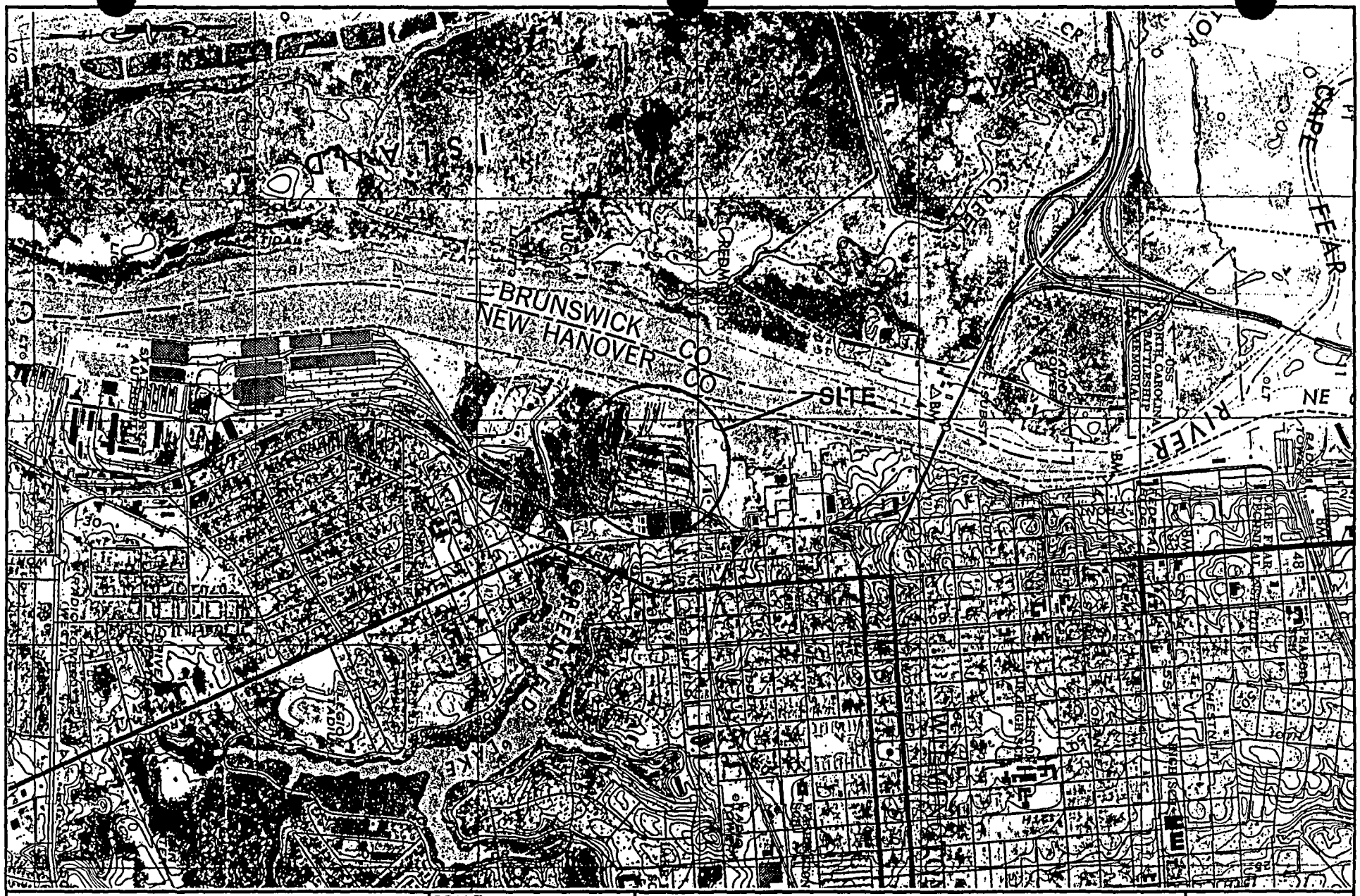
All information has been thoroughly communicated to all employees.

Signature _____ Date _____

Site Safety and Health Officer
and Emergency Coordinator

Signature _____ Date _____

Alternate Site Safety and Health Officer
and Alternate Emergency Coordinator



ViroGroup
Air•Water•Soil
TECHNOLOGY

ETE Division
ViroGroup, Inc.
1445 Piegah Church Road
Lexington, SC 29072
Phone 803-957-8270
FAX 803-957-3845
Watts 1-800-788-0654

SCALE	1:24,000
DRAWN BY	CAB
CHECKED BY	GBK
DATE	2/11/94

SITE LOCATION MAP
SOUTHERN WOOD PIEDMONT/ WILMINGTON, N.C. FACILITY

FIGURE NO.	1
CADD NO.	G: 5301501
PROJECT NO.	12-53015.00

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Material Safety Data Sheets Collection:

Sheet No. 296
Arsenic and Compounds

Issued: 4/90

Section 1. Material Identification 31

Arsenic Description: Obtained from flue dust of copper and lead smelters as white arsenic (arsenic trioxide). Reduction with charcoal and sublimation in an N_2 current yields pure arsenic. Metallic arsenic is used for hardening copper, lead, and alloys; as a doping agent in germanium and silicon solid-state products, special solders, and medicine; and to make gallium arsenide for dipoles and other electronic devices. Arsenic compounds are used in manufacturing certain types of glass; in textile printing, tanning, taxidermy, pharmaceuticals, insecticides and fungicides, pigment production, and antifouling paints; and to control sludge formation in lubricating oils. Arsenic trioxide is the source for 97% of all arsenic products.
Other Designations: CAS No. 7440-38-2; arsen; arsenic black; As; gray arsenic; metallic arsenic.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

R	1
I	4
S	2
K	0

Genium

HMIS
H 3
F 2
R 2
PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Arsenic and soluble compounds, as As

OSHA PEL
8-hr TWA: 0.5 mg/m³,* 0.01 mg/m³†

ACGIH TLV, 1989-90
TLV-TWA: 0.2 mg/m³

NIOSH REL, 1987
Ceiling: 0.002 mg/m³

Toxicity Data‡
Man, oral, TD_{Lo}: 76 mg/kg administered intermittently over a 12-year period affects the liver (tumors) and blood (hemorrhage)
Man, oral: 7857 mg/kg administered over 55 years produces gastrointestinal (in the structure or function of the esophagus), blood (hemorrhage), and skin and appendage (dermatitis) changes
Rat, oral, TC_{Lo}: 605 µg/kg administered to a 35-week pregnant rat affects fertility (pre- and post-implantation mortality)

* Organic compounds.
† Inorganic compounds.
‡ See NIOSH, *RTECS* (CG0525000), for additional mutative, reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data*

Boiling Point: sublimes at 1134 °F/612 °C
Melting Point: 1497 °F/814 °C
Vapor Pressure: 1 mm at 702 °F/372 °C (sublimes)
Atomic Weight: 74.92
Density: 5.724 at 57 °F/14 °C
Water Solubility: Insoluble†

Appearance and Odor: A brittle, crystalline, silvery to black metalloid. Odorless.

* This data pertains to arsenic only.
† Arsenic is soluble in nitric acid (HNO_3).

Section 4. Fire and Explosion Data

Flash Point: None reported	Autoignition Temperature: None reported	LEL: None reported	UEL: None reported

Extinguishing Media: Use dry chemical, CO_2, water spray, or foam to fight fires.
Unusual Fire or Explosion Hazards: Flammable and slightly explosive in the form of dust when exposed to heat or flame.
Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Arsenic is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Arsenic can react vigorously on contact with powerful oxidizers such as bromates, peroxides, chlorates, iodates, lithium, silver nitrate, potassium nitrate, potassium permanganate, and chromium (VI) oxide. This material is also incompatible with halogens, bromine azide, palladium, dirubidium acetylide, zinc, and platinum.
Hazardous Products of Decomposition: Thermal oxidative decomposition of arsenic and its compounds produces irritating or poisonous gases.

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Material Safety Data Sheets Collection:

Sheet No. 162
Copper

Issued: 12/85 Revision: A, 8/90

Section 1. Material Identification

32

Copper (Cu) Description: Widely distributed in nature in elemental state, arsenites, sulfides, chlorides, and carbonates. Prepared by crushing, grinding, and concentrating copper ores by flotation and leaching or by smelting copper ore concentrates to yield a blister (96 to 98%) copper which is electrolytically refined to yield 99.9+% copper. Copper is the most widely used structural metal, next to iron and aluminum. Used in electric wiring; switches, heating, plumbing, roofing, and building construction; alloys (brass, bronze, Monel metal, beryllium-copper); coins; chemical and pharmaceutical machinery; electroplated protective coatings and undercoats for nickel, chromium, zinc, etc., cooking utensils; insecticides; antifouling paints; and as a catalyst. Copper whiskers are used in thermal and electrical composites. Copper flakes are used as insulation for liquid fuels.

Other Designations: CAS No. 7440-50-8, bronze powder, copper slag-airborne, copper slag-milled.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(TM) for a suppliers list.

Cautions: *Copper may be toxic through contact, inhalation, and ingestion.* It may cause skin and eye irritation and metal fume fever. Copper is not considered a fire hazard, but fine particles may burn in air.

R 0
I 4
S 1
K 0

Genium

HMIS
H 2
F 0
R 0
PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Copper, ca 100%

1989 OSHA PELs	1989-90 ACGIH TLVs	1988 NIOSH REL	1985-86 Toxicity Data‡
8-hr TWA: 1 mg/m³*	TLV-TWA: 1 mg/m³*	None established	Human, oral, TD_{Lo}: 120 µg/kg affects the gastrointestinal tract (nausea or vomiting)
8-hr TWA: 0.1 mg/m³†	TLV-TWA: 0.2 mg/m³†		Rat, oral, TD_{Lo}: 1210 µg/kg (35 weeks prior to mating) affects fertility (pre- and post-implantation mortality)

* Copper dusts and mists, as Cu.
† Copper fume.
‡ See NIOSH, *RTECS* (GL5325000), for additional reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 4703 °F (2595 °C)
Melting Point: 1981 °F (1083 °C)
Vapor Pressure: 1 mm Hg at 2962 °F (1628 °C)
Molecular Weight: 63.546
Density/Specific Gravity: 8.94
Water Solubility: Insoluble

Appearance and Odor: Solid, various shapes, odorless, red/brown-colored metal or powder. Copper is ductile, tough, and easily worked. It is very resistant to corrosion, but readily attacked by alkalies.

Section 4. Fire and Explosion Data

Flash Point: None reported	Autoignition Temperature: None reported	LEL: None reported	UEL: None reported

Extinguishing Media: Use extinguishing media appropriate to the surrounding fire since copper does not burn. Finely divided copper burns in air, and in extreme cases ignites spontaneously.

Unusual Fire or Explosion Hazards: Liquid copper explodes on contact with water. High concentrations of fine copper particles in the air may present an explosion hazard.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and a fully encapsulating suit.

Section 5. Reactivity Data

Stability/Polymerization: Copper is stable at room temperature in closed containers under normal storage and handling conditions. However, on long standing, a white, highly explosive peroxide deposit may form. Copper's vapors are uninhibited and may form polymers in vents and flame arresters.

Chemical Incompatibilities: Copper reacts violently with ammonium nitrate, bromates, iodates, chlorates, ethylene oxide, hydrazoic acid, potassium oxide, dimethyl sulfoxide + trichloroacetic acid, hydrogen peroxide, sodium peroxide, sodium azide, sulfuric acid, hydrogen sulfide + air, and lead azide. A potentially explosive reaction occurs with actylenic compounds. Copper ignites on contact with chlorine, fluorine [above 250 °F (121 °C)], chlorine trifluoride, and hydrazinium nitrate [above 158 °F (70 °C)]. It is also incompatible with 1-bromo-2-propyne; an incandescent reaction occurs with potassium dioxide.

Conditions to Avoid: Avoid prolonged exposure to air and moisture. On exposure to moist air, copper slowly converts to the carbonate.

Hazardous Products of Decomposition: Thermal oxidative decomposition of copper can produce metallic oxides (copper fumes).

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Material Safety Data Sheet

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GENIUM PUBLISHING CORP.

No. 182

CHROMIUM (III) OXIDE

Issued: April 1986

SECTION 1. MATERIAL IDENTIFICATION 20

MATERIAL NAME: CHROMIUM (III) OXIDE

OTHER DESIGNATIONS: Chrome Oxide, Chromic Oxide, Chromium Sesquioxide, Cr_2O_3, CAS #1308-38-9

MANUFACTURER/SUPPLIER: Available from several suppliers, including:
Ciba-Geigy Corp., Plastics, Pigments, and Additives Division, Three Skyline Drive, Hawthorne, NY 10532; Telephone: (914) 347-4700.

HMIS Not Found
H: Chronic
F: 0
R: 0
PPE*
*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Chromium (III) Oxide, Cr_2O_3, CAS #1308-38-9	>99	ACGIH TLV, 8-hr TWA: 0.5 mg/m^3* OSHA PEL, 8-hr TWA: 1 mg/m^3**

* Current (1985-86) ACGIH TLV for chromium (III) Compounds, as Cr.

** Current OSHA PEL for chromium metal and insoluble salts, as Cr.

SECTION 3. PHYSICAL DATA

Boiling Point ... 7232°F (4000°C)
Melting Point ... 4415°F (2435°C)
Specific Gravity ... 5.21
Vapor Pressure @ 25°C ... Negligible
Solubility in Water ... Insoluble
Molecular Weight ... 152

Appearance and odor: Green granules, crystals, or powder. No odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER
Not Found	Not Found	Not Found --	--	

EXTINGUISHING MEDIA: Chromic oxide is not combustible. Use extinguishing agents that are suitable for the surrounding fire.

UNUSUAL FIRE/EXPLOSION HAZARDS: None

SPECIAL FIRE-FIGHTING PROCEDURES: Fire fighters should wear self-contained breathing apparatus and full protective gear for protection against dust, mist, or fumes that may be generated during fire-fighting activities.

SECTION 5. REACTIVITY DATA

Chromium oxide is stable under normal conditions.

Hazardous polymerization will not occur.

INCOMPATIBILITIES: Chromic oxide can react vigorously with lithium, chlorine trifluoride, oxygen difluoride, and molten alkali. An explosion may occur on contact with glycerol.

HAZARDOUS DECOMPOSITION PRODUCTS: None.

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Material Safety Data Sheets Collection:

Sheet No. 5
Chromic Acid and Chromates

Issued: 10/77 Revision: C, 7/91

Section 1. Material Identification

Chromic Acid (CrO_3) Description: Produced by roasting chromite ore with alkali or lime, leaching with calcium oxide, crystallizing the chromate or dichromate, and then treating it with an excess of sulfuric acid. Used in ceramic glazes, colored glass, dyes, batteries, explosives, water treatment, wood treatment and preservatives, refractories, copper stripping, aluminum anodizing, photomechanical processing, chromium metal plating, purifying oil and acetylene, hardening microscopic preparations, and manufacturing chromated copper arsenate; and as a corrosion inhibitor, a catalyst, an oxidizing agent in organic chemistry, and an etchant for plastics.

R	1
I	4
S	3*
K	0

* Percutaneous (broken skin)

NFPA: 3 / 0 / 1 / OXY

HMIS: H 3, F 0, R 1, PPG† († Sec. 8)

Other Designations: CAS No. 1333-82-0; chromic acid; chromic acid, solid (DOT); chromium anhydride; chromium (VI) oxide; chromium trioxide; chromium (6+) trioxide; monochromium trioxide; puratronic chromium trioxide. Chromic acid is the commonly used name, although true chromic acid (CrH_2O_4, CAS No. 7738-94-5) cannot be isolated from solution. Chromic acid and chromates (as CrO_3, CAS No. 7440-47-3).

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(TM) for a suppliers list.

Caution: A powerful oxidizer, chromic acid may explode on contact with reducing agents and cause ignition on contact with organic materials. This poison and human carcinogen is corrosive to skin and irritating to mucous membranes. Eye contact may cause permanent blindness.

Section 2. Ingredients and Occupational Exposure Limits

Chromic acid, 99% CrO_3

1990 OSHA PEL
Ceiling: 0.1 mg(CrO_3)/m³

1987 IDLH Level
30 mg/m³

1990-91 ACGIH TLVs
TWA: 0.05 mg(Cr)/m³
Ceiling: 0.1 mg/m³

1990 NIOSH REL
TWA: 0.025 mg(Cr(VI))/m³
Ceiling: 0.05 mg/m³/15 min (Cr(VI))

1985-86 Toxicity Data*
Rat, oral, LD_{50}: 80 mg/kg
Mouse, oral, LD_{50}: 127 mg/kg
Human, inhalation, TC_{Lo}: exposed continuously to 110 µg over 3 years. Toxic effects include tumorigenic (carcinogenic by *RTECS* criteria); sense organs and special senses (olfaction tumors); lungs, thorax, or respiration (tumors).
Dog, subcutaneous, LD_{Lo}: 330 mg/kg

* See NIOSH, *RTECS* (GB6650000), for additional mutative, reproductive, toxicity and tumorigenic data.

Section 3. Physical Data*

Boiling Point: Decomposes at 482 °F (250 °C) to $Cr_2O_3 + O_2$
Melting Point: 385 °F (196 °C)
Molecular Weight: 99.98

Specific Gravity: 2.7
Water Solubility: Soluble
Heat of Fusion: 37.7 cal/g

Appearance and Odor: Dark, purplish-red, prismatic, deliquescent (absorbs all moisture from air) crystals, or a granular powder with no detectable odor.

* These physical data apply only to chromic acid (CAS No. 1333-82-0).

Section 4. Fire and Explosion Data

Flash Point: None reported	Autoignition Temperature: None reported	LEL: None reported	UEL: None reported

Extinguishing Media: Chromic acid is noncombustible, but accelerates burning of combustibles (wood, paper, oil). For small fires, *use only water*, not dry chemical, carbon dioxide (CO_2), or halon.

Unusual Fire or Explosion Hazards: A powerful oxidizer, chromic acid ignites on contact with acetic acid and alcohol. It may react rapidly enough with organic materials to cause ignition. Containers may explode if involved in fire.

Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Cool fire-exposed containers with flooding amounts of water since the decomposing material may form a hot, viscous foam that can cause containers to rupture and explode. *Use caution!* For large fires, flood area from a safe distance, and cool containers from the side with a water spray until after fire is well out. If possible without risk, move containers. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holder. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Chromic acid is generally stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: This material is incompatible with acetic acid, acetic anhydride, acetone, alcohols, alkali metals, ammonia, arsenic, anthracene, benzene, bromine penta fluorine, butyric acid, camphor, chromous sulfide, diethyl ether, glycerol, hydrogen sulfide, methyl alcohol, naphthalene, peroxyformic acid, phosphorus, potassium hexacyanoferrate, pyridine, selenium, sodium, and turpentine. Chromic acid ignites ethyl alcohol and many hydrocarbons.

Conditions to Avoid: Avoid excess heat and contact with combustible or organic materials.

Hazardous Products of Decomposition: Thermal oxidative decomposition of chromic acid can produce carbon dioxide, smoke, and irritating toxic fumes.

Section 6. Health Hazard Data

Carcinogenicity: The IARC and NTP list chromic acid and other forms of hexavalent (VI) chromium as human carcinogens.

Summary of Risks: Chromic acid is a poison and a powerful irritant to skin, eyes, and respiratory tract. Skin or lung sensitization (allergic reactions) may occur. Exposure can cause dermatitis (skin rash), asthma, pulmonary edema (fluid in lungs), kidney damage, a "chrome hole," or a perforation of the nasal septum (tissue between nostrils).

Medical Conditions Aggravated by Long-Term Exposure: Any chronic lung or skin condition.

Target Organs: Skin, respiratory tract (including nose, throat, airways, and lungs), and kidney.

Primary Entry Routes: Eyes, skin contact, inhalation, and ingestion.

Acute Effects: Inhalation may cause irritation or burning of nose, throat, and air passages, cough, wheezing, and shortness of breath. Higher exposures may cause pulmonary edema (fluid in lungs). Skin exposure may cause dermatitis (skin rash), irritation, burning, itching, redness, and ulceration (skin destruction) which may penetrate. Eye contact can cause irritation, burning, lacrimation (watering), loss of sight and permanent blindness if not removed quickly.

Chronic Effects: Chronic inhalation of excessive levels may cause epistaxis (nosebleed), "chrome holes," nasal congestion, tooth enamel erosion, chest pain, asthma (via allergic sensitization), bronchitis, or respiratory tract cancer. Chronic eye exposure may cause conjunctivitis. Skin contact

Continue on next page

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Material Safety Data Sheets Collection:

Sheet No. 470
Diesel Fuel Oil No. 2-D

Issued: 10/81 Revision: A, 11/90

Section 1. Material Identification

Diesel Fuel Oil No. 2-D Description: Diesel fuel is obtained from the middle distillate in petroleum separation; a distillate oil of low sulfur content. It is composed chiefly of unbranched paraffins. Diesel fuel is available in various grades, one of which is synonymous with fuel oil No. 2-D. This diesel fuel oil requires a minimum Cetane No. (efficiency rating for diesel fuel comparable to octane number ratings for gasoline) of 40 (*ASTM D613*). Used as a fuel for trucks, ships, and other automotive engines; as mosquito control (coating on breeding waters); and for drilling muds.

Other Designations: CAS No. 68334-30-5, diesel fuel.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*[73] for a suppliers list.

Cautions: Diesel fuel oil No. 2-D is a skin irritant and central nervous depressant with high mist concentrations. It is an environmental hazard and moderate fire risk.

R	1
I	-
S	2
K	2

NFPA

HMIS
H 0
F 2
R 0
PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Diesel fuel oil No. 2-D*

1989 OSHA PEL	1990-91 ACGIH TLV	1988 NIOSH REL	1985-86 Toxicity Data‡
None established	Mineral Oil Mist TWA: 5 mg/m³† STEL: 10 mg/m³	None established	Rat, oral, LD_{50}: 9 g/kg produces gastrointestinal (hypermotility, diarrhea) effects

* Diesel fuel No. 2-D tends to be low in aromatics and high in paraffinics. This fuel oil is complex mixture of: 1) >95% paraffinic, olefinic, naphthenic, and aromatic hydrocarbons, 2) sulfur (<0.5%), and 3) benzene (<100 ppm). [A low benzene level reduces carcinogenic risk. Fuel oils can be exempted under the benzene standard (29 CFR 1910.1028)]. Although low in the fuel itself, benzene concentrations are likely to be much higher in processing areas.
† As sampled by nonvapor-collecting method.
‡ Monitor NIOSH, *RTECS* (HZ1800000), for future toxicity data.

Section 3. Physical Data

Boiling Point Range: 340 to 675 °F (171 to 358 °C)
Viscosity: 1.9 to 4.1 centistoke at 104 °F (40 °C)
Specific Gravity: <0.86
Water Solubility: Insoluble

Appearance and Odor: Brown, slightly viscous liquid.

Section 4. Fire and Explosion Data

Flash Point: 125 °F (52 °C) min.	Autoignition Temperature: >500 °F (932 °C)	LEL: 0.6% v/v	UEL: 7.5% v/v

Extinguishing Media: Use dry chemical, carbon dioxide, or foam to fight fire. Use a water spray to cool fire exposed containers. Do not use a forced water spray directly on burning oil since this will scatter the fire. Use a smothering technique for extinguishing fire.

Unusual Fire or Explosion Hazards: Diesel fuel oil No. 2-D is a OSHA Class II combustible liquid. Its volatility is similar to that of gas oil. Vapors may travel to a source of ignition and flash back.

Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective clothing. If feasible, remove containers from fire. Be aware of runoff from fire control methods. Do not release to sewers or waterways due to pollution and fire or explosion hazard.

Section 5. Reactivity Data

Stability/Polymerization: Diesel fuel oil No. 2-D is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: It is incompatible with strong oxidizing agents; heating greatly increases the fire hazard.

Conditions to Avoid: Avoid heat and ignition sources.

Hazardous Products of Decomposition: Thermal oxidative decomposition of diesel fuel oil No. 2-D can produce various hydrocarbons and hydrocarbon derivatives, and other partial oxidation products such as carbon dioxide, carbon monoxide, and sulfur dioxide.

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Material Safety Data Sheets Collection:

Sheet No. 757
Coal Tar Creosote

Issued: 7/91

Section 1. Material Identification

34

Coal Tar Creosote (molecular formula varies with purity) Description: Three main derivations: by distillation of coal tar produced by high-temperature carbonization of bituminous coal; by mixing strained naphthalene oil, wash oil, and strained or light anthracene oil; as a by-product of conventional coal coking. It typically contains up to 160 chemicals, mainly aromatic compounds such as phenol, pyrol and pyridine. Used mainly as a wood preservative for railroad ties, poles, fence posts, marine pilings, and other lumber for outdoor use; as a water-proofing agent, fuel oil constituent, frothing agent for mineral separation, hop defoliant, and lubricant for die molds; in manufacturing chemicals; and in medicine as an antiseptic, disinfectant, antipyretic, astringent, germicide, and styptic.
Other Designations: CAS No. 8001-58-9, Awpa,® brick oil, Caswell No. 225,® coal tar oil, creosote, creosote oil, creosotum, cresylic creosote, heavy oil, liquid pitch oil, naphthalene oil, Preserv-o-sote,® Sakresote,® tar oil, wash oil.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.
Cautions: Flammable, liquid coal tar creosote is toxic by inhalation, ingestion, and skin contact. The IARC and NTP classify it as *a human carcinogen.*

R 1
I 4
S 4*
K 2
* Skin absorption

NFPA
2 / 2 / 0 / -

HMIS
H 2
F 2
R 0
PPG†
† Sec. 8

* Skin absorption can occur with phenol, a major component of coal tar creosote.

Section 2. Ingredients and Occupational Exposure Limits

Coal tar creosote, ca 100%

1990 OSHA PEL
8-hr TWA: 0.2 mg/m³*

1990-91 ACGIH TLV
TWA: 0.2 mg/m³*

1987 IDLH Level
700 mg/m³

1990 NIOSH REL
0.1 mg/m³ (cyclohexane extractable portion)

1985-86 Toxicity Data†
Rat, oral, LD_{50}: 725 mg/kg; toxic effects not yet reviewed
Dog, oral, LD_{Lo}: 600 mg/kg; toxic effects not yet reviewed
Rat, TD_{Lo}: 52,416 mg/kg administered during 91 days prior to mating produces reproductive effects on fallopian tubes and ovaries
Mouse, skin, TD_{Lo}: 99 g/kg produces tumors in skin and appendages

* As coal tar pitch volatiles.
† See NIOSH, *RTECS* (GF8615000), for additional mutation, reproductive, tumorigenic, and other toxicity data.

Section 3. Physical Data

Boiling Point: 381 to 752 °F (194 to 400 °C)
Distillation Range: 446 to 554 °F (230 to 290 °C)
Heat of Combustion: -12,500 Btu/lb
Heat of Vaporization: 107 Btu/lb
Molecular Weight: Varies with purity
Density/Specific Gravity: 1.07 to 1.08 at 68 °F (20 °C)
Water Solubility: Slightly soluble

Appearance and Odor: Pure coal tar creosote is colorless, but the industrial product is a yellow to black oily liquid with an aromatic smoky smell and a burning caustic taste.

Section 4. Fire and Explosion Data

Flash Point: 165.2 °F (74 °C), CC	Autoignition Temperature: 637 °F (336 °C)	LEL: None reported	UEL: None reported

Extinguishing Media: For small fires, use dry chemical, carbon dioxide (CO_2), or regular foam. For large fires, use fog or regular foam. Since water is least effective, use it as an extinguishing agent only when the preferred measures are unavailable. However, use water spray to cool fire-exposed containers.
Unusual Fire or Explosion Hazards: Vapors may travel to an ignition source and flash back. Containers may explode in heat of fire. Coal tar creosote presents a vapor explosion hazard indoors, outdoors, and in sewers.
Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Also, wear full protective clothing. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from area and let fire burn. Immediately leave area if you hear a rising sound from venting safety device or notice any fire-caused tank discoloration. Isolate area for 1/2 mile in all directions if fire involves tank, rail car or tank truck. Be aware of runoff from fire control methods. Do not release to sewers or waterways. Fully decontaminate or properly dispose of personal protective clothing.

Section 5. Reactivity Data

Stability/Polymerization: Coal tar creosote is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Creosote oil mixed with chlorosulfonic acid in a closed container causes an increase in temperature and pressure.
Conditions to Avoid: Avoid excessive heat and contact with chlorosulfonic acid.
Hazardous Products of Decomposition: Thermal oxidative decomposition of coal tar creosote can produce oxides of carbon and thick, black, acrid smoke.

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Material Safety Data Sheets Collection:

Sheet No. 517
Pentachlorophenol

Issued: 10/83 Revision: A, 11/90

Section 1. Material Identification 33

Pentachlorophenol (C_6HCl_5O) **Description:** Derived by chlorination of phenol in the presence of a catalyst. Used as a fungicide, a bactericide, a molluscicide, an algicide, an insecticide (termite control) and herbicide (pre-harvest defoliant); in sodium pentachlorophenate; in wood preservation (telephone poles, pilings, etc.), wood products, starches, dextrins, and glues. Other registered industrial uses include boat and building construction; treatment of cable coverings, canvas belting, nets, and construction lumber and poles; mold control in petroleum drilling and production; incorporation in paints, pulp, pulp stock, paper, cooling tower water, and hardboard and particle board. Registered homeowner uses include maintenance of boats, trailers, station wagons, siding, fences, and outdoor furniture.

Other Designations: CAS No. 0087-86-5, chlorophen, PCP, penchlorol, penta.

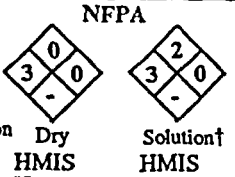
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

Cautions: Pentachlorophenol is *highly toxic by skin absorption, ingestion, and inhalation.* The agent is highly irritating. General metabolism, the heart, the circulatory system, the liver, and the kidneys may be affected.

R	1
I	3
S	2*
K	0

* Skin absorption

NFPA



Dry	Solution†
HMIS	HMIS
H 3	H 3
F 0	F 2
R 0	R 0
PPG‡	PPG‡
‡ Sec. 8	‡ Sec. 8

† PCP is freely soluble in alcohol, ether, and benzene. Depending on medium, PCP's health and flammability hazards increase in solution with such media.

Section 2. Ingredients and Occupational Exposure Limits

Pentachlorophenol, ca 100%*

1989 OSHA PEL
8-hr TWA (skin): 0.5 mg/m³

1987 IDLH Level
150 mg/m³

1990-91 ACGIH TLV
TWA (skin): 0.5 mg/m³

1988 NIOSH REL
None established

1985-86 Toxicity Data†
Rat, oral, LD_{50}: 27 mg/kg ingested affects the vascular (blood pressure elevation), endocrine (hyperglycemia), nutritional, and gross metabolic (body temperature increase) systems
Rat, inhalation, LC_{50}: 355 mg/m³ inhaled affects behavior (excitement; muscle contraction or spasticity) and respiration (shortness of breath)

* Technical grade pentachlorophenol contains traces of hexa, hepta, and octachlorodibenzo-p-dioxins; hexa, hepta, and octachlorodibenzofurans; and hexachlorobenzene.
† See NIOSH, *RTECS* (SM6300000), for additional irritative, mutative, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 588 to 590 °F (309 to 310 °C),* 592 °F (311 °C) (decomposes)†
Melting Point: 374 °F (190 °C),* 374 °F (190 °C)†
Vapor Pressure: 0.00011 mm Hg at 77 °F (25 °C)
Vapor Density (Air = 1): 9.2
Molecular Weight: 266.35
Specific Gravity (22 °C/4 °C): 1.978
Water Solubility: 14 mg/l at 20 °C

Appearance and Odor: Light brown or tan flake or solid with a phenolic odor and pungent taste. Odor detection is at 1.6 mg/l.

* Pentachlorophenol solution
† Dry pentachlorophenol

Section 4. Fire and Explosion Data

Flash Point: None reported	Autoignition Temperature: None reported	LEL: None reported	UEL: None reported

Extinguishing Media: Since pentachlorophenol is noncombustible, use extinguishing media appropriate to the surrounding fire: dry chemical, water spray, carbon dioxide, or foam. Use the water spray to cool fire-exposed containers.
Unusual Fire or Explosion Hazards: When involved in a fire, pentachlorophenol emits toxic fumes. Wood treated with 5% pentachlorophenol solution or pentachlorophenol in petroleum solvents such as mineral spirits or kerosine are combustible.
Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Avoid skin contact. If feasible, remove containers from fire area. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Pentachlorophenol is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Pentachlorophenol solutions subjected to sunlight or ultraviolet light undergo photochemical degradation.
Chemical Incompatibilities: Pentachlorophenol is incompatible with strong oxidizers and alkalies.
Conditions to Avoid: Avoid contact with heat and ignition sources (open flame, electric arcs, or hot surfaces) which can cause thermal decomposition.
Hazardous Products of Decomposition: Thermal oxidative decomposition of pentachlorophenol can produce hydrogen chloride, chlorine, and chlorinated hydrocarbons. Prolonged heating above 392 °F (200 °C) produces traces of octachlorodibenzo-para-dioxin.

Section 6. Health Hazard Data

Carcinogenicity: There is animal evidence of an increase in liver and endocrine tumors in some research studies, but not in others. Also, PCP shares some structural similarity to other carcinogens. However, NTP, IARC, and OSHA do not list PCP as a carcinogen. It may be toxic to the fetus, especially during early pregnancy.
Summary of Risks: Airborne exposure is irritating to the eyes, skin, throat, and lungs, and may cause acute and possibly chronic effects (see below). Levels above 1 mg/m³ may cause cough, sneezing, and tearing of the eyes, especially in unacclimated workers. Skin contact is also irritating and provides an efficient way for the chemical to enter the body and cause systemic poisoning. Skin rashes (dermatitis) including chloracne (a severe and persistent cystic form of acne characterized by blackheads, whiteheads, and yellow cysts) may result from repeated or prolonged contact with even dilute solutions (e.g., 1%). Ingestion may cause severe systemic poisoning.

Continue on next page

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SOUTHERN WOOD PIEDMONT COMPANY

Waste Material Emergency Response Information

To accompany shipping papers for materials contaminated with creosote and/or pentachlorophenol

The following information can be used in the mitigation of an incident involving hazardous materials contaminated with creosote and/or pentachlorophenol.

1. Basic description and technical name of the hazardous material - Creosote (2, 3 and 4 ringed polynuclear aromatic hydrocarbons including some substituted compounds) and/or Pentachlorophenol. Creosote and Pentachlorophenol are dark in color. Creosote has a strong, aromatic coal tar odor. Pentachlorophenol has a mild sweet odor.

2. Immediate hazards to health - Skin irritation. Prolonged exposure in excess of permissible air concentrations can result in acute toxic effects, such as respiratory difficulty, convulsions and possible cardiovascular collapse.

   Permissible air concentrations -
   Creosote (Coal tar pitch volatiles) - 0.2 mg/m^3 benzene soluble fraction 8 hour - TWA.
   Pentachlorophenol - 0.5 mg/m^3 8 hour TWA.
   IDLH level - 150 mg/m^3

3. Risks of fire or explosion - Material may burn, but does not ignite readily. The material is incompatible with oxidizers.

4. Immediate precautions to be taken in the event of an accident or incident: Avoid breathing vapors. Use level C protection. Half mask respirators with cartridges approved for organic vapors and acid gases should be used if ventilation is poor.

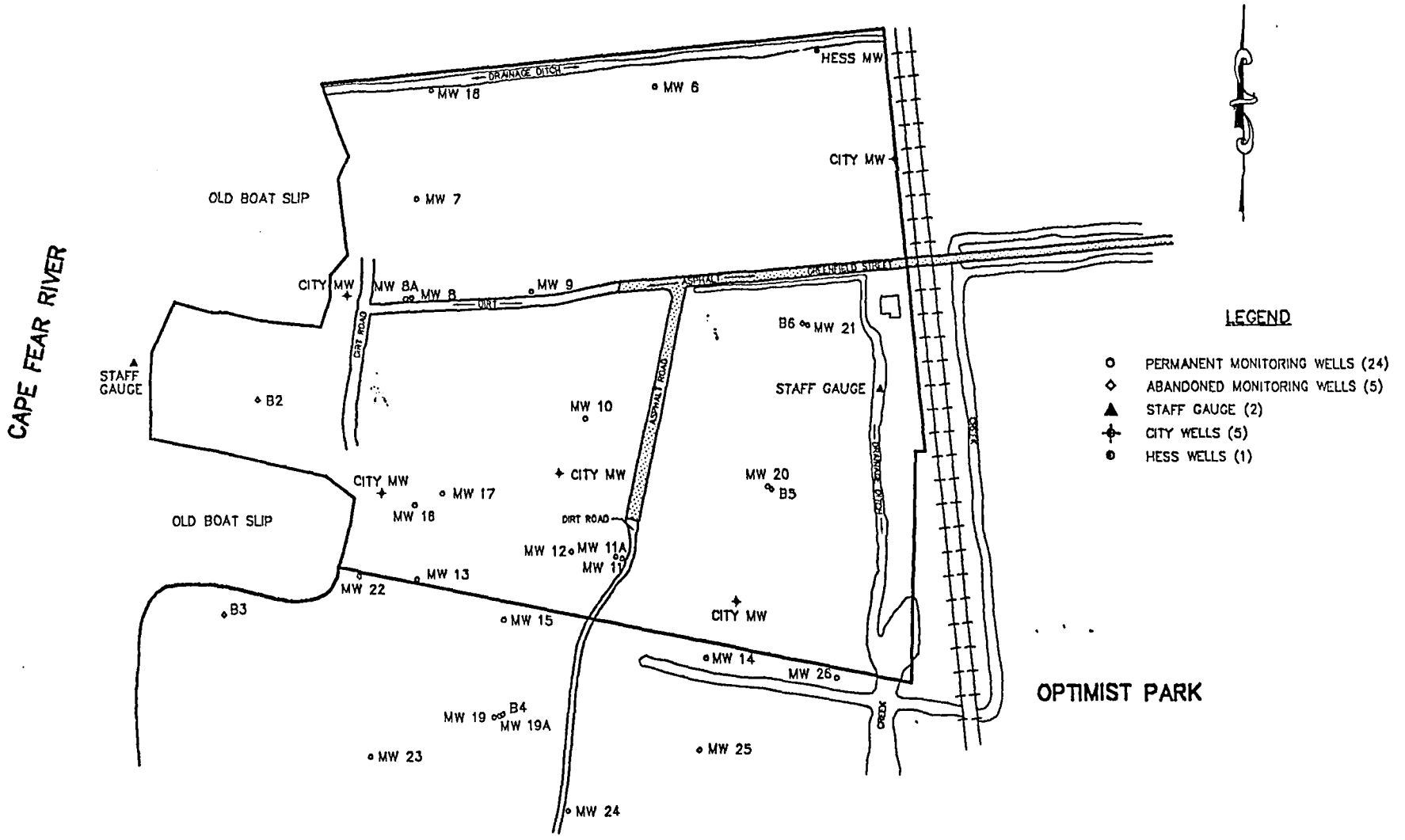
5. Immediate methods for handling fires - Extinguish with foam or dry chemical.

6. Initial methods for handling spills or leaks in the absence of fires: Contain spilled liquids by using absorbent materials and by creating barriers to flow. Spilled solids can be moved by heavy equipment as well as hand tools (shovel, broom, etc.)

7. Preliminary first aid measures -
   Eye contact - flush with large amounts of water and seek medical attention.
   Skin contact - Remove with waterless hand cleaner or soak in water as soon as possible.
   Inhalation - Remove to fresh air if breathing becomes difficult.

The above information is provided in compliance with 49 CFR 172.602.

SITE MAP


CAPE FEAR RIVER
OLD BOAT SLIP
OLD BOAT SLIP
STAFF GAUGE
STAFF GAUGE
DRAINAGE DITCH
HESS MW
MW 18
MW 6
CITY MW
MW 7
CITY MW
MW 8A
MW 8
MW 9
DIRT
DIRT ROAD
ASPHALT
GREENFIELD STREET
B6
MW 21
B2
MW 10
ASPHALT ROAD
CITY MW
CITY MW
MW 17
MW 18
MW 20
B5
DIRT ROAD
MW 12
MW 11A
MW 11
MW 13
MW 22
B3
MW 15
CITY MW
MW 14
MW 26
MW 19
B4
MW 19A
MW 23
MW 25
MW 24
CREEK
OPTIMIST PARK
LEGEND
PERMANENT MONITORING WELLS (24)
ABANDONED MONITORING WELLS (5)
STAFF GAUGE (2)
CITY WELLS (5)
HESS WELLS (1)

DIRECTORY

WILMINGTON , N. C. ENVIRONMENTAL LOCATION

AREA CODE 910

		TELEPHONE NUMBER(S)
ACTING SITE MGR.	H. O. Phillips	791-2706 328-6331
POLICE - LOCAL		911 or 343-3600
SHERIFF		911 or 341-4200
HIGHWAY PATROL		791-5311
EMERGENCY UNIT	Leland Rescue Squad New Hanover Rescue Odgen Rescue Squad	371-2444 911 911
HOSPITAL(S)	Cape Fear Memorial New Hanover Mem.	395-8100 343-7000
FIRE STATION	Wilmington Fire Dept. Carolina Beach Fire Dept. Seagate Volunteer Dept.	341-7846 458-8208 911
NEWS MEDIA	Wilmington Journal Star News	762-5502 343-2000
RADIO STATION	WAAV WMFD	763-6511 763-6363
TELEVISION STATION	WECT TV-6 WAAY TV-3	791-6681 763-0979

Southern Wood Piedmont Company

P.O. Box 5447
Spartanburg, S.C. 29304
Phone: (803) 599-1070
FAX: (803) 599-1087

To: H. O. Phillips - Wilmington, NC *Date:* February 8, 1994

From: W. P. Arrants WPA

Subject: SPILL PREVENTION CONTROL & COUNTERMEASURE PLAN (SPCC)

The SPCC Plan requires immediate notification of certain regulatory and emergency response groups in the event of a spill of a reportable quantity of a chemical. A spill of pure material or material containing the following quantities should be reported:

Creosote	1 pound, or 1 pint, or more
Pentachlorophenol	10 pounds of solid material, or more
CCA	2.2 pounds, or more

A spill will be defined as any sudden, unexplained release of one or more of these materials to the land or water.

Action Plan in the event of a spill:

1. Immediately put into effect the actions described in the Contingency Plan of the Site Safety and Environmental Health Plan.

2. Immediately notify one of the following (if the spilled material leaves the site, or has the potential to leave the site, by land or water, call the Governmental agencies in item 4 before attempting to reach Spartanburg personnel):

	OFFICE	HOME
W. P. Arrants	599-1078	803/578-3874
M. D. Pruett	599-1077	803/579-2730
S. B. Watson	599-1082	803/472-2296
T. M. Davis	599-1075	803/576-0126
W. S. Anderson	599-1080	803/579-4099

3. Information needed regarding the spill would be as follows:

   1. When spill occurred
   2. Time spill occurred
   3. Where spill occurred
   4. What was spilled
   5. How much spilled
   6. How was the material spilled
   7. How far down stream spill reached
   8. Corrective action taken on the spillage

4. The following authorities will be notified in the event of a spill of a reportable quantity. Spartanburg office personnel can notify these agencies if available, however, in no case can this notification be delayed. If the spilled material leaves the SWP site, or will possibly leave the SWP site, by either land or water, you must contact the governmental agencies before contacting Spartanburg personnel. Fines have been levied when notification took more than four hours. Twenty-four hours is the absolute maximum for notification to the proper authorities. Delay should occur only in a case of a need to immediately stabilize the condition before making the call, or if time is needed to correctly determine the answers to questions listed in #3 to fulfill reporting requirements.

   Governmental agencies that will be contacted by the Spartanburg Headquarters will be as follows:

o	National Response Center	800/424-8802(24-hr answering service)
o	NC Division of Environmental Management	919/733-5291 (Business Hrs.) 919/733-3867 (after hours will forward message) 800/662-7956 In State (24 Hrs.)
o	New Hanover County Emergency Management - Dan Summers	910/341-4300 (Business Hrs.) 910/762-5228 (after hours will forward message)

5. The list of contractors available for emergency response actions is attached.

Emergency Contractors - Wilmington, North Carolina

1. Specialized Marine, Inc.
   7225 Wrightsville Avenue
   P. O. Box 813
   Wilmington, NC Business Hrs. 910-256-5780
   P. O. Box 813 24-hour number 800-277-5638
   Wrightsville Beach, NC 28480

   Burt Lee or Mark Greenleaf Fax 910-256-6011

2. Delta Environmental 205-336-8451
   P. O. Box 206
   Boligee, AL 35443

   24 hour number 205-336-8451

PCT SERVICES

Certificate of Completion

This Certifies That

GREG KUNTZ

is Awarded this Certificate for

OSHA 8 Hr CFR 1910.120 HAZWOPER REFRESHER COURSE

Given at Cayce, SC, this 15th day of JULY, A.D., 19 94

Instructor

Instructor

CERT. NO. 9408R0069

EXPIRES 07/15/95

PCT SERVICES 989 KNOX ABBOTT DRIVE, CAYCE, SC 803-791-3980

SPATCO

Certificate of Completion

This Certifies That

Tim Hornosky

has successfully completed the

8-hour Hazardous Waste Workers Refresher Training Course
as specified in the
OSHA Hazardous Waste Operations and Emergency Response Standard
[29 CFR 1910.120(e)]

Given at:

SPATCO Environmental
Columbia, South Carolina

Date: January 12, 1994
Number: 2011194

J. Ned Beatty, Director of Training

© GOES 482-1/2

LITHO IN U.S.A.

PCT SERVICES

Certificate of Completion

This Certifies That
247-96-4160

DANNY RAWL

is Awarded this Certificate for

OSHA 29 CFR 1910.146 CONFINED SPACE COURSE

Given at Cayce, SC, this 14th day of JULY, A.D., 19 94

Instructor

Instructor

CERT. NO. 94CS0036

PCT SERVICES

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OSHA 8 HR CFR 1910.120 HAZWOPER REFRESHER COURSE

Given at Cayce, SC, this 15th day of NOVEMBER, A.D., 19 94

Instructor

Instructor

CERT. NO. 9408R0118

EXPIRES 11-15-95

PCT SERVICES 989 KNOX ABBOTT DRIVE, CAYCE, SC 803-791-3980

PCT SERVICES

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This Certifies That

FRANK ROBERTSON

is Awarded this Certificate for

OSHA 8 Hr CFR 1910.120 HAZWOPER REFRESHER COURSE

Given at Cayce, SC, this 15th day of JULY, A.D., 19 94

Instructor

Instructor

CERT. NO. 9408R0071

EXPIRES 07/15/95

PCT SERVICES 989 KNOX ABBOTT DRIVE, CAYCE, SC 803-791-3980

PCT SERVICES

Certificate of Completion

This Certifies That

JAMES LEAPHART

is Awarded this Certificate for

OSHA 8 HR CFR 1910.120 HAZWOPER REFRESHER COURSE

Given at Cayce, SC, this 14TH day of DECEMBER, A.D., 19 93

Instructor

Instructor

CERT. NO. 9308R0363

EXPIRES 12-14-94

PCT SERVICES 989 KNOX ABBOTT DRIVE, CAYCE, SC 803-791-3980

PCT SERVICES

Certificate of Completion

This Certifies That

250-90-6379

JIMMY HOOK

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OSHA 29CFR 1910.146 CONFINED SPACE COURSE

Given at Cayce, SC, this 14th day of JULY, A.D., 19 94

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CERT. NO. 94CS0035

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This Certifies That

KEVIN ANDERSON

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8 Hr REFRESHER 29 CFR 1910.120 (e)(8)

Given at Cayce, SC, this 22nd day of SEPTEMBER, A.D., 19 94

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EXPIRES 09/22/95

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OSHA 8 HR CFR 1910.120 HAZWOPER REFRESHER COURSE

Given at Cayce, SC, this 15th day of NOVEMBER, A.D., 19 94

Instructor

Instructor

CERT. NO. 9408R0119

EXPIRES 11-15-95

PCT SERVICES 989 KNOX ABBOTT DRIVE, CAYCE, SC 803-791-3980

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This Certifies That

MARK G. WHITTLE

is Awarded this Certificate for

OSHA 8 HR CFR 1910.120 HAZWOPER REFRESHER COURSE

Given at Cayce, SC, this 21ST day of JANUARY, A.D., 19 94

J. Blake Linder
Instructor

Instructor

CERT. #9408R0007

EXPIRES 01/21/95

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PCT SERVICES

Certificate of Completion

This Certifies That

RAYMOND KNOX

is Awarded this Certificate for

OSHA 8 HR CFR 1910.120 HAZWOPER REFRESHER COURSE

Given at Cayce, SC, this 15th day of DECEMBER, A.D., 19 94

Instructor

Instructor

CERT. NO 9408R0140

EXPIRES 12/15/95

PCT SERVICES 989 KNOX ABBOTT DRIVE, CAYCE, SC 803-791-3980

PCT SERVICES

Certificate of Completion

This Certifies That

GREGORY FORCE

is Awarded this Certificate for

OSHA 8 HR CFR 1910.120 HAZWOPER REFRESHER COURSE

Given at Cayce, SC, this 15th day of DECEMBER, A.D., 19 94

Instructor

J. Blake Lindsey
Instructor

CERT. NO. 9408R0141

EXPIRES 12/15/95

PCT SERVICES 989 KNOX ABBOTT DRIVE, CAYCE, SC 803-791-3980

ATTACHMENT K

SAMPLING AND ANALYSIS PLAN

FOR

GROUNDWATER, SOIL, SEDIMENT, AND SURFACE WATER MONITORING

SOUTHERN WOOD PIEDMONT COMPANY, CITY OF WILMINGTON, & NORTH CAROLINA STATE PORTS AUTHORITY

WILMINGTON, NORTH CAROLINA

APRIL, 1996

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SAMPLING AND ANALYSIS PLAN FOR GROUNDWATER, SOIL, SEDIMENT, AND SURFACE WATER MONITORING SOUTHERN WOOD PIEDMONT COMPANY, CITY OF WILMINGTON, & NORTH CAROLINA STATE PORTS AUTHORITY WILMINGTON, NORTH CAROLINA

I. INTRODUCTION

The purpose for this protocol is to provide for the collection of representative groundwater, soil, sediment, and surface water samples.

Representative samples have the physical and chemical characteristics of the matrix within the zone (aquifer, water body, vadose zone, or air) from which the sample is obtained. This plan will guide environmental field personnel with techniques that preserve the integrity of the sample during the collection, storage, and transportation processes.

This plan and the procedures outlined should be read carefully and completely before sampling begins. Do not refer to individual sections without having read the entire Sampling and Analysis Plan.

Emphasis has been placed on procedures that reduce the potential of contaminating the sample by careless sampling and that prevent degradation of the sample due to improper preservation and/or packaging for shipment prior to chemical analysis.

Sampling and analysis of each matrix requires implementation of the following sequence of decisions, procedures, or events:

1) Sample location selection,
2) Parameter selection,
3) Sample matrix preparation,
4) Procedure for obtaining a representative sample,
5) Preparation of sample for shipment to analytical laboratory, and
6) Proper documentation of field events including sample matrix data sheets and chain-of-custody forms.

Procedures for each of the above are found in the following plan.

II. GENERAL SAMPLING REQUIREMENTS

Sampling will be performed by ViroGroup, Inc. employees trained in collecting and processing environmental samples for transport to the analytical laboratory. The analysis will be performed by an outside contractor, Savannah Laboratories and Environmental Services, Inc. Field personnel are required to maintain a field log and document all field events. Tables 1, 2, and 3 show an example of log sheets which may be used. The following information should be included:

1) Person(s) performing the sampling,
2) Day and time recorded to the minute in military 2400 hour format,
3) All calculations,
4) Visual observations (inspection of well casing, concrete collar, well identification, measuring point, lock, soil type, moisture content, evidence of contamination such as staining or odors, etc.),
5) Field measurements (pH, temperature, specific conductance, OVA, etc.),
6) Type of equipment used (PID, FID, YSI Conductivity Bridge, etc.),
7) Climatic conditions (windy, overcast, etc.),
8) Sampling sequence (up to downgradient, least to most contaminated),
9) Order of sample collection (volatiles, semi-volatiles, metals, etc.), and
10) Problems or variance from procedures listed in this plan.

At the end of the sampling event, all field notes should be dated, signed, and copied. A copy of the field notes should accompany the sample bottles when shipped to the analytical laboratory. When the analytical results are received from the laboratory, SWP headquarters personnel will send copies of the field sheets, chain-of-custody forms, and laboratory report sheets to the appropriate regulatory agencies.

A. Decontamination

Equipment will be cleaned prior to arrival at the site by the below procedure:

a. Clean equipment thoroughly with tap water and laboratory detergent followed by a thorough tap water rinse.
b. Rinse thoroughly with deionized water.
c. Rinse twice with pesticide-grade isopropanol.
d. Rinse thoroughly with organic-free water and allow to air dry.
e. Wrap equipment in aluminum foil and then in plastic to prevent contamination before use at the site.

NOTE: If organic-free water is not available for Step (d), let equipment air dry as long as possible.

Once at the site the procedures as listed below can be followed:

a. Clean equipment thoroughly with tap water.
b. Rinse thoroughly with deionized water.
c. Rinse with pesticide-grade isopropanol.
d. Rinse three times with deionized water.

NOTE: If at any time visual contamination is observed a non-phosphate soap wash is required in step (a).

B. Chain-of-Custody Forms

A chain-of-custody form is an accurate written record which will trace possession and handling of the sample from the moment of collection through laboratory analysis and final recording of results. An example of a chain-of-custody form is shown in Table 4. A chain-of-custody form should accompany the sample bottles at all times.

The most practical way to minimize chain-of-custody problems is to involve the least number of people and use standardized documentation. The activities associated with establishing and maintaining a chain-of-custody can be summarized as follows:

1) Each sample should be uniquely identified on the container(s).
2) Samples should be properly packaged and dispatched as soon as possible to the appropriate laboratory for analysis. Sample containers should be packed in a proper sample shipper (i.e., cooler) along with chain-of-custody forms, copies of pertinent field records, and copies of analytical request forms, if used. Field personnel should place a seal (such as a strip of tape) around the shippers which will indicate tampering.
3) When transferring possession of the samples, the transferee should sign and record the date and time on the chain-of-custody form. Each person who takes custody should fill in the appropriate section of the chain-of-custody form.
4) Once the samples have arrived at the analytical laboratory, laboratory personnel should then reconcile the information on the sample label and seal against that on the chain-of-custody form. Discrepancies between the information on the sample and seal and that on the chain-of-custody form and the sample analysis request sheet should be resolved before the sample is assigned for analysis. Samples should then be placed in a secured sample storage room or locked cabinet until analyzed.

When filling out chain-of-custody forms, include the following information: sample identification; sample log number, if applicable (SWP in-house identification); date and time of sample collection; number of bottles per sample; method of shipment, sample type (i.e., soil), parameters requested for analysis, and signatures of person(s) involved in the chain-of-possession.

C. Preparation of Sample for Shipment to Analytical Laboratory

After all samples have been obtained and placed into shipping containers, and before the sample is sent to the analytical laboratory, the following steps must be taken:

1. Pack samples in plastic lined shipping container very carefully to prevent breakage,
2. Include trip and equipment blanks with the sample, if appropriate,
3. Place ice in a zip-lock bag and place in shipping container after packing,
4. Place notes, chain-of-custody, etc. in zip-lock bag and place in shipping container,
5. Place shipping label on container to be shipped,
6. Seal container with tape, and
7. Check package for integrity.

If a sample analysis form is used, indicate which bottles are to be analyzed and what parameters are requested. If a sample analysis form is not used, indicate on the chain-of-custody form the analysis requested. Make copies of the chain-of-custody form, sample analysis form, and field log. Place original paperwork in a protective covering and place in shipper with sample bottles. Add more ice to cooler, if necessary. Make sure ice is packaged securely in a zip-lock bag to prevent water from leaking out of container during shipping. Label and seal shipper. Ship cooler to analytical laboratory by means which assure arrival at the laboratory within twenty-four hours. Record method of shipment in field log book. Confirm that the samples arrived at the laboratory.

III. GROUNDWATER SAMPLING

Follow the general requirements outlined in Section II for groundwater sampling. The groundwater samples will be collected with disposable polyethylene bailers. A clean, new nylon rope will be used at each well. Water level measurement and groundwater sample collection should occur such that areas of minimal contamination are sampled before the more heavily contaminated areas (upgradient to downgradient), if such conditions are known.

A. Sampling Equipment

Detailed below is a list of supplies and equipment needed to obtain a representative groundwater sample.

1) Bailers: Disposable polyethylene bailers will be used to the sample the wells.
2) Sample containers: The container type (glass or plastic), the preservatives (if any), and the number of each type of container to be filled at each well will be on a form included by the laboratory with the sample containers. The types of containers and preservatives to be used are specified in Table 5. The containers will be prepared by the laboratory according to EPA 600/4-79-020 and other EPA guidelines. Size and number of sample containers will be determined by the laboratory (depending upon the parameters to be analyzed). The sample containers will be shipped to the plant site in sample shippers prior to each sampling event. The laboratory will also include with the sample containers a chain-of-custody form to be used when

returning filled containers to the laboratory for analysis. Equipment and trip blank containers will be included with each sampling event, as needed. The equipment or rinsate blank is to contain the rinse water used in the field during the sampling process and will be analyzed for the same parameters as the groundwater samples. A total of 1 rinsate blank per 20 samples per sampling event will be taken. The trip blank will contain reagent water from the analytical laboratory and will not be handled during the sampling event. The trip blank will also be analyzed along with the groundwater samples.

3) Deionized water & organic-free water: Deionized water and organic-free water is required for cleaning the sampling equipment before and after each sampling event.
4) Gloves: Disposable powder-free, latex gloves are to be worn when sampling. The gloves will be discarded after use at each well. The gloves will be properly disposed by SWP personnel at the end of the sampling event.
5) Cleaning solvent: Pesticide grade isopropyl alcohol.
6) Rope: A new nylon rope will be attached to each bailer. This rope will be discarded after use at each well. At the end of the sampling event all rope will be properly disposed of by SWP personnel.
7) pH meter: A Corning Model 3 pH meter or equivalent pH meter will be used to measure the pH of the groundwater. Buffer solutions within the expected pH range will be used to calibrate the pH meter.
8) Conductivity Bridge: A YSI Model 31 Conductivity Bridge or equivalent will be used to determine the specific conductance of the groundwater. Standard solutions of potassium chloride will be used to calibrate the conductivity meter.
9) Thermometer: A thermometer will be used to take the temperature of the groundwater at the time of sampling.
10) Water Depth Indicator: A Soiltest, Inc., Model DR-760A water level meter or equivalent method, such as an electronic meter or weighted tape, will be used to determine the water level of the wells prior to sampling. The depth indicator will be cleaned as per Section II. (A) between sampling locations. The total depth of each well will also be measured.
11) Plastic Sheets: Plastic sheets will be placed on the ground adjacent to or around each well during sampling to prevent surface soils from coming in contact with the sampling equipment. The sheets will be discarded after each well has been sampled, and a different sheet used at the next well. The used plastic sheets will be properly disposed by SWP personnel.
12) Five Gallon Pail: To contain the groundwater during purging.
13) Beaker: To be used when measuring pH, specific conductance, and temperature.
14) Sealing tape: Used to seal the sample shipper prior to shipping.

B. Groundwater Elevation Determination

Groundwater elevation and total well depth determinations at each well are necessary before sampling can begin. Water level and well depth measurements are used to determine the volume of standing water in the well casing. The volume of standing water in the well in turn is used to determine the amount of water to be purged prior to sampling. Measurement of groundwater elevation is as follows:

1. Preparation for Water Level Measurement
   a. Place a clean plastic sheet on the ground around or adjacent to the well to prevent surface soils from coming into contact with the purging and sampling equipment.
   b. Unlock the well and place the cap on the plastic sheet.
   c. If a dedicated bailer is used, remove the dedicated bailer from the well and place it on the plastic sheet. If the bailer became unattached or is submerged in water, measure the water level before removing the bailer. If this is impossible, remove the bailer, pour water from the bailer back into well and then proceed with water level measurement.
2. Measuring Water Levels
   a. Turn on the water level meter if meter is used.
   b. Verify that the instrument is working properly by pressing the check button.
   c. Rinse the weight of the precleaned water level meter with isopropanol followed by deionized water (See Section II. A).
   d. Begin to lower the weight and cord attachment into well while watching closely for the first meter reading.
   e. When the circuit is complete the needle will move or a buzzer will be activated.
   f. Mark the point of the cord at the top of the PVC pipe (at the surveyed measuring point), where the buzzer first beeps or the needle first moves.
   g. Remove the cord from the well and measure from that mark to the nearest calibrated mark on the cord (measured to the nearest 0.01 feet).
   h. Record this number in the field log book to calculate the elevation.
   i. Remove the cord from the well.
   j. Rinse the portion of the cord and probe which entered the well with solvent and deionized water. If visual oil is observed use a nonphosphate soap wash.
   k. Place water level meter in it's storage container and proceed with measurement of the total well depth.

3. Measuring Well Depths
   a. Using a sounder, water level indicator or weighted tape, measure the depth of the well by lowering probe to the bottom of the well.
   b. Record depth obtained in field log book.
   c. In case of immiscible fluids (floating or heavy layers), they must be observed and noted in the field log book. Using string, tape, or monofilament with weight attached to the end, measure the thickness of the immiscible fluid present.

C. Well Purging

1. Introduction
   a. Monitoring wells must be purged prior to sampling. The purging process is necessary to allow water representative of the aquifer to enter the well.
2. Calculate Purge Volume
   a. Calculate the amount of standing water in the well by subtracting the depth to water from the total well depth.
   b. Measure the inside diameter of the well.
   c. Using the table below, determine the "Sample Volume Factor" corresponding to the inside well diameter.
   d. Multiply the "Sample Volume Factor" by the amount of standing water in the well.
   e. The number obtained represents one volume of water to be purged. Multiply this number by three to determine the amount of water necessary for purging at least three volumes from the well.

SAMPLE VOLUME FACTOR

Internal Diameter (inches)	Fluid $[V=5.22(ID)^2]$	Gallons $[V=0.0408(ID)^2]$	Milliliter $[V154.4(ID)^2]$
1/2	1.31	0.01	38.6
3/4	2.95	0.02	86.9
1	5.22	0.04	154.4
1/4	8.16	0.06	241.3
1/2	11.74	0.09	347.3
2	20.80	0.16	617.6
2 1/2	32.60	0.26	965.0
3	47.00	0.37	1390.0
4	83.50	0.65	2470.0

- Use the field log book to record the calculations for the volume of water required to be evacuated from the well.

- With gloves on, connect an adequate length of clean, new rope to a bailer. Use the well depth to determine the amount of rope to use.
- Before purging begins, catch the rinse (water obtained from rinsing the bailer) and place it in bottles labelled "equipment blank." One equipment blank per 20 wells will be collected per sampling event. The equipment blank will be analyzed for the same parameters as the other samples.
- Remove the calculated amount of water from the well by bailing and collecting it in a container of known volume (5 gallon pail).
- Bail at least three well casing volumes from the well. If the well bails dry, allow the groundwater to re-enter the well and collect sample. If the well is slow to recharge, allow enough time after purging (not to exceed 10 hours) for groundwater to re-enter the casing before sampling. Determination of pH, specific conductance, and temperature is necessary during the bailing process. Take readings after each well volume purged from the well. Record all measurements in the field log book.
- Once the calculated amount of water has been purged, dispose of the water on-site away from the well head, unless the purged water contains visible oil or has had previous constituent detection. In the latter cases the water is to be placed in drums or another on site storage tank. The storage container must be labeled properly and a waste generation form (Table 6) submitted to SWP. SWP will dispose of the water using hazardous waste disposal procedures.

D. Procedures for Obtaining a Representative Groundwater Sample

After purging, in order to obtain a representative groundwater sample the following procedures are to be used:

1) Obtain groundwater samples by slowly lowering bailer into well until it contacts the water surface. Allow bailer to sink slowly, filling with minimal disturbance. Slowly retrieve bailer from the well taking care not to allow the rope or bailer to contact ground.
2) Transfer enough water to a clean beaker to measure pH, temperature, and specific conductance. Record these measurements in the field log book.
3) Do not take pH, specific conductance, or temperature measurements directly from the sample bottle. Pour into beaker and then measure.
4) Rinse the pH and conductivity probes and thermometer with deionized water and isopropanol. Store the instruments in their designated containers.
5) Fill the labelled bottles in a way as to minimize agitation and aeration. Fill the bottles in the proper order as follows:
    a. Volatile organics (VOA) [zero headspace],

b. Purgeable organic carbon (POC),
c. Extractable organics, and
d. metals.

Do not overfill bottles as some may contain preservatives.

6) Repeat above steps as needed to acquire a sufficient sample volume to fill all containers.
7) Label the sample bottles after filling with the well identification and date.
8) Observe the sample as container(s) are being filled and record observations in the field log book (i.e., extremely turbid, discolored, odor, etc.).
9) Immediately place sample bottles on ice.
10) Properly discard bailer and rope.
11) Wash any other equipment used (i.e., beaker, 5 gallon pail, etc., as per Section II).
12) Discard the plastic sheet, gloves, etc. in proper disposal container as designated by SWP, and repeat the same procedure at the next well.

IV. SOIL SAMPLING

Follow the above general requirements during the collection of the soil samples. The majority of the soil samples will be collected with a clean stainless-steel hand auger

A. Sampling Equipment

Detailed below is a list of supplies and equipment needed to obtain representative soil samples.

1) Hand Auger: A stainless-steel hand auger. The hand auger will be decontaminated in accordance with Section II (A) before being brought on site and between each sample.
2) Sample Containers: The container type (glass or plastic) and the number of each type of container to be filled at each sampling location will be on a form included by the laboratory with the sample containers. The containers will be prepared by the laboratory according to EPA Method 600/4-79-020 and other applicable EPA guidelines. Size and number of sample containers will be determined by the laboratory (depending upon the parameters to be analyzed). The sample containers will be shipped to the designated location in sample shippers prior to each sampling event. The laboratory will also include with the sample containers a chain-of-custody form to be used when returning filled containers to the laboratory for analysis.

3) Deionized and Organic-Free Water: Deionized and organic-free water is required

for cleaning the sampling equipment.

4) Gloves: Disposable powder-free, latex gloves are to be worn when sampling. The gloves will be discarded after use at each location. The gloves will be properly disposed in a designated container managed by SWP personnel.
5) Cleaning Solvent: Pesticide grade isopropanol.
6) Plastic Sheets: Plastic sheets will be placed on the ground adjacent to each sampling location during sampling to prevent surface soils from coming in contact with the sampling equipment. The sheets will be discarded after each sample has been taken, and a different sheet used at the next location. The used plastic sheets will be properly disposed in a designated container managed by SWP personnel.
7) Sealing Tape: Used to seal the sample shipper prior to shipping.
8) Stainless Steel/Pyrex™ Bowl: Used to thoroughly mix soil samples for compositing.
9) Scoopula: Used for placing the soil sample in the container.
10) Trowel: Used for compositing and mixing soils samples for SVOC analysis.

B. Procedures for Obtaining a Representative Soil Sample

In order to obtain representative soil samples the following procedures are to be used:

1) All sampling locations will be staked and flagged until surveyed.
2) The sampling location will be cleared of vegetation and root matter, to the extent possible.
3) The sample collection tool will be decontaminated between each discrete sampling interval.
4) Soil samples collected for VOC's will not be mixed or composited. The soil samples will be transferred directly from the sampling tool to the laboratory supplied sample containers using a scoopula. The soil sample containers will be filled to zero headspace with minimal disturbance to prevent volatilization and sealed with a Teflon™ coated lid.
5) Soil samples collected for SVOC analysis will be mixed by transferring the soil from the sampling tool to a stainless steel/Pyrex™ sample bowl. The collected soil will be stirred and turned over with a trowel/spoon in a circular motion to assure that a uniform mixture is obtained prior to placing the sample into the analytical containers.
6) Fill the sample containers in a way as to minimize agitation and aeration. Fill the bottles in the proper order as follows:
    1. Volatile organics (VOA) [zero headspace],
    2. Purgeable organic carbons (POC), and
    3. Extractable organics, and

4. Metals.

7) Sample bottles provided by the contract laboratory must be appropriately labelled with the site location, identification, and date.
8) Wash any equipment used (i.e., auger, Pyrex™ bowl, and trowel, etc.) as per Section II (A).
9) Discard the plastic sheet, gloves, etc. in proper disposal container as designated by SWP.
10) Record field sampling data on the Sampling Field Data Sheet (Table 3), and repeat the same procedure at the next location.

V. SEDIMENT AND SURFACE WATER SAMPLING

Follow the general requirements outlined in Section II for sediment and surface water sampling. The sediment samples will be collected with a 6-inch by 6-inch decontaminated stainless steel Ponar™ dredge sampler or a PVC push tube, as appropriate. The surface water samples will be collected directly into the sample containers.

A. Sampling Equipment

Detailed below is a list of supplies and equipment needed to obtain a representative sediment and surface water sample.

1) Ponar™ Dredge: A 6-inch by 6-inch stainless steel ponar dredge sampler will be used to collect sediment samples. The ponar dredge will be decontaminated in accordance with Section II (A) before arrival to the site and between each sample.
2) PVC Push Tube: A PVC push tube will be used to collect sediment samples that are predominantly muck and cannot be collected using the Ponar™ dredge. The push tube will be decontaminated in accordance with Section II (A) before being brought on site and between each sample.
3) Hand Auger: A stainless-steel hand auger will be used when appropriate to collect sediment samples. The hand auger will be decontaminated in accordance with Section II (A) before being brought on site and between each sample.
4) Surface Water Sampling Equipment: Laboratory provided clean sample containers will be used to collect surface water samples.
5) Sample Containers: The container type (glass or plastic) and the number of each type of container to be filled at each sampling location will be on a form included by the laboratory with the sample containers. The types of containers to be used are specified in Table 4. The containers will be prepared by the laboratory according to EPA Method 600/4-79-020 and other applicable EPA guidelines. Size and number of sample containers will be determined by the laboratory (depending

upon the parameters to be analyzed). The sample containers will be shipped to the designated location in sample shippers prior to each sampling event. The laboratory will also include with the sample containers a chain-of-custody form to be used when returning filled containers to the laboratory for analysis.

6) Deionized and Organic-Free Water: Deionized and organic-free water are required for cleaning the sampling equipment.
7) Gloves: Disposable powder-free, latex gloves are to be worn when sampling. The gloves will be discarded after use at each location. The gloves will be properly disposed in a designated container managed by SWP personnel.
8) Cleaning Solvent: Pesticide grade isopropanol.
9) Plastic Sheets: Plastic sheets will be placed adjacent to the sediment sampling location to prevent cross-contamination from contact adjacent surfaces. The sheets will be discarded after each sample has been taken, and a different sheet used at the next location. The used plastic sheets will be properly disposed in a designated container managed by SWP.
10) Sealing Tape: Used to seal the sample shipper prior to shipping.
11) Trowel: Used for compositing and mixing sediment samples for SVOC analysis.
12) Scoopula: Used for placing the sediment sample in the sampling containers.
13) Stainless Steel/Pyrex™Bowl: Used for holding the sediment sample during mixing and compositing.

B. Procedures for Obtaining a Representative Surface Water Sample

In order to obtain a representative surface water sample the following procedures are to be used:

1) The sampling location will be staked and flagged until surveyed.
2) Surface water samples should be collected prior to sediment samples.
3) Laboratory provided sample containers will be used to collect the surface water samples. The sample containers will be filled by positioning the container in the downstream direction. Care should be taken not to disturb the sediments and surface water upstream of the sample location. Unpreserved surface water samples will be collected directly into the sample containers. Preserved surface water samples (i.e. VOC's) will also be collected directly in the sample container with minimum disturbance and without overfilling the container. The portion of the container remaining to be filled should be topped using the cap for the container. Samples for VOC's must have zero headspace.
4) Fill the bottles in the proper order as follows:
    a. Volatile organics (VOA),
    b. Purgeable organic carbons (POC),

c. Extractable organics, and
d. Metals.

5) Label the sample bottles with the identification and date.
6) Wash any equipment used per Section II (A).
7) Discard the gloves, etc. in proper disposal container as designated by SWP, and repeat the same procedure at the next location.

C. Procedures for Obtaining a Representative Sediment Sample

In order to obtain a representative sediment sample the following procedures are to be used:

1) The sampling location will be staked and flagged until surveyed.
2) The sampling location will be cleared of vegetation and root matter, to the extent possible.
3) The sediment sample collection tool will be decontaminated between each discrete sampling interval.
4) Sediment samples for SVOC analysis will be mixed by transferring the sediment from the sediment collection tool to a stainless/Pyrex™ sample dish. The collected sediment will be stirred and turned over with a trowel in a circular motion to assure that a uniform mixture is obtained prior to placing the sample into the analytical containers.
5) Sediment samples collected for volatile organic compounds will not be mixed. The sediment sample will be transferred directly from the sample collection tool to the sample containers using a scoopula. The soil sample containers will be filled completely with minimal disturbance to prevent volatilization and sealed with a Teflon™ coated lid. The containers should be filled with zero headspace.
6) Fill the bottles in the proper order as follows:
   a. Volatile organics (VOA),
   b. Purgeable organic carbons (POC),
   c. Extractable organics, and
   d. Metals.
7) Label the sample bottles with the identification and date.
8) Wash any equipment used (i.e., auger, trowel, etc.) as per Section II (A).
9) Discard the plastic sheet, gloves, etc. in proper disposal container as designated by SWP, and repeat the same procedure at the next location.

TABLE 1

STANDARDIZED GROUNDWATER SAMPLING DATA FIELD SHEET

STANDARDIZED GROUNDWATER PURGING AND SAMPLING FIELD DATA SHEET

WELL ID	WATER LEVEL		WELL DEPTH (TOC)	FLOATER THICKNESS (FT)	SINKER THICKNESS (FT)	ODOR*	CALIBRATION		PURGING		PURGE METHOD	CALC. PURGE VOL.	VOL. PURGED (GAL)	TEMP (C)	COND (UMHOS)	pH	TURB**	SAMPLING			REMARKS
	DATE	DEPTH (TOC)					pH	COND	DATE	TIME								DATE	TIME	SAMP. INT.	

Note descrepencies from below comments in the remarks section for each well:

- Well Locked
- Bailer Present
- Bottles Labeled
- Samples Iced
- Reference Point Inspected
- Well Casing Inspected
- Well Pad Inspected

Check When Complete:

_____Copy of All Notes Sent with Samples To Lab
_____Log Numbers Obtained For Samples
_____Samples Shipped FedEx Priority Overnight Daily
_____Confirmed Samples Arrived At Lab
_____All Data Recorded With An Indelible Waterproof Pen
_____Custody Form Completed
_____Cooler Sealed
_____All Purge Water Disposed Of At Designated Location
_____All Sampling Derived Waste Disposed as Potentially Hazardous Waste (i.e. gloves, plastic, twine, etc..)

SITE: _____
WEATHER: _____
COLLECTOR'S SIGN.: _____
_____
DATE/TIME: _____

*Very slight (VS), Slight (S), Moderate (M), Strong (ST), Very Strong (VST)
**Clear (C), Slight Turbid (ST), Turbid (T), Very Turbid (VT)

PAGE_____OF_____

TABLE 2

STANDARDIZED SURFACE WATER SAMPLING FIELD DATA SHEET

SURFACE WATER SAMPLE FIELD DATA SHEET

ID	TIDE	SAMPLE METHOD	ODOR*	SHEEN	CALIBRATION		TEMP (C)	COND (UMHOS)	pH	TURB**	SAMPLING			DEPTH	REMARKS
					pH	COND					DATE	TIME	SAMP. INT.		

Note descrepencies from below comments in the remarks section for each well:

- Bottles Labeled
- Samples Iced

Check When Complete:

_____ Copy of All Notes Sent with Samples To Lab
_____ Log Numbers Obtained For Samples
_____ Samples Shipped FedEx Priority Overnight Daily
_____ Confirmed Samples Arrived At Lab
_____ All Data Recorded With An Indelible Waterproof Pen
_____ Custody Form Completed
_____ Cooler Sealed
_____ All Sampling Derived Waste Disposed as Potentially Hazardous Waste (i.e. gloves, plastic, twine, etc..)

SITE: _____
WEATHER: _____
COLLECTOR'S SIGN.: _____
_____
DATE/TIME: _____
PAGE: _____ OF _____

*Very slight (VS), Slight (S), Moderate (M), Strong (ST), Very Strong (VST)

**Clear (C), Slight Turbid (ST), Turbid (T), Very Turbid (VT)

TABLE 3

STANDARDIZED SOIL/SEDIMENT COLLECTION SUMMARY SHEET

SOIL/SEDIMENT SAMPLE COLLECTION FIELD DATA SHEET

PROJECT NAME: _____ SAMPLING METHOD: _____

PROJECT NUMBER: _____ DECONTAMINATION METHOD: _____

WEATHER: _____ WASTE DISPOSAL METHOD: _____

SAMPLE						FIELD	SAMPLE	LOCATION/	SAMP.
ID	DATE	TIME	DEPTH	ODOR	STAIN	SCREENING	DESCRIPTION	DESCRIPTION	INT.

Check When Complete:

_____ Bottles Labeled
_____ Samples Iced
_____ Sample Location Staked
_____ Copy Of All Field Notes Sent With Sample To Lab
_____ Lot Numbers Obtained For Samples
_____ Samples Shipped For Overnight Delivery
_____ Confirmed Samples Arrived At Lab
_____ Data Recorded With Indelible Pen
_____ Custody Form Completed
_____ Sample Shipper Sealed
_____ All Sampling Derived Waste Disposed Of Properly

Collector's Signature: _____

Date: _____

PAGE _____ OF _____

TABLE 4

CHAIN-OF-CUSTODY FORM

SL S AVNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

18157

☐ 5102 LaRoche Avenue, Savannah, GA 31404 Phone: (912) 354-7858 2) 352-0165
☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301 Phone: (904) 878-3994 (904) 878-9504
☐ 414 Southwest 12th Avenue, Deerfield Beach, FL 33442 Phone: (305) 421-7400 Fax (305) 421-2584
☐ 900 Lakeside Drive, Mobile, AL 36693 Phone: (205) 666-6633 Fax (205) 666-6696
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634 Phone: (813) 885-7427 Fax (813) 885-7049

LYSIS REQUEST AND CHAIN OF CUSTODY RECORD

UMBER	PROJECT NUMBER	PROJECT NAME	MATRIX TYPE	REQUIRED ANALYSES	PAGE	OF
IT NAME		TELEPHONE/FAX NO.				
IT ADDRESS		CITY, STATE, ZIP CODE				
LER(S) NAME(S)		CLIENT PROJECT MANAGER				

☐ STANDARD TAT

☐ EXPEDITED TAT *

REPORT DUE DATE _____

* SUBJECT TO RUSH FEES

SAMPLING TE	TIME	SAMPLE IDENTIFICATION	AQUEOUS MATRIX	NONAQUEOUS MATRIX	OIL MATRIX	AIR MATRIX	NUMBER OF CONTAINERS SUBMITTED										

QUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
IVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

FOR SAVANNAH LABORATORY USE ONLY

IVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	S.L. LOG NO.	LABORATORY REMARKS
			☐ YES ☐ NO			

TABLE 5

WILMINGTON SITE-SPECIFIC WOOD-PRESERVATIVE CONSTITUENT LISTS, SAMPLE CONTAINERS, AND ANALYTICAL METHODS

TABLE 5
SITE-SPECIFIC WOOD-PRESERVATIVE CONSTITUENT LIST
SOUTHERN WOOD PIEDMONT COMPANY, CITY OF WILMINGTON,
& NORTH CAROLINA PORTS AUTHORITY
WILMINGTON, NORTH CAROLINA FACILITY

SEMI-VOLATILE ORGANIC COMPOUNDS
USEPA METHOD 8270

Acenaphthene	Acenaphthylene
Anthracene	Benzo(a)anthracene
Benzo(a)pyrene	Benzo(b)fluoranthene
Benzo(k)fluoranthene	Bis(2-chloroethyl)ether
Carbazole	4-chloro-3-methylphenol
Chrysene	2-chlorophenol
Dibenzo(a,h)anthracene	2,4-dimethylphenol
2,4-dinitrophenol	Fluoranthene
Indeno(1,2,3-cd)pyrene	Naphthalene
p-Chloro-m-cresol	Pentachlorophenol
Phenanthrene	Phenol
Tetrachlorophenol	2,4,5-trichlorophenol
2,4,6-trichlorophenol	

NOTE: All ground water and surface water samples collected for semi-volatile organic compound analysis will be placed into 1-liter amber glass sample containers with Teflon™ coated lids and stored at 4°C. All soil and sediment samples will be placed in 250-millimeter wide mouth glass sample containers with a Teflon™ coated lid. The holding time before extraction will not exceed 7 days and the holding time after extraction will not exceed 40 days.

TABLE 5 cont.

VOLATILES ORGANIC COMPOUNDS

USEPA METHOD 8240

Benzene	Bromodichloromethane
Bromomethane	Carbon Tetrachloride
Chlorobenzene	Chloroethane
2-chloroethylvinylether	Chloromethane
Cis-1,3-dichloropropene	Dibromochloromethane
1,2-dibromomethane (Edb)	Dichlorodifluoromethane
1,1-dichloroethane	1,2-dichloroethane
1,1-dichloroethene	Dichloromethane
1,2-dichloropropane	Ethyl benzene
Fluorotrichloromethane	M/P-Xylene
Methyl-T-Butyl Ether (Mtbe)	O-Xylene
1,1,2,2-tetrachloroethane	Toluene
Trans-1,2-dichloroethene	1,1,1-trichloroethane
1,1,2-trichloroethane	Trichloroethene
Vinyl Chloride	

NOTE: All ground water and surface water samples collected for volatile organic compound analysis will be placed into 40-milliliter VOA glass sample vials with Teflon™ lined septa and preserved with HCL to a pH <=2. Soil and sediment samples will be placed into 125-milliliter amber glass sample containers with a Teflon™ coated lid. The samples will be stored at 4^0C. The holding time before analysis will not exceed 14 days.

TOTAL AND DISSOLVED METALS

USEPA METHOD 6010

Arsenic	Chromium
Copper	

NOTE: All ground water and surface water samples collected for total metals will be placed into 500 ml plastic sample containers and preserved with HNO_3. All ground water and surface water samples for dissolved metals will not be filtered in the field and will be placed in 500 ml plastic sample containers with no preservatives. Soil and sediment samples will be placed into 250-milliliter plastic sample containers. The samples will be stored at 4°C. The holding time before analysis will not exceed six months.

TABLE 6

WASTE GENERATION/TEMPORARY STORAGE RECORD