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Soil, Sediment, and Surface Water Assessment Workplan
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

RECEIVED
JUN 03 1996
SUPERFUND SECTION

Prepared By The

ViroGroup
Air • Water • Soil
TECHNOLOGY

ViroGroup Job No. 12-53019.00

February 1996

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ATTACHMENT B	Human Health Based Risk Assessment Workplan
ATTACHMENT C	Ecological Based Risk Assessment Workplan
ATTACHMENT D	Wilmington Health and Safety Plan

SOIL, SEDIMENT, AND SURFACE WATER ASSESSMENT WORKPLAN
SOUTHERN WOOD PIEDMONT COMPANY, CITY OF WILMINGTON, & NORTH CAROLINA STATE PORTS AUTHORITY
WILMINGTON, NORTH CAROLINA FACILITY

1.0 INTRODUCTION

This plan describes a voluntary soil, sediment, and surface water assessment workplan that is proposed to delineate (to the extent reasonably possible) the impacts to soil, surface water, and sediment in areas where previous investigations suggest un-delineated impacts may exist; and to provide the necessary information for developing a risk-based remedial action plan that is protective of human health and the environment. This assessment workplan is based on the discussions originating from the May 24, 1995 meeting between Southern Wood Piedmont Company (SWP), the City of Wilmington (City), the North Carolina State Ports Authority (NCSPA), the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR), and the Region IV United States Environmental Protection Agency (EPA).

The data collected during the completion of this workplan and other existing data will be utilized during the completion of a human health and ecological risk assessment. The risk assessment will address the entire site, including the on-site drainage ditch, Greenfield Creek, and the former site slips along the Cape Fear River.

2.0 PROPOSED ASSESSMENT ACTIVITIES

Implementation of the investigative methods will be in accordance with the EPA REGION IV ENVIRONMENTAL COMPLIANCE BRANCH STANDARD OPERATING PROCEDURES AND QUALITY ASSURANCE MANUAL (ECBSOPQAM) dated February 1, 1991. The proposed investigation activities and locations are summarized on Figure 1.

2.1 Former Production Area & Treated Wood Storage Area B Soil Borings

Previous soil assessments included grid sampling of the treated (TWSA) and non-treated (NTA & NTB) wood storage areas at the site (Figure 1). The main production area and treated wood storage area B, located in the northwest portion of the site, were not included in the previous assessments. These two areas are proposed to be investigated utilizing the same methodology as the previous soil assessments. A surveyed sampling grid on 100-foot centers will be prepared. A total of 78 boreholes will be completed within the grid to a depth of 18-inches using a three-inch diameter, clean stainless steel hand auger. Each soil boring will be described for degree of staining and odor and logged according to the Unified Soil Classification Scheme. A head-space analysis will be performed to screen each sample in the field for total volatile organic compounds (VOC's) using a photo-ionization detector-organic vapor analyzer (PID-OVA). Twenty-six of the boreholes (1/3) will be randomly selected for chemical analysis using a random number table. A soil sample will be 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 (Table 1). All sampling locations will be permanently marked in the field with a steel pin and surveyed.

To evaluate the bioavailability of organic compounds on site, total organic carbon (TOC) samples will be collected. Two TOC samples will be collected from each of the production, NTB, and TWSA areas on site (total of 6 TOC samples). The TOC soil samples will be collected at a depth of 0- to 6-inches below land surface. In each of the production, NTB, and TWSA areas, one of the TOC samples will be collected in an area that appears to be influenced by wood-preserving constituents. The second TOC sample from each area will be collected in an area that appears to be uninfluenced by wood-preserving constituents. Existing data from previous soil sampling activities in the NTA and TWSA areas will be used to identify the TOC sampling locations. Field observations during the completion of the production area soil borings will be used to identify the production area TOC soil samples.

2.2 Landfarm Soil Borings

A soil sampling investigation was completed by Geraghty & Miller, Inc. in the two landfarm areas (LF1 and LF2) to provide a baseline condition for an expanded list of site-specific constituents on October 10, 1990. In each landfarm area five locations were sampled (A, B, C, D, and E; Figure 1) and composited to form one sample for laboratory analysis of wood-preserving constituents and nutrients (Table 2). At each location, three samples were collected in the landfarm material and one sample was taken from the underlying substrate. In the landfarm material the first sample was collected at approximately 3 inches below the landfarm surface, the second sample was collected midway through the landfarm material, and the third sample was collected from the bottom 6-inches of the landfarm material. The substrate sample was taken approximately 6-inches below the base of the landfarm material. The thickness of the landfarm material was determined by completing a test boring prior to sampling at each location.

In October 1991, Geraghty & Miller, Inc. collected soil samples from the previously sampled locations to provide data on the presence and degradation of the wood-preserving constituent list for the landfarm material (Table 2). During the 1991 sampling event, the sampling depths were modified to include only the upper and lower layers of the landfarm material since the analytical results from the 1990 sampling event documented that the PAH concentrations in the landfarm were consistent with depth and were significantly lower in the underlying substrate.

In order to evaluate the presence and continued degradation of the expanded list of wood-preserving constituents in the landfarm material and the underlying substrate, it is proposed that soil samples be collected from the landfarm utilizing the same methodology as the October 1991 soil investigation with the addition of an underlying substrate composite sample from each landfarm area. A total of 10 locations (5 per landfarm area; Figure 1) will be sampled to form 6 composite soil samples (3 composite samples per landfarm area). An upper (0" to 3" below the landfarm surface) and lower (6-inches from the bottom of the landfarm material) landfarm sample

and a substrate sample (6-inches below the base of the landfarm material) will be collected. A test borehole will be completed to determine the thickness of the landfarm material. The boreholes will be completed at approximately the same locations as the previous boreholes using a clean stainless steel hand auger. Each soil boring will be described for degree of staining and odor and logged according to the Unified Soil Classification Scheme. The soil samples will be analyzed for the wood-preserving and nutrient constituents landfarm list located in Table 2. All sampling locations will be permanently marked in the field with a steel pin and surveyed.

2.3 Dioxin and Furan Soil Sampling

Following completion of the grid soil sampling investigation in the production and TWSB areas and after receipt of the laboratory analysis, dioxin and furan soil sampling will be conducted. Dioxin and furan soil samples may be collected from each of the NTA, NTB, TWSA, TWSB, and production areas. The location of each dioxin and furan soil sample will be selected based on the grid point(s) with the greatest pentachlorophenol concentration. If pentachlorophenol is not detected in an area, no dioxin or furan soil samples will be collected from that area. If pentachlorophenol is detected in an area, a soil sample(s) will be collected. One soil sample may be collected from both the non-treated area A & B and two soil samples may be collected from each of the treated wood storage areas A & B and the former production area (total of 8 potential dioxin and furan soil samples).

If dioxins or furans are collected on site, then five background soil samples will also be collected in the vicinity of the site (Figure 2). The background dioxin and furan concentrations will be compared to the levels detected on-site to determine the nature of dioxin and furan concentrations that may be attributed to the site, as compared to background concentrations for these constituents. The background dioxin and furan sample locations will be located using a global positioning system (GPS) to determine the latitude/longitude of the sample location. A steel pin will be placed at the actual sample location and the field notes will describe the location of the steel pin.

The dioxin and furan soil samples from the production area, wood storage areas, and the background areas will be collected at a depth of 0- to 6-inches below land surface using a clean stainless steel hand auger. The dioxin and furan soil samples will be analyzed for the dioxin and furan list (Table 3) by USEPA Method 8280. All sampling locations will be permanently marked in the field with a steel pin and surveyed.

On October 9, 1990 Geraghty & Miller, Inc. collected surficial (0- to 6-inch) dioxin and furan soil samples from the landfarm material. The soil samples were taken at each of the five locations in LF1 and LF2 and composited into two samples. To evaluate the present concentrations and degradation of dioxins and furans in the landfarm material, two composite surficial soil samples will be collected. The soil samples will be collected at approximately the same location as those previously collected by Geraghty & Miller, Inc. in 1990. The dioxin and furan soil samples from the landfarm area will be collected at a depth of 0- to 6-inches below land surface using a clean stainless steel hand auger. The landfarm dioxin and furan soil samples will be analyzed for the dioxin and furan list (Table 3) by USEPA Method 8290.

2.4 Surface Water and Sediment Samples

Surface water samples have been collected semi-annually from the Cape Fear River since 1985. However, no surface water samples have been collected from the on-site drainage ditch or Greenfield Creek and its tributaries. It is proposed that one surface water sample be collected from the on-site drainage ditch and four surface water samples be collected from Greenfield Creek and its tributaries (Figure 1).

A sediment sample was collected by the EPA in 1985 in the Cape Fear River adjacent to the north slip. In order to further define the Cape Fear River sediments, eleven additional sediment samples are proposed (Figure 1).

Eleven sediment samples were collected from the on-site drainage ditch and Greenfield Creek in 1992 as part of the Phase II Groundwater Quality Assessment (GQA). During the Phase II GQA, sediment samples were not collected within a southern tributary to Greenfield Creek. In order to assess this southern tributary, two sediment samples will be collected (Figure 1).

All of the surface water and sediment sample locations will be permanently located by placing survey stakes at a right angle to the shoreline. Two survey stakes will be placed at each sample location, such that, when lined up they indicate the direction to the surface water or sediment sample location. Along Greenfield Creek the distance between the permanent stake closest to the bank and the sample location will be recorded. The sediment samples within the Cape Fear River will be collected 50 feet from the stake closest to the shoreline consistent with the 1985 EPA sediment sample. The sediment samples in the south slip will be collected near the bank and at the center of the slip. The distance between the stake closest to the shoreline and the sediment samples in the slip will be recorded. Sediment samples consisting predominantly of sand will be collected using a 6-inch by 6-inch stainless steel Ponar™ dredge sampler. The sediment samples consisting of muck will be collected with a stainless steel hand auger or a PVC push tube, whichever provides the most undisturbed sediment sample. All of the surface water and sediment samples will be analyzed for the Wilmington site-specific wood-preserving constituent list (Table 1).

To determine the bioavailability of the metals in the sediments, samples will be collected for acid volatile sulfide with simultaneous extracted metals (AVS-SEM) analysis. AVS-SEM sediment samples will be collected in the on site drainage ditch at former sediment sample locations SS-7 and SS-8, along Greenfield Creek at former sediment sample locations SS-1, SS-9, and SS-11, and along the Cape Fear River at proposed sample locations at the Highway 74 bridge, the T-head, the southern slip, and the mouth of Greenfield Creek (Figure 1).

2.5 Quality Assurance/Quality Control

Decontamination will be completed between each borehole and between each discrete sample as described in Appendix B of the ECBSOPQAM, in Section II.(A) of the Wilmington Sampling & Analysis (S&A) Plan (Attachment A), and in Section 2.6 of this workplan.

Soil sample collection procedures will be as described in Section 4.11 of the ECBSOPQAM and in Section III of the Wilmington S&A plan.

Section 4.8 of the ECBSOPQAM and Section IV of the Wilmington S&A plan will be followed during the collection of all surface water and sediment samples.

Sample containers, sample preservation, sample holding times, and permissible sample type will be as listed in ECBSOPQAM Appendix A. Shipping will be as listed in ECBSOPQAM Appendix C and as described in Section II.(C) of the Wilmington S&A plan. Chain-of-custody procedures will be as described in Section 3.3 of the ECBSOPQAM and Section II.(B) of the Wilmington S&A plan.

Semi-volatile organic compounds will be analyzed by USEPA approved Method 8270 and volatile organic compounds by USEPA Method 8240. Arsenic will by analyzed by USEPA Method 7060 and chromium and copper by USEPA Method 6010. Total Kjeldahl nitrogen will be analyzed by USEPA Method 351.2, nitrate + nitrite by USEPA Method 353.1, total phosphorus by USEPA Method 365.1, total organic carbon by USEPA Method 415.1, chloride by USEPA Method 325.1, pH by USEPA Method 150.1, and AVS-SEM by USEPA Method 68-03-3534/6010. Dioxins and furans will be analyzed by USEPA Method 8280 for site and background samples and USEPA Method 8290 for landfarm samples, as described is Section 2.3 of this workplan.

Quality assurance/quality control (QA/QC) field samples will be collected. Field QA/QC samples will include: (1) a minimum of one duplicate sample per medium per container type per field day; (2) an equipment rinsate blank, per sampling procedure, as appropriate, and; (3) a VOA trip blank, as necessary.

Laboratory QA/QC will be as described in SW-846, EPA Test Methods for Evaluating Solid Waste for each EPA approved analytical methodology utilized during this investigation. Laboratory QA/QC will include at a minimum:

1) A signed statement that samples were received in good condition and at the required temperature and that analysis of the samples complied with all procedures outlined in the USEPA methodology. Any deviation from the methods will be described and justified.

2) Laboratory sheets for the analytical results, including sample identification, sampling dates, date samples received by laboratory, extraction dates, analysis dates, analytical methods used, dilution factors, and sample quantitative limits.

3) Laboratory sheets for all laboratory quality control samples, including results for bias and precision and control limits used. The following minimum laboratory quality control samples are required: (1) at least one matrix spike and one matrix spike duplicate per sample delivery group or 12-hour period, whichever is less; (2) at least one method blank per sample delivery group or 12-hour period, whichever is less; (3) system monitoring compounds, surrogate recovery analysis and laboratory control samples. All samples which exceed control limits/acceptance criteria must be flagged in the laboratory report.

4) Complete chain-of-custody with associated air bill attached.

5) The laboratory report will include the names and qualifications of the individuals performing each analysis, the quality assurance officer reviewing the data, and the laboratory manager.

6) The laboratory report will include a statement certifying that the laboratory is either certified under 15A NCAC Subchapter 2H.0800, or that it is a contract laboratory under EPA's Contract Laboratory Program.

2.6 Equipment and Personnel Decontamination Procedures

A portable decontamination area will be established to contain liquid and solid waste generated during the decontamination of equipment and personnel between sampling locations. All waste generated from decontamination will be containerized and sampled for proper disposal.

All sampling equipment will be decontaminated prior to arrival at the site by the following procedures:

1) Clean with tap water and laboratory grade, phosphate-free detergent, using a brush, if necessary.
2) Rinse thoroughly with tap water.
3) Rinse thoroughly with deionized water.
4) Rinse twice with organic-free solvent (pesticide grade isopropanol).
5) Rinse with organic-free water and allow to air dry.
6) Wrap with aluminum foil and then in plastic to prevent contamination if the equipment is to be stored or transported.

NOTE: Do not rinse with deionized water or distilled water for Step 5. If organic-free water is not available, let equipment air dry as long as possible.

Once at the site and between discrete samples the procedures as listed below can be followed:

1) Clean equipment thoroughly with tap water.
2) Rinse thoroughly with deionized water.
3) Rinse with pesticide-grade isopropanol.
4) Rinse three times with deionized water.

NOTE: If at any time visual contamination is observed a non-phosphate soap wash is required in step 1.

2.7 Investigation Derived Waste Management

Investigation derived waste (IDW) materials will be generated during field activities. Waste types include liquids, solids, and sludge. Some of these materials may be hazardous wastes which must be handled, stored, and disposed of properly. Materials that may become IDW include:

- Personnel protective equipment (PPE) - coveralls, gloves, respirator canisters, etc.
- Cleaning fluids such as spent solvent and wash water.
- Disposable equipment (DE) - plastic ground and equipment covers, aluminum foil, conduit pipe, sample containers, sample boxes, tape, etc.

Hazardous IDW must be disposed of properly. Due to the anticipated low volume of waste to be generated at the site, the liquid IDW and solid IDW will be placed in 55-gallon drums. The drums will be sealed to prevent accumulation of precipitation. A hazardous waste label will be placed on each drum on the first day in which any waste is added to the container. A waste generation form will also be completed at this time. The waste materials will not be stored more than 90 days from the first date of accumulation. At the end of IDW accumulation or before 90 days from the date of first accumulation, a sample will be collected to determine proper off-site disposal. The waste containers will be labeled with the proper D.O.T. placards, manifested, and shipped off-site to an approved waste disposal facility.

All non-hazardous IDW will be disposed at the local sanitary landfill at the end of investigation activities or at other appropriate times. Soil cuttings from hand auguring will be returned to the borehole from which they were excavated.

3.0 HUMAN HEALTH RISK ASSESSMENT

A human health risk assessment will be performed to characterize potential risks to humans who may be exposed to chemicals of potential concern in the various environmental media located at

or near the Wilmington, North Carolina Facility. The risk assessment will incorporate the entire site, an on-site drainage ditch, Greenfield Creek in the vicinity of the site, and the slips adjacent to the site along the Cape Fear River. The risk assessment will specifically address potential future risks associated with residual chemicals at the site. The risk assessment assumes that only the landfarm area will be capped with fill material (1 foot thick) and an impervious surface. The scope of work for the human health risk assessment is presented in Attachment B to this workplan.

4.0 ECOLOGICAL RISK ASSESSMENT

An ecological risk assessment will be performed to determine the primary ecological receptors exposed to compounds in various environmental media located at or near the Wilmington, North Carolina site. The scope of work for the ecological risk assessment is presented in Attachment C to this workplan.

5.0 HEALTH AND SAFETY PLAN

A health and safety plan that conforms to OSHA 1910.120 requirements and address the activities described in this workplan is included in Attachment D.

6.0 SCHEDULE

Begin field work . . . . . On or before February 19, 1996

Complete field work . . . . . On or before April 1, 1996

Submit report of field activities . . . . . On or before May 1, 1996

Submit risk assessment reports . . . . . On or before July 1, 1996

7.0 CERTIFICATION

Certification (signature and seal) by either a professional engineer or a geologist registered in the State of North Carolina will be included on all documents relating to assessment activities performed at this site.

8.0 ASSESSMENT REPORT

An assessment report will be prepared that includes at a minimum the information listed below:

A. Methods of Investigation

1. Narrative of investigation and variances from workplan
2. Soil, surface water, and sediment sample location map
3. Narrative of QA/QC for field and laboratory
4. Narrative on investigation derived waste management

B. Investigation Results

1. Tabulated analytical results and lab reports
2. Soil, surface water, and sediment contamination maps, if applicable

C. Notes/Photographs

1. Copies of all field logs, notes, and color copies of photographs

D. Other Information

E. Certification

FIGURES

NO.	REVISION	DATE	BY

HWY #74 BRIDGE
(0.5 MILES NORTH OF PROPERTY BOUNDARY)

AMERADA HESS
BULK PETROLEUM STORAGE FACILITY

TO ATLANTIC OCEAN
CAPE FEAR RIVER

LF1
LF2
LANDFARM
(SAMPLED BY G&M 1985–1991)
NTA
TWSB
NTB
TWSA
PRODUCTION AREA

GREENFIELD STREET
FRONT STREET
PARKING
HESS WELL
STAFF GAUGE
1985 SEDIMENT SAMPLE
CITY OF WILMINGTON PROPERTY LINE
COVERED DITCH AREA
DRAINAGE DITCH
OPTIMIST PARK
WASTE WATER TREATMENT PLANT
GREENFIELD CREEK
NOT TO SCALE
GREENFIELD LAKE DAM

MW 27 MW 6 MW18 MW 7 MW 8A MW 8 MW 9 CW 4 CW 5 B2 MW 10 CW 2 CW 3 MW 17 MW 16 MW 12 MW 11A MW 11B MW 11 MW 22A MW 13 MW 22 B3 MW 15 MW 14 MW 14A MW 26 MW 28 MW 28A MW 19A MW 19 B4 MW 23 MW 25 MW 24R MW 24A AB-24 MW 30 MW 29 MW 29A B6 MW 21 MW 20 MW 20A B5 CW 1 SS1 SS2 SS3 SS4 SS5 SS6 SS7 SS8 SS9 SS10 SS11

PACTANK BULK CHEMICAL STORAGE FACILITY

EDGE OF N.C. PORTS AUTHORITY PROPERTY
(0.5 MILES SOUTH OF GREENFIELD CREEK)

LEGEND

- PERMANENT MONITORING WELLS (35)
- STAFF GAUGE (3)
- SEDIMENT SAMPLES (12)
- CAPE FEAR SURFACE WATER SAMPLES (4)
- ABANDONED TEMPORARY MONITORING WELLS (5)
- CITY WELLS (5)
- HESS WELLS (1)
- ABANDONED MONITORING WELL (1)
- EXISTING SOIL BORINGS (92)
- PROPOSED SOIL BORINGS – 18" (78)
- PROPOSED SURFICIAL SEDIMENT SAMPLES (13)
- PROPOSED SURFACE WATER SAMPLES (5)
- LANDFARM COMPOSITE SOIL SAMPLES
  0"–3" BELOW TOP OF LANDFARM MATERIALS (2)
  6" ABOVE BASE OF LANDFARM MATERIALS (2)
  6" BELOW BASE OF LANDFARM MATERIALS (2)
  LANDFARM DIOXIN & FURAN SOIL SAMPLES 0"–6" (2)
  NOTE: LANDFARM SOIL SAMPLES WILL BE TAKEN BY COMPOSITING SAMPLES FROM A,B,C,D & E FROM EACH LANDFARM AREA (LF1 & LF2)
- SOIL SAMPLES FOR TOC (6)
  NOTE: TWO TOC SAMPLES IN PRODUCTION AREA TO BE DETERMINED DURING ASSESSMENT ACTIVITIES
- SEDIMENT SAMPLES FOR AVS–SEM ANALYSIS (9)

TWS TREATED WOOD STORAGE
NT NON–TREATED WOOD STORAGE
LF1 LANDFARM AREA 1

FIGURE 1

ViroGroup Air•Water•Soil TECHNOLOGY
ViroGroup, Inc. of South Carolina
1445 Plaugh Church Road
Lexington, SC 29072
Phone 803–957–6270
FAX 803–957–3845
Watts 1–800–786–0654

SOUTHERN WOOD PIEDMONT
WILMINGTON, NORTH CAROLINA FACILITY

PROPOSED REMEDIAL INVESTIGATION WORKPLAN ACTIVITIES

DRAWN BY:	CAB	DATE:	8/9/95
DESIGNED BY:	GBK	CADD NO:	5301901
APPROVED BY:		PROJECT NO:	12–53019.00
SCALE:	1" = 100'	SHEET NO.	OF

NO.	REVISION	DATE	BY

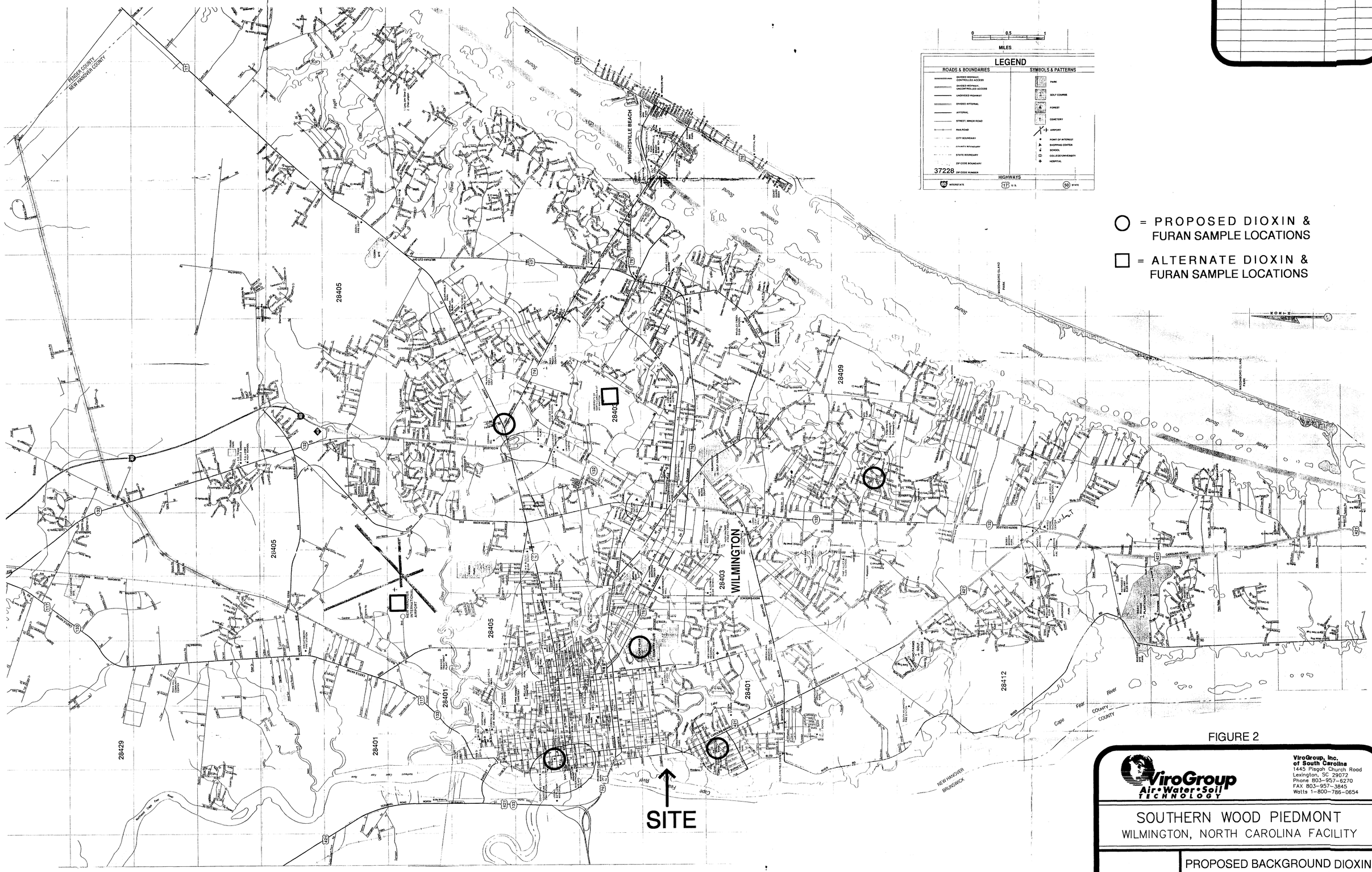

FIGURE 2

ViroGroup, Inc. of South Carolina
1445 Pisgah Church Road
Lexington, SC 29072
Phone 803-957-6270
FAX 803-957-3845
Watts 1-800-786-0654

ViroGroup Air•Water•Soil TECHNOLOGY

SOUTHERN WOOD PIEDMONT
WILMINGTON, NORTH CAROLINA FACILITY

PROPOSED BACKGROUND DIOXIN SOIL SAMPLE LOCATIONS

DRAWN BY:	CAB	DATE:	8/9/95
DESIGNED BY:	GBK	CADD NO:	5301901
APPROVED BY:		PROJECT NO:	12-53019.00
SCALE:	N.T.S.	SHEET NO.	OF

TABLES

TABLE I
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 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 4^0C. 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 1 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 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°C. The holding time before analysis will not exceed 14 days.

METALS

Arsenic (Method 7060)	Chromium (Method 6010)
Copper (Method 6010)	

NOTE: All surface water samples collected for metals will be placed into 200 ml plastic sample containers and preserved with HNO_3. 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 2
LANDFARM WOOD-PRESERVATIVE CONSTITUENT LIST
SOUTHERN WOOD PIEDMONT COMPANY, CITY OF WILMINGTON,
AND NORTH CAROLINA STATE PORTS AUTHORITY
WILMINGTON, NORTH CAROLINA FACILITY

SEMI-VOLATILE ORGANIC COMPOUNDS
USEPA METHOD 8270

Acenaphthene	Acenaphthylene
Anthracene	Benzo(a)anthracene
Benzo(b,k)fluoranthene	Benzo(a)pyrene
Benzo(g,h,i)perylene	1,1-Biphenyl
Carbazole	Chrysene
2-chlorophenol	Dibenzo(a,h)anthracene
2,4-dimethylphenol	2,4-dinitrophenol
Fluoranthene	Fluorene
Indeno(1,2,3-cd)pyrene	Naphthalene
1-Methylnaphthalene	2-Methylnaphthalene
o-Cresol	p-Chloro-m-cresol
Pentachlorophenol	Phenanthrene
Phenol	Pyrene
Tetrachlorophenol	Trichlorophenols

NOTE: Soil samples will be placed into 125-milliliter amber glass sample containers with a Teflon™ coated lid. The samples will be stored at 4°C. The holding time before analysis will not exceed 14 days.

METALS

Arsenic (Method 7060)	Chromium (Method 6010)
Copper (Method 6010)	

NOTE: Soil 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 2 cont.

NITROGEN SERIES

Total Kjeldahl Nitrogen-N (Method 351.2) Nitrate + Nitrite-N (Method 353.1)
Total Nitrogen

NOTE: Soil samples will be placed into 250-milliliter plastic sample containers. The samples will be stored at 4^0C. The holding time before analysis will not exceed six months.

NUTRIENTS

Total Phosphorus (Method 365.1) Total Organic Carbon (415.1)
Chloride (Method 325.1) pH (Method 150.1)

NOTE: Soil samples for Total Organic Carbon will be placed in 125-milliliter amber glass containers with a Teflon™ lined cap. All other soil samples will be placed into 250-milliliter plastic sample containers. The samples will be stored at 4^0C. The holding time before analysis will not exceed 6 months.

DIOXINS AND FURANS (USEPA METHOD 8290)

Dioxin and Furan samples are not routinely collected from the landfarm. Refer to the scope of work prior to collecting the dioxin and furan samples for analysis.

Refer to Site-Specific Dioxin and Furans Constituent List.

NOTE: Soil samples will be placed into 8 ounce glass sample containers. The samples will be stored at 4^0C. The holding time is 30 days before extraction and 40 days before analysis.

TABLE 3
SITE-SPECIFIC DIOXIN AND FURAN CONSTITUENT LIST
SOUTHERN WOOD PIEDMONT COMPANY, CITY OF WILMINGTON, AND NORTH CAROLINA STATE PORTS AUTHORITY
WILMINGTON, NORTH CAROLINA FACILITY

DIOXINS (USEPA METHOD 8280)

Tetrachlorodibenzodioxins (total)	TCDDs total
2,3,7,8-Tetrachlorodibenzodioxin	2,3,7,8-TCDD
Pentachlorodibenzodioxins (total)	PeCDDs (total)
1,2,3,7,8-Pentachlorodibenzodioxin	1,2,3,7,8-PeCDD
Hexachlorodibenzodioxins (total)	HxCDDs (total)
1,2,3,4,7,8-Hexachlorodibenzodioxin	1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-Hexachlorodibenzodioxin	1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-Hexachlorodibenzodioxin	1,2,3,7,8,9-HxCDD
Heptachlorodibenzodioxins (total)	HpCDDs (total)
1,2,3,4,6,7,8-Heptachlorodibenzodioxin	1,2,3,4,6,7,8-HpCDD
Octachlorodibenzodioxins (total)	OCDD

FURANS (USEPA METHODS 8280)

Tetrachlorodibenzofurans (total)	TCDFs total
2,3,7,8-Tetrachlorodibenzofuran	2,3,7,8-TCDF
Pentachlorodibenzofurans (total)	PeCDFs (total)
1,2,3,7,8-Pentachlorodibenzofuran	1,2,3,7,8-PeCDF
2,3,4,7,8-Pentachlorodibenzofuran	2,3,4,7,8-PeCDF
Hexachlorodibenzofurans (total)	HxCDFs (total)
1,2,3,4,7,8-Hexachlorodibenzofuran	1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-HxCDF
2,3,4,6,7,8-Hexachlorodibenzofuran	2,3,4,6,7,8-HxCDF
1,2,3,7,8,9-Hexachlorodibenzofuran	1,2,3,7,8,9-HxCDD
Heptachlorodibenzofurans (total)	HpCDFs (total)
1,2,3,4,6,7,8-Heptachlorodibenzofuran	1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-Heptachlorodibenzofuran	1,2,3,4,7,8,9-HpCDF
Octachlorodibenzofurans (total)	OCDF

NOTE: Soil samples will be placed into 250-milliliter glass sample containers. The samples will be stored at 4°C. The holding time is 14 days before extraction and 40 days before analysis.

NOTE: Dioxin and furan samples from the landfarm will be analyzed by Method 8290.

ATTACHMENT A

Wilmington Sampling and Analysis Plan

SAMPLING AND ANALYSIS PLAN

FOR

SOIL, SEDIMENT, AND SURFACE WATER MONITORING

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

WILMINGTON, NORTH CAROLINA

FEBRUARY, 1996

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

I. INTRODUCTION

The purpose for this protocol is to provide for the collection of representative 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 and 2 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 (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, 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 3. 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 protective covering 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 samples arrived at the laboratory.

III. 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.

IV. 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 SOIL/SEDIMENT COLLECTION SUMMARY SHEET

SOIL/SEDIMENT SAMPLE CO[illegible]CTION 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 2

STANDARDIZED SURFACE WATER SAMPLING FIELD DATA SHEET

SURFACE WATER SAMPLE FIELD DATA SHEET

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

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)

TABLE 3

CHAIN-OF-CUSTODY FORM

SL S AVNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

18157

5102 LaRoche Avenue, Savannah, GA 31404 — Phone: (912) 354-7858 — (912) 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

.YSIS REQUEST AND CHAIN OF CUSTODY RECORD

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

☐ STANDARD TAT

☐ EXPEDITED TAT *

REPORT DUE DATE _____

* SUBJECT TO RUSH FEES

AMPLING. E	TIME	SAMPLE IDENTIFICATION	AQUEOUS MATRIX	NONAQUEOUS MATRIX	OIL MATRIX	AIR MATRIX	NUMBER OF CONTAINERS SUBMITTED										

;UISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
VED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

FOR SAVANNAH LABORATORY USE ONLY

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

TABLE 4

WILMINGTON SITE-SPECIFIC AND LANDFARM
WOOD-PRESERVATIVE CONSTITUENT LISTS
AND ANALYTICAL METHODS

TABLE 4A
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 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 4^0C. 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 4A 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 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°C. The holding time before analysis will not exceed 14 days.

METALS

Arsenic (Method 7060)	Chromium (Method 6010)
Copper (Method 6010)	

NOTE: All surface water samples collected for metals will be placed into 200 ml plastic sample containers and preserved with HNO_3. 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 4B
SITE-SPECIFIC DIOXIN AND FURAN CONSTITUENT LIST
SOUTHERN WOOD PIEDMONT COMPANY, CITY OF WILMINGTON, AND NORTH CAROLINA STATE PORTS AUTHORITY
WILMINGTON, NORTH CAROLINA FACILITY

DIOXINS (USEPA METHOD 8280)

Tetrachlorodibenzodioxins (total)	TCDDs total
2,3,7,8-Tetrachlorodibenzodioxin	2,3,7,8-TCDD
Pentachlorodibenzodioxins (total)	PeCDDs (total)
1,2,3,7,8-Pentachlorodibenzodioxin	1,2,3,7,8-PeCDD
Hexachlorodibenzodioxins (total)	HxCDDs (total)
1,2,3,4,7,8-Hexachlorodibenzodioxin	1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-Hexachlorodibenzodioxin	1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-Hexachlorodibenzodioxin	1,2,3,7,8,9-HxCDD
Heptachlorodibenzodioxins (total)	HpCDDs (total)
1,2,3,4,6,7,8-Heptachlorodibenzodioxin	1,2,3,4,6,7,8-HpCDD
Octachlorodibenzodioxins (total)	OCDD

FURANS (USEPA METHODS 8280)

Tetrachlorodibenzofurans (total)	TCDFs total
2,3,7,8-Tetrachlorodibenzofuran	2,3,7,8-TCDF
Pentachlorodibenzofurans (total)	PeCDFs (total)
1,2,3,7,8-Pentachlorodibenzofuran	1,2,3,7,8-PeCDF
2,3,4,7,8-Pentachlorodibenzofuran	2,3,4,7,8-PeCDF
Hexachlorodibenzofurans (total)	HxCDFs (total)
1,2,3,4,7,8-Hexachlorodibenzofuran	1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-HxCDF
2,3,4,6,7,8-Hexachlorodibenzofuran	2,3,4,6,7,8-HxCDF
1,2,3,7,8,9-Hexachlorodibenzofuran	1,2,3,7,8,9-HxCDD
Heptachlorodibenzofurans (total)	HpCDFs (total)
1,2,3,4,6,7,8-Heptachlorodibenzofuran	1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-Heptachlorodibenzofuran	1,2,3,4,7,8,9-HpCDF
Octachlorodibenzofurans (total)	OCDF

NOTE: Soil samples will be placed into 250-milliliter glass sample containers. The samples will be stored at 4^0C. The holding time is 14 days before extraction and 40 days before analysis.

TABLE 4C
LANDFARM WOOD-PRESERVATIVE CONSTITUENT LIST
SOUTHERN WOOD PIEDMONT COMPANY, CITY OF WILMINGTON,
AND NORTH CAROLINA STATE PORTS AUTHORITY
WILMINGTON, NORTH CAROLINA FACILITY

SEMI-VOLATILE ORGANIC COMPOUNDS
USEPA METHOD 8270

Acenaphthene	Acenaphthylene
Anthracene	Benzo(a)anthracene
Benzo(b,k)fluoranthene	Benzo(a)pyrene
Benzo(g,h,i)perylene	1,1-Biphenyl
Carbazole	Chrysene
2-chlorophenol	Dibenzo(a,h)anthracene
2,4-dimethylphenol	2,4-dinitrophenol
Fluoranthene	Fluorene
Indeno(1,2,3-cd)pyrene	Naphthalene
1-Methylnaphthalene	2-Methylnaphthalene
o-Cresol	p-Chloro-m-cresol
Pentachlorophenol	Phenanthrene
Phenol	Pyrene
Tetrachlorophenol	Trichlorophenols

NOTE: Soil samples will be placed into 125-milliliter amber glass sample containers with a Teflon™ coated lid. The samples will be stored at 4°C. The holding time before analysis will not exceed 14 days.

METALS

Arsenic (Method 7060)	Chromium (Method 6010)
Copper (Method 6010)	

NOTE: Soil 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 4C cont.

NITROGEN SERIES

Total Kjeldahl Nitrogen-N (Method 351.2) Nitrate + Nitrite-N (Method 353.1)
Total Nitrogen

NOTE: Soil samples will be placed into 250-milliliter plastic sample containers. The samples will be stored at 4^0C. The holding time before analysis will not exceed six months.

NUTRIENTS

Total Phosphorus (Method 365.1) Total Organic Carbon (415.1)
Chloride (Method 325.1) pH (Method 150.1)

NOTE: Soil samples for Total Organic Carbon will be placed in 125-milliliter amber glass containers with a Teflon™ lined cap. All other soil samples will be placed into 250-milliliter plastic sample containers. The samples will be stored at 4^0C. The holding time before analysis will not exceed 6 months.

DIOXINS AND FURANS (USEPA METHOD 8290)

Dioxins and furans samples are not routinely collected. Refer to scope of work for authorization prior to collecting dioxin and furans samples. Refer to the Site-Specific Dioxin and Furans Constituent List. Analysis is by USEPA Method 8290.

NOTE: Soil samples will be placed into 8 ounce glass sample containers. The samples will be stored at 4^0C. The holding time is 30 days before extraction and 40 days before analysis.

ATTACHMENT B

HUMAN HEALTH BASED RISK ASSESSMENT

HUMAN HEALTH RISK ASSESSMENT
SCOPE OF WORK FOR THE FORMER SOUTHERN WOOD PIEDMONT
WILMINGTON, NORTH CAROLINA SITE

1.0 INTRODUCTION

On behalf of Southern Wood Piedmont (SWP), the ChemRisk® Division of McLaren/Hart, Inc., has prepared the following Human Health Risk Assessment (HHRA) Scope of Work (SOW) to characterize potential risks to humans exposed to chemicals of potential concern (COPC) in the various environmental media located at or near the Wilmington, North Carolina Facility Site. This SOW specifically addresses potential future risks to human health associated with COPC at the site after it has undergone industrial redevelopment. As described in the RI Workplan, the likely remedial alternative will include covering the landfarm area with an impervious surface.

A risk assessment addressing current site conditions was previously completed by Geraghty & Miller (1993a). The human health risk assessment addressing potential future uses of the site will conform to the framework established by the National Academy of Sciences (NAS) in 1983 and subsequently adopted by the EPA (1987). Site-specific data and the most recent and accepted advances in the science will be incorporated into the risk assessment consistent with EPA guidelines (1992a; 1995). The assessment will include the following four components: Hazard Identification, Toxicity Assessment, Exposure Assessment, and Risk Characterization.

The HHRA will determine the potential human receptors of chemicals in various media and evaluate exposure pathways consistent with projected future use scenarios. Quantitative and qualitative estimates of risk to human receptors will be developed based on the potential uptake of COPC via exposure pathways. The risk characterization will focus on identifying and quantifying the relative contribution of COPC to the receptors of concern for the primary exposure pathways. In addition to characterizing potential risks, the risk assessment will provide key information, including the following:

- Evaluation of the number and types of COPC and their relative contribution to the overall risk to human receptors;

- Identification of those human populations for which the risks may be greatest, based on their behavior, location, and potential for exposure;

- Identification of the media, exposure pathways, and locations that hypothetically may contribute the most to human health risks; and
- Evaluation of the risks from selected chemicals on-site after redevelopment has occurred, as well as possible exposure to COPC in sediment and surface water on-site and adjacent to the site (i.e.,., Cape Fear River, Greenfield Creek, and on-site drainage ditch).

2.0 HAZARD IDENTIFICATION

The primary objective of Hazard Identification is to determine which data are most appropriate for use in the risk assessment and identify COPCs for human receptors.

2.1 SUMMARY AND EVALUATION OF AVAILABLE INFORMATION

Available chemical data pertaining to sediments, soils, biological tissue, and surface water from the site will be compiled and evaluated. The primary objectives of the data evaluation are to determine which data will be used in the risk assessment.

2.1.1 Sources of Information

Sources of information on site soil, sediment, groundwater, and surface water include: the Risk Assessment Report for Landfarm Areas (Geraghty & Miller, 1993a); Data Summary Report for the Treated and Non-Treated Wood Storage Areas Soil Investigation (Geraghty & Miller, 1993b); Phase III Groundwater Quality Assessment (ViroGroup, 1994); and the State of North Carolina Site Inspection Prioritization report. Each of these resources will be consulted in conducting the Site HHRA. In addition, ChemRisk will incorporate all relevant sampling data proposed by ViroGroup in this site Investigation Workplan.

2.1.2 Procedures for Data Quality Assessment

Data from the aforementioned sources will be evaluated in accordance with relevant EPA guidance on assessing data quality for risk assessment purposes (EPA 1987, 1992b), to determine whether

the information contained therein should be included in the HHRA. Datasets that were not evaluated using EPA QA/QC protocols will be identified.

Soil, sediment, and water quality datasets from the different sampling programs will be evaluated for compatibility and for use in the risk assessment through consideration of the following elements:

- analytical methods employed and analytes reported;
- quantitation/detection limits;
- data presentation (dry weight, wet weight);
- sample depth;
- consistency of QA/QC procedures (such as following SOPs, analysis of matrix spikes and duplicates, documentation, holding times, etc.); and
- sample location (method and accuracy).

2.2 Identification of Chemicals of Potential Concern

Based on the data evaluation, a preliminary list of COPCs will be compiled. The list will contain all chemicals that were detected in soils, sediments, groundwater, and surface water. The list of preliminary COPCs will undergo several screens (consistent with EPA protocol as noted below) to eliminate chemicals that are easily identified as posing no risk to human health. The chemicals that are not screened out will then become COPCs to be addressed in the risk assessment.

Guidance on the selection of chemicals of potential concern for Superfund sites is presented in the EPA's *Risk Assessment Guidance for Superfund Volume I, Human Health Evaluation Manual (Part A) – Interim Final* (RAGS) (EPA, 1989a). As indicated in RAGS, there are several options for reducing the number of chemicals to be carried through the quantitative risk assessment, once the data quality assessment is complete. The options that will be used in this assessment are: 1) evaluate frequency of detection; 2) evaluate essential nutrients; and 3) use a concentration-toxicity screen (EPA, 1989a).

2.2.1 Frequency of Detection

The first option for reducing the number of chemicals quantitatively evaluated in the HHRA is the frequency of detection assessment. This consists of eliminating all chemicals from further consideration that are detected in fewer than 5 percent of the samples for which they were analyzed (EPA, 1989a).

2.2.2 Evaluation of Essential Nutrients

The second screen is the essential nutrient evaluation. According to EPA (1989a), compounds that are essential human nutrients and are toxic only at very high doses may be eliminated from the quantitative human health risk assessment.

2.2.3 Concentration–Toxicity Screen

The final screen is the concentration–toxicity screen. It will be conducted to screen out chemicals that are unlikely to contribute significantly to the total risk associated with exposure to chemicals in various media at the Site. To conduct the screen, "risk factor" scores will be calculated for chemicals (other than the essential human nutrients) for which toxicity values can be obtained. Consistent with EPA guidance (EPA, 1989a), and as discussed further in the Section 3.0 Toxicity Assessment, toxicity values for use in this assessment will be obtained from the following sources (in descending order of preference): Integrated Risk Information System (IRIS), Health Effects Assessment Summary Tables (HEAST), EPA criteria documents, and the Environmental Criteria and Assessment Office of the EPA (ECAO) [recently renamed as the National Center for Environmental Assessment (NCEA)]. Chemicals for which no toxicity values are available will be retained in the analysis for further evaluation.

2.3 Identification of Potential Human Receptors

Populations potentially exposed to contaminated media will be identified, based on an understanding of the potential future uses of the site, the drainage ditch, Greenfield Creek, and the Cape Fear River. It is anticipated that the primary human receptors will include the following activity groups: trespassers, construction/utility repair workers and recreational anglers. All other potentially exposed populations will be evaluated for inclusion in the HHRA.

3.0 TOXICITY ASSESSMENT

Toxicity assessment is defined by EPA (1989b) as the evaluation of the degree and type of health hazards known or believed to be associated with exposure to a particular chemical. In this section, toxicological profiles will be prepared for each COPC, and relevant dose-response information will be evaluated. Dose-response assessment is identified by EPA (1989b) as the relationship between the magnitude of exposure and the probability of a given health effect occurring.

3.1 TOXICOLOGICAL PROFILES

Consistent with EPA guidance (EPA 1989b), a succinct toxicological profile will be prepared for each COPC. Included within each toxicological profile will be a summary of the relevant laboratory animal studies and epidemiologic studies considered by the EPA for determining reference doses (RfDs), cancer slope factors (CSFs), and carcinogen classification, as well as information on the sources and fate and transport behavior of COPCs. Current toxicological data with relevance to regulatory criteria or toxicity values will be considered during the hazard identification process.

3.2 DOSE-RESPONSE ASSESSMENT

Chemical toxicity values for human health risk assessment, including RfDs for noncarcinogenic effects and CSFs for carcinogenic effects, will be evaluated for each COPC in accordance with EPA guidance (EPA 1989b). Sources of toxicity information will be: (a) Integrated Risk Information Service (IRIS); (b) Health Effects Assessment Summary Tables (HEAST); and (c) consultation with EPA's Environmental Criteria and Assessment Office (ECAO). Toxicity equivalency approaches to assessing specific chemical groups will be considered when applicable (EPA 1989c). In addition to those provided by the sources referenced above, alternative toxicity values will be identified or derived in accordance with EPA guidance (1993). Alternative toxicity values that are adopted in the risk assessment will be supported by recent scientific evidence and discussed with EPA and North Carolina DEHNR prior to use.

4.0 EXPOSURE ASSESSMENT

Exposure assessment is the process of measuring or estimating the intensity, frequency, and duration of human or animal exposure to an agent present in the environment or of estimating hypothetical exposures that might occur from the release or presence of chemicals in the environment (NAS 1983). Consistent with EPA guidance (EPA 1989b, 1989c, 1991, 1992a), the exposure assessment will describe the magnitude, duration, and route of potential chemical exposures; the size of the potentially exposed human population; and the uncertainties inherent in all estimates (NAS 1983; EPA 1992a). In this section, a conceptual site model (CSM) will be developed to clearly illustrate the inter-relationships between environmental contamination, exposure pathways, and potential receptors.

4.1 RECEPTOR PATHWAY ANALYSIS

The primary receptor populations identified for the site include:

- A trespasser, who may contact COPC in surface soils and sediment;
- Construction/Utility Repair workers, who may contact COPC in surface and subsurface soils and in groundwater during repair activities; and,
- Recreational anglers, who may be exposed to site-related COPC in fish and shellfish

Potential pathways of human exposure to COPC in site media to be confirmed include:

Soils

- incidental ingestion of soils (trespassing or construction activities)
- dermal contact with soils (trespassing or construction activities)
- inhalation of air-borne soil particles (construction activities)

Groundwater

- dermal contact and inhalation of COPC in groundwater (construction activities)

Surface Water

- incidental ingestion of surface water (recreational activities)
- dermal contact with surface water (recreational activities)

Sediments

- incidental ingestion (trespassing or construction activities)
- dermal contact with sediments (trespassing or construction activities)

Edible Biota

- consumption of fish and shellfish (recreational angler)

Exposure pathways will be evaluated consistent with EPA guidance (1989b). A complete human health exposure pathway should include the following elements:

- a source and mechanism of chemical release to the environment;
- an environmental transport medium (e.g., groundwater, sediment);
- a point of potential human contact with the medium; and
- a human exposure route at the contact point (e.g., ingestion, dermal contact).

4.2 Development of Conceptual Site Model

The conceptual site model (CSM) will summarize the information on location and concentrations of COPCs, exposure pathways, and receptors, in order to clarify potential interactions. A diagram will be developed that portrays the relationships between:

- location of contamination;
- contaminant types and concentrations;
- potentially contaminated media;
- migration pathways;
- exposure pathways; and
- potential human receptors (EPA, 1993c).

4.3 Exposure Point Media Concentrations

Direct exposure to chemicals in soils, sediments, groundwater, and surface water will be assessed using measured concentrations of COPCs in the various media. Indirect exposure to chemicals through ingestion of biota will be assessed by estimating fish and shellfish tissue concentrations by application of measured COPC concentrations in sediments to empirical and mechanistic models. Mechanistic models (e.g., a bioenergetics-based food web model by Thomann et al. (1992) may be used to estimate organic chemical and organometal concentrations, while ratios of chemical concentrations in sediment and biological tissues (i.e., BAFs) based on the scientific literature may be used to estimate metal concentrations. The exposure assessment will be conducted using chemical data in edible portions of fish (e.g., fillets) and shellfish (e.g., crab muscle).

4.4 Quantification of Potential Exposure

The goal of this task is to use information gathered in the preceding sections relating to the potentially exposed populations, exposure pathways, exposure points, and exposure point concentrations, in order to develop exposure scenarios and estimated intakes resulting from exposures under future uses at the Site. The quantification of potential exposure will be performed in accordance with EPA guidance (1989b, 1989c, 1992a, 1992c, 1995). Cancer risk and non-cancer hazard will be estimated for the typically exposed individual (central tendency estimate) and for a high-end exposed individual (HEE) in conformity to EPA guidelines (1995).

Quantitative exposure assessment requires the estimation of intakes for each significant chemical and exposure route. To estimate such intakes, it is necessary to determine values for all relevant exposure parameters. This involves the determination of such values for the exposure parameters that are common to all or most exposure scenarios and for those that are specific to particular exposure scenarios. Every effort will be made to tailor estimates of exposure parameter values to the predicted future conditions so that they are specific to the site. Site-specific parameters may be derived from a number of different sources, including federal, state, and local government agencies, scientific literature, and original sampling and surveying.

5.0 RISK CHARACTERIZATION

The primary objective of risk characterization is to integrate the dose-response assessment and exposure assessment into quantitative and qualitative expressions of potential carcinogenic and noncarcinogenic health risks. Potential noncarcinogenic effects will be characterized by comparing estimated intakes of COPCs to identified toxicity values. Potential carcinogenic effects will be characterized as probabilities that an individual will have an incremental risk of developing cancer over a lifetime of exposure, based on predicted intakes and dose-response information. A second objective of risk characterization is to qualitatively and/or quantitatively address the sources of uncertainty in the assessment of potential human health risks, as well as the likely impact of each source of uncertainty on the risk results.

The risk characterization will include: (1) quantification of potential carcinogenic risks and noncarcinogenic hazards for each exposure scenario; (2) presentation of uncertainty and conservatism of each element of the risk assessment; and (3) assessment of relative importance of Site risks.

5.1 CARCINOGENIC AND NONCARCINOGENIC RISKS

Consistent with EPA guidance (1989b), risk estimates and hazard indices will be evaluated and presented in the risk assessment. Upper-bound incremental lifetime cancer risks associated with human exposure to COPCs at the Site will be estimated. Consistent with EPA guidance (1989b), cancer risks will be calculated by multiplying chemical-specific exposures, expressed as chronic daily intakes (CDIs), by corresponding CSFs:

$$\text{Risk} = \text{CDI} \times \text{CSF}$$

where,

Risk = Lifetime incremental cancer risk (unitless);
CDI = Chronic daily intake (mg/kg-day); and
CSF = Cancer slope factor $(\text{mg/kg-day})^{-1}$.

Cumulative cancer risks will be estimated for chemical carcinogens.

Noncarcinogenic effects will be evaluated by comparing an exposure level over a specified time period with a reference dose derived for a similar time period; this ratio is called a hazard quotient (EPA 1989b). The hazard quotient is based on the toxicological premise that there is a level of exposure (i.e., the RfD) below which adverse health effects are unlikely to occur (EPA 1989b). The hazard quotient is expressed as follows:

$$\text{Hazard Quotient} = \text{NCDI} / \text{RfD}$$

where,

Hazard Quotient	=	Ratio of estimated exposure to acceptable exposure;
NCDI	=	Noncancer chronic daily intake (mg/kg-day); and
RfD	=	Reference Dose (mg/kg-day).

Cumulative hazard indices for noncarcinogenic chemicals will be estimated for common target organs and critical toxic effects, as recommended by EPA (1989a).

5.2 Uncertainty Analysis

Sources of uncertainty in the human health risk assessment will be presented, including a qualitative discussion of the uncertainties in the various exposure assumptions and toxicological parameter values and their influence on the theoretical risks and hazards (EPA, 1989b). If deemed necessary, a probabilistic risk evaluation may be implemented at this point in the assessment in order to provide supplemental information regarding the distribution of potential exposures and corresponding risks as a result of interpersonal and other variability in the exposure parameters.

5.3 Perspective on Site Risks

Cancer risk estimates will be compared to the range of acceptable risk levels (10^{-6} to 10^{-4}) supported by the EPA (1990) for CERCLA sites. The range of risk estimates for the site will also be compared to everyday risks considered to be acceptable by society.

6.0 REPORT PREPARATION

Results of the human health risk assessment will be presented in a fully-referenced, stand-alone report. All calculations will be included in the Appendices of the report to enable the reviewer to recreate calculations if necessary.

7.0 PROJECT TEAM

As shown on the attached organizational chart, ChemRisk will dedicate an experienced project team to ensure that the human health risk assessment is implemented in an efficient, effective manner. Resumes of all key technical staff are contained in ChemRisk's Statement of Qualifications.

8.0 REFERENCES

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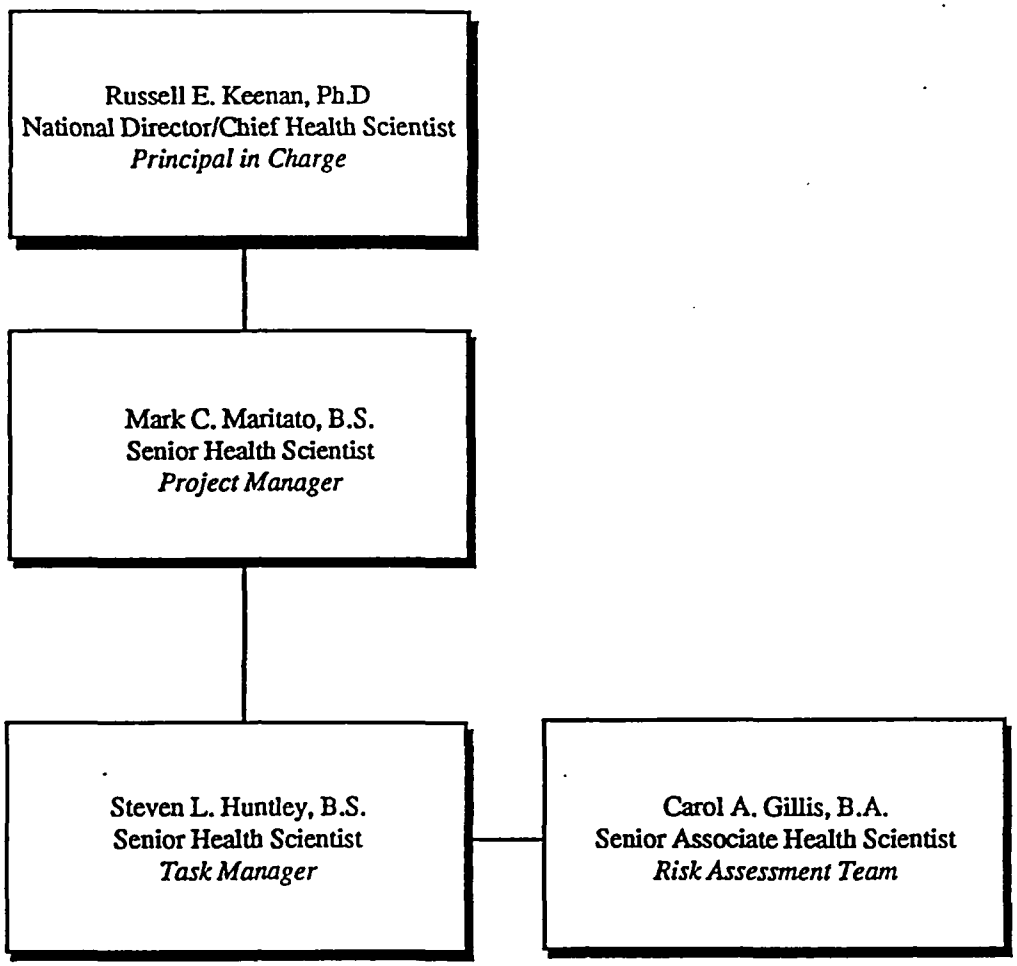
ORGANIZATION CHART FOR HUMAN HEALTH ASSESSMENT TEAM



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ATTACHMENT C

ECOLOGICAL BASED RISK ASSESSMENT

ECOLOGICAL RISK ASSESSMENT
SCOPE OF WORK FOR THE FORMER SOUTHERN WOOD PIEDMONT WILMINGTON, NORTH CAROLINA SITE

INTRODUCTION

On behalf of Southern Wood Piedmont Company, ChemRisk®, the human health and ecological risk assessment division of McLaren/Hart Inc., has prepared the following ecological risk assessment Scope of Work (SOW) as a component of the site Remedial Investigation Work Plan. Consistent with EPA Guidance (1989a,b, 1991a, 1992a, 1993a,b, 1994a), and with the goals of this Scope of Work, the Ecological Risk Assessment (ERA) will determine the primary ecological receptors exposed to compounds in various environmental media located at or near the Wilmington, North Carolina site. To that end, an evaluation of potential ecological receptors and exposure pathways will be performed. Quantitative and qualitative estimates of risks to ecological receptors will be generated based on the potential uptake of compounds via sediment and water ingestion through derivation of a site-specific food web analysis. The risk characterization will identify and quantify the relative contribution of compounds in various environmental media to the receptors of concern for the primary exposure pathways. In addition to the characterization of potential risks, the ecological risk assessment will provide the remedial decision-maker with several key pieces of information, including the following:

- Evaluation of the number and types of compounds, as well as other physico-chemical stressors, and their relative contribution to the overall risk to ecological receptors;

- Identification of ecological receptors for which the risks may be greatest, based on their behavior, location, and potential for exposure;

- Identification of the media, exposure pathways, and locations that are hypothesized to contribute the most to ecological risks; and

- Evaluation of the risks from compounds attributable to historical and present site use.

A baseline ecological risk assessment will be performed to evaluate the potential impacts of Compounds of Potential Concern (COPCs) and other stressors on key organisms at the site. The primary objectives of the ecological risk assessment are to: (1) utilize the available sediment and water quality data, other available literature, and unpublished environmental data to characterize potential impacts to key organisms posed by physical and chemical stressors at the site and (2) identify data gaps, if any, in the available site-specific literature regarding current or past environmental conditions in the river, particularly those which may affect the exposure of key organisms to compound and water quality stressors.

The EPA (1992b) recommends conducting assessments of ecological risks in three stages, consisting of 1) Problem Formulation, 2) Analysis, and 3) Risk Characterization. During Problem Formulation, potential exposures and effects are preliminarily characterized and site-specific factors that define the feasibility, scope and objectives of the ecological risk assessment are presented (EPA 1991b, 1992b). Completing the problem formulation stage will assist in the development of the conceptual model for implementing the ecological risk assessment for the site.

The problem formulation stage of the risk assessment will involve ecosystem and stressor characterizations of the site (Section 1.0) which will be accomplished through an evaluation of available historical literature and reconnaissance surveys, the results of a site biological and habitat surveys, available published and unpublished data reports, and supporting materials such as aerial photographs and maps. The results of the literature evaluations and site biological and habitat surveys will be used to select key organisms at the site and to construct a food web (Section 2.0). In addition, changes in the ecology of the site will be evaluated in relationship to historical ecosystem stressors and changes in the ecological community.

Consistent with the Analysis element of EPA's framework (1992b), a technical evaluation will be performed on the potential effects related to exposure to the environmental stressors (in this case, compounds in sediments and water and physical stressors). The analysis will consist of an exposure assessment and ecological effects assessment, as described in Sections 3.0 and 4.0, respectively.

Consistent with the third element of EPA's framework (1992b), Risk Characterization (Section 5.0), the results of the analysis will be used to assess the likelihood of adverse impacts resulting

from the exposure of key organisms to environmental stressors at the site (EPA 1991b, 1992b). The risk characterization will also include a summary of assumptions used, scientific uncertainties, and strengths and weaknesses of the analysis (EPA 1989a, 1991b, 1992b).

1.0 IDENTIFICATION OF COMPOUND AND WATER QUALITY STRESSORS

In this phase of the project, ChemRisk will compile and evaluate the available data obtained through sampling sediment and surface water at the drainage ditch, in Greenfield Creek, and from the Cape Fear River. The primary objectives of the data evaluation are to (a) determine which data are most appropriate for use in the ecological risk assessment, (b) identify significant data gaps, if any, (c) screen the data with respect to its relative risk potential (i.e., concentration-toxicity) and sediment and water quality guidelines, and (d) identify compounds of potential concern (COPCs) for ecological receptors.

Sources of information on sediment and water quality stressors include existing data on compounds detected in sediment, water, and biota from the site during previous sampling programs. Biological and water quality data will be derived from habitat surveys, scientific literature, government reports, and computerized databases (i.e., EPA STORET, etc.).

1.1 Summary and Evaluation of Available Compound Data

Available site sampling data will be evaluated utilizing relevant EPA guidance on data quality for risk assessment purposes (EPA 1987, 1992c) to determine whether the information contained therein should be included in the risk assessment. Datasets that are not evaluated using EPA Region IV QA/QC protocols will be discussed and characterized in the text.

During the implementation of the ecological assessment for the site, the data from different sampling programs will be reviewed to evaluate its compatibility for use in the risk assessment. Sediment and water quality datasets from the different sampling programs will be evaluated for use in the risk assessment through consideration of data compatibility in the following areas:

- analytical methods employed and analytes reported;
- quantitation/detection limits;

- data presentation (dry weight, wet weight)
- sample depth (grouping of data)
- consistency of QA/QC procedures (such as following SOPs, analysis of matrix spikes and duplicates, etc.); and,
- sample location (method and accuracy).

Biological datasets (if available) will be evaluated for compatibility in the following areas:

- analytical methods employed and analytes reported;
- quantitation/detection limits;
- species analyzed;
- tissues analyzed;
- data presentation (dry weight, wet weight, lipid normalized);
- season of sample collection;
- sample location (method and accuracy); and,
- consistency of QA/QC procedures.

Consistent with EPA guidance (EPA 1989c), the site will be evaluated based on the likely exposure area(s) for the potentially exposed populations. It is believed that, as a result of this evaluation, the site will be defined as a single exposure area for the following ecological considerations. Aquatic organisms such as fish and crabs are mobile and, therefore, are exposed to the range of chemical concentrations in surface sediments, water, and biota (including benthic invertebrates) throughout the Study Area and beyond. Data distributions will be developed for the entire site to estimate exposures of fish and other key organisms to compounds of potential concern.

1.2 Criteria for Selection of Compounds of Potential Concern (COPCs)

Data determined to be of sufficient quality for use in the ecological risk assessment will be evaluated utilizing guidance provided by EPA (1989b). Based on this evaluation and, consistent with EPA guidance (EPA 1992c), the preliminary COPCs for possible inclusion in the ecological risk assessment will include:

- inorganic chemicals, other than those that are considered essential nutrients for ecological receptors; these include calcium, sodium, magnesium, and potassium, and;
- organic compounds that have been detected in the existing databases from the site.

For the baseline ecological risk assessment, the list of preliminary COPCs will be compared to available sediment and water quality guidelines to determine a final list of COPCs for the ecological assessment. These guidelines will include, but are not limited to National Oceanic Atmospheric Administration's ER-M/ER-Ls, Washington State's Apparent Effects Threshold (AET), and EPA's ambient water quality guidelines. Consistent with EPA guidance (EPA 1989a, 1992b), state or federal sediment and/or water quality criteria will be included in the COPC screening analysis.

For the ecological screening analysis, the 95% upper confidence limit of the mean concentrations for COPC at the site will be used as exposure point concentrations. Tables will be used to present the site data, the screening values, and the comparisons of the site data to the screening values for each media in the Draft ERA report.

1.3 Assessment of Bioavailability

In addition to comparing site sediment data with the existing guidelines described in Section 1.2, an additional task to further evaluate the selection of COPCs will involve an assessment of bioavailability. This assessment will follow the approach as outlined by EPA (1994b) for estimating the concentration of bioavailable metals in sediments based on equilibrium partitioning (EqP) theory. The approach is premised on the observation that many metal ions form sulfides and organic complexes that make them unavailable to biota and hence non-toxic. As described by EPA (1994) by measuring the concentration of acid volatile sulfides and simultaneously extractable metals (AVS/SEM) in sediments, and deriving an SEM:AVS ratio, a prediction can be made as to the availability and, thus, toxicity of selected metals at the site. Similarly, total organic carbon (TOC) analyses conducted on site sediments will provide additional information regarding the potential bioavailability of volatile constituents at the site.

2.0 CHARACTERIZATION OF THE ECOLOGICAL COMMUNITY

An ecological inventory of the site will be prepared from the available information, such as: (a) data from technical reports, Masters' and Doctoral theses, and available maps and charts; (b) scientific literature on regional and local ecological resources; (c) documented occurrences of state and federal threatened and/or endangered species; and, (d) the results of a site biological and habitat survey. The ecological inventory will identify finfish, shellfish, plankton (phytoplankton and zooplankton), benthic invertebrates, mammals, and fish-eating birds that occur or may be present at the site. Data on the seasonal distributions of species at the site will be evaluated. The inventory will be used to identify key organisms, and to construct an aquatic food web for the site.

2.1 SUMMARY AND EVALUATION OF AVAILABLE ECOLOGICAL INFORMATION

Three categories of information will be collected for the ecological inventory: (1) physical habitat data; (2) ecological community data; and (3) reported occurrences of state or federal threatened or endangered species.

Information on the physical characteristics of the site ecosystem, including hydrography, surrounding land use, and the presence and extent of aquatic and wetland habitats will be obtained. Potential sources of information will include U.S. Geological Survey (USGS) and National Oceanic and Atmospheric Administration (NOAA) maps and charts, available aerial photography, and available engineering and technical reports prepared by the U.S. Army Corps of Engineers (USACE) and other sources from historical studies performed on the Cape Fear River. Presumably, no habitat assessments have been conducted in Greenfield Creek or the drainage ditch area at this time, although there has been some work done in several other marsh creeks along the Cape Fear River (Weinstein, 1979; and Weinstein et al., 1980).

Information on the terrestrial and aquatic ecological communities at the site will be obtained from technical reports and databases, Masters' and Doctoral theses, published and unpublished scientific data, and habitat and environmental resource maps prepared from historical studies of the Cape Fear River. In addition, an ecological survey will be performed on Greenfield Creek and the ditch area. The survey will be conducted to quantify and characterize the available ecological habitats, and identify the fish and invertebrate species that exist on-site. The results of this survey will be

compiled and evaluated, and will be submitted to EPA with the Draft ERA report. In addition to both site-specific data and data pertaining to the Cape Fear River, any other regional studies that address relevant habitats will be considered to support the potential distributions of key migratory species that potentially occur at the site.

Information on the presence of either state or federal threatened or endangered species at the site will be obtained. Potential sources of information will include the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR), the U.S. Fish and Wildlife Service (USFWS), and the National Marine Fisheries Service (NMFS). The locations of any noted occurrences of state or federal threatened or endangered species will be identified on a map of the site.

2.2 Criteria for the Selection of Key Organisms

Datasets that are identified for possible use in the baseline ecological risk assessment will be evaluated for their scientific integrity. Evaluative criteria will include, but will not be limited to, acceptability of the collection and analytical methodologies, appropriateness of the sampling plan and technique, areal and seasonal extent of sampling, and date of the sampling event.

Only data that adheres to acceptable scientific procedures and guidelines (i.e., EPA or standard scientific field and laboratory protocols) in terms of data collections techniques, laboratory QA/QC, and data presentation, will be used in the baseline ecological risk assessment. Any deviations from available EPA collection and analytical protocols, or QA/QC procedures will be specified in the Draft ERA report.

Where allowed by the quantity and quality of the available datasets, the ecological community data will be subjected to statistical analyses to calculate quantitative indices of diversity. In addition, an assessment of species abundance will be performed and, where possible, estimates of biomass for various species will be determined. If statistical analyses cannot be performed using the available data, then a qualitative evaluation of species diversity and abundance will be conducted. In addition to the site-specific data, pertinent regional ecological data will be evaluated for the purpose of providing supporting information regarding the migratory species that could occur at the site, and as general background information on the regional ecology.

The ecological inventory, together with the results of the species diversity and abundance analyses, will be evaluated to determine the trophic structure of the food web at the site. The inventory will be broken down by primary trophic levels, with each species, genera or family being assigned to its respective position (i.e., trophic level) in the food web. The exposure pathways information and trophic level data will then be evaluated in conjunction with the physical and habitat data, as well as species diversity and abundance data, to select the key organisms in the food web at the site.

Consistent with EPA guidance (1989a, 1991a, 1992a,b), key organisms will include: (a) resident organisms subject to the greatest exposure to potentially affected media; (b) species considered to be essential to, or indicative of, the normal functioning of the existing habitat; and (c) federal or state threatened or endangered species that occur at the site. Key organisms will be selected for each primary trophic level that is identified at the site based on species abundance and dominance at their respective trophic levels. Seasonal distribution patterns for resident and migratory species will also be considered in the selection of key organisms. In addition, sensitive life stages of ecological receptors that may be more vulnerable than adults to COPCs will be identified and considered in the selection of key organisms.

2.3 Construction of Site-Specific Food Webs

Consistent with EPA guidance (1989a), a simplified food web will be constructed which links the key organisms from each trophic level based on the transfer of energy, nutrients, and compounds. The objectives of establishing a food web are to: (a) describe the feeding interactions of the species at the site, and (b) establish the pathway for the transfer of sediment-associated compounds from the benthic invertebrates in contact with contaminated sediments to selected organisms at higher trophic levels. Consistent with EPA guidance (1989a), the food web will serve as the basis for predicting exposures of key organisms to COPCs as a result of uptake from sediment, water, and food sources.

3.0 EXPOSURE ASSESSMENT

Consistent with EPA guidance (1989a, 1992b), the exposure assessment will integrate information on the ecological community and COPCs, in order to quantify potential exposure of the key organisms to compounds in the sediments and surface water from the site. As detailed below, potential exposure pathways for key organisms will be identified and analyzed through a food web exposure analysis.

The food web exposure analysis will be conducted using conservative exposure assumptions for key organisms based on exposure point concentrations using the Arithmetic Mean and 95% UCL of COPC concentration in site sediments. The EPA Wildlife Exposure Factors Handbook (EPA 1993c) will be consulted in addition to all available literature regarding the exposure factors for the key organisms identified at the site.

3.1 IDENTIFICATION AND EVALUATION OF POTENTIAL EXPOSURE PATHWAYS FOR KEY ORGANISMS

Consistent with EPA guidance (EPA 1989a, 1992a), exposure pathways for key organisms will be evaluated. A complete ecological exposure pathway should include the following elements:

- a source and mechanism of stressor release to the environment
- an environmental transport medium (e.g., water, sediment)
- an exposure route at the contact point which provides the interface for uptake of the stressor by the ecological receptor. Ingestion, dermal contact, and inhalation are typical routes of exposure.

For each key organism identified, potential exposure pathways will be listed and evaluated for completeness and likelihood of occurrence. The ERA will consider compound exposure at the site related to surface water, biota, and sediments. Potential pathways of ecological exposure to compounds in these media include ingestion or dermal contact with surface water and sediments, and consumption of biota. Upon completing the evaluation of potential exposure pathways, each complete pathway will be examined through a food web exposure analysis. Although the food

web for the site cannot be determined prior to conducting the baseline ecological risk assessment, it is likely that any of the following representatives may be present at the site:

- Plankton;
- Benthic invertebrates;
- Detritovorous or omnivorous crustaceans (crabs and/or shrimp);
- Forage Fish; and
- Predatory Finfish and Crustaceans.

3.2 DEVELOPMENT OF SITE CONCEPTUAL MODEL

The major focus of the conceptual model as described by EPA (1992b), is to develop a series of working hypotheses regarding how the stressor might affect ecological components of the natural environment (NRC, 1986). In developing a conceptual model, several factors are considered including: a preliminary analysis of the ecosystem, specific habitats, identification of key organisms, stressor characteristics, and ecological effects to organisms. The conceptual model serves to track the compound stressors or COPCs through environmental transport pathways and through the food web to the organisms that could potentially be exposed.

4.0 ECOLOGICAL EFFECTS ASSESSMENT

Consistent with relevant EPA guidance (EPA 1989a, 1991a, 1992b), the relationships between the COPCs in sediment, surface water, and key organisms, and the potential ecological effects under consideration will be evaluated. Ecological effects under consideration will include increased mortality, impaired growth and development, and impaired reproductive success. The latter will be evaluated in the context of potential population-level effects.

The objective of the assessment will be to identify toxicological criteria for comparison to the tissue concentrations estimated from the food web exposure analysis. To that end, and consistent with EPA guidance (EPA 1989a, 1991a, 1992b), completion of the assessment will entail: synthesis of ecotoxicity information from the literature, including results of field and laboratory studies, and evaluation of quantitative structure activity relationships (QSARs); identification of ecotoxicological criteria for key organisms, including tissue-residue based toxicological guidelines; and a comparison of the toxicities of COPCs.

4.1 Identification and Evaluation of Ecotoxicological Criteria for Key Organisms

Consistent with relevant EPA guidance (EPA 1989a, 1992a), available toxicity information for the COPCs and key organisms will be compiled and evaluated, in order to select the most appropriate criteria for evaluating potential ecological effects associated with existing concentrations of COPCs at the site. The endpoints to be considered will include, but will not be limited to mortality, impaired growth and development, impaired reproductive success, alterations in species abundance and diversity, and subsequent alterations in ecological community structure. Consistent with EPA guidance (EPA 1992a), ecotoxicological data including, but not limited to tissue-residue and histopathological data, will be evaluated by considering the relevance to the selected endpoints.

The range of effects concentrations compiled from the literature for each compound or groups of compounds will be extracted and tabulated. Appropriate effect concentrations (i.e, no observable adverse effects levels; NOAELs) that are relevant to the key organisms at the site will be tabulated and used in the ecological risk characterization. The use of any surrogate values in the absence of NOAELs will be noted and discussed.

5.0 ECOLOGICAL RISK CHARACTERIZATION

In the risk characterization, the measurement endpoint results will be evaluated to determine whether a significant risk is present for each assessment endpoint. The data generated during the analysis phase will be evaluated in the context of hypotheses developed during the problem formulation phase.

5.1 Characterization of Ecological Risks

Consistent with EPA guidance (1989a, 1992b), the ecological effects data (i.e., NOAELs) for each COPC will be compared to the actual or predicted tissue concentrations for each of the key organisms at the site. Ecotoxicological quotients (EQs) will then be calculated for each COPC and key species. Consistent with EPA guidance (1989a), the EQ is defined as the concentration of the COPC in the key organisms, divided by the ecotoxicological effects concentration. In general, an EQ that is greater than one is indicative of potential risks to ecological receptors (EPA 1989a).

The EQs derived for each compound and key organism will be totalled and presented as a hazard index. In addition, the EQs for each COPC will be quantitatively compared and ranked for each key organism. The results will be used to characterize the potential risks to key organisms from the various COPCs. The risk characterization will also include a summary of assumptions used, scientific uncertainties, and strengths and weaknesses of the analysis (EPA 1989a, 1992b). The uncertainties associated with this type of assessment will be discussed in Section 5.2 of the ERA.

5.2 Uncertainty Analysis

An uncertainty analysis will be conducted to assess the confidence associated with the results of the risk characterization. When possible, quantitative measures of uncertainty will be estimated. The most significant sources of uncertainty will be identified relative to assumptions made in the development of the conceptual model, the collection and relevance of historical data, and inherent variability of biological and compound processes. A discussion focusing on the potential influence of uncertainty on the overall risk assessment will be described in the ERA.

5.3 Perspectives on Site Risks

All estimates of ecological risks and uncertainty will be summarized as a discussion, with an emphasis on providing results that present adequate information for risk management decision-making. A weight-of-evidence approach will be used to summarize ecological risk, and the information will be presented in a clear, concise manner. Weight-of-evidence refers to the process of quantitatively or qualitatively integrating independent measurement endpoints and other corroborative information to the assessment endpoint. If applicable, and as part of the weight-of-evidence approach, case studies will be used to support conclusions summarized in this section. Finally, recommendations for future evaluations of existing data (or the need for collecting additional data), will be presented following an appraisal of the information obtained in the risk assessment.

6.0 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT (ERA) REPORT

To facilitate the regulatory approval process for the ERA, at the completion of the Conceptual Site Model (Section 3.2), a draft screening-level report will be submitted to the EPA and NCDEHNR that details the results of the identification of physical and water quality stressors, and characterization of the ecological community. The report will also outline the exposure pathways and assumptions that will be used in the risk assessment.

The agencies will review and comment on the draft report, and also determine if additional field sampling will be needed to complete the ERA. If the agencies determines that additional field sampling is not needed, then a draft ERA will be prepared and submitted. If however, it is determined that insufficient information is available for completing the ERA, then field sampling will be necessary to fill the data gaps in the risk assessment. A draft Ecological Sampling Plan (ESP) will be prepared that details the field sampling techniques and analyses that will be used to fill the data gaps in the screening level ecological risk assessment.

7.0 PROJECT TEAM

As shown on the attached organizational chart, ChemRisk is prepared to dedicate an experienced project team to ensure that the ecological assessment is implemented in an efficient, effective manner. Resumes of all key technical staff are contained in ChemRisk's Statement of Qualifications, submitted under separate cover.

8.0 REFERENCES

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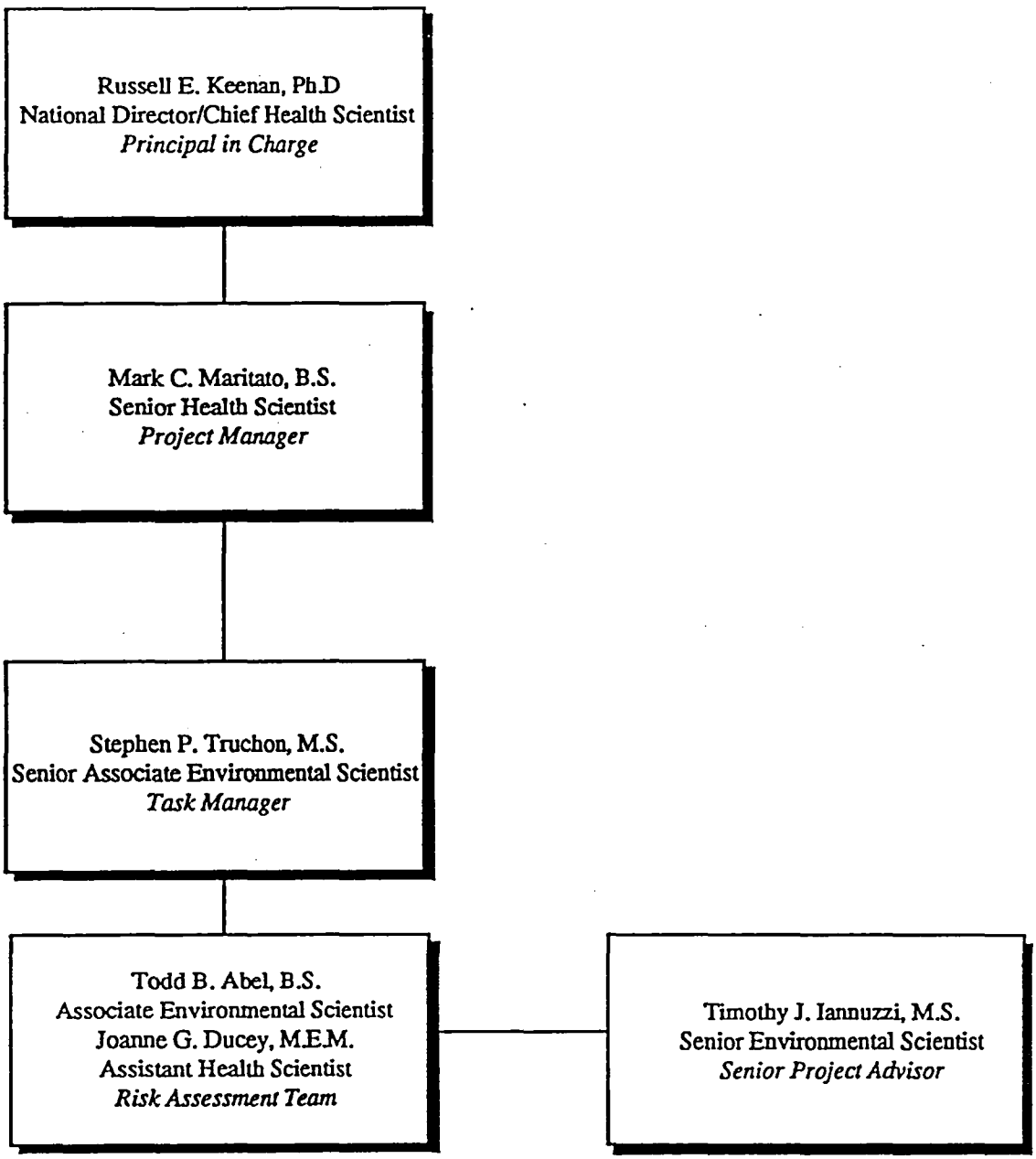
ORGANIZATION CHART FOR ECOLOGICAL ASSESSMENT TEAM



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ATTACHMENT D

WILMINGTON HEALTH AND SAFETY PLAN

SITE SAFETY AND ENVIRONMENTAL HEALTH PLAN

SITE SAFETY PLAN INFORMATION FORM

SITE SAFETY AND ENVIRONMENTAL HEALTH PLAN
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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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SOUTHERN WOOD PIEDMONT COMPANY
SITE SAFETY AND ENVIRONMENTAL HEALTH PLAN

GENERAL REQUIREMENTS

The Southern Wood Piedmont Company Site Safety and Environmental Health Plan is developed for the protection of personnel involved with hazardous waste operations or emergency response actions. The plan contains the following sections:

1. Site Safety and Health Officer and other key personnel
2. Site characterization and analysis
3. Training
4. Engineering controls, work practices and personal protective equipment
5. Medical surveillance
6. Monitoring
7. Site Control
8. Decontamination procedures
9. Standard Operating Procedures
10. Drum Handling
11. Contingency Plan
12. Confined Space Entry Procedures

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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

also be updated whenever any change makes a portion of the existing plan obsolete.

The form also includes a contingency plan section. This section is designed to describe actions which will be taken to respond to fires, explosions or any unplanned release of hazardous waste/hazardous waste constituents to air, soil or surface water at the facility. The contingency plan section also contains telephone numbers a Southern Wood Piedmont Company representative must call in the event of a spill of a reportable quantity of a hazardous material.

3. Training

All employees involved with hazardous waste operations who may be exposed to hazardous substances, health hazards or safety hazards shall:

- be thoroughly trained in each section of this plan.
- have had or shall receive 40 hours of instruction off the site and shall have a minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor as per the requirements of OSHA 29 CFR 1910.120(e).
- receive 8 hours of refresher training annually on the sections of this plan.

On-site managers and supervisors shall receive the training described above and at least 8 hours of additional training specialized in managing operations covered by this plan. Training records for each employee will be maintained on site.

Contractor employees involved with hazardous waste operations who may be exposed to hazardous substances in the course of their work will also be required to receive the 29 CFR 1910.120 training prior to job startup.

- 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.

- Working upwind of the hazardous substance if possible.
- Use of foam or water on excavated materials to reduce volatile emissions and dust should be used where applicable
- Openings on excavations should be kept to a minimum. Backfilling with clean dirt should occur as soon as possible, or at the end of each work day.
- Contaminated excavated material should be placed directly into a container, such as a drum or roll-off box, if possible.
- Areas where excavated dirt will be staged should be used on a limited basis only. These areas should be sloped toward the excavated area. Staging areas should be bermed.
- Rinse water from equipment decontamination will be contained, and analyzed, and if necessary, disposed of at a permitted disposal or treatment facility.
- Scheduling the time of work so that hazardous substance potential exposure is lowered.
- Planning to reduce exposure time through efficient procedures and use of proper equipment.

C. Personal Protective Equipment (PPE)

- PPE shall be selected and used to protect employees from exposure to hazardous materials.
- Training on the proper use of PPE will be presented to all employees subject to this plan.
- Examples of PPE appropriate for use on SWP sites would be:
  - Air purifying respirators (MSHA/NIOSH Approved)

    Half mask canister or full face mask canister types
  - Air supplying respirators

- 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.

- Employees required to wear respirators shall have a medical examination that determines employee's physical ability to wear respirators. The extent of the medical exam shall be based on the employees age and possible exposure to hazardous material. The exam will follow NIOSH guidelines and guidelines set forth in Rayonier's Health Practice entitled Medical Clearance for Respirator Wear.

- Employee medical records will be retained by SWP for 30 years beyond the duration of employment.

6. Air Monitoring

- Air monitoring shall be performed to identify and quantify airborne levels of a hazardous substance if conditions exist for an airborne concentration of the substance above defined permissible exposure limits.

- Monitors used for general air quality analyses will be the diaphragm pump type or contact sensor type. Diaphragm pumps will be used in conjunction with filter paper holders, charcoal tubes, inpingers, contact sensors or other appropriate sample collection devices. Choice of monitors and the decision to monitor will be based on existing conditions, past monitoring results, and potential for worker exposure to air quality that exceeds specified Permissible Exposure Limits.
- All air monitors will be calibrated in accordance with the manufacturers recommendations.

- Monitoring shall be performed before any entry into a confined space which formerly contained hazardous materials. The monitoring shall be for % oxygen content and % lower explosive limit as required by the SWP Safety Procedure for

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

areas. The zone should be located adjacent to the exclusion zone. In this zone, personnel or equipment are cleaned before moving into a clean zone. If there is heavy equipment that requires decontamination, an equipment decontamination zone should be set up separate from the personnel decontamination zone.

A well marked line, the hotline, should separate the exclusion zone from the decontamination zone. Typically, as personnel move away from the hotline into the decontamination zone, a straight line procedure should be followed to remove contamination until the personnel or equipment are ready to enter the clean zone.

B.3 Support zone - The support zone is where administrative and other functions needed to support operations in the exclusion zone and contamination reduction zone are located. This zone typically contains the command post. The support zone does not have to be visibly marked.

- Both the exclusion zone and the decontamination zone must be marked by readily visible materials. The type and color of the marking material must be defined in the Site Safety Plan Information Form and described to all site workers.

C. A site buddy system - Activities in a contaminated or otherwise hazardous area at a site should be conducted with a buddy who is able to observe and assist his or her co-worker. The buddy should also notify emergency personnel if necessary.

D. Site communications - An internal and external communication system must be established. The communication systems must be adequate for the job and its scope. At a minimum the communication system must be able to:

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.

- All reusable personal protective equipment will be cleaned at the end of the work day.
- Contaminated PPE should be placed in a leakproof container with a cover. The container should labeled and dated. If contaminated, the PPE should be disposed of at an EPA approved disposal facility.
- Non-impervious clothing, i.e. cotton/polyester uniforms, that become soiled with hazardous constituents to the point where employee exposure is likely, should be removed as soon as possible. The clothing shall be cleaned or disposed and replaced. The employee should wash or shower immediately after removing clothing.
- Commercial laundries or cleaners shall be informed of the potentially harmful effects of exposure to any hazardous substances which might be on the clothes they are laundering.
- All of the described decontamination procedures should take place in an area that will minimize the exposure of uncontaminated employees, equipment, and land to the hazardous materials.
- The site safety and health officer shall monitor decontamination procedures to assure they are completed effectively.

9. Standard Operating Procedures and Safe Work Practices

Standard operating procedures and safe work practices must be established. These guidelines will include:

A. Site personnel and their job duties (job titles must be listed). All personnel must be listed.

B. Chain of command

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

Contractors involved with hazardous waste operations as outlined in the scope of 29 CFR 1910.120 will also be required to follow that regulation, where applicable.

10. Drum Handling

Proper drum handling and management procedures must be followed. This is necessary to minimize risks to site personnel and the environment. The following procedures must be done:

A. Visually inspect all drums before use. An acceptable drum will not have rust or a deformed shape. It will have a top or cap which can be secured tightly on the drum.

B. Handle drums only if necessary. Plan work activity so that drum handling is minimized.

C. Label all drums. Place on the label the contents. When hazardous waste is stored in a drum the accumulation start date should be written on the drum.

D. Inspect drums which are holding hazardous waste for leaks, a secure cover and the label. The inspection should be conducted at least weekly.

E. Do not overfill drums. Fill a 55 gallon drum to approximately 50 gallons. This will allow room for expansion of contents when ambient temperatures increase.

F. Handle containers with equipment designed for the task. The use of drum grapples and slings is acceptable. Protective gloves should be worn by personnel who physically handle a drum.

G. Empty containers completely. To meet the definition of an empty container, EPA requires the following:

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.

12. Confined Space Entry Procedure

The Southern Wood Piedmont Company Confined Space Entry Procedure shall be followed. (See attached)

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: The Foot of Greenfield Street, Wilmington, NC 28401

Phone No.: 803–599–1070 SWP Headquarters

Fax No.: 803–599–1087

Pager No.:

Additional Phone No's: 800–786–0654 ViroGroup, Inc. Headquarters

Site Safety and Health Officer: Greg B. Kuntz 1–803–957–6270(Day)
803–957–7669 (Evenings)

Alternate Site Safety & Health Officer: Greg Force 800–786–0654

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)

Site assessment activities including surveying and soil, sediment, and surface water sampling.

3. Duration of Activity From Present to Ongoing

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
Wilmington, NC

B. Name of person who contacted emergency medical facility about project scope and/or site activities: Greg B. Kuntz/ViroGroup, Inc.
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 (MSDS presented in Appendix I)

Name	Hazard Type(i.e. Dermal, Inhalation, etc)	PEL	ID (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

3. Current Health and Safety Training Certificates are enclosed as Appendix II.

IV. ENGINEERING CONTROLS, WORK PRACTICES AND PERSONAL PROTECTIVE EQUIPMENT

1. Engineering Controls

Describe Engineering Controls used to minimize exposure to hazardous materials

Fans, pumps, backhoe, loader, truck, dozer, drums, sludge box, shovels, absorbent material and booms.

2. Work Practices

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

Wear proper protective clothing and safety gear or maintain a safe distance from the material when practical. Engineering controls and personal protective equipment (PPE) will be utilized by on site personnel and storage containers will be tracked by container storage records.

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

Glove type	Latex	Job type	Soil/Water/Health&Safety Respo
Glove type	Nitrile	Job type	Chemical
Glove type	Leather	Job type	Equipment Operator
Respirator type	Full or half face w/ dust and organic vapor canisters	Job type	Emergency response & when notable vapors or heavy dust is present
Head and Eye Protection	Safety goggles	Job type	Dust & debris in air
Head and Eye Protection	Hard hats	Job type	Overhead hazard
Steel Toe Boots will be worn at all times	Yes		
Other safety shoe types	Rubber steel toe boots	Job type	Work in liquid
Other safety shoe types		Job type	
Protective Clothing	Tyvek	Job type	Water, mud, chemical, equipment handling

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	

5. All ViroGroup employees perform daily field tasks in accordance with the company's internal Health and Safety/Standard Operating Procedure Manual.

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 — Appendix III
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:

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 (Appendix IV)

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.

   During surface water, soil and sediment sampling.

   Soluble and insoluble wood preserving constituents.

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

   Health & Safety Training Certificates are enclosed as Appendix II.

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 Gregory B. Kuntz

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 Greg Force

Address 1445 Pisgah Church Rd., Lexington, SC 29072

Phone Number 800–786–0654

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

Breach in a storage container/spill.

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. A list of on–site emergency response equipment is attached. The equipment storage 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 corner of Front and Greenfield Streets.

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. Date 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 Environment Management

919–733–5291 (Business Hours)

919–733–3867 (After Hours)

800–662–7956 (In state 24 hours)

– 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 Gregory R. Kurtz Date 2/12/96
Site Safety and Health Officer
and Emergency Coordinator

Signature [illegible] Date 2-12-96
Alternate Site Safety and Health Officer
and Alternate Emergency Coordinator

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

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.

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

APPENDIX I
HAZARDOUS SUBSTANCES MSDS

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

Sheet No. 757
Coal Tar Creosote

Issued: 7/91

Section 1. Material Identification

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*(TM) 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.

* 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 fi 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 ta 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 facepie 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 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 prop 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 pressur
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, blac acrid smoke.

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Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the IARC, NTP, and OSHA list coal tar creosote as a carcinogen.
Summary of Risks: Coal tar creosote is toxic by inhalation, ingestion, and skin contact. It contains a variety of hydrocarbons such as phenol and polycyclic aromatic hydrocarbons such as benzo[a]pyrene, benzanthracene, and phenol derivatives. The range of toxicity depends on the exposure concentration, amount, and duration. Effects may include irritation, burns, and several forms of cancer.
Medical Conditions Aggravated by Long-Term Exposure: Chronic respiratory or skin diseases.
Target Organs: Eyes, skin, bladder, kidneys, and respiratory system.
Primary Entry Routes: Inhalation, ingestion, and skin contact.
Acute Effects: Skin contact may cause irritation, burning, itching, redness, pigment changes, dermatitis (a rash of redness and small bumps), or burns. Photosensitization (worsening of rash with exposure to sunlight) may occur. Inhalation may be irritating to the respiratory tract. Eye contact may cause conjunctivitis (inflammation of the eye's lining), keratitis (corneal inflammation), or corneal burns with scarring. Ingestion may result in nausea, vomiting, abdominal pain, rapid pulse, respiratory distress, and shock. Systemic absorption by any route (including skin absorption) may cause trouble breathing, thready (continuous or drawn out) pulse, dizziness, headache, nausea, vomiting, salivation, and convulsions. Exposure to large doses (particularly by ingestion) may be fatal.
Chronic Effects: Dermatitis, skin cancer, and lung cancer.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. *Do not* let victim rub eyes or keep them tightly closed. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Wash affected area with soap and flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious* person drink 1 to 2 glasses of milk or water. *Do not induce vomiting!*
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Cresol may be detected in urine.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel. Isolate hazard area, deny entry, and stay upwind of spills. Shut off all ignition sources–no flares, smoking, or flames in hazard area. Cleanup personnel should protect against vapor inhalation and skin or eye contact. If possible with no risk, stop leak. Water spray may be used to reduce vapor but it may not prevent ignition in closed spaces. For small spills, take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers for later disposal. For large spills, dike far ahead of liquid spill for later disposal. Follow applicable OSHA regulations (29 CFR 1910.120).
Environmental Degradation: Coal tar creosote is fouling to shoreline. Ecotoxicity values are: TL_{50}, goldfish (*Carassius auratus*), 3.51 ppm/24 hr (60:40) mixture of creosote and coal tar; LD_{50}, bob white quail (*Colinus virginianus*), 1,260 ppm/8 days (60:40) mixture of creosote and coal tar.
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33), Hazardous Material No. U051
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* per RCRA, Sec. 3001]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Listed (as coal tar pitch volatiles) as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent all skin contact. Applying a layer of petroleum jelly or lanolin castor oil ointment to the face reduces vapor contact and penetration through skin. Frequent change of protective garments is an additional protective measure.
Ventilation: Provide general and local exhaust ventilation systems equipped with high-efficiency particulate filters to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Take particular care to avoid any contamination of drains or ventilation ducts. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Avoid physical damage to containers. Store in a cool, dry, well-ventilated area. Store coal tar creosote as close to area of use as possible to minimize transporting distance.
Engineering Controls: Use engineering controls to keep airborne concentrations below the OSHA PEL. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Always perform synthesis and purification procedures under a vertical ventilation hood and make regular operational safety checks. Label doors to rooms where coal tar creosote is produced, used, or stored as containing a carcinogen. Locate emergency equipment at well-marked and clearly identified stations in case emergency escape is necessary.
Other Precautions: Preplacement and periodic medical examinations of exposed workers emphasizing respiratory, skin, liver, and kidney disorders, including comprehensive work and medical history, physical examination, CXR, PFTs, urinalysis, LFT, and sputum cytology as the attending physician considers appropriate. Educate workers about coal tar creosote's carcinogenicity and proper handling procedures to avoid exposure.
Other Comments: Caution is in order when handling or sawing old creosote-treated lumber since it retains a considerable portion of creosote for up to 25 to 30 years.
Transportation Data (49 CFR 172.101)
DOT Shipping Name: Creosote
DOT Hazard Class: Flammable liquid
ID No.: UN1136
DOT Label: Flammable liquid

MSDS Collection **References:** 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138, 139, 140, 142, 143, 146, 148, 153, 159
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** Mark Upfal, MD, MPH; **Edited by:** JR Stuart, MS

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Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

Sheet No. 5
Chromic Acid and Chromates

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

Section 1. Material Identification

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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.

NFPA
R 1
I 4
S 3*
K 0
* Percutaneous (broken skin)

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*(73) 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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Section 6. Health Hazard Data, *continued*

cause irritant or allergic contact dermatitis, or skin ulceration. Chronic systemic absorption could cause liver or kidney damage.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Do not let victim rub eyes or keep them tightly shut. Consult a physician immediately.
Skin: Rinse with flooding amounts of water for at least 15 min, and wash with a gentle soap. Promptly remove contaminated clothing. For redness, blistering, or persistent irritation, consult a physician.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious* person drink 1 to 2 glasses of water. *Do not induce vomiting* since this worsens the victim's condition. *Do not* neutralize this acid.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: After decontamination and neutralization, treatment of acid burns is similar to that of thermal burns, although bullae and loose necrotic tissue should be debrided. Update tetanus status. *For severe acid burns*, fluid resuscitation is critical to prevent mortality from hypovolemia and renal failure. Monitor serial vital signs, urine output, electrolytes, blood count, and urinalysis as clinically indicated. Neurovascular compromise distal to a circumferential extremity burn may require escharotomy or fasciotomy. *For inhalation exposures to acids*, a CXR, EKG, ABGs, PFTs, SMA, and CBC may aid in treatment. Evaluate and treat as indicated for reactive airways, upper airway obstruction and noncardiogenic pulmonary edema (possibly delayed onset). Although literature documentation is inadequate, a burst of steroids may help prevent development of sequelae such as reactive airways dysfunction syndrome or bronchilitis obliterans. For ocular exposures to acids, ensure adequate decontamination. Determination of pH may be helpful. A Morgan Lens® and topical anesthesia may aid in irrigation. Perform fluorescein staining and slit lamp evaluation and consult an opthamalogist. Antibiotic ointments, mydriatic/cycloplegics, topical corticosteroids (after epithelial recovery), patching, and possibly anterior chamber paracentesis may be indicated depending on clinical presentation. Acutely and in follow-up, evaluate as indicated for intraocular pressure, lacrimal and lid function, corneal integrity and infection. Urinary chromium is of questionable value.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel and evacuate all unnecessary personnel. Cleanup personnel should protect against dust inhalation and eye contact. Do not handle broken packages unless wearing appropriate personal protective equipment. Keep combustibles (wood, paper, etc.) away from spilled material. Whenever possible, use wet cleanup methods; if not, use vacuum cleanup. Remove spills immediately to prevent dust dispersion. For a water spill, neutralize with agricultural lime, crushed limestone, or sodium bicarbonate. For a land spill, dig a pit, pond, or lagoon to contain material. If time permits, seal these with an impermeable, flexible membrane liner. Dike surface flow with soil, sand or foamed concrete. Follow applicable OSHA regulations (29 CFR 1910.120).
Environmental Transport: If allowed contact with soil, chromic acid, solid, lowers pH and may leach into water sources, causing an effect similar to acid rain's on water sources. This material's carcinogenicity makes it hazardous to the environment in its hexavalent state.
Environmental Degradation: The recommended disposal means are reduction, precipitation, or ion exchange. Landfill disposal is not recommended since it raises soil acidity.
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.22): Corrosive waste
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 10 lb (4.54 kg) [*per Clean Water Act, Sec. 311(b)(4)]†
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Tables Z-1-A and Z-2)
† Chromic acid (CAS No. 7738-94-5) is listed.

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For 0.5-g/m³ concentrations (if not fumes), use any dust and mist respirator except single-use and quarter-mask respirators. For 1.25-g/m³ concentrations, use any powered air-purifying respirator with a high-efficiency particulate filter. For 2.5-m/m³ concentrations, use any air-purifying full facepiece respirator with a high-efficiency particulate filter. For 30-g/m³ concentrations, use any supplied air respirator with a full facepiece and operated in a pressure-demand or other positive-pressure mode. All concentrations may require eye protection. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.
Ventilation: Provide general and local ventilation systems to maintain airborne concentrations below occupational exposure levels. Local exhaust ventilation is preferred since it prevents contaminant dispersion into work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Contact lenses may minimize or worsen eye injuries. In some cases, soft lenses can actually protect eyes, not worsen corneal damage, due to strong chemicals. In other cases, chemical entrapment is presumed a possible hazard. Since contact lens use in industry is controversial, establish your own policy. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in glass bottles, cans, or drums. Protect against physical damage. Separate from combustible, organic, or other easily oxidizable materials. Protect from excess moisture which could cause containers to rust. Do not store on wooden floors. Store away from foodstuffs and flammable liquids and solids.
Engineering Controls: Avoid dust inhalation and skin or eye contact. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good housekeeping procedures.
Other Precautions: Institute preplacement and periodic medical exams of exposed workers with attention to the skin and respiratory tract. Consider preplacement and periodic chest radiographs.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Chromic acid, solid
DOT Hazard Class: Oxidizer
ID No.: NA1463
DOT Label: Oxidizer
DOT Packaging Exceptions: 173.153
DOT Packaging Requirements: 173.164

IMO Shipping Name: Chromium trioxide, anhydrous
IMO Hazard Class: 5.1
ID No.: UN1463
IMO Label: Oxidizer, Corrosive
IMDG Packaging Group: II

MSDS Collection References: 26, 38, 73, 85, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138, 139, 140, 143, 142, 145, 148, 159
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Upfal, MD, MPH; **Edited by:** JR Stuart, MS

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1145 Catalyn Street
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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

R 0
I 4
S 1
K 0

Genium

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

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*[73] 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.

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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Section 6. Health Hazard Data

Carcinogenicity: The NTP, IARC, and OSHA do not list copper as a carcinogen. Experimental studies show tumorigenic and teratogenic effects in laboratory animals.
Summary of Risks: Copper is a necessary human nutrient, excessive intake levels of which the kidneys normally eliminate. In individuals with kidney disease or, rarely, Wilson's disease (abnormal retention and storage of copper in the body that damages the liver, kidneys, brain, blood, bones, and endocrine glands), copper levels may accumulate. Significant industrial exposure to copper occurs mainly through inhalation of fumes during welding, smelting, or refining operations; or through exposure to copper dusts and mists during mining, extracting, refining, or manufacturing processes. Copper particles may irritate, discolor, and damage eyes. Exposure to copper salts in many applications is potentially toxic. Copper dusts, fumes, and salts may irritate the upper respiratory tract. Long-term exposure may irritate the skin and discolor the skin or hair.
Medical Conditions Aggravated by Long-Term Exposure: Individuals with impaired pulmonary or renal function should avoid exposure.
Target Organs: Respiratory system, skin, eyes, liver, kidneys.
Primary Entry Routes: Inhalation, ingestion.
Acute Effects: Inhalation of copper fumes may give rise to metal fume fever (after an incubation period of about 5 hr), an allergic reaction with flu-like symptoms—high temperature, metallic taste, nausea, coughing, general weakness, muscle aches, and exhaustion. These symptoms usually disappear within 24 hr. Direct contact with copper causes skin and (less often) eye irritation, and itching of the linings of the nose, mouth, and respiratory tract. Exposure to copper dust may cause a greenish-black skin discoloration. Copper ingestion causes nausea, vomiting, abdominal pain, and diarrhea. Ingestion of large doses may cause stomach and intestine ulceration, jaundice, and kidney and liver damage.
Chronic Effects: Continued exposure to copper may cause mild dermatitis and degeneration of the mucous membranes. Repeated or prolonged exposure to copper dusts and mists can discolor skin and hair and irritate the skin. Repeated inhalation can cause chronic respiratory disease. Individuals with Wilson's disease (1 in 200,000 individuals) are more susceptible to chronic copper poisoning. If undetected and untreated, this progressive condition is eventually fatal.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing with artificial respiration.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious* person drink 1 to 2 glasses of water, then induce vomiting.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: A blood count shows leucocytosis if an individual has metal fume fever. Consider chellation with penicillamine or BAL (British Anti-Lewisite or dimercaprol) for chronic intoxication.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, remove all heat and ignition sources, and provide adequate ventilation. Avoid creating dusty conditions. Cleanup personnel should protect against vapor inhalation and skin and eye contact. Cleanup methods such as vacuuming (with the appropriate filter) or wet mopping minimizes dust dispersion. Absorb liquid containing copper with vermiculite, dry sand, or other inert materials. Place in appropriate containers for disposal. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 5000 lb (2270 kg) [* per Clean Water Act, 307(a)]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. Some recommendations follow. For copper dust and mists greater than 50 mg/m^3, wear a high-efficiency particulate respirator, a supplied-air respirator, or an SCBA, all with a full facepiece. For copper dust and mists greater than 2000 mg/m^3, wear a supplied-air respirator equipped either with a full facepiece operated in pressure-demand or positive-pressure mode or with a hood in continuous-flow mode. For copper fumes over 100 mg/m^3, wear either a powered air-purifying respirator with a high-efficiency filter, or a supplied-air respirator equipped either with a full facepiece operated in pressure-demand or positive-pressure mode or with a hood in continuous-flow mode. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Eye and face protection is required when grinding, welding, cutting, or remelting. Protect skin from molten metal and radiant heat when melting scrap. Machine turnings may also present a laceration hazard. When handling oil-contaminated copper, wear rubber gloves to prevent skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below OSHA PELs and ACGIH TLVs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store copper in tightly closed containers in a cool, dry, well-ventilated area. Avoid exposure to air and moisture.
Engineering Controls: Avoid dust and fume inhalation and direct contact with skin and eyes. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures. Maintain exposures below the PEL/TLV. Monitor copper dust and mist levels in the air.
Other Precautions: Provide placement and periodic examinations that emphasize the skin, eyes, and respiratory system. Prevent exposing individuals with chronic respiratory disease or Wilson's disease.
Transportation Data (49 CFR 172.101, .102): Not listed

MSDS Collection References: 26, 38, 73, 84, 88, 89, 100, 101, 103, 109, 124, 126, 127, 132, 133, 134, 136, 138, 139, 143, 144
Prepared by: MJ Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: W Silverman, MD; Edited by: JR Stuart, MS

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Material Safety Data Sheet

Genium Publishing Corporation
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(518) 377-8855

GENIUM PUBLISHING CORP.

No. 182

CHROMIUM (III) OXIDE

Issued: April 1986

SECTION 1. MATERIAL IDENTIFICATION

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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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SECTION 6. HEALTH HAZARD INFORMATION | TLV

CARCINOGENIC ASSESSMENT: The IARC and NTP list "chromium and certain chromium compounds" as suspected carcinogens. Chromic oxide is not specifically cited. Hexavalent chromium compounds are those most generally associated with carcinogenic effects.

PRIMARY ROUTES OF ENTRY: This material can enter the body if it is inhaled or swallowed. EFFECTS OF OVEREXPOSURE: Trivalent chromium compounds (such as Cr_2O_3) are considered to exhibit a low degree of toxicity. Excessive concentrations of airborne dust may irritate the nose, throat, and respiratory tract. Prolonged overexposure may result in pulmonary changes. Skin and eye contact may cause irritation.

FIRST AID: EYE CONTACT: Flush eyes, including under the eyelids, with a gentle flow of running water to remove particles. If irritation persists, seek medical attention.* SKIN CONTACT: Thoroughly wash contaminated area with mild soap and water. Seek medical attention if irritation persists.* INHALATION: Remove victim from exposure. Seek medical attention if irritation or discomfort persist or if other symptoms develop.* INGESTION: If victim is conscious, give him a large quantity of milk or water to drink. Get medical assistance.*

* GET MEDICAL ASSISTANCE = In plant, paramedic, community. Get medical help for further treatment, observation, and support after first aid, if indicated.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

CLEANUP PROCEDURES: Carefully scoop up or vacuum spilled material into a suitable container. Avoid generating dust. Cleanup personnel should wear gloves, goggles, and an approved respirator.

DISPOSAL: Reclaim material when possible. Unsalvageable waste may be disposed of in an approved landfill. Follow Federal, state, and local regulations.

Reportable spill quantity: None given in 40 CFR 117.3.

EPA Hazardous Waste Number: D0007 (EP Toxic 40 CFR 261.24). Applies to waste containing leachable chromium using EPA's extraction procedure.

SECTION 8. SPECIAL PROTECTION INFORMATION

VENTILATION: Use local exhaust ventilation to maintain airborne dust levels below the TLV. RESPIRATORS: Where airborne levels exceed the TLV, NIOSH-approved respirators with appropriate protection factors should be worn. High-efficiency particulate respirators are suitable for concentrations up to 10 mg/m^3. Respirator usage must be in accordance with OSHA requirements (29 CFR 1910.134).

OTHER PROTECTIVE EQUIPMENT: Dustproof goggles and gloves should be worn when handling this material. Protective clothing should be worn as required by the work situation to prevent prolonged or repeated skin contact.

Eyewash stations and washing facilities should be readily accessible to employees handling this material.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

PRECAUTIONS IN STORAGE: Store in tightly closed containers away from incompatible materials (see sect. 5). Protect containers from physical damage.

PRECAUTIONS IN HANDLING: Maintain good housekeeping procedures to prevent accumulating dust. Use procedures that minimize dust generation. Use good personal hygiene: launder contaminated clothing before reuse; wash exposed skin after handling; wash hands before eating, drinking, or smoking.

Avoid skin/eye contact and inhalation. Use with adequate ventilation. Do not ingest.

DOT Hazard Class: Not listed in hazardous materials tables (49 CFR 172.101 or 172.102).

Data Source(s) Code: 1, 2, 4, 5, 9, 12, 14, 27, 44, 58, 61, 62, 84. CV

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Approvals	JO Acuracco, 11/86.
Indust. Hygiene/Safety	9-86
Medical Review	Oct 86

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Material Safety Data Sheets Collection:

Sheet No. 296
Arsenic and Compounds

Issued: 4/90

Section 1. Material Identification

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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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Section 6. Health Hazard Data

Carcinogenicity: The IARC, NTP, and OSHA list arsenic as a human carcinogen (Group 1). This evaluation applies to arsenic and arsenic compounds as a whole, and not necessarily to all individual chemicals within the group. Studies report that both the trivalent and pentavalent compounds are strongly implicated as causes of skin, lung, and lymphatic cancers. Experimental studies have shown that arsenic has tumorigenic and teratogenic effects in laboratory animals.
Summary of Risks: Arsenic compounds are irritants of the skin, mucous membranes, and eyes. The moist mucous membranes are most sensitive to irritation. Prolonged contact results in local hyperemia (blood congestion) and later vesicular or pustular eruption. Epidermal carcinoma is a reported risk of exposure. Peripheral neuropathy (degenerative state of the nervous system) is common after acute or chronic arsenic poisoning. Symptoms include decreased sensation to touch, pinprick, and temperature; loss of vibration sense; and profound muscle weakness and wasting. Other complications of acute and chronic arsenic poisoning are encephalopathy (alterations of brain structure) and toxic delirium.
Medical Conditions Aggravated by Long-Term Exposure: Damage to the liver, nervous, and hematopoietic (responsible for the formation of blood or blood cells in the body) system may be permanent. Pulmonary and lymphatic cancer may also occur.
Target Organs: Liver, kidneys, skin, lungs, lymphatic system.
Primary Entry Routes: Inhalation, ingestion of dust and fumes, via skin absorption.
Acute Effects: Acute industrial intoxication is more likely to arise from inhalation of arsine. However, with corrosive arsenical vapors, conjunctivitis, eyelid edema, and even corneal erosion may result. Inhalation may result in nasal irritation with perforation of the septum, cough, chest pain, hoarseness, pharyngitis, and inflammation of the mouth. If ingested, metallic or garlic taste, intense thirst, nausea, vomiting, abdominal pain, diarrhea, and cardiovascular arrhythmias (heartbeat irregularities) may occur. Symptoms generally occur within 30 minutes, but may be delayed for several hours if ingested with food. Acute poisoning may result in acute hemolysis (breakdown of red blood cells).
Chronic Effects: Chronic symptoms include weight loss, hair loss, nausea, and diarrhea alternating with constipation, palmar and plantar hyperkeratoses (thickening of the corneous layer of skin on palms and soles of feet), and skin eruptions, and peripheral neuritis (inflammation of the nerves). Leukemia, bone marrow depression, or aplastic anemia (dysfunctioning of blood-forming organs) may occur after chronic exposure.
FIRST AID
Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.
Skin: *Quickly* remove contaminated clothing. After rinsing affected skin with flooding amounts of water, wash it with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have a *conscious* person drink 1 to 2 glasses of water, then induce repeated vomiting until vomit is clear.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: If emesis is unsuccessful after two doses of Ipecac, consider gastric lavage. Monitor urine arsenic level. Alkalinization of urine may help prevent disposition of red cell breakdown products in renal tubular cells. If acute exposure is significant, maintain high urine output and monitor volume status, preferably with central venous pressure line. Abdominal X-rays should be done routinely for all ingestions. Chelation therapy with BAL, followed by n-penicillamine is recommended, but specific dosing guidelines are not clearly established.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel of spill, evacuate all unnecessary personnel, remove all heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and contact with skin and eyes. Use nonsparking tools. With a clean shovel, scoop material into a clean, dry container and cover. Absorb liquid material with sand or noncombustible inert material and place in disposal containers. Do not release to sewers, drains, or waterways. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations*
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance† (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [† per Clean Water Act, Sec. 307(a); per Clean Air Act, Sec. 112]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations‡
Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

* Designations for arsenic only.
‡ Listed as arsenic organic compounds (as As).

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA.
Warning: Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres.
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PELs, ACGIH TLVs, and NIOSH REL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed, properly labeled, containers in a cool, well-ventilated area away from all incompatible materials (Sec. 5) and heat and ignition sources. Protect containers from physical damage.
Engineering Controls: Avoid inhalation or ingestion of dust and fumes, and skin or eye contact. Practice good personal hygiene and housekeeping procedures. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program with training, maintenance, inspection, and evaluation. All engineering systems should be of maximum explosion-proof design and electrically grounded and bonded. Provide preplacement and annual physical examination with emphasis on the skin, respiratory system, and blood.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Arsenic, solid
DOT Hazard Class: Poison B
ID No.: UN1558
DOT Label: Poison
DOT Packaging Requirements: 173.366
DOT Packaging Exceptions: 173.364

IMO Shipping Name: Arsenic, metallic
IMO Hazard Class: 6.1
IMO Label: Poison
IMDG Packaging Group: II
ID No.: UN1558

MSDS Collection References: 7, 26, 38, 53, 73, 85, 87, 88, 89, 100, 103, 109, 123, 124, 126, 127, 130, 136, 138
Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Hardies, MD M4

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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

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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, diarrhe: 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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Section 6. Health Hazard Data

Carcinogenicity: Although the IARC has not assigned an overall evaluation to diesel fuels as a group, it has evaluated occupational exposures in petroleum refining as an IARC probable human carcinogen (Group 2A). It has evaluated distillate (light) diesel oils as not classifiable as human carcinogens (Group 3).
Summary of Risks: Although diesel fuel's toxicologic effects should resemble kerosine's, they are somewhat more pronounced due to additives such as sulfurized esters. Excessive inhalation of aerosol or mist can cause respiratory tract irritation, headache, dizziness, nausea, vomiting, and loss of coordination, depending on concentration and exposure time. When removed from exposure area, affected persons usually recover completely. If vomiting occurs after ingestion and if oil is aspirated into the lungs, hemorrhaging and pulmonary edema, progressing to renal involvement and chemical pneumonitis, may result. A comparative ratio of oral to aspirated lethal doses may be 1 pt vs. 5 ml. Aspiration may also result in transient CNS depression or excitement. Secondary effects may include hypoxia (insufficient oxygen in body cells), infection, pneumatocele formation, and chronic lung dysfunction. Inhalation may result in euphoria, cardiac dysrhythmias, respiratory arrest, and CNS toxicity. Prolonged or repeated skin contact may irritate hair follicles and block sebaceous glands, producing a rash of acne pimples and spots, usually on arms and legs.
Medical Conditions Aggravated by Long-Term Exposure: None reported.
Target Organs: Central nervous system, skin, and mucous membranes.
Primary Entry Routes: Inhalation, ingestion.
Acute Effects: Systemic effects from ingestion include gastrointestinal irritation, vomiting, diarrhea, and in severe cases central nervous system depression, progressing to coma or death. Inhalation of aerosols or mists may result in increased rate of respiration, tachycardia (excessively rapid heart beat), and cyanosis (dark purplish discoloration of the skin and mucous membranes caused by deficient blood oxygenation).
Chronic Effects: Repeated contact with the skin causes dermatitis.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. If large areas of the body have been exposed or if irritation persists, get medical help immediately. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* due to aspiration hazard. Contact a physician immediately. Position to avoid aspiration.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Gastric lavage is contraindicated due to aspiration hazard. Preferred antidotes are charcoal and milk. In cases of severe aspiration pneumonitis, consider monitoring arterial blood gases to ensure adequate ventilation. Observe the patient for 6 hr. If vital signs become abnormal or symptoms develop, obtain a chest x-ray.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate area for large spills, remove all heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and liquid contact. Clean up spills promptly to reduce fire or vapor hazards. Use a noncombustible absorbent material to pick up small spills or residues. For large spills, dike far ahead to contain. Pick up liquid for reclamation or disposal. Do not release to sewers or waterways due to health and fire and/or explosion hazard. Follow applicable OSHA regulations (29 CFR 1910.120). Diesel fuel oil No. 2-D spills may be environmental hazards. Report large spills.
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
RCRA Hazardous Waste (40 CFR 261.21): Ignitable waste
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed
OSHA Designations
Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, use a NIOSH-approved respirator with a mist filter and organic vapor cartridge. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations that promote worker safety and productivity. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[107]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Use and storage conditions should be suitable for a OSHA Class II combustible liquid. Store in closed containers in a well-ventilated area away from heat and ignition sources and strong oxidizing agents. Protect containers from physical damage. To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations. Use nonsparking tools and explosion-proof electrical equipment. No smoking in storage or use areas.
Engineering Controls: Avoid vapor or mist inhalation and prolonged skin contact. Wear protective rubber gloves and chemical safety glasses where contact with liquid or high mist concentration may occur. Additional suitable protective clothing may be required depending on working conditions. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures. Do not wear oil contaminated clothing. At least weekly laundering of work clothes is recommended. Do not put oily rags in pockets. When working with this material, wear gloves or use barrier cream.
Transportation Data (49 CFR 172.101)
DOT Shipping Name: Fuel oil
DOT Hazard Class: Combustible liquid
ID No.: NA1993
DOT Label: None
DOT Packaging Exceptions: 173.118a
DOT Packaging Requirements: None

MSDS Collection References: 1, 6, 7, 12, 73, 84, 101, 103, 126, 127, 132, 133, 136, 143, 146
Prepared by: MJ Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: AC Darlington, MD; Edited by: JR Stuart, MS

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Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

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.

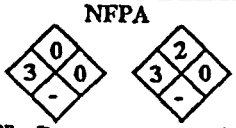
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(TM) for a suppliers list.

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

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

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)

1987 IDLH Level
150 mg/m³

1988 NIOSH REL
None established

* 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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Section 6. Health Hazard Data, *continued*

Medical Conditions Aggravated by Long-Term Exposure: Individuals with kidney, liver, endocrine, and metabolic disorders may be at a higher risk from exposure to pentachlorophenol. Consult a physician.
Target Organs: Cardiovascular system, endocrine system, general metabolism, liver, kidneys, respiratory system, eyes, skin, and central nervous system (CNS).
Primary Entry Routes: Inhalation, skin absorption, ingestion, eye contact.
Acute Effects: Acute exposures are irritating and may cause tachycardia (rapid heartbeat), tachypnea (rapid breathing), hypertension (high blood pressure), fevers, muscular weakness, anorexia (loss of appetite), sweating, dizziness, and nausea. Very high doses may cause unconsciousness, seizures (convulsions), or death due to cardiac arrest. The risk of acute poisoning may increase in hot weather.
Chronic Effects: Absorption of PCP and/or its contaminants may cause chloracne. Bronchitis and weight loss may develop. Animal studies suggest that liver and kidney damage may occur.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing with artificial respiration, CPR if necessary, and oxygen if available.
Ingestion: Call a physician or Poison Control Center immediately. Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious* person drink 1 to 2 glasses of water, then induce vomiting. If possible, induce vomiting under medical supervision. Do not instill milk or other materials containing vegetable or animal fats since they are likely to enhance absorption.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Severe systemic poisoning results primarily from uncoupling of mitochondrial oxidative phosphorylation, with ensuing hyperpyrexia. Promote heat loss and aggressively manage hyperthermia with physical methods. *Antipyretics (including aspirin), atropine, and phenothiazines are contraindicated.* Force diuresis to reduce body burden. Carefully follow and treat fluid/electrolyte and acid/base alterations. Treat supportively and reduce anxiety. Diagnostic testing should include rectal temperature, PCP urine or plasma levels, blood chemistries (including electrolytes, LFTs, BUN, creatinine), and CBC. Treat ingestion with emesis, gastric lavage, and saline cathartic.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, provide adequate ventilation, and remove all heat and ignition sources. Cleanup personnel need full protection against vapor inhalation and contact with solution or solid. Collect dry spilled material in a metal container for reclamation or disposal. For liquid spills, collect with an absorbent solid and place in a metal container for disposal. For large liquid spills, dike far ahead of liquid spill to contain. Wash residue with soap and water. Prevent spills from entering sewers, streams, and open waters. Pentachlorophenol is toxic to fish and wildlife. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33), RCRA Waste No. U242
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 10 lb (4.54 kg) [* per Clean Water Act, Sec. 311(b)(4), Sec. 307(a), and per RCRA, Sec. 3001]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, where concentrations of pentachlorophenol exceed or are likely to exceed .5 mg/m^3, wear a NIOSH-approved organic vapor-dust filter type respirator; a full facepiece is needed at concentrations >2.5 mg/m^3. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA; SCBA can be used to 150 mg/m^3. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves (polyvinyl chloride, neoprene or nitrile latex), boots, aprons, and gauntlets to prevent skin contact. Extremely high concentrations may require a full containment suit. Always consult an industrial hygienist.
Ventilation: Provide general and local exhaust ventilation systems to maintain airborne concentrations below both OSHA PEL and ACGIH TLV (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing. Use separate lockers for street clothes.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in properly labeled and closed containers in a cool, dry, well-ventilated, low fire hazard area away from heat and ignition sources and combustible materials. Protect containers from physical damage. Outside or detached storage is preferred. Accumulated sludge at the bottom of dipping tanks may concentrate toxic impurities at much higher levels than original product. Do not reuse drums. Clean empty drums, liners, and block wrappings in accordance with 40 CFR 261.7(b)(3) prior to returning for reconditioning, recycling, or other disposal.
Engineering Controls: Educate workers about pentachlorophenol's hazards. Avoid skin contact and vapor or dust inhalation. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures.
Medical Surveillance: Preplacement and periodic medical evaluations should include a complete history and physical examination and a biochemical profile (including LFTs, BUN, creatinine, and electrolytes). Consider baseline pulmonary function tests. Perform biologic monitoring for PCP levels at the end of work shifts (plasma) and toward end of workweek (urine). 24-hr urine collections are more accurate than spot testing.

Transportation Data (49 CFR 172.102)

IMO Shipping Name: Chlorophenols, liquid	IMO Shipping Name: Chlorophenols, solid
IMO Hazard Class: 6.1	IMO Hazard Class: 6.1
ID No.: UN2021	ID No.: UN2020
IMO Label: St. Andrews Cross	IMO Label: St. Andrews Cross
IMDG Packaging Group: III	IMDG Packaging Group: III

MSDS Collection References: 1, 38, 73, 84, 85, 88, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138, 140, 143, 146
Prepared by: MJ Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: MJ Upfal, MD, MPH; Edited by: JR Stuart, MS

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MATERIAL SAFETY DATA SHEET

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1145 CATALYN STREET
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(518) 377-8855

GENIUM PUBLISHING CORP.

No. 467

AUTOMOTIVE
GASOLINE, LEAD-FREE

Date October 1981

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: AUTOMOTIVE GASOLINE, LEAD-FREE
DESCRIPTION: A volatile blend of hydrocarbons for automotive fuel
OTHER DESIGNATIONS: Petrol, CAS #008 006 619, ASTM D439
MANUFACTURER: Available from several suppliers.

SECTION II. INGREDIENTS AND HAZARDS

SECTION II. INGREDIENTS AND HAZARDS	%	HAZARD DATA
Gasoline A hydrocarbon blend that can include normal and branched chain alkanes, cycloalkanes, alkenes, aromatics and other additives.** (Lead max 0.013 g/L, phosphorus max 0.0013 g/L, sulfur max 0.10 wt%. May contain benzene, <5%; see ASTM D3606). *ACGIH 1981 TLV (Intended Changes List). See also Am. Ind. Hyg. A. 39 110-117 (1978) **The composition of fuel is varied with altitude and seasonal requirements for a locality. The blend must meet antiknock requirements. (Antiknock Index min 85, ASTM D439.)	100	8-hr TWA 300 ppm or 900 mg/m^3* Man Eye: 500 ppm/1H Moderate irritation Inhalation: TCLo 900 ppm/1H TFX:CNS

SECTION III. PHYSICAL DATA

Distillation at 1 atm, Initial, deg C >39
50% distilled - 77-121
End point ——— <240
Vapor density (Air=1) ———— 3.0-4.0
Solubility in water ———— Insoluble

Specific gravity, 60/60 F - 0.72-0.76
Melting point, deg C ——— -90.5-95.4
Evaporation rate ——— N/A

Appearance and Odor: A clear, mobile liquid with a characteristic odor which can be recognized at about 10 ppm in air. (Gasoline may be colored with dye.)

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air % by volume	LOWER	UPPER
-45 F	536-853 F		1.4	7.6

Extinguishing Media: Dry chemical, carbon dioxide, alcohol foam. Use of water may be ineffective to extinguish fire, but use water spray for cooling fire-exposed drums and tanks to prevent pressure rupture. It is a dangerous fire and explosion hazard when exposed to heat and flames. Vapors can flow along surfaces, reach distant ignition sources and flash back. Can react violently with oxidizing agents.
Firefighters should wear self-contained breathing apparatus and full protective clothing.

SECTION V. REACTIVITY DATA

This is a stable material in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.
This is an OSHA Class IA flammable liquid. A mixture of gasoline vapors and air can be explosive. It is incompatible with oxidizing agents.
Thermal-oxidative degradation can yield carbon monoxide and partially oxidized hydrocarbons.

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No. 467

SECTION VI. HEALTH HAZARD INFORMATION

TLV 300 ppm (See Sect. II)

Inhalation causes intense burning of the mucous membranes, throat and respiratory tract; overexposure to vapors can lead to bronchopneumonia. Inhalation of high conc. can cause fatal pulmonary edema. Repeated or prolonged skin exposure causes dermatitis. Can cause blistering of skin due to its defatting properties. Exposure to eyes can cause hyperemia of the conjunctiva.

Ingestion or excessive vapors can cause inebriation, drowsiness, blurred vision, vertigo, confusion, vomiting and cyanosis (2000 ppm produces mild anesthesia in 30 min, higher conc. are intoxicating in less time.) Aspiration after ingestion causes bronchitis, pneumonia, or edema which can be fatal.

FIRST AID:

Eye Contact: Flush thoroughly with running water for 15 min. including under eyelids.

Skin Contact: Remove contaminated clothing. Wash affected area with soap and water.

Inhalation: Remove to fresh air. Restore breathing and administer oxygen if needed.

Ingestion: Do not induce vomiting. Aspiration hazard. Contact physician.

Seek prompt medical assistance for further treatment, observation and support.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel of leaks or spills. Remove sources of heat or ignition. Provide adequate ventilation. Clean-up personnel require protection against liquid contact and vapor inhalation. If a leak or spill has not ignited, use water spray to disperse vapors and to protect men attempting to stop the leakage. Contain spill. Do not allow to enter sewer or surface water. Add absorbent solid to small spills or residues and pick up for disposal.

DISPOSAL: Burn scrap material in an approved incinerator. Burn contaminated liquid by spraying into an incinerator. Follow Federal, State, and Local regulations.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Use general and local exhaust ventilation (explosion-proof) to keep vapors below the TLV requirements in the workplace. Respirators should be available for nonroutine or emergency use above the TLV.

Avoid eye contact by use of chemical safety goggles and/or full faceshield where splashing is possible. Wear protective clothing appropriate for the work situation to minimize skin contact such as rubber gloves and boots. Clothing to be changed daily and laundered.

Eyewash fountains, showers and washing facilities should be readily accessible

Provide suitable training to those handling and working with this material.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed containers in a cool, dry, well-ventilated area away from sources of heat, ignition and strong oxidizing agents. Protect containers from physical damage. Avoid direct sunlight. Storage must meet requirements of OSHA Class IA liquid.

Outdoor or detached storage preferred. No smoking in areas of use. Prevent static electric sparks and use explosion-proof electrical services. (Must meet code.)

Avoid skin and eye contact. Avoid inhalation of vapors. Wear clean work clothing daily.

Indoor use of this material requires exhaust ventilation to remove vapors.

ICC Flammable Liquid, Red Label. LABEL: Flammable Liquid DOT I.D. No. UN 1203.

DOT Classification: FLAMMABLE LIQUID

DATA SOURCE(S) CODE: 2,4-9,34,37

APPROVALS: MIS CRD J.M. [illegible]

Industrial Hygiene and Safety [illegible] 10-27-81

MEDICAL REVIEW: 14 November 1981

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APPENDIX II
OSHA 8 HOUR
CFR 1910.120 HAZWOPER
REFRESHER COURSE CERTIFICATES

PCT SERVICES

Certificate of Completion

This Certifies That

GREGORY B. KUNTZ

is Awarded this Certificate for

OSHA 8 HOUR (29 CFR 1910.120) HAZWOPER REFRESHER COURSE

Given at Cayce, SC, this 16th day of AUGUST, A.D., 19 95

Roger Tull

Instructor

Instructor

CERT. NO. 9508R0107

EXPIRES 8/16/96

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

PCT SERVICES

Certificate of Completion

This Certifies That

DANNY RAWL

is Awarded this Certificate for

OSHA 8 HR CFR 1910.120 HAZWOPER REFRESHER COURSE

Given at Cayce, SC, this 8th day of MAY, A.D., 19 95

Instructor

Instructor

CERT. NO 9508R0048

EXPIRES 05/08/96

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

PCT SERVICES

Certificate of Completion

This Certifies That

JIMMY HOOK

is Awarded this Certificate for

OSHA 8 HR CFR 1910.120 HAZWOPER REFRESHER COURSE

Given at Cayce, SC, this 23rd day of MARCH, A.D., 19 95

Roger Tillman
Instructor

Instructor

CERT. NO. 9508R0024

EXPIRES 03-23-96

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 8th day of MAY, A.D., 19 95

Roger Tillman
Instructor

Instructor

CERT. NO. 9508R0049

EXPIRES 05/08/96

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

INDUSTRIAL TRAINING SERVICES

CERTIFICATE OF TRAINING

Awarded to

Raymond L. Knox

in recognition for completion of

=I·T·S=

Hazardous Materials
8 Hour Refresher

David B. Rusher
Instructor

November 17, 1995
Date

INDUSTRIAL TRAINING SERVICES

CERTIFICATE OF TRAINING

Awarded to

James D. Kotti

in recognition for completion of

=I·T·S=

Hazardous Materials
8 Hour Refresher

David P. Rusler
Instructor

November 17, 1995
Date

INDUSTRIAL TRAINING SERVICES

CERTIFICATE OF TRAINING

Awarded to

Charles K. Anderson

in recognition for completion of

=I·T·S=

Hazardous Materials
8 Hour Refresher

Instructor

October 13, 1995

Date

PCT SERVICES

Certificate of Completion

This Certifies That

FRANK ROBERTSON

is Awarded this Certificate for

OSHA 8 HR (29 CFR 1910.120) HAZWOPER REFRESHER COURSE

Given at Cayce, SC, this 12th day of JULY, A.D., 19 95

Roger Tillman

Instructor

Instructor

CERT. NO. 9508R0089

EXPIRES 07/12/96

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 Smith

Instructor

* waiting on new certificate

CERT. NO. 9408R0141

EXPIRES 12/15/95

PCT SERVICES 960 KNOX ABBOTT DRIVE, CAYCE, SC 803-791-3980

PCT SERVICES

Certificate of Completion

This Certifies That

TIM HORONOSKY

is Awarded this Certificate for

OSHA 8 HR CFR 1910.120 REFRESHER COURSE

Given at Cayce, SC, this 19th day of JANUARY, A.D., 19 95

Instructor

Instructor

*Waiting on new certificate

9508R0001

EXPIRES 01-19-96

ViroGroup
Air • Water • Soil
TECHNOLOGY

ETE Division
ViroGroup, Inc.
1445 Pisgah Church Road
Lexington, SC 29072
Phone 803-957-6270
FAX 803-957-3845

February 9, 1996

To: Whom it may concern.

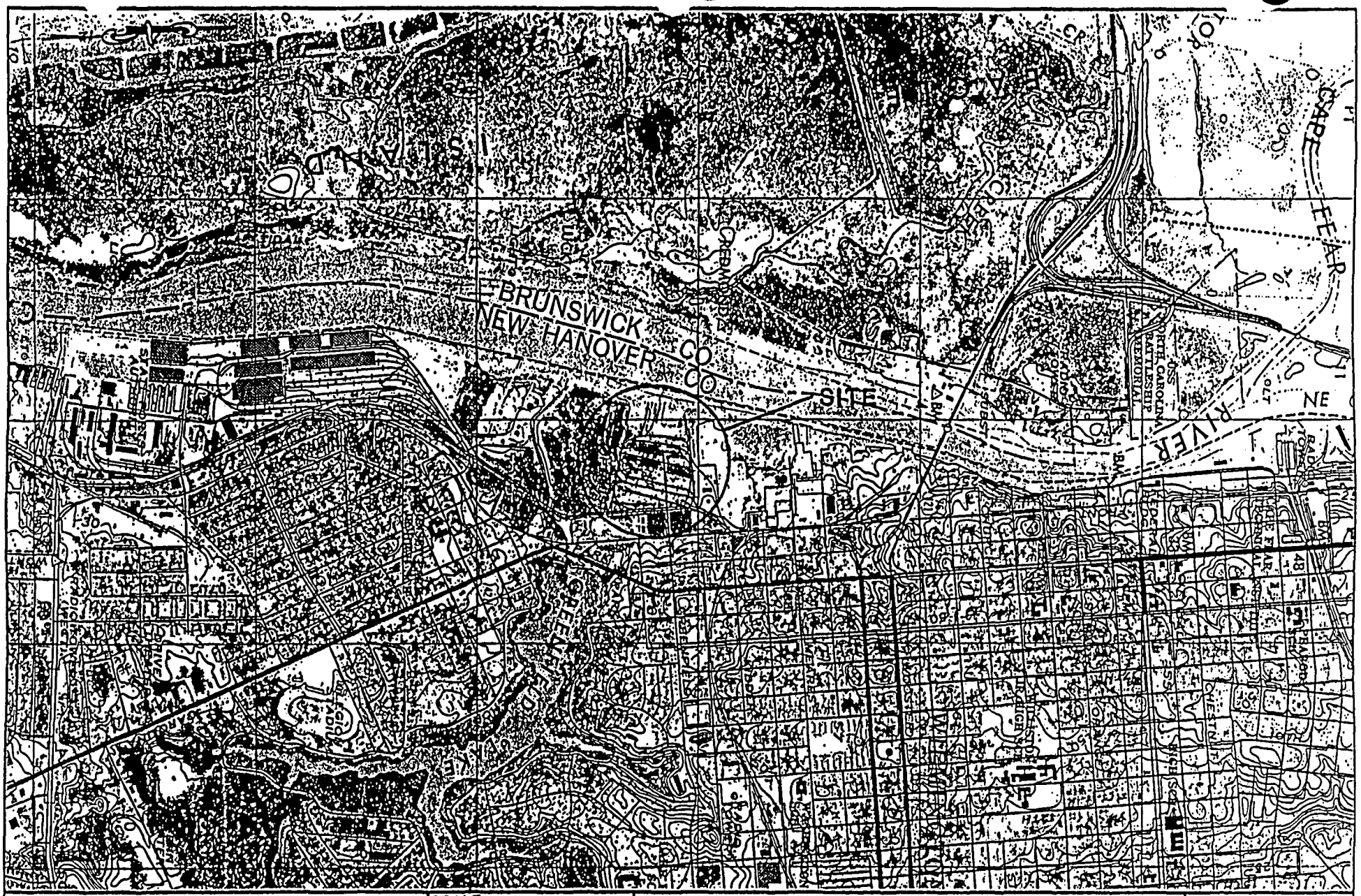
Gregory L. Force has completed his OSHA 8 HR Refresher Course pursuint of 29 CFR 1910.120 Hazardous Waste Operations standard on Februay 9, 1996. A certificate of training will be issued as soon as it can be completed.

Sincerely,

ViroGroup, Inc.

Mark G. Woltanski, C.I.H.
Senior Industrial Hygienist

APPENDIX III
SITE MAP



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ETE Division
ViroGroup, Inc.
1445 Pisgah Church Road
Lexington, SC 29072
Phone 803-957-6270
FAX 803-957-3845
Watts 1-800-755-0654

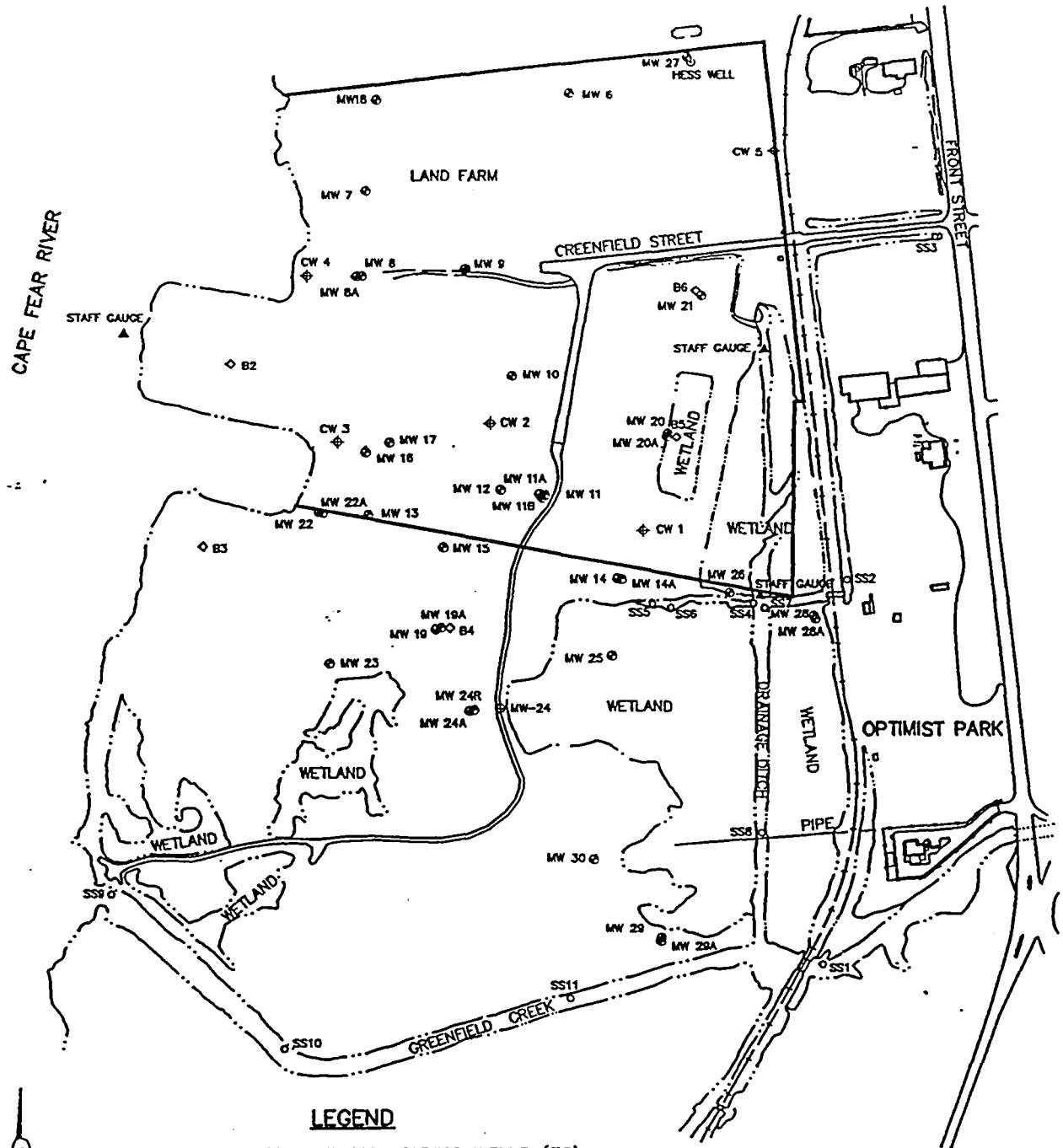
SCALE	1:24,000
DRAWN BY	CAB
CHECKED BY	GBK
DATE	2/11/94

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

FIGURE NO.
1

CADD NO.
G: 5301501

PROJECT NO.
12-53015.00



LEGEND

- ⊕ PERMANENT MONITORING WELLS (35)
- ▲ STAFF GAUGE (3)
- ○ SOIL SAMPLES (11)
- ◇ ABANDONED TEMPORARY MONITORING WELLS (5)
- ⌖ CITY WELLS (5)
- ⊙ HESS WELLS (1)
- ⊕ ABANDONED MONITORING WELL (1)

ViroGroup P.O. Box 1667 • 1445 Pleasant Church Rd. • Lexington, S.C. 29072 (803) 957-8270	SCALE 1"=400' DRAWN BY CAB CHECKED BY GBK DATE 8/9/95	SITE MAP SOUTHERN WOOD PIEDMONT/ WILMINGTON, N.C. FACILITY	FIGURE NO. 3 CADD NO. 5301902 PROJECT NO. 12-53019.00

APPENDIX IV
CHAIN OF COMMAND

CHAIN OF COMMAND
ORGANIZATIONAL CHART

Health and Safety Coordinator	Greg Kuntz
Alternate Health and Safety Coordinator	Greg Force
ViroGroup – Project Manager (Team Leader)	Greg Kuntz
ViroGroup – Project Site Manager (Field Activities Coordinator and Health & Safety Officer)	Greg Force
ViroGroup – Drill Rig Operator	—
Subcontractor Foreman	—
ViroGroup – Drill Crew Members	—
	—
ViroGroup – Sample Team Members	Danny Rawl
	Frank Robertson
	Jay Joshi
Heavy Equipment Operators	Billy Hamilton

APPENDIX V
CONFINED SPACE ENTRY PROCEDURE AND PERMIT

VIROGROUP, INC., ETE DIVISION

CONFINED SPACE ENTRY PROTOCOL

1.0 INTRODUCTION

The U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), has established safety requirements for entry into confined spaces which are identified as posing special dangers for entrants due to their contents, configuration, chemicals and machinery.

A confined space may be defined as an area not designated for human occupancy and has restricted entries and exits. Examples of confined spaces are tunnels, sewers, vaults, tanks, pits, ditches and a host of other typical structures one might encounter at manufacturing and physical plants or construction sites.

The following confined space entry protocol is intended to comply with or exceed the OSHA 29 CFR 1910.146 requirements to ensure employee safety. Implementation of this protocol, as well as with any safety protocol, is the responsibility of each employee as well as management. The strictest adherence to this policy will be enforced.

2.0 PROTOCOL APPLICATION

This protocol provides guidelines to help employees recognize and reduce the risks associated with confined space entry. This Protocol shall apply to the following:

A. All ViroGroup, Inc. operations and employees, both permanent and casual.

B. Operations conducted by outside organizations and subcontractors under the direction of ViroGroup, Inc.

C. It does not apply at locations where ViroGroup, Inc. employees or subcontractors are required to follow site safety rules which provide for a different but equivalent procedure for confined space entry.

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3.0 DANGERS ASSOCIATED WITH CONFINED SPACE ENTRY

Confined spaces sometimes present a risk of accidental injury or death for personnel entering or working in them due to:

A. Hazardous oxygen levels outside the range of 19.5 % to 23.0 %.

B. Flammable or explosive levels of gaseous materials in the area which are equal to or greater than 10 % of the lower explosive limit (LEL).

C. Concentrated levels of toxic substances.

D. Potential for engulfment by particular matter or liquids.

E. Mechanical/Electrical hazards.

4.0 PRE-PERMIT EVALUATION

A. Before personnel may enter any confined space, the area must be evaluated by a responsible party, generally the project manager or site supervisor, to determine if there is a hazard potential for employees entering the area. This will be accomplished by:

1. Performing a survey of the work area using the "Confined Space Survey" form attached as appendix C.

2. Using environmental monitoring to determine if the space presents a potential hazardous atmosphere or other condition immediately dangerous to life or health.

3. Evaluating the work to be done in the area to determine if hazards may be introduced into the confined space.

If the hazard potential is determined to be zero, an entry permit may not be required. If it is established that a potential hazard exists, an entry permit will be required.

B. Identification of Permit Required Confined Space:

Once an area has been identified as a confined space requiring a permit to enter, an appropriate sign must be posted in a conspicuous area and the point of entry barricaded if at all possible. An example of an appropriate sign is included as Figure 1.

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5.0 EXECUTION OF THE ENTRY PERMIT

If an entry permit is required for confined space entry, the following information will be included:

A. General Information:

1. Description of job to be performed.

2. Date and time the permit is issued and when it expires.

3. Employees for whom the permit is valid.

4. Specification for all environmental testing to be performed prior to entry and any follow-up testing such as oxygen percent, flammability, toxicity, etc.

B. Required Safeguards:

1. Ventilation or cleaning prior to entry.

2. Attention to electrical shock hazards.

3. Outside attendants.

4. Continuous mechanical ventilation.

5. Lockout/tagout requirements.

6. Physical isolation of piping to prevent hazardous materials from entering the confined space.

7. Personnel protective equipment.

8. Special work practices.

C. Rescue Procedures:

Rescue procedures must be defined prior to allowing entry into any confined space area where the potential for hazards exists. Appropriate actions will include:

1. Ensure that appropriate rescue is present at the entrance of the confined space.

2. If employees within the confined space are wearing safety harnesses, they must be securely tied-off outside the confined space.

Rescue Procedures Continued...

3. If safety harnesses are not feasible, the possible use of alternative rescue equipment must determined.

4. The rescue team must be readily available in the area.

5. At least one member of the rescue team must be familiar with basic first-aid and cardiopulmonary resuscitation (CPR) skills.

D. Final Requirement in Completing the Entry Permit:

When the entry permit has been executed, the final action will be to sign the form and instruct the person in charge of entry work to:

1. Post the entry permit outside of the confined space.

2. Return the permit at the end of the period which it covers.

6.0 MONITORING REQUIRED PRIOR TO EACH ENTRY INTO A CONFINED SPACE

Environmental monitoring must be conducted before each entry into a permit entry space. Additional monitoring may be required by the site manager at specific intervals. Monitoring shall be conducted as follows:

A. If feasible, monitoring should be performed without entering the confined space.

B. Monitoring should be performed at representative locations within the confined space.

C. Monitoring should be performed in the following order, using instruments that are calibrated at intervals and in accordance with the manufactures recommendations.

1. Percent oxygen (must be within 19.5 % to 23%).

2. Flammable gases or vapors, or combustible solids (LEL must be <10%).

3. Concentrations of known toxic substances.

Monitoring Required Prior to Each Entry Into a Confined Space Continued...

D. If any of the monitoring readings exceed the ranges specified by the permit, employees must not enter the confined space or must leave it immediately.

E. If the confined space must be exited, the site manager will evaluate the situation and stipulate if entry is possible using additional safeguards.

7.0 RULES APPLYING TO CONFINED SPACE ATTENDANTS:

When attendants are required for confined space activities, they must be trained referencing the role they are to play as follows:

A. Attendants must not enter the confined space and must not leave the vicinity of the entry point except for self-preservation or until replaced by another trained attendant.

B. Attendants must be trained to summon emergency rescue assistance and must have a reliable means for summoning the assistance.

C. The attendant must be able to maintain visual, voice, sound or line contact with the persons in the confined space at all time.

D. At least annually, rescue teams must practice removing victims through openings the same size, configuration and accessibility as those spaces from which an actual rescue could be required.

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CONFINED SPACE ENTRY PLAN/PERMIT

LOCATION & DESCRIPTION: _____

_____

PURPOSE of ENTRY: _____

_____

PROJECT MANAGER
(name/signature) _____ / _____
DATE: _____ TIME: _____ EXPIRATION: _____
SITE MANAGER
(name/signature) _____ / _____

Supervisor	Crew Member	Signature

SPECIAL REQUIREMENTS		
REQUIREMENTS	YES	NO
LINES BROKEN - CAPPED or BLANKED		
LOCK OUT - De-energized		
PURGE - FLUSH - VENT		
VENTILATION		
SECURE AREA		
BREATHING APPARATUS (SCBA)		
INHALATOR/RESPIRATOR		
ESCAPE HARNESS		
TRIPOD EMERGENCY ESCAPE UNIT		
LIFELINES		
FIRE EXTINGUISHER		
LIGHTING		
PROTECTIVE CLOTHING		

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MONITORING REQUIREMENTS (valid for one entry)	P.E.L.*	YES	NO	TIME (in)	TIME (out)
PERCENT OF OXYGEN	19.5 % TO 23.0 %				
PERCENT LOWER EXPLOSIVE LIMIT (LEL)	< 10%				
AROMATIC HYDROCARBONS	< 10 PPM				
OTHER					

* P.E.L = Permissible Entry Level

AIR MONITOR:
(name/signature)_____/_____

NOTE: Continuous/periodic monitoring shall be established before beginning job. All monitoring readings shall be recorded in a monitoring log.

MONITORING EQUIPMENT USED	CALIBRATION DATE/TIME	FACTORY CAL. DATE

SAFETY STANDBY PERSONS	SIGNATURE	DATE/TIME

AMBULANCE_____ FIRE_____

CONFINED SPACE ENTRY PERMIT
SUPPLEMENTAL SHEET
MONITORING LOG

WORK ORDER NUMBER:_____
CLIENT:_____
PHYSICAL LOCATION:_____
CITY AND STATE:_____
DATE:_____

CONFINED SPACE ATMOSPHERE

ENTRANT(S)	LEL %	OXYGEN %	PPM	TIME/LOCATION(i.e., END, TOP, BOTTOM, MIDDLE)

SIGN AND DATE
AIR MONITOR:_____
SITE SUPERVISOR:_____

PRODUCT REMOVAL

	1	2	3	4	5
SOUNDINGS					
TIME/DATE OF PUMPING					
GALLONS PUMPED					

NK SIZE IN GALLONS:_____
IOD USED TO INERT TANK/CONFINED SPACE:_____
T TIME OF INERTING TANK/CONFINED SPACE:_____

SIGN AND DATE
SITE SUPERVISOR:_____

Using the following checklist, identify the location of all confined spaces. For each of the confined spaces, indicate the types of hazards which might be present.

CONFINED SPACE ENTRY PROTOCOL

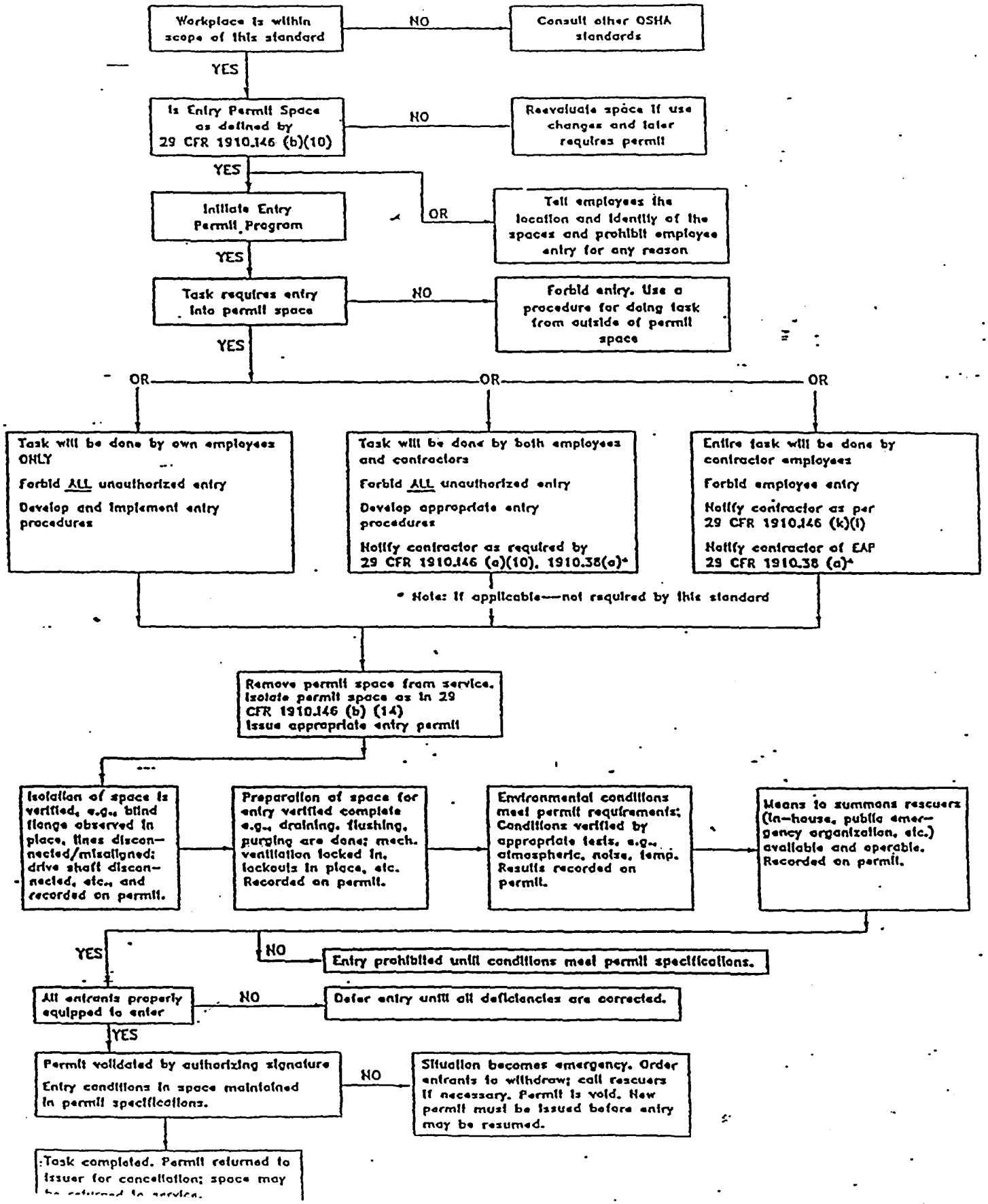
CONFINED SPACE SURVEY

	HAZARDOUS ATMOSPHERE			OTHER CONDITIONS IMMEDIATELY DANGEROUS TO LIFE OR HEALTH								
	FLAMMABLE GAS, VAPOR, MIST, OR AIRBORNE DUST IN EXCESS OF 10% OF ITS LOWER FLAMMABILITY LIMIT	LESS THAN 19.5% OR MORE THAN 23% OXYGEN	ANY OSHA-IDENTIFIED SUBSTANCE THAT IS IN EXCESS OF THE PERMISSABLE EXPOSURE LIMIT OR IS OTHERWISE KNOWN TO PRESENT A SAFETY OR ACUTE HEALTH HAZARD	MECHANICAL HAZARD	ELECTRICAL HAZARD	EXTREME TEMPERATURE	EXCESSIVE NOISE	FALLING OBJECTS	POTENTIAL FOR ENGULFMENT	INSUFFICIENT MANEUVERABILITY	OTHER (PLEASE SPECIFY)	REMARKS
TUNNELS												
SEWERS												
VAULTS												
TANKS(OPEN OR CLOSED)												
BINS(OPEN OR CLOSED)												
HOPPERS												
CONVEYOR ENCLOSURES												
FURNACES												
BOILERS												
PITS(OPEN OR CLOSED)												
DITCHES												
SILOS												
PIPES												
ROOMS WITH LIMITED ACCESS												
VESSELS(OPEN OR CLOSED)												
VATS												
WELLS												
MIXERS												
OTHER(PLEASE SPECIFY)												

SIGN AND DATE:_____

Appendix D: Confined Space Entry Protocol

Permit Required Confined Space Decision Flow Chart



Confined Space Entry Protocol

All Copies Of Permit
Will Remain At Job Site
Until Job Is Completed

☐ CONFINED SPACE ENTRY PERMIT
☐ HAZARDOUS AREA ENTRY PERMIT

/ORK ORDER NO._____

.OCATION and DESCRIPTION
ıf Confined Space_____ Date_____

'URPOSE of Entry_____ Time_____

'ROJECT MGR.(Name/Signature)_____ / _____ Expiration_____

'ERSON In Charge of On Site Work(Name/Signature)_____ / _____

SUPERVISOR(S) In Charge of Crews	CREW MEMBER	SIGNATURE

SPECIAL REQUIREMENTS	YES	NO		YES	NO
Lock Out – De-energize			Escape Harness		
·ines Broken – Capped or Blanked			Tripod Emergency Escape Unit		
·ge – Flush and Vent			Lifelines		
·tilation			Fire Extinguishers		
·ure Area			Lighting		
·athing Apparatus (SCBA)			Protective Clothing		
·uscitator – Inhalator			Respirator		

TEST(S) TO BE TAKEN (VALID FOR ONE 8-HOUR TURN ONLY)	P.E.L. *	YES	NO	Time M	Time M
% of Oxygen	–19.5% +21%				
% of L.E.L. *	Any % over 10				
Carbon Monoxide	50 ppm				
Aromatic Hydrocarbon	10 ppm				
Other					

Name/Title Signature

AIR MONITOR_____ _____

Note: Continuous/periodic tests shall be established before beginning job. All readings shall be entered on the monitoring log.

MONITORING EQUIPMENT USED	Factory Calibration Date	Field Calibrator

·ETY STANDBY PERSON(S)	Name/Signature	Date/Time
☐		
☐		

AMBULANCE
FIRE

Site Supv. authorizing all above conditions satisfied_____

* P.E.L. Permissible Entry Level

APPENDIX VI
HEALTH & SAFETY PLAN ACKNOWLEDGEMENT FORM

ACKNOWLEDGEMENT SHEET

I HAVE REVIEWED AND BEEN INFORMED OF THE HEALTH AND SAFETY CONCERNS ON THE PROJECT SITE.

DATE	NAME (PRINT)	COMPANY	SIGNATURE	SOCIAL SECURITY #
2-12-96	Greg Force	ViroGroup	Greg Force	251-98-6776
2-12-96	Frank Robertson	ViroGroup	Frank Robertson	260-80-9653
2-12-96	Danny Rawl	ViroGroup	Danny Rawl	247-96-4160
2-12-96	Gregory B. Kuntz	ViroGroup	Gregory B. Kuntz	459-94-1296

CORPORATE HEALTH AND SAFETY POLICY HANDBOOK

All Employees of ViroGroup

Control No. 1760

S. O. Ogden CEO/President	Signature	Date
Charles S. Higgins, Jr., P.E. Corp. V.P./Chief Operating Officer	Signature	Date
Mark G. Woltanski, C.I.H. Corporate Director Health & Safety	Signature	Date

DOCUMENTED SAFETY PROGRAM

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1.0 INTRODUCTION

1.1 PURPOSE

ViroGroup, Inc. (ViroGroup) is a multi-discipline geo-technical, engineering and environmental consulting firm. The nature and diversity of this business presents unique situations not normally encountered in typical work place environments which may routinely expose ViroGroup employees to potentially hazardous situations. ViroGroup has developed the following Health and Safety Policy Manual which details specific procedures to be followed by all ViroGroup employees, thus ensuring continual maintenance of their health and welfare.

1.2 COMPANY SAFETY POLICY

ViroGroup's employees are its most valuable resource. Loss of the skills of a valued employee, however temporary, can diminish target goals, ability to meet contractual deliveries, or morale. It is paramount our employees know of management's commitment and policy to develop and maintain reasonably safe and healthy work site conditions for all ViroGroup employees, ViroGroup contractors, and the general public.

This shall be accomplished through the application of the following policies and procedures outlined in this manual. ***At all ViroGroup locations and job sites, safety shall take precedence over more expedient unsafe operations.***

ViroGroup requires strict compliance with this Health and Safety Policy Manual. Failure on the part of <u>any</u> employee to comply with this manual may result in disciplinary action and possible termination of employment. In addition, all subcontractors shall be expected to abide by the provisions of the ViroGroup Health and Safety Policy.

2.0 ORGANIZATIONS AND RESPONSIBILITIES

The ViroGroup Health and Safety Program, with all of its related elements, is administered by the Acting Corporate Director of Health and Safety (CDHS). All plans, procedures, equipment requirements, training, personnel and site monitoring, and program audits are directed by the CDHS. The CDHS has the authority to stop unsafe operations until full compliance with the program is met.

Additional members of the ViroGroup health and safety team include the safety officers at each ViroGroup location, the division managers, and the employees.

The following information more clearly defines each team member's role in the Health and Safety Program:

2.1 CORPORATE DIRECTOR OF HEALTH AND SAFETY (CDHS)
- Tom Martin, Jacksonville Office

1) Administers the overall medical monitoring and surveillance program
2) Audits written plans and the administration of health and safety programs on job sites
3) Develops and directs monitoring programs for ambient air and personnel exposure
4) Assures compliance with the OSHA Hazard Communication Standard and other OSHA regulations
5) Develops and maintains health and safety standard operating procedures and policies
6) Provides guidance on the proper health and safety equipment and clothing
7) Provides guidance on site-specific health and safety plans and issues
8) Provides guidance for accident investigations
9) Develops specialized health and safety plans for unique project requirements

4) Supervising the safety performances of his or her staff to ensure that the required work practices are employed
5) Arranging appropriate medical attention for employees in the event of an injury
6) Promptly reporting to the CDHS and worker's compensation insurance company the occurrence of any work-related injury or illness
7) Ensuring that the site safety plans have been prepared and reviewed for all applicable projects

2.5 VIROGROUP EMPLOYEES

Ultimately, the responsibility of safety at ViroGroup rests with the employees themselves. They are responsible for:

1) Following all ViroGroup safety policies and procedures
2) Utilizing all safety equipment in the proper manner
3) Promptly reporting all unsafe situations to their supervisor
4) Promptly reporting all work-related injuries and illnesses, to their supervisor
5) Promptly seeking appropriate medical attention when injured on the job

4) Label all hazardous chemical containers. ViroGroup will utilize the Hazardous Materials Identification System (HMIS) for labeling of all chemicals. Each location is responsible for ensuring that their chemicals are properly labeled both in the office and on job sites.

5) Provide a chemical hazard awareness education seminar which will be provided to all new and existing employees under the direction of the office safety officer. It is to be provided prior to initial assignment which involves potential exposure to hazardous chemicals. Each safety officer will initially be trained by the Acting Corporate Health and Safety Officer.

3.2 VIROGROUP MEDICAL SURVEILLANCE PROGRAM

A comprehensive medical surveillance program has been developed for all ViroGroup field personnel. ViroGroup has developed this program to help ensure continuing welfare of each employee exposed to potentially hazardous situations. Specifically, the program is designed to determine the ability to safely wear personal protective equipment, to determine the extent of exposure to hazardous chemicals and to provide medical treatment and advice. All facets of the program have been designed to comply with medical monitoring guidelines presented in 29CFR 1910.120,29 CFR 1926.58.

Participation in the program is currently mandatory for all field personnel who may be required to work around hazardous chemicals or materials. This includes all environmental and industrial hygiene field personnel.

These employees shall receive pre-employment baseline, annual, and exit examinations. If exam results indicate an employee may be a "high risk" they will be excluded from projects with potential for exposure. Likewise, if results indicate a person's inability to safely work under specific physical conditions or to wear specific protective equipment, then that individual will not be placed in high risk situations. In the event of a work site accident,

4.0 HEALTH AND SAFETY TRAINING

4.1 NEW EMPLOYEE SAFETY ORIENTATION

Upon initial hire and prior to job assignment, each new ViroGroup employee shall receive a health and safety orientation pertaining to his or her particular duties. At a minimum, this shall include a complete review of all policies and procedures outlined in this manual. This review shall be conducted under the direction of the employee's supervisor and/or office safety officer. The employee is required to complete a "Safety Certification" form after all initial orientation and safety training has been conducted.

Prior to an initial job assignment, the new employee shall be issued all necessary safety equipment and personal protective equipment and shall be given specific instruction on its proper use.

Upon initial job assignment, the new employee shall work under the direct supervision of experienced personnel for a period of not less than three (3) days. This time frame may be shortened if it is determined that the individual has worked under similar circumstances in previous job situations.

4.2 HAZARD COMMUNICATION TRAINING

Each new ViroGroup employee must successfully participate in ViroGroup's Hazard Communication Awareness training as required by OSHA 29 CFR 1910.1200. Training will be performed by each location's safety officer. The training will be documented with the successful completion (70%) of a written exam.

9) Site Safety Plans
10) Emergency Procedures
11) Confined Space Entry
12) Trench and Excavation Safety
13) Medical Surveillance
14) Temperature Stress
15) Cardiopulmonary Resuscitation (CPR) and First Aid Instruction
16) Final Written Examination

The program must also include, at a minimum, actual dress-out simulations in Level C protective clothing.

4.3.2 Additional Training

ViroGroup employees trained in the 40 hour course are required to participate in an annual 8-hour refresher course which provides an overview of material presented in the 40-hour course. Supervisory personnel must participate in an additional 8-hour supervisor's health and safety course, which emphasizes safety management and more in-depth evaluation of health and safety procedures. These courses will be offered through the ViroGroup Jacksonville location.

B) **Contact the Acting Corporate Director of Health and Safety or Assistant CDHS**

- Be prepared to give all details of the situation and instructions on how the CDHS can contact those involved at the site.

c) **Contact Supervisor and/or Safety Officer**

- Personnel should immediately inform their supervisor regarding the situation.

Following these actions, personnel will be given proper direction on how to proceed. Remember, if there is <u>any</u> doubt about the safety of ViroGroup employees in a particular circumstance, initiate this course of action immediately and without hesitation.

5.1.2 Employee Injury

In the event that an ViroGroup employee is injured in the field due to physical or chemical hazards, the following course of action will be taken by properly trained personnel:

1) Initiate first-aid procedures and arrange for prompt medical attention for the employee. If possible, move or evacuate all personnel from the area of immediate hazard.

2) If the injury involves potential chemical exposure, immediately contact the office physician. He will give instructions as to specific procedures which may need to be followed. Also, remember to inform all emergency personnel that there is potential chemical contamination involved. If possible, initiate decontamination procedures to prevent contamination of responding personnel.

3) Promptly notify the appropriate off-site supervisor.

4) If the injury is serious or involves potential overexposure to hazardous chemicals, immediately notify the Acting Corporate Director of Health and Safety and local supervisor.

3) **Eye Wash/Emergency Shower**

A portable eye wash and emergency shower must be maintained on sites where workers may physically contact corrosives or other eye and skin irritants. The eye wash must be capable of delivering a 15 minute flow of water simultaneously to both eyes.

5.2.2 Office Equipment

1) **First-Aid Kits**

At least one centrally located first-aid kit must be maintained at each ViroGroup office. All employees must be familiar with its location. First-Aid kits shall be stocked with an acid/alkali neutralizer.

injuries, the local safety officer or a representative of the Jacksonville office may assist with the investigation.

6.1.3 Notifications

1) It is the injured employee's responsibility to notify his or her supervisor as soon as possible regarding an injury. The supervisor should be notified of all injuries, no matter how minor.

2) **If the incident results in a lost-time injury or any type of chemical exposure, the supervisor must immediately contact the Acting Corporate Director of Health and Safety (CDHS).**

3) In the event of an occupationally related death, the supervisor must immediately contact the CDHS. The CDHS is required by law to notify the regional OSHA office within 48 hours.

6.1.4 Recordkeeping

Proper paperwork follow up to any occupational injury or illness is mandated by OSHA and is essential for ViroGroup to conduct injury analysis.

1) Within six (6) days following any injury, it is the project manager or job site supervisor's responsibility to properly complete the appropriate "First Report of Injury" form (Appendix B). The original copy of this form must be forwarded to ViroGroup's worker compensation insurance company for processing. Concurrently, a copy must be forwarded to the CDHS and a copy should also be maintained in the local office's injury files.

6.2.2 Accident Investigation

It is the supervisor's responsibility to initiate an investigation into the cause of any on-the-job vehicle accident.

6.2.3 Notifications

1) It is the employee's responsibility to notify his or her supervisor as soon as possible regarding any on-the-job vehicle accident.
2) If the accident involves a lost-time injury, the supervisor must immediately contact he CDHS.

7.0 SITE SAFETY PLANS

7.1 INTRODUCTION

Every project, no matter how trivial, poses some risk of injury or other on-site emergency. In order to be prepared for these emergencies, the need for a Site Safety Plan (SSP) must be evaluated prior to the start of each project.

Site Safety Plans informs employees of what hazards they could be exposed to, when that exposure is likely to occur, how to protect themselves from the hazards, and what to do in case of emergency. This allows the entire project to run more smoothly and, hopefully, without the need for the emergency response section of the plan.

Not all projects present an equal number of hazards or risks and as such, different levels of generic SSPs are available for use. Each type of SSP, as well as the situations to which they apply, are described below. Please note that these SSP formats may need to be modified to fit the particular characteristics of a project.

7.2 WHICH SSP FOR THE JOB?

Site safety plans, in their various forms, are necessary for almost all projects. However, some jobs or sites may require a more in-depth plan than others.

7.2.1 Non-Hazardous Projects

Some jobs are relatively non-hazardous, such as Phase I site assessments or building walk-throughs. **Each project is different and in each situation the project manager must carefully evaluate the need for a SSP.** SSPs are normally not required for these types of activities.

4) Operations involving hazardous wastes that are conducted at TSD facilities.

5) Emergency response operations for releases or threats of releases of hazardous substances.

Even if an ViroGroup project site does not fall into one of the above mentioned categories, a SSP should be prepared for any site which involves sampling, remediation, or potential contact with contaminated materials. A generic SSP format is included in Appendix C.

8.2 MEDICAL CLEARANCE

Prior to placement in a situation where respiratory protection is required, each ViroGroup employee must receive a medical examination. Specific aspects of the complete exam are outlined in the Medical Surveillance section of this manual and are designed to evaluate the employees ability to safely wear respiratory protection (i.e., pulmonary function test). A positive statement must be obtained from the supervising physician that the employee is capable of wearing respiratory equipment, particularly air-purifying respirators. If, in the opinion of the physician, the employee cannot wear a respirator, he or she will not be assigned to jobs where its use is required.

8.3 TRAINING AND INSPECTION

As part of the 40 hour comprehensive health and safety course, ViroGroup employees will receive extensive training on all types of respiratory protective equipment including air-purifying respirators, air-line respirators and self contained breathing apparatus. Specifically, all personnel shall receive classroom and hands-on training covering, at a minimum, the following:

1) Explanation of the different types of respiratory protection available and the degree of protection afforded by each
2) The limitations of air-purifying respirators
3) Instruction on the proper selection of respirators, cartridges, filters, etc.
4) Instruction on donning, doffing and properly fitting a respirator
5) Participation in a qualitative fit test for air-purifying respirators
6) Instruction on inspecting, cleaning and maintaining respirators
7) Actual hands-on field use of air-purifying respirators and SCBA

Items 1-6 are to be repeated annually as part of the 8-hour health and safety refresher course.

3) In atmospheres containing unknown types and concentrations of contaminants (i.e., initial site entry)

4) For protection against gases, vapors, mists, fumes or dusts with inadequate warning properties

8.4.2 APR Fit Testing Procedure

Prior to using any air-purifying respirator, the employee must successfully pass a qualitative fit test to ensure the selection of the proper make, model, and size respirator. An annual fit test will be performed thereafter to continually ensure the proper fit of that particular model. A new fit test will be required if the employee selects a different type respirator than initially fitted.

The entire qualitative fit test procedure consists of the initial size selection, negative pressure test, positive pressure test, and the irritant smoke test. The fit test protocol must be conducted routinely as part of the 40-hour health and safety course and/or the 8 hours refresher.

8.4.3 Individual Issue

Respirators will be assigned to those employees designated for field work that requires the use of a respirator. A respirator will be assigned individually for their exclusive use and employee names will be marked indelibly on the face piece. Exchanging respirators between employees is unacceptable unless proper fit testing is done and the respirator is cleaned and disinfected.

8.4.4 APR Cleaning

Respirators shall be cleaned and disinfected as frequently as necessary to ensure proper protection is maintained and as a minimum requirement, cleaned and disinfected after each

1) Facepiece - check for:

- Excessive dirt (clean all dirt from facepiece)
- Cracks, tears, or holes (obtain new facepiece)
- Distortion (allow facepiece to "sit-free" from any constraints and see if distortion disappears; if not, obtain new facepiece)
- Cracked, scratched, or loose fitting lenses (contact respirator manufacturer to see if replacement is possible; otherwise, obtain new facepiece)

2) Headstraps - check for:

- Breaks or tears (replace headstraps)
- Loss of elasticity (replace headstraps)
- Broken or malfunctioning buckles or attachments (obtain new buckles)

3) Inhalation valve, exhalation valve - check for:

- Detergent residue, dust particles or dirt on valve or valve seat (clean residue with soap and water)
- Cracks, tears, or distortion in the valve material or valve seat (obtain replacement valves from manufacturer)
- Missing or defective valve cover (obtain valve cover from manufacturer)

4) Filter element(s) - check for:

- Proper filter for the hazard
- Approval designation
- Missing or worn gaskets (contact manufacturer for replacement)
- Worn threads - both filter threads and facepiece threads (replace filter or facepiece, whichever is applicable)

8.6.2 Eye Glasses

Employees who wear eye glasses and must wear a full facepiece respirator will be provided special corrective lenses that can be mounted inside the facepiece. **Contact lenses will not be permitted at any time when wearing a respirator.**

8.6.3 Protective Clothing

No clothing, facelets, or coverings will be permitted between the face and facepiece. Coverall hoods and head coverings will be put on over the respirator.

8.7 PROGRAM EVALUATION

The Acting Corporate Director of Health and Safety will periodically evaluate the entire ViroGroup respiratory protection program to ensure its continued effectiveness. This evaluation will include unannounced field and office inspections, intermittent meetings with office safety officers, and discussions with personnel. In addition, the respirator training program will be reviewed and updated as necessary.

9.1.2 Level C

Level C offers more protection than Level D and incorporates a degree of dermal and respiratory protection. It should be selected under the following conditions:

1) Hazardous air contaminants have been measured and documented.
2) There is a known contaminant.
3) All criteria for using APRs are met.
4) Air monitoring will be conducted to detect any changes in the concentration.

Typically Level C protection shall include the following:

- Full-face APR with appropriate cartridge
- Chemically resistant outer clothing
- Chemically resistant inner and outer gloves
- Chemically resistant outer boots
- Steel toe work shoes or boots
- Hard hat

9.1.3 Level B

Level B represents the highest degree of respiratory protection and shall be selected under the following conditions:

1) The type and concentration of contaminants is unknown.
2) The limitations for APRs are exceeded.
3) The concentration of the contaminant(s) is immediately dangerous to life and health.

9.3 FOOT PROTECTION

ViroGroup personnel are required to wear steel toed safety footwear (complying with ANSI specification Z41.1) in the following situations:

1) All construction sites (including UST projects, hazardous waste sites, etc.) or any site which contains building debris or other foots hazards.
2) Around any drilling operation
3) Around any heavy equipment operation
4) When handling any concrete cylinders
5) All industrial sites

The use of safety footwear in other situations must be determined by the project manager based upon the potential for foot injury.

9.4 HEAD PROTECTION

ViroGroup employees working in areas where there is a potential for head injury due to impact, or from falling or flying objects, are required to wear protective hard hats, which meet ANSI Specification Z89.1. Head protection is mandatory in the following situations:

1) All construction sites
2) Around any drilling operation
3) Around any heavy equipment operation

The need for hard hats in other situations must be determined by the project manager based upon the potential for head injury.

10.0 CONFINED SPACE ENTRY PROCEDURES

10.1 POLICY

ViroGroup has developed this confined space entry policy to outline requirements, equipment needs, and procedures necessary to conduct safe operations in field confined space situations. Confined spaces can become unsafe as a result of:

- Oxygen deficiency
- Toxic vapors or gases
- Flammable vapors or gases
- Contact with chemicals
- Moving equipment
- Slips, trips, falls
- Electric Shock
- Etc.

The provisions of this program apply to all ViroGroup personnel, ViroGroup contractors and subcontractors, and site visitors who may enter confined work spaces such as, but not limited to, underground storage tanks, process vessels, crawl spaces, pipe tunnels, ventilation ducts, low-lying excavations, utility vaults, caissons, footings, etc.

ViroGroup personnel shall make every effort <u>not</u> to enter a confined space. However, if they must enter, this policy <u>must be strictly followed.</u> **(All confined space entries must be performed under the direct supervision of the CDHS or his/her designee.)**

Isolation - A process whereby the confined space is removed from service and completely protected against the inadvertent release of materials by the following means: inserting a suitable full-pressure blank (skillet type metal blank between flanges) in all lines, misaligning sections of lines and pipes, or valve-chain lockout of lines, and lockout of all sources of electrical power and blocking or disconnecting all mechanical linkages.

Lead Hazard - Refers to the potential for exposure to organic (tetraethyl) lead in tanks which have been used for leaded petroleum products. Since these tanks will contain residual lead of varying concentrations, they must be regarded as dangerous to the extent that respiratory (supplied air respiratory protective equipment) and whole body skin protection must be used throughout the cleaning process. These tanks must not be considered lead-free until proven so by lead-in-air analysis.

LEL (lower explosive limit) - The minimum concentration of a flammable gas or vapor in air (usually expressed in percent by volume at sea level) which will ignite if an ignition source is present.

Oxygen Deficiency - Refers to an atmosphere with a partial pressure of oxygen of less than 132 mm Hg. Normal air contains approximately 21% oxygen. For the purpose of this directive, any atmosphere containing less than 19.5% oxygen shall be considered oxygen deficient and immediately dangerous to life and health. All requirements for work in Confined Space, Class "A", must be met.

Purging - The method by which gases, vapors or other airborne impurities are displaced from a confined space. This may involve such measures as mechanical ventilation, steam ventilation, or introducing another gas such as nitrogen or carbon dioxide to control flammable vapors.

1) Entry into a confined space is prohibited until initial testing of the interior atmosphere has been completed from the outside.

2) Testing shall be done by the site supervisor who has been trained in the use of the monitoring equipment, familiar with the nature of the hazards, and authorized to perform the tests.

3) All monitoring instruments must be UL approved for use in Class I, Division I, Group A, B, C, and D atmospheres.

4) All instrumentation must be maintained in proper working condition and must be calibrated immediately before and after each use.

5) Entry into a confined space for any type of work is prohibited when tests indicate the concentration of flammable gases in the atmosphere is equal to or greater than 20% of the lower explosive limit (LEL).

6) Entry into a confined space for any type of work is prohibited when tests indicate the concentration of oxygen to be less than 19.5% or greater than 23.5%.

7) Entry into a confined space for any type of work is prohibited when tests indicate the concentrations to be in excess of the established Immediately Dangerous to Life and Health (IDLH) level for a particular toxic contaminant.

8) All air monitoring results must be documented and posted at the job site.

10.3.3 Ventilation Procedures

1) Prior to actual confined space entry and throughout the entry procedure, the space shall be mechanically ventilated to prevent accumulation of:

- Flammables in the atmosphere at concentrations above 20% of the LEL
- Concentrations of combustible dusts
- Toxic contaminants in the atmosphere above the TLV
- Toxic contaminants having no rated TLV
- Oxygen deficient (<19.5%) or excessive (>25%) atmospheres

10.3.5 Electrical Safety Procedures

1) Lockout-Tagout

- All equipment and sources of potential hazardous energy release shall be physically deenergized and immobilized using the lockout-tagout procedures presented in 29 CFR 1910.147.

2) Electrical Lighting and Equipment

- All temporary lighting and power equipment taken into a confined space must be intrinsically safe and approved for use in Class I, Division I, Group A, B, C, and D atmospheres.
- Extension cords shall be equipped with connectors or switches approved for hazardous locations.
- All electrical equipment must be regularly inspected for signs of damage.

10.4 PERSONAL PROTECTIVE EQUIPMENT

10.4.1 Protective Clothing

All employees, including the standby person, shall use applicable protective equipment, such as head and eye protection, gloves, boots and impervious clothing, as required by the nature of the residues to be removed and atmospheric contaminants.

10.4.2 Respiratory Protection

All procedures and equipment for respiratory protection in confined spaces must comply with the ViroGroup respirator policy.

The degree of respiratory protection is dependent upon the classification of the confined space as indicated below:

10.5 CONTAMINATION REDUCTION

10.5.1 Confined Space Decontamination

Maximum effort shall be made to remove and clean all flammable, toxic, or corrosive chemicals from the work space prior to entry.

Vacuum trucks, if used to remove sludge from a tank, shall be properly bonded to the tank and located where vapors will disperse away from the site.

10.5.2 Personnel Decontamination

Employees who come into contact with hazardous chemicals while in a confined space must undergo proper personnel decontamination procedures upon exiting the space. The extent of decontamination and the cleaning solutions utilized is dependent upon the chemical hazards involved and the level of protective equipment. Personnel decontamination procedures will be described in the Site Specific Safety Plan.

10.6 EMERGENCY RESCUE PROCEDURES

1) One person shall be designated as emergency standby and stationed outside of the confined space at all times when internal work is being performed, ready to give assistance in case of an emergency. The standby shall be familiar with the permit procedure, be alert for changing conditions, know how to summon assistance immediately, and know how to use all rescue equipment specified for the job.

The designated individual should have current training in:

- CPR
- First Aid
- Air-line respiratory systems
- Self-contained breathing apparatus (SCBA)

6) Prior to the start of confined space entry, the standby shall determine the location of the nearest:

- Phone
- Fire Extinguisher
- Eyewash and Shower
- First Aid Kit

7) The standby employee will enter the vessel only after alerting at least one additional employee outside the confined space of the existence of an emergency and of the standby employee's intent to enter the confined space, and only in case of emergency such as:

- A worker inside suffers an injury
- A worker inside indicates breathing difficulties

8) The standby shall call the worker(s) out of the vessel:

- If the standby employee has to leave for any reason
- If an emergency signal or alarm is sounded
- If the standby employee detects or suspects the presence of any harmful substance

10.7 ADDITIONAL SAFETY RULES

10.7.1 Compressed gas cylinders, other than breathing air, are <u>never</u> to be taken into a confined space.

10.7.2 Pneumatic tools should be operated with compressed air, <u>not</u> compressed oxygen or other inert gases.

10.7.3 Minimize the number of hoses, tools, and other equipment in a confined space which may contribute to slip, trip or fall hazards.

11.1.2 Oxygen

An oxygen detector must be utilized by ViroGroup personnel to monitor upon entry and periodically, where conditions exist, for an oxygen deficient environment. The normal concentration of oxygen in air is approximately 20.8% by volume. It is ViroGroup policy that no personnel shall enter an atmosphere or conduct any work in an atmosphere which contains an oxygen content equal to or less than 19.5% by volume unless equipped with a pressure demand supplied air respirator. Likewise, no personnel shall enter or work in an oxygen enriched atmosphere equal to or greater than 23.5% by volume.

11.1.3 Organic Vapors and Gases

Direct reading monitors which utilize photo or flame ionization detection systems shall be used to conduct general on-site surveys for the presence of airborne volatile organic vapors and gases. These devices have definite limitations in that they monitor only certain vapors and gases in the air and are non-specific in their results. Consequently, other devices such as colorimetric detector tubes, designed for specific compounds, may have to be utilized as well.

Unlike combustible gases or oxygen, the action level for toxic gases and vapors is variable and dependent upon the permissible exposure limit (PEL) of the substance. The action levels for toxic vapors and gases will be determined prior to project start up and outlined in the site safety plan. If ViroGroup is to undertake a project where an employee will enter an atmosphere containing unknown concentrations of the substances, only trained personnel in the use of air Level B personal protection will be allowed to enter and conduct specific air monitoring. Only when levels are documented within the limits of using APR will other employees be allowed to participate.

11.3 INSTRUMENT CALIBRATION

All ambient and personal air sampling devices must be calibrated according to manufacturer recommended procedures immediately before using the instrument. A verification of calibration should also be done immediately after use to see that the instrument has remained in calibration. All calibration activities must be documented.

12.0 SITE CONTROL

ViroGroup is targeting and becoming more involved with remediation projects. As our involvement increases in this type of work, so must our safety awareness. To minimize the transfer of hazardous materials from a contaminated site to uncontaminated areas, ViroGroup will establish site work zones and will institute strict decontamination procedures.

12.1 WORK ZONES

An essential measure toward reducing the migration of contaminants is to delineate the site into three specific work zones. Movement of personnel and equipment must be coordinated through designated access control points. All personnel entering or visiting the site must first review the site specific safety plan and must also sign in.

12.1.1 Exclusion Zone

The innermost of the three zones is the Exclusion Zone. It shall be established in the area where contamination has been documented does or potentially could exist. The outer-most boundary of the Exclusion Zone is the Hotline. Any ViroGroup personnel, subcontractors, or site visitors who cross over the Hotline and into the Exclusion Zone must wear <u>all</u> necessary protective equipment as prescribed in the site specific safety plan. The Hotline must be made visually identifiable with fencing, traffic cones, traffic barricades, yellow tape, etc.

12.1.2 Support Zone

The Support Zone, the outermost zone on the work site, shall be established in the non-contaminated or "clean area". All support equipment (office trailer, tent, etc.) is designated for this area. Contaminated personnel, equipment, or samples are strictly prohibited from

9) Potential for exposure

10) Proximity to residential or industrial areas

12.3 WORK SITE MODIFICATIONS

Once work zones have been established, changing conditions or scope of work may necessitate the modification of the work site. Work zones may be reduced or enlarged, shifted or otherwise changed for any of the following reasons:

1) Wind direction shift
2) Monitoring and sampling reveals a more hazardous situation than originally thought
3) Monitoring and sampling reveals a less hazardous situation than originally thought
4) Monitoring and sampling indicates an abnormal spread of contamination into the CRZ
5) Monitoring and sampling reveals the spread of contamination into the Support Zone

13.1 PERSONAL DECONTAMINATION

13.1.1 Decontamination Equipment

The following equipment is typical of the materials necessary for decontamination:

1) Plastic drop cloth (10' X 25')
2) Two basins or wading pools (for wash and rinse)
3) Two pressurized garden sprayers (for application of wash and rinse)
4) Water
5) Decontamination solution
6) Two long handled scrub brushes
7) Two 55 gallon drums with liners (for disposal of contaminated items)
8) Chairs, benches, or stools
9) Small bucket (to wash respirator facepieces)

13.1.2 Decontamination Solutions

Usually, protective equipment is decontaminated by scrubbing with detergent water using a soft-bristle brush, followed by rinsing with copious amounts of water. Specific decontamination solutions may be required for more difficult decontamination problems. Table 12.1 lists several decontamination solutions which may be utilized.

13.1.3 Decontamination Protocol

Typically the personnel decontamination procedure starts with the most heavily contaminated areas of the body and proceeds to the least contaminated. The following outline illustrates the decontamination scenario used by personnel working in Level C protection.

Station 6 (Outer Glove Removal)

- Remove outer gloves and deposit in container with plastic liner.

Station 7 (Protective Coverall Removal)

- Remove outer protective coverall inside out and deposit it into a plastic lined drum. If wearing an inner coverall, keep it on.

Station 8 (Facepiece Removal)

- Remove respirator and place in designated container for complete sanitization.

Station 9 (Inner Glove Removal)

- Remove inner gloves inside out. Fold one glove down halfway from the wrist (left hand), remove right hand glove. Remove left hand glove by grasping "clean" and non-exposed section.

------CONTAMINATION CONTROL LINE------

Station 10 (Shower and Locker Room)

- If a shower trailer is available, thoroughly shower with soap and water.

13.3.2 Heavy Equipment

Contractor machinery such as bulldozers, trucks, back-hoes, etc. may require decontamination in certain circumstances. Such heavy equipment will be decontaminated utilizing a combination of high pressure water wash, and/or steam cleaning, and/or hand scrubbing with decontamination solution. Run-off from the area must be prevented using polyethylene plastic and/or a sump system. Wipe tests may be utilized to measure decontamination effectiveness, if deemed necessary.

13.4 DECONTAMINATION MODIFICATION

It is possible that changing conditions, changes in work scope, the discovery of additional hazardous materials, etc. may necessitate the alteration of the decontamination system being used on site. ViroGroup personnel must always be prepared to adjust to such situations by maintaining extra decontamination equipment on site (i.e. brushes, basins, decon solutions, etc.). ***All modifications must be documented and dated in the site safety plan.*** The CDHS should be informed of any changes.

13.5 DISPOSAL OF CONTAMINATED MATERIAL

All materials and equipment used for decontamination must be disposed of properly. Non-disposable clothing (i.e., respirators, boots, gloves, etc.) must be completely decontaminated before removing from the site.

In many instances, disposable clothing will be utilized. This material must be secured in drums or other containers, properly labeled, and disposed of with other contaminated substances on site. In addition, tools, brushes, plastic, wash and rinse solutions, etc. which cannot be decontaminated must be secured in drums, labeled and disposed of with other substances on site.

14.0 TEMPERATURE STRESS

ViroGroup personnel may frequently be required to perform site operations outdoors, thus increasing the potential for exposure to temperature extremes. The use of required PPE at hazardous waste sites can compound the effects of temperature exposure. Because of the potential seriousness of this problem, the means to recognize, evaluate, and control this specific hazard must be addressed with each project.

14.1 HEAT STRESS

Heat-related problems occur when the body's physiological process fails to maintain a normal body temperature due to excessive heat and/or humidity. A number of physical reactions can occur ranging from fatigue, irritability, anxiety and decreased dexterity, to nausea, unconsciousness, coma and death. ViroGroup personnel must be capable of recognizing the onset of heat stress disorders as outlined below:

14.1.1 Stages of Heat Stress

1) Heat rash results from continuous exposure to heat or humid air.

2) Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:
   - muscle spasms
   - pain in hands, feet and abdomen

3) Heat exhaustion occurs from increased stress on various body organs inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:
   - pale, cool, moist skin
   - heavy sweating

- ViroGroup personnel should not wear a semipermeable or impermeable garment when his/her oral temperature exceeds 100.6 degrees F (38.1 degrees C).

3) Weight Loss

- ViroGroup personnel may be weighed on a scale at the beginning and end of each work day to determine if enough fluids are being taken to prevent dehydration. Body weight loss should not exceed 1.5 percent of total body weight per day.

14.1.3 Preventive Measures

ViroGroup shall use one or more of the following control measures to prevent the onset of heat stress.

1) Water or electrolyte supplemental drink shall be provided for body fluid replacement. Workers should drink approximately 16 ounces of fluid before work and one or two cups at each break. A total of 1 to 1.6 gallons of fluid per day are recommended, but more many be necessary to maintain body weight.
2) Establishment of a work routine that will provide adequate rest periods for cooling down and gradual acclimatization.
3) Ice vests or other cooling devices may be worn under protective clothing.
4) Breaks shall be taken in a cool rest area if possible. A portable should be erected if no shade is naturally available.
5) Employees shall not be assigned other tasks during rest breaks.
6) All employees shall be informed of the importance of adequate rest, acclimatization, and proper diet in the prevention of heat stress.

3) Breaks shall be taken in a warm rest area if possible. This may be an office trailer or the cab of a truck.

4) If clothing becomes wet, dry replacements shall be donned.

5) If personnel become chilled or their extremities become painful or numb, they shall be removed from the cold environment until warm.

15.2.2 Size Up the Load

If the object is too heavy or awkward, get help! Tip the load to see how light or heavy it is before attempting to lift it. Any objects over 50 lbs. should be carried by two persons. If the load is too large to grip firmly and comfortably, it is too large to carry alone.

Check the load for splinters and staples, loose strapping or tape, or other hazards that could injure hands or cause a tripping hazard.

15.2.3 Lifting

1) When preparing to lift, place one foot alongside the object and one foot behind it. Keep the back straight. Grip the load firmly with the palms of the hands.
2) The employee should ensure that their body weight is centered over their feet. Draw the object close if necessary. Lift the object straight up, using the legs and keeping the back straight.
3) When turning while carrying a load, shift the feet rather than twisting the body. Feet should be pointed in the direction of travel before lifting the object.
4) Do not try to lift an object above the waist level in one motion. Set the load on a table or bench, then adjust the grip to lift it higher.

15.3 CARRYING TECHNIQUES

1) Before carrying a load, check the intended route for tripping hazards. Check doorways for clearance, and open those doors before lifting the load.
2) Use just as much caution when carrying "light" loads. A light load can be just as hazardous as a heavy one.
3) When carrying long items, such as piping or lumber, carry it on the shoulder, keeping the front end high. If two or more people are going to carry a load, decide ahead of

16.0 UNDERGROUND STORAGE TANK (UST) OPERATIONS SAFETY

Work at UST sites can typically involve exposure to a variety of physical as well as chemical hazards including the potential for fire, explosions, trench cave-in, and confined space dangers. The following safety procedures outline the minimum guidelines to be implemented during the following UST site activities:

A) Monitoring well installation
B) QC and management of tank closure or removal
C) Tank removal
D) Physical entry of tanks for any purpose
E) Collection of samples
F) Cutting operations on tanks or associated piping
G) Pumping product from pits or tanks for subsequent disposal

16.1 TRAINING

All ViroGroup employees conducting UST operations **MUST** first successfully complete a 40-hour health and safety course and have current certificates on file at the Jacksonville office.

If any ViroGroup employees are to conduct confined space entry they must first receive specific training in confined space entry procedures.

16.2 SITE SAFETY PLANS

A site safety plan must be prepared for each UST project. It is the backbone of the safety effort on any job. Its intent is to convey safety information, specifically for a particular job, to the employees assigned to the project.

compressors, ventilation units, vacuum trucks, etc. must be explosion-proof if used in the vicinity of flammable gases or vapors.

5) No welding or cutting with a torch is permitted inside, outside, or near a tank or excavation which contains flammable materials. Non-sparking tools must be used in such a situation.

6) After the tank has been purged or inerted, and before it is removed from the excavation, all accessible holes should be plugged or capped. One plug should have an 1/8 inch vent hole to compensate for excessive pressure differential caused by temperature changes.

7) Tanks should not be dragged at any time.

8) If a tank explodes, the weakest points are typically the ends, so stay clear of them.

9) Constantly be aware of other potential sources of combustible gases or vapors which might enter the project site (i.e., nearby tanks, etc.)

10) ABSOLUTELY NO SMOKING ON SITE!!

16.3.2 Trenches and Excavations

Entry into an unstable pit, excavation, or trench is an extremely dangerous practice which can result in serious injury or death. OSHA requires in 29 CFR 1926.65 that proper preventive measures be taken for excavations deeper than 5 feet. However, even excavations shallower thank 5 feet can be dangerous in unstable conditions. The following guidelines must always be observed:

1) **If at all possible, never physically enter a pit, trench or excavation. To take a soil sample, have the equipment operator collect the material in his bucket, or use an extension probe to obtain the sample.**

2) If it is necessary to enter the pit, the sides must first be sloped, shored, sheeted, braced, or otherwise supported. When sloping the sides, the angle of the cut ("angle of repose") will vary depending upon the type of soil conditions. The specifications and materials necessary for shoring and bracing are outlined in 29 CFR 1926.65.

3) Without exception, all ViroGroup personnel must wear the following when on a UST site:

- Safety glasses or goggles
- Hard hat
- Steel-toe/steel-shank safety footwear

REMEMBER: No protective clothing can protect you in the event of fire or explosion!

16.5 SUBCONTRACTORS AND SITE VISITORS

ViroGroup shall employ only prequalified subcontractors with knowledge of tank removal procedures. Subcontractors retained by ViroGroup to conduct work at UST sites must abide by all ViroGroup safety regulations and all facets of the site safety plan. All subcontractor employees must provide written proof they have completed the 40 hour health and safety training course before setting foot on a project site. Subcontractor employees must participate in a medical surveillance program and shall be required to wear all appropriate protective equipment. A complete review of the subcontractor's safety policy and procedures should be conducted prior to project start-up, and closely monitored throughout.

All site visitors must also follow all procedures as outlined in the site safety plan.

2) Catastrophe or Fatality

Catastrophe or fatality inspection follows any employment-related fatality or accident which results in hospitalization of five (5) or more employees, OSHA is notified, and generally conducts an inspection.

3) Special Emphasis Program

Special emphasis program inspections are those conducted in high hazard industries or operations, specifically, hazardous waste removal, trenching, etc.

4) General Schedule

General schedule inspections are made on a routine basis by OSHA in those industries determined by OSHA to have a high frequency of reported injuries.

5) Follow-up Inspections

Follow-up inspections are conducted to ascertain whether or not the alleged violations of the earlier inspection have in fact abated (corrected). The inspector will usually not return until after the fifteen (15) day contest period has expired. (In most cases, a follow-up inspection will not be scheduled if confirmation of full abatement has been mailed to OSHA).

6) Employee Complaint

If the inspection has been initiated by an employee complaint, the inspector must provide a copy of the complaint to the ViroGroup representative at the time of the inspection. Employee complaints must be in writing, must set forth with reasonable particularity the grounds for the complaint, and must be signed by the employee or a representative of the employees. The employee may request that his name be deleted from the copy of the complaint given to the employer.

After obtaining the above information, advise the OSHA inspector that you cannot authorize entry into the job site without clearance from the Director of Health and Safety and that you

3) Do not operate equipment or demonstrate a process at the request of the inspector. Do not explain how something is used, whether it is in service, or how long a condition has existed. Make explicit notes regarding what the inspector says.

4) The compliance officer will also ask to see the Hazard Communication Program, OSHA 200 injury logs, and, if required, medical monitoring records. In addition, have the respirator program and current fit test records available on sites where respirators are being utilized. The 200 log and injury reports may be seen at the corporate or district office.

5) The inspector may, during the inspection, point out to the employer unsafe or unhealthy conditions. **DO NOT COMMENT** on the inspector's observations. **DO NOT** agree on an abatement date or any corrective action. Although something could be corrected immediately, do not attempt to correct it. It may still be cited and fined, despite the fact that the perceived deficiency was corrected. Additionally, your attempt to correct something is, in effect, an admission that it was in violation to begin with. (You may say "no comment," "I don't know," "I don't agree with your assessment of the hazard," or "you'll have to contact the corporate office.")

6) The inspection may encompass the entire site, even if only a small portion was the source of the complaint.

17.2.4 The Closing Conference

The inspector will attempt to go over the violations he believes he found and will attempt to get you to commit to an abatement date and corrective action. **UNDER NO CIRCUMSTANCES** should the ViroGroup representative admit there was a violation or agree that the situation can be corrected or agree to a date of abatement. Any admission or activities taken to correct a situation can only damage ViroGroup's position relative to the inspection.

These violations can carry penalties up to $250,000 (for willful violations resulting in employee death, $500,000 for a corporation) or $1,000 per day until the violation is corrected (failure to abate).

17.4 APPEALS PROCESS

Within 15 working days of the employer's receipt of a written citation, the employer who wishes to contest must submit a written objection to OSHA. If you wish to set up an informal hearing, this too must be done within 15 days, but can be done by phone. **Contact the Corporate Director of Health and Safety, who will handle this process.**

OTHER HAZARDS

Heat Stress: ____yes ____no. If yes, please specify precautions to be taken:

_____

_____

Cold Stress: ____yes ____no. If yes, please specify precautions to be taken:

_____

_____

_____

Excessive Noises: ____yes ____no. If yes, please specify precautions to be taken:

_____

_____

Confined Space Entry: ____yes ____no. If yes, please insure sub-contractor provides site entry permit.

Open Excavations: ____yes ____no. If yes, entry into excavation required?

____yes ____no. If so, specify precautions to be taken:

_____

_____

Welding and/or Cutting: ____yes ____no. If yes, please specify precautions to be taken:

_____

_____

Heavy Equipment Operation: ____yes ____no. If yes, please specify precautions to be taken: _____

_____

Heavy Equipment Operation: ____yes ____no. If yes, specify type of equipment and precautions taken: _____

_____

Equipment Decontamination

Gross Removal By:

Hand scrubbing _____
Cold high pressure wash _____
Hot high pressure wash _____
Steam cleaning _____
Other (specify) _____

Clean rinse _____

Decon solution (specify) _____

Decontamination Waste Water

Collection (specify how) _____

_____

Direct Discharge (specify how and where) _____

_____

Pre-treatment (specify) _____

_____

Disposal (specify how and where) _____

_____

J. AMBIENT AIR MONITORING (1910.120(B)(4))

Activity	Instruments	Action Level	Frequency

Insert Site map

All personnel have read the above plan and are familiar with its provisions. All personnel have received local surveillance and training in compliance with the ViroGroup Health and Safety Policy.

NAME	SIGNATURE

VIROGROUP, INC.

Company Health and Safety
Program and Procedure Manual

Program No.: HS 150
Date: 8/26/94
Supersedes: 11/92
Approved: MG Woltanski, CIH MGW

Subject: Respiratory Protection Program

This procedure establishes ViroGroup, Inc.'s (ViroGroup) Respiratory Protection Program (RSP). It establishes responsibilities and basic requirements for ViroGroup personnel who are required to work in situations where respiratory hazards may be present. This Program was developed in accordance with the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), the American National Standards Institute (ANSI) Practices for Respiratory Protection (Z88.2), and the NIOSH Guide to Respiratory Protection.

ViroGroup will provide approved and certified respirators and component parts to employees at no cost to the individual. Employees will use this respiratory protective equipment in accordance with this procedure, and the instructions and training that are provided. This document, with applicable procedures, constitutes ViroGroup's written Respiratory Protection Program.

RSP Procedures

HS-150.1	Program Administration and Responsibilities
HS-150.2	Type of Approved Respirators
HS-150.3	Hazard Evaluation and Respirator Selection
HS-150.4	Medical Surveillance
HS-150.5	Respirator Fit Testing
HS-150.6	Training
HS-150.7	Inspection, Maintenance, Cleaning, and Storage
HS-150.8	Respirator Inspection Procedures
HS-150.9	Evaluation of Program Effectiveness
HS-150.10	Respirator Types in Use at ViroGroup Offices
HS-150.11	Qualitative Fit Test Procedures

Subject: Respiratory Protection Program - Program Administration and Responsibilities

The Respiratory Protection Program is administered by the ViroGroup Health and Safety Manager (HSM) with assistance from the Office Safety Coordinators (OSC). The HSM will:

- Oversee the Company wide implementation of the Respiratory Protection Program;
- Periodically audit and evaluate the Program implementation at the various offices;
- Evaluate this Program on an on-going basis to ensure that it reflects current practice and regulations;
- Evaluate various makes and types of respirators to determine their suitability for ViroGroup use;
- Assist OSCs in their implementation of this Program;
- Develop and provide training programs as described in procedure HS 110; and
- Responsible for undertaking, on an annual basis, a formal written evaluation of the effectiveness of the ViroGroup Respiratory Protection Program.

The Regional/Office Managers are responsible for ensuring that this program is implemented and that the appropriate resources are available to implement and administer the program in their area of responsibility. The Regional/Office Manager will:

- Ensure employees are provided training as required by this Program (See Procedure HS-150.6);
- Ensure employees participate in the Medical Surveillance program prior to the issuance of respiratory protection; and
- Ensure that provisions of any local or state regulations are also implemented.

The OSCs are responsible for assisting the HSM in the implementation of the Respiratory Program by:

- Providing guidance to local staff regarding the use of respiratory protective equipment that has been approved under this procedure;
- Providing qualitative fit tests to local staff; and
- Providing feedback to the HSM regarding program effectiveness.

Project managers (PM) and Site Safety Officers (SSO) are responsible for:

- Implementing this Program, as described in the site-specific health and safety plan, in all field operations;
- Ensuring each project field staff members training and fit testing is current as required by this Program; and
- Providing feedback to the HSM regarding program effectiveness.

Staff members are responsible for:

- Complying with this Program as it applies to their activities and
- Provide feedback to their supervisor regarding program effectiveness.

Subject: Respiratory Protection Program - Types of Approved Respirators

Only respirators approved and certified by the National Institute for Occupational Safety and Health (NIOSH) and/or the Mine Safety and Health Administration (MSHA) under 30 CFR Part 11 shall be used by ViroGroup personnel. Such respirators are listed in the NIOSH Certified Equipment List, which is issued in December of each year.

Respirators can be divided into two categories, negative pressure and positive pressure. Within these categories, the following types of respirators are approved for use by ViroGroup personnel:

- Negative pressure;
  - half-face air purifying respirators and
  - full-face air purifying respirators.

- Positive pressure;
  - powered air purifying respirators,
  - pressure-demand self-contained breathing apparatus, and
  - air line/supplied air respirator with escape bottle.

ViroGroup will provide employees with an opportunity to fit test negative pressure air purifying respirators from several manufacturers in order that an employee will get the appropriate fit. For the purposes of uniformity and availability, the following hierarchy will be followed when fit-testing negative pressure air purifying respirators:

- Half-face:
  1 - Mine Safety Appliances Comfo II;
  2 - American Optical AO 5 Star;
  3 - Scott Model 66; and
  4 - Any other certified half-face respirator.

- Full-face:
  1 - Mine Safety Appliances Ultra-Twin;
  2 - American Optical AO 7 Star/Omni Star;
  3 - Scott Model 65; and
  4 - Any other certified full-face respirator.

Descriptions of these types of respirators and their capabilities are provided in the Respiratory Protection Training course.

ViroGroup personnel will not alter any respirator from its approved configuration for any reason. Any question in this regard should be directed to the HSM.

Subject: Respiratory Protection Program - Hazard Evaluation and Respirator Selection

The Office Safety Coordinator, in conjunction with the HSM, will determine the appropriate type of respirator for a specific hazard. The selection of respiratory protective equipment will be based upon these five basic steps:

- Identification of the hazard;
- Evaluation of the hazard level;
- Consideration of the user's personal characteristics;
- Consideration of the conditions of use;
- Use of an approved respirator.

The accompanying Respirator Decision Flow Diagram outlines the decision process typically used by ViroGroup.

IDENTIFICATION OF THE HAZARD

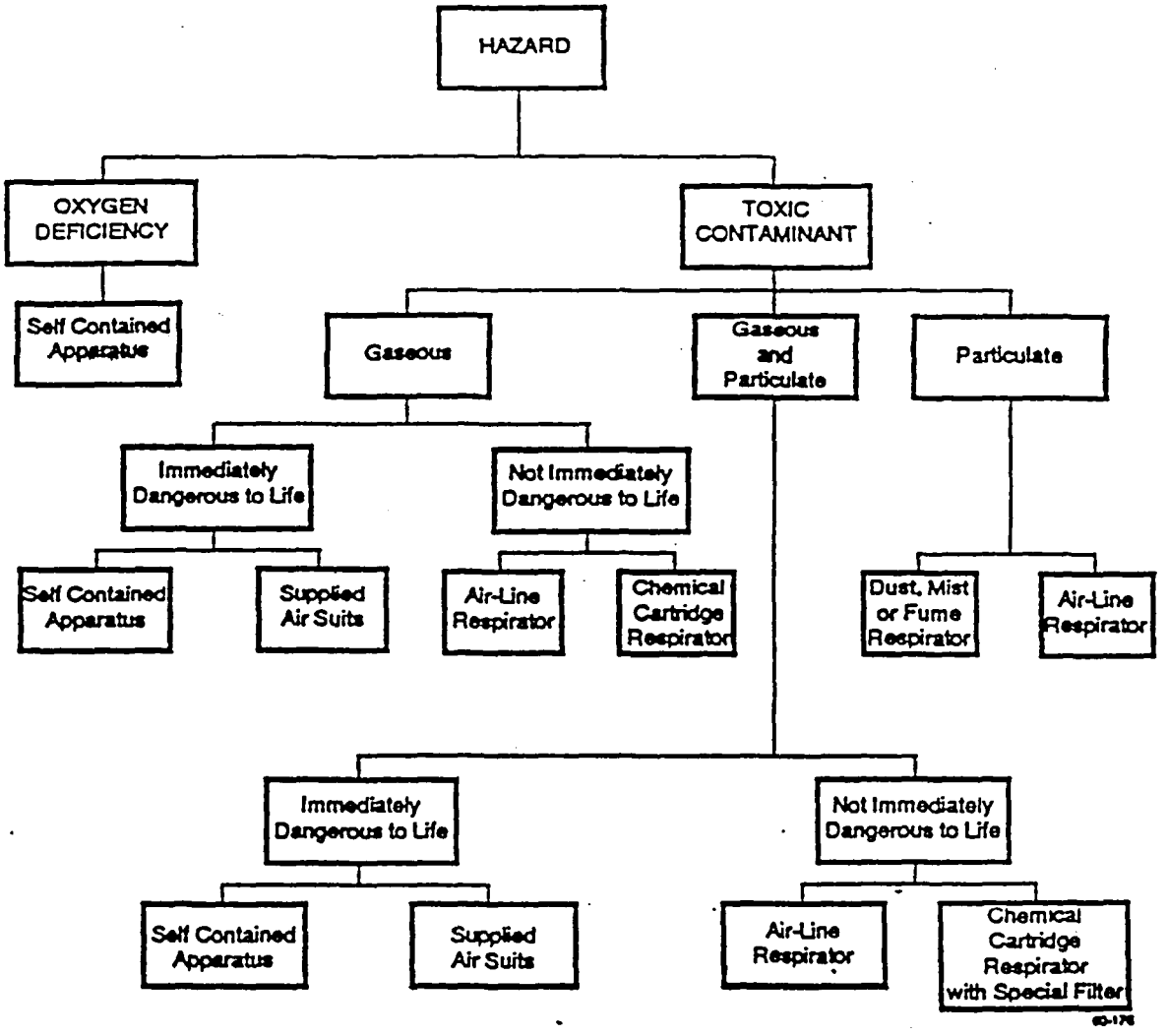
Identification of the type of hazard is the first step in the selection of a respirator. Although the number of hazardous conditions which might require a respirator are virtually limitless, they will generally fall into one of the following five categories:

Gas or Vapor Contaminant

Gases are substances which normally exist as such at ordinary temperature and pressure; e.g., carbon monoxide or sulfur dioxide, where as vapors are the gaseous state of substances that would be solid or liquid at ordinary temperature and pressure; e.g., acetone or benzene vapors.

Most gases and vapors are colorless but may have a distinctive odor which helps in hazard identification. The odor threshold of many gases and vapors are below the Permissible Exposure Limit (PEL) or Threshold Limit Value (TLV) and odor therefore can be used as an indication of a hazard. A few gases and vapors, however, have odor thresholds above their respective PEL's and the perception of their odor indicates that a hazardous concentration has already been exceeded. The HSM can provide information regarding odor thresholds for specific chemicals. Regardless of the relationship between the odor threshold and PEL, the perception of contaminant odor is an indication of respirator leakage or cartridge breakthrough and the respirator wearer should exit the area immediately.

RESPIRATOR DECISION FLOW DIAGRAM



Particulate Contaminants

Particulate contaminants are made up of tiny particulates or droplets of a substance. Many of these particles are so small (less than 50 microns in diameter) that they cannot be seen, and those less than 10 microns in diameter can be easily inhaled. Particles less than 5 microns in diameter are small enough to reach deep into the lungs or into the alveoli.

Particulates are produced by mechanical means through the disintegration processes such as grinding, crushing, drilling, blasting or spraying; or by physicochemical reactions such as combustion, vaporization, distillation, sublimation, calcination or condensation.

Combination of Contaminants

Gaseous and particulate contaminants frequently occur together. Paint spraying, for example, produces both paint mist (particulate) and solvent vapors (gaseous). Smoke also contains particulates and gases.

Oxygen Deficient Atmospheres

In an oxygen deficient atmosphere, the problem is not the presence of something harmful but the absence of something essential. Such atmospheres are most commonly found in confined and usually poorly ventilated spaces; such as silos, in-ground vaults, petrochemical tanks, and the holds of ships. Oxygen deficient atmospheres are classified as immediately dangerous to life or health (IDLH).

An accurate description of an oxygen deficient atmosphere is important for proper respirator selection, but no one definition has been universally accepted. For ViroGroup and OSHA compliance purposes, an oxygen-deficient atmosphere is any area which contains less than 19.5 percent oxygen in the breathing zone of workers in that area.

IDLH Atmospheres

An IDLH atmosphere is defined as an atmosphere in which exposure results in irreparable, irreversible damage and/or death to the exposed person within 30 minutes or less. These are atmospheres where an employee exposure can:

- Cause serious injury or death within a short period of time (e.g., high concentrations of carbon monoxide or hydrogen sulfide);
- Cause serious delayed effects (e.g., airborne radioactive materials or cancer-causing agents); and/or
- Prevent exposed personnel from escaping the environment within 30 minutes.

Once a hazardous situation has been categorized as one of the hazards above (i.e., gas, vapor, particulate, oxygen deficient, IDLH), an initial decision can be made concerning the general type of respirator that may be selected. HS 150.10 describes general types of respirators available and a decision logic chart for respirator selection based on these five hazard types is contained in this procedure.

EVALUATION OF THE HAZARD LEVEL

The second consideration in selecting a respirator is the level or concentration of the hazard requiring the respirator. The concentration of the air contaminant and how it compares to the TLV or PEL for that substance must be known in order to determine the "protection factor" which the respirator must provide. The "protection factor" is the ratio of the concentration of the contaminant outside the respirator to that inside the respirator under typical conditions of use. Respirators should be selected so that the concentration inside the respirator will not exceed the TLV or PEL.

$$MUC = PF \times TLV$$
$$PF = MUC/TLV$$

Where: MUC = maximum use concentration; PF = protection factor (calculated); TLV = threshold limit value (or use PEL-permissible exposure limit).

Respirator protection factors tend to vary depending upon the specific standard cited. The list below presents protection factors that are generally accepted in the absence of standards that indicate otherwise.

Protection Factor	
Half-face filter or chemical cartridge respirator	10
Full-face filter or chemical cartridge respirator	50
Powered air-purifying respirator	100
Self-contained breathing apparatus, pressure-demand[1]	10,000 +

CONSIDERATION OF THE USER'S PERSONAL CHARACTERISTICS

It is imperative that individuals required to work in various levels of respiratory protection be evaluated and fit to use the equipment properly. Physical and/or mental conditions such as, claustrophobia, impaired lung functions, smoking, and obesity, may preclude specific individuals from wearing this type of equipment. If this is the case, these individuals should be assigned other duties at the site or assigned to office duty only. Such conditions can be identified through the evaluation procedures and processes discussed below.

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[1] It should be noted that this "protection factor" is under review and may already be lowered to 1,000. This is being considered based on the fact 10,000 may reach percutaneous hazard levels and/or exceed LEL values for one or more of the chemicals present.

Medical Condition

The use of any type of respirator will impose some physiological stress on the user. For example:

- Air-purifying respirators make breathing more difficult because the filter or cartridge impedes the flow of air;
- The special exhalation valve on an open circuit-pressure demand respirator requires the wearer to exhale against some resistance;
- The bulk and weight of an SCBA can be a burden; and
- If the wearer is using an airline respirator, they might have to drag up to 300 feet of hose around.

All these factors can significantly increase the employee's workload and wearers will have medical examinations to determine if they are medically able to wear respiratory protective equipment without aggravating preexisting medical problems.

In order for the Medical Doctor to render a qualified opinion on employee respirator usage, the physician should be provided with the following information:

- The type of respiratory protection equipment to be used, and its modes of operation;
- The tasks an employee will be expected to perform while wearing the respirator;
- The length of time that the employee might wear the equipment; and
- Any substance to which the employee could be exposed, and related the substance's physical and chemical characteristics.

Emotional and Mental Factors

Emotional and mental factors must also be considered when employees wear respirators. Some individuals feel claustrophobic when wearing them, especially with protective clothing. If there are indications that an individual suffers from chronic claustrophobia, such individuals should not be placed in such a situation.

Physical Characteristics

Scars, hollow temples, very prominent cheekbones, deep skin creases, and lack of teeth or dentures may cause respirator facepiece sealing problems. Full dentures should be retained when wearing a respirator, but partial dentures may or may not have to be removed, depending upon the possibility of swallowing them under duress.

Corrective Lenses

If glasses or goggles are required, they shall be worn so as not to affect the respirator. If a full face piece respirator is worn, a proper seal cannot be established due to eyeglasses temple bars extending through the sealing edge of the facepiece. **Wearing contact lenses with any type of respirator is not permitted.**

Systems have been developed for mounting corrective lenses inside full facepieces; and when a person must wear corrective lenses, the proper facepiece and lenses must be obtained to provide good vision, comfort, and a gas-tight seal. ViroGroup will arrange, at no cost to the employee, for such systems to be provided to those personnel who need them.

CONSIDERATION OF THE CONDITIONS OF USE

Eye Irritation

If the air contaminant can cause eye irritation a full facepiece respirator shall be used. These contaminates comprise all those materials classified as mucous membrane irritants.

Skin Irritation or Absorption Through the Skin

Some airborne contaminants are extremely irritating to the skin (ammonia or hydrochloric acid) while others are capable of being absorbed through the skin and into the blood-stream with serious and possibly fatal results (hydrocyanic acid, benzene, or organophosphate pesticides such as parathion, malathion or tetraethyl pyrophosphate).

Rubber facepiece material can cause skin irritation, contact dermatitis, for some individuals; the use of non-allergenic silicone facepieces can help alleviate this condition.

Communication

Speech communication may be necessary in jobs where a respirator is required. Conventional respirators, however, distort the human voice to some extent and shouting can cause facepiece or component leakage.

Mechanical speech transmission devices called speaking diaphragms are available as an integral part of some respirators. These consist of a resonant cavity and diaphragm which amplify sound in the frequency range most important to speech. The diaphragm acts as a barrier to entry of ambient atmospheres and should be carefully handled and protected by a cover to prevent puncture or breakage.

Methods of electronically transmitting speech from the respirator utilize microphones connected to a telephone, facepiece, or earlobe while the amplifier, power pack and loudspeaker or transmitter are attached to the exterior of the mask, are carried on the body or are remotely located. Respirators with electric or electronic speech transmission devices having an integral or body-attached battery power supply should be used with caution in explosive atmospheres, and connecting cables from microphones inside the facepiece must have gas-tight seals were they emerge from the facepiece. When the loudspeaker diaphragm is part of the barrier between the respirator wearer and the ambient

atmosphere, it should be inspected frequently for leakage and protected from puncture or breakage.

Location of Hazardous Work Area

The location of the contaminated area with respect to a possible source of respirable air requires special consideration. When using an airline respirator, the distance that the wearer can go into a contaminated atmosphere is limited by the length of hose connected to the source of respirable air. The hose also requires that the user must enter and leave the area by the same route unless the device is equipped with an auxiliary air cylinder appropriate for use in egress from the work area. While wearing an SCBA or filter respirator, a person may leave the contaminated area by any approved exit, but one must make certain that the device will afford protection until reaching respirable air, taking into account possible delays including decontamination.

Duration of Task

Work time usually determines the period for which respiratory protection is needed, including time necessary to enter and leave a contaminated area. A self-contained breathing apparatus or chemical cartridge respirator provides respiratory protection for relatively short periods, whereas an airline respirator provides protection for as long as the facepiece is supplied with adequate respirable air. Particulate-filter respirators can provide protection for long periods, without need for filter replacement, but only if the atmospheric particulate loading is low. Therefore, for protracted periods of use, an airline respirator offers definite advantages over a filter respirator.

Some respirators have a means for indicating remaining service life. Some type of warning is available for all self-contained breathing apparatus. This may be a pressure gage, timer, or an audible or physical alarm. The user should understand the operation and limitations of each type of warning device. Most chemical-cartridge respirators have no indicator of remaining service life. Canisters and cartridges should be changed according to the manufacturer's directions.

Activity Required

The work area to be covered, work rate, and mobility of the wearer in carrying out the work should be considered in respirator selection. Air-purifying respirators present minimal interference with the wearer's movement. Supplied air respirators with trailing hoses severely restrict the area the wearer can cover and present a potential hazard if the hose comes in contact with machinery or other objects. SCBAs presents a size and weight penalty which may restrict climbing and movement in tight places.

The wearer's work rate determines his respiratory minute volume, maximum inspiratory flow rate, and inhalation ant exhalation breathing resistance. The respiratory minute volume is of great significance in self-contained and airline respirators operated from cylinders since it determines their operating life; it is also a factor in cartridge service life on air-purifying respirators. Useful life under moderate work conditions may be one-third of that under rest conditions.

Peak flow rate is important in the use of constant flow airline equipment. The air supply rate should always be greater than the peak inspiratory flow rate to maintain the respiratory enclosure under positive pressure. When using air-purifying respirators, the high breathing resistance of air-purifying respirators under conditions of heavy work can result in distressed breathing.

Work in Low Temperatures

The major problem in the use of respirators at low temperatures is freezing of exhalation valves, and for full facepieces, poor visibility for interior fogging during exhalation. Full facepieces are designed so that the incoming fresh air sweeps over the inside of the lens to reduce fogging. Otherwise, it would be impossible to wear a full facepiece even at ordinary room temperature without severe fogging. Anti-fog compounds may be used to coat the inside of the lens to prevent fogging at room temperatures and down to temperatures approaching 32 degrees Fahrenheit (°F). However, below 0°F, anti-fog compounds will not prevent severe fogging. Full facepieces also are available with nose cups that direct moist exhaled air through the exhalation valve. A properly fitted nose cup should, in theory, allow adequate visibility at temperatures down to -30° F.

At very low temperatures, the exhalation valve may collect moisture and freeze open, allowing the wearer to breathe contaminated air, or freeze closed, which prevents normal exhalation. High-pressure connections on SCBA also may leak because of metal contraction at low temperatures. The connections should not be overtightened since they may break when the temperature returns to normal.

Work in High Temperatures

A person working in areas of high ambient or radiant temperature is already under stress, and any additional stress resulting from use of respirators should be minimized. This can be done by selecting and using respirators having minimum weight and breathing resistance. Supplied-air respirators and hoods and suits having an adequate supply of cool breathing air are recommended. Also, a simple venturi valve, operated by compressed breathing air, is available for that purpose.

USE OF AN APPROVED RESPIRATOR

Having considered the type of hazard, the level of the hazard, user characteristics, and the conditions of use, a decision can be made concerning the appropriate type of respirator. HS 150.9 provides a description of various types of respirators.

As important as selecting the right type of respirator is the selection of an approved respirator. The National Institute for Occupational Safety and Health (NIOSH) provides a testing, approval, and certification program for respiratory protective devices. Approved devices are listed in the NIOSH Publication, NIOSH Certified Equipment List. This publication is updated periodically with the addition of newly approved equipment and deletion of equipment which has lost its approval. All approved devices have a "TC" (Tested and Certified) number permanently printed on each item; this number is referenced in the NIOSH Certified Equipment list described above. Only NIOSH/MSHA approved respiratory protective equipment will be issued to and worn by ViroGroup employees.

Subject: Respiratory Protection Program - Medical Surveillance

No employee will be assigned to a task that requires the use of a respirator unless it has been determined that the person is physically and psychologically able to perform the task using an appropriate respirator. This determination will be made on an annual basis by the ViroGroup Medical Doctor.

All ViroGroup personnel who will be using respiratory protective equipment must also be participants in the ViroGroup Medical Surveillance Program (see HS 120). In baseline and subsequent medical examinations, participants will undergo, among others, a pulmonary function test; the results of this exam will be reviewed by the Medical Doctor to determine the participant's fitness for use of respiratory protective equipment. The components of the various examinations are described in HS 120.8. Periodic exposure monitoring of respirator users will be conducted in accordance with the parameters set forth in HS 180.

ViroGroup uses all the resources available to screen each employee required to wear respiratory protective equipment before they perform their work task. Some factors that may impose hardships on an employee required to wear respiratory protective equipment are described below:

Physiological Factors

Wearing any type of respirator imposes some physiological stress on the wearer. With air-purifying devices, resistance to inhalation is always experienced-because the filter or chemical cartridge restricts airflow; in addition, the wearer must work against the exhalation valve upon expiration. Similar breathing resistance is encountered when using pressure-demand type air-line respirators or SCBA because the spring-loaded exhalation valve used is designed to always maintain positive pressure within the mask. This feature requires an additional 1.5 to 3.0 psi of exhalation pressure to open this type of exhalation valve. The bulk and weight of SCBAs (up to 35 lbs.) is of some concern, especially when an employee must perform strenuous work. Air-line respirator units require that the wearer drag around the hose or airline, which provides additional stress on the job performance.

Pulmonary Factors

In the physical exam, respirator wearers are examined for any evidence of respiratory impairment such as emphysema, obstructive lung disease, or bronchial asthma. Historical and clinical evidence of impairment of pulmonary function, including x-ray findings or a reduction in vital capacity or forced expiratory volume, may justify a restriction from wearing a respirator that restricts inhalation and exhalation, even though the individual may be able to perform adequately in a continuous-flow supplied air device.

Cardiovascular Consideration

The use of air-purifying demand or pressure-demand supplied air devices may pose a serious problem for employees with cardiovascular disease, but they may be able to use continuous-flow devices. As always, the physician must make a final determination. If an employee has cardiovascular disease, serious consideration should be given to assigning him where he need not require the use of respiratory protection and also where he need not respond to an emergency situation or escape from a contaminated area with respiratory protective devices.

Health Problems

Conditions that may prevent an employee from wearing a respirator, and thus from working in a contaminated area, include:

- Diabetes;
- Epilepsy;
- Alcoholism;
- Use of certain medication;
- Punctured ear drum;
- Skin sensitivities;
- Impaired or non-existent sense of smell; and/or
- Any other condition that the physician determines to place the employee at added physical risk.

Each make and model of respirator facepiece has a slightly different fit. Although each manufacturer designs their facepieces to fit as broad a cross section of the working population as possible, no respirator fits everyone. Conditions which may adversely affect a good facepiece fit include: growth of beard; sideburns; a hair style that projects under the facepiece; temple pieces on glasses; facial scars; facial injuries; and dentures.

ViroGroup provides employees with respirators from several manufacturers so that each person can select a respirator that fits properly and is reasonably comfortable. It is in the process of matching the respirator to the individual user that a fit testing procedure is needed.

Subject: Respiratory Protection Program - Respirator Fit Testing

Fit testing is required by OSHA and ANSI. OSHA requires it every 6 months for asbestos workers. ViroGroup provides each respirator user a fit test in order to select the specific type, make, and model of negative pressure respirator for use by the wearer.

The following policies are observed in the fitting and use of the respirator:

- Fit testing for positive pressure respirators (see HS 150.11) is required;
- Personnel shall be allowed to use only the specific make(s) and model(s), of air purifying respirators for which the person has obtained a satisfactory fit verified through fit testing procedures;
- An employee is not permitted to use any respirator not previously fit tested or if the results of the fit test indicated that the person was unable to obtain a satisfactory fit;
- No facial hair or glasses are allowed during fit testing that could interfere with the attainment of a good seal. Facial hair (e.g., some moustaches) that does not interfere with a good facepiece-to-face seal is permissible;
- ViroGroup will provide persons requiring glasses with specially mounted glasses inside the full face mask. Under no circumstances will contact lenses be worn while using any type of respirator;
- If it is found that a employee cannot obtain a good facepiece-to-face seal because of facial features or medical factors, that equipment shall not be used and they shall not enter an atmosphere requiring the use of that equipment;
- The Health and Safety Manager and the Office Safety Coordinators will keep records of the make, model, size, and type of respirator each employee has been fit tested with. The record will include the date and signature of the person performing the test;
- Fit tests will be repeated at least annually; asbestos operations personnel will be fit-tested every six months;
- ViroGroup respirator fit testing criteria are found in HS 150.11.

Subject: Respiratory Protection Program - Training

Although equipment selection is important to the success of a respiratory protection program, the proper use of the equipment is equally important. Proper use can be ensured by carefully training employees in the selection, use and maintenance of the selected equipment.

ViroGroup provides initial respiratory protection training and annual refresher training which is usually included in the initial and annual certification. The training will cover the following topics, as a minimum:

- ViroGroup Respiratory Protection Program;
- Overview of respiratory protection;
- Physiology of the respiratory system;
- Classification of respiratory hazards;
- Air-purifying respirators;
- Supplied air respirators;
- Respirator selection, use and limitations;
- Fit testing, maintenance and cleaning; and
- Examination.

Optional Topics

- SCBA/Airline Respirators Check-out Procedures and Donning.
- SCBA/Airline Respirators Field exercise.

Subject: Respiratory Protection Program - Inspection, Maintenance, Cleaning, and Storage

Respirator maintenance is a integral part of ViroGroup's Respiratory Protection Program. Wearing a poorly maintained or malfunctioning respirator is, in one sense, more dangerous than not wearing a respirator at all because workers wearing defective devices THINK they are protected when in reality they are not. It is the responsibility of the Office Safety Coordinator and/or Site Safety Officer to ensure compliance with inspection, cleaning, maintenance and storage requirements. The program requires at a minimum:

- Inspection for defects, including a leak check;
- Repair as required;
- Cleaning and disinfecting; and
- Proper and sanitary storage of equipment.

The maintenance program should ensure that each worker's respirator remains as effective as when it was new.

Inspection For Defects And Maintenance

If properly performed, inspections will identify damaged or malfunctioning respirators before they can be used. The OSHA standard outlines two types of inspections:

- Before and after use, and
- During cleaning.

All respiratory equipment will be inspected thoroughly during the cleaning process and before the apparatus is used. Identified defects will be repaired or the defective part replaced. Proper inspection, maintenance, and cleaning of respiratory equipment is the responsibility of the user of the equipment. Inspection procedures are described in HS 150.8.

Cleaning

Cleaning and sanitizing of the units is accomplished in the following manner:

- The apparatus is broken down into its components as described in the manufacturer's schematic display that accompanies the unit. This step also affords the opportunity to thoroughly inspect each of the components for any defects, excessive wear and tear, etc. Discard any previously used cartridges.

- Thoroughly wash the facepiece and mask components in a cleaning and sanitizing solution, such as the one ounce package of powdered MSA Cleaner-Sanitizer to 1 gallon of warm water (120°F). The components should be scrubbed with a sponge or soft brush to remove dust, dirt, or other contaminants.

- Thoroughly rinse all component pieces in warm water. This step is important because residuals of cleaning solutions can cause irritation and/or dermatitis for some individuals.

- Air dry all components thoroughly, inspect them again for any defects, reassemble the units, and store properly until the next use.

Storage

Respirators will be stored in a convenient, clean, and sanitary location to protect them against dust, sunlight, excessive heat or cold, excessive moisture, damaging chemicals and mechanical damage. They will be stored individually, not stacked one upon the other or in cramped spaces, in such a manner as prevent distortion of rubber or other elastomeric parts. Respirators should be stored in plastic bags, preferably in the cartons in which they came, and readily identifiable as to the individual to whom it has been assigned.

Subject: Respiratory Protection Program - Respirator Inspection Procedures

Air-purifying respirators should be checked on a routine monthly basis to insure safe operating conditions for the equipment. Additionally, respirators should be inspected, as follows, before and after each use:

1. Examine the facepiece for:

    - Excessive dirt;
    - Cracks, tears, holes, or physical distortion of shape from improper storage;
    - Inflexibility of rubber facepiece (stretch and knead tc restore flexibility).;
    - Cracked or badly scratched lenses in full facepieces;
    - Incorrectly mounted full facepiece lenses, or broken or missing mounting clips; and
    - Cracked or broken cartridge/filter holder(s), badly worn threads, and/or missing gasket(s) if required.

2. Examine the head straps or head harness for:

    - Breaks;
    - Loss of elasticity;
    - Broken or malfunctioning buckles and attachments; and
    - Excessively worn serrations on head harness, which might permit slippage (full facepieces only).

3. Examine the inhalation and exhalation valves for the following, after removing its cover:

    - Foreign material, such as detergent residue, dust particles, or human hair under the valve seat;
    - Cracks, tears, or distortion in the value material;
    - Improper insertion of the valve body into the facepiece;
    - Cracks, breaks, or chips in the valve body, particularly in the sealing surface;

- Missing or defective valve cover(s); and
- Improper installation of the valve into the valve body.

4. Examine the air-purifying element (cartridge/filter) for:

- Incorrect cartridge, canister, or filter for the hazard;
- Incorrect installation, loose connections, missing or worn gasket, or cross threading in the holder;
- Expired shelf-life date on the cartridge or canister;
- Cracks, dents, or rust on or in the outside case of the filter, cartridge, or canister, indicated by the absence of sealing material, tape, foil, etc., over the inlet.

5. If the device has a corrugated breathing tube, examine it for:

- Broken or missing end connectors;
- Missing or loose hose clamps;
- Deterioration of the tube, determined by stretching the tube and looking for cracks;

ATMOSPHERE-SUPPLYING RESPIRATORS

For an SCBA/Air line device in routine use, employ the following procedures:

1. If the device is a tight fitting facepiece, use the procedures outlined under air-purifying respirators, except for the air supply hose to the air supply or air purifying elements.

2. If the device is a hood, helmet, blouse or full suit, use the following procedures:

- Examine the hood, blouse, or full suit for rips, tears, seam integrity, etc;
- Examine the protective headgear, if required, for general condition with emphasis on the suspension inside the headgear;
- Examine the protective face shield, if any, for cracks, breaks, or impaired vision; and
- Make sure the protective screen is intact and secured correctly over the face shield of abrasive blasting hoods and blouses.

3. Examine air supply systems for:

- Integrity and condition of air supply lines and hoses, including attachment and end fittings, replacing worn, damaged or severely abraded elements and

- Correct operation and condition of all regulators, or other air flow regulators.

SCBA INSPECTION PROCEDURES

Before a self-contained breathing apparatus can be used, it must be properly inspected to help prevent malfunctions during use. The checklist that follows can help ensure proper inspection.

PRESSURE-DEMAND SCBA WITHOUT MODE SELECT LEVER

Prior to starting checklist, make sure that:

- High-pressure-hose connector is hand-tight on cylinder fitting;
- Bypass valve is closed;
- Mainline valve is closed; and
- Regulator outlet is not covered or obstructed.

Back Pack and Harness Assembly - Straps

- Visually inspect for complete set and
- Visually inspect for frayed or damaged straps.

Back Pack and Harness Assembly - Buckles

- Visually inspect for mating ends and
- Check locking function.

Back Plate and Cylinder Lock

- Visually inspect back plate for cracks, missing rivets, or missing screws;
- Visually inspect cylinder hold-down strap; and
- Physically check strap tightener and lock to assure that it is fully engaged.

Cylinder and Cylinder Valve Assembly

Cylinder

- Physically check to assure that it is tightly fastened to back plate;
- Visually inspect for large dents or gouges in metal;
- Check hydrostatic test date to assure it is current; and
- Ensure that cylinder is fully charged.

Head and Valve Assembly

- Visually determine cylinder valve lock is present;
- Visually inspect cylinder gauge for condition of face, needle, and lens;
- Open cylinder valve - listen or feel for leakage around packing - if leakage is noted, do not use until repaired; and
- Note function and operation of valve lock.

Regulator and High-Pressure Hose

High-pressure hose and connector

- Listen or feel for leakage in hose or at hose-to-cylinder connector and
- Check for bubble in outer hose covering which can be caused by seepage of air through hose when stored under pressure and does not necessarily indicate a faulty hose.

Regulator and low-pressure alarm

- Place mouth onto or over regulator outlet and blow. A positive pressure should be created and maintained for 5 to 10 seconds without loss of air. Next, inhale to create a slight negative pressure on regulator, hold for 5 to 10 seconds, vacuum should remain constant. This tests integrity of the diaphragm. Any loss of pressure or vacuum during this test indicates a leak in the apparatus;
- Ascertain that regulator outlet is not covered or obstructed. Open and close bypass valve momentarily to assure flow of air through by-pass system;
- Cover regulator outlet with palm of hand. Open mainline valve and read regulator gauge (must read at least 1,800 psi and not more than rated cylinder pressure);
- Remove hand from outlet and replace in rapid movement. Repeat twice more. Air should escape when hand is removed each time, indicating a positive pressure in chamber; and
- Close cylinder valve, leaving the main line valve open, and slowly move hand from regulatory outlet to allow air to flow slowly. Gauge should begin to show immediate loss of pressure as air flows. Low-pressure alarm should sound between 520 and 480 psi. Remove hand completely from outlet and close mainline valve.

Facepiece and Corrugated Breathing Tube

Facepiece

- Visually inspect straps and harness for damaged serrations and deteriorated rubber. Visually inspect rubber facepiece body for signs of deterioration or extreme distortion;

- Visually inspect lens for proper seal in rubber facepiece, retaining clamp properly in place, and absence of cracks or large scratches;

- Visually inspect exhalation valve for visible deterioration or buildup of foreign materials; and

- Carry out negative pressure test for overall seal and check of exhalation valve.
  (In monthly inspection, place mask against face and use following procedure; in preparing for use, don back pack, then facepiece, and use following procedure: "With facepiece held tightly to face, or facepiece properly donned, stretch breathing tube to open corrugations and place thumb or hand over end of connector. Inhale, negative pressure should be created inside mask, causing it to pull tightly to face for 5-10 seconds. If negative pressures drops this indicates a leak in the facepiece or breathing tube.")

Breathing tube and connector

- Stretch breathing tube and visually inspect for deterioration and holes;

- Visually inspect connector to assure good condition of threads and for presence and proper condition of rubber gasket seal.

Storage of Units

The following procedures and/or activities need to be accomplished prior to returning units to storage:

- Cylinders are refilled as necessary and units are cleaned and inspected;

- Cylinder valves are closed;

- High-pressure-hose connectors are hand- tight on cylinder;

- Pressure is bled off of high-pressure hose and regulator;

- Bypass valve is closed;

- Mainline valve is closed;

- All straps completely loosened and laid straight;

- Facepieces are properly stored to protect against dust, direct sunlight,

extreme temperatures, excessive moisture, and damaging chemicals.

Respirator Maintenance Record form is on the following page.

RESPIRATOR USE AND MAINTENANCE RECORD

RESPIRATOR

_____

ID NUMBER

OFFICE: _____

LOCATION: _____

DIVISION: _____

LHSR: _____

RESPIRATOR TYPE: _____

MANUFACTURER: _____

MODEL NUMBER: _____ DATE PLACED IN SERVICE: _____

Date	Assigned to Whom and Location of Storage	Inspection/Maintenance and Charging (SCBA) Information	Serviced By

Subject: Respiratory Protection Program - Evaluation of Program Effectiveness

In compliance with 29 CFR 1910.134 and ANSI Z88.2, ViroGroup will evaluate its Respiratory Protection Program effectiveness regularly so that all persons involved are being provided with the best respiratory-protection possible. This will be accomplished through the ViroGroup Health and Safety Manager and action will be taken to correct defects in the program.

Project Managers and Site Safety Officers will perform spot inspections of respirator use to ensure that:

- the proper types of respirators are being used for the job;
- that employees properly perform positive/negative pressure fit tests prior to entering contaminated areas
- individuals who are required to wear respirators have received proper training;
- respirators are inspected and maintained properly;
- respirator storage is satisfactory
- respiratory hazards are monitored;
- the respirators being used are in good operating condition; and
- medical and biochemical surveillance of the respirator user is being carried out.

They will also periodically consult with respirator users about respirator comfort, interference to breathing, interference with job performance and their confidence in respirator effectiveness. To determine the continued need for respiratory protection or a necessity for additional protection, there will be appropriate surveillance of the work area and the degree of employee exposure or stress, including area and personal monitoring of contaminant levels and types.

Data obtained from periodic inspections of respirator use, work area surveillance, medical surveillance, and wearer comments will be reviewed and analyzed to evaluate the continued effectiveness of the program. Any evidence of excessive exposure to a hazardous atmosphere will be investigated and action taken to remedy the problem.

Subject: Respiratory Protection Program - Respirator Types in Use at ViroGroup Offices

AIR PURIFYING RESPIRATORS

These respirators remove contaminants from the air breathed but do not supply oxygen. They cannot be worn in oxygen deficient atmospheres.

Particulate (dust, mist, fume) Removing

These respirators are called "dust", "mist", or "fume" respirators and remove particulates by a filtering action before they can be inhaled. They offer no protection against atmospheres containing contaminant gases or vapors.

The airflow resistance of a particulate-removing respirator filter element increases as the quantity of particles it retains increases, thus increasing the breathing resistance. As a rule of thumb, when comfortable breathing is impaired because of dust build-up, the filter should be replaced. The performance of some filter materials is also affected by open storage in very humid atmospheres and care should be taken in storing filter elements.

NIOSH approves air-purifying and powered air-purifying particulate removing respirators to protect the wearer against one or more of the following hazards:

- Dust exposure, where the OSHA allowable daily exposure for the dust is not less than 0.05 mg/m^3;
- Mist exposure, where the OSHA allowable daily exposure for the mist is not less than 0.05 mg/m^3;
- Metal fume exposure, where the OSHA allowable daily exposure for the fume is not less than 0.05 mg/m^3;
- Dust, fume, and mist exposure, where the OSHA allowable daily exposure for the dust, fume, or mist is less than 0.05 mg/m^3;
- Exposure to radon daughters and radon daughters attached to dusts, fumes, and mist;
- Exposure to asbestos containing dusts or mists; and
- Exposure to dusts or mists which cause the formation of scar tissue in the lungs (pneumoconiosis and fibrosis producing materials).

Dust, Mist, and Fume Half-Face Respirator

The half-face respirator fits over the nose and under the chin. The half-face usually produces a good facepiece to face seal but not as good a seal as the full facepiece. Depending on the filter used, the half-mask is approved for use against fumes or dusts and mists having a PEL or TLV greater than 0.05 mg/m3.

High-Efficiency Half-Face Respirator

These respirators use a high efficiency filter and can be used against dusts, mists, and fumes with PEL or TLV less than 0.05 mg/m3.

Dust, Mist, and Fume Full Facepiece Respirator

Full facepiece respirators cover the face from the hairline to below the chin. They provide more protection to the face, and give a better seal than do the half- or quarter-masks. These respirators provide protection against dusts, mists, fumes, or any combination of these contaminants depending upon the type of filter used.

Powered Dust, Mist, and Fume (PAPR) Respirators (Asbestos Operations)

These respirators use a blower that passes the contaminated air through a filter where the contaminant is removed and passes the purified air into the facepiece. The face covering can be a half-mask, full-face mask, hood, or helmet.

The advantage of using a powered air-purifying respirator is that it supplies air at a positive pressure within the facepiece, hood, or helmet, so that any leakage is outward. The protection
provided depends on the air-purifying element and the type and concentration of the contaminants. Powered respirators must deliver at least 4 cubic feet per minute (cfm) to a tight fitting facepiece such as a mask and at least 7 cfm to a loose fitting helmet or hood. If the powered respirator is battery operated, it should provide the airflows mentioned for at least 4 hours without having to recharge the battery.

Gas and Vapor Removing Respirators

Vapor and gas-removing respirators use cartridges or canisters containing chemicals to absorb or react with specific vapors and gases to remove them from the air breathed. The basic difference between a cartridge and a canister is the volume of the sorbent. Generally, a "cartridge" refers to the smaller chemical filtering element which attaches directly to the facepiece, whereas a "canister" refers to the larger chemical filter element held in a harness connected to the facepiece by a corrugated breathing tube. A color code system is used to assist in identifying the approved uses for individual cartridges and canisters. Table 1 lists various air contaminants and their associated colors. Labels on the cartridge and canister will also indicate the maximum concentration in which the element can be used and, in some cases, the service life or expiration date of the element. However, it should be emphasized that personnel should not attempt to memorize the color coding. The label should always be reviewed to determine what contaminants they may be used for.

Gas and Vapor Removing Half-Face Respirators

These are available for protection against single chemicals such as ammonia or against entire classes such as organic vapors depending on the cartridge or canister used.

Important note: because a cartridge or canister label indicates it may be useful against a class of contaminants, e.g., organic vapors, it does not ensure that it is useful for all chemicals within that class. If in doubt, contact the OSC or HSM for specific uses.

Gas and Vapor Removing Full Facepiece Respirators

The full facepiece respirator may use a canister or cartridge(s) as the full-facepiece canister respirators are also referred to as "gas masks.

Table 1
Colors Used for Respirator Filters or Canisters

Atmospheric Contaminants	Color
Acid gases	White
Chlorine gas	White with 1/2-inch yellow stripe completely around the canister near the bottom
Organic vapors	Black
Ammonia gas	Green
Acid gases and ammonia gas	Green with 1/2-inch white stripe completely around the canister near the bottom
Carbon monoxide	Blue
Acid gases and organic vapors	Yellow
Acid gases, organic vapors, and ammonia gases	Brown
Radioactive materials, except tritium and noble gases*	Purple (magenta)
Particulates (dusts, fumes, mists, designated fogs, or smokes) in combination with any of the above with gases or vapors	Canister color for contaminant, as above, with l/2-inch gray stripe around the canister near the top
All of the above atmospheric contaminants	Red with 1/2-inch gray stripe completely around the canister near the top

*Also acceptable for particulates with a TLV less than 0.05 mg/m3 and asbestos.

ATMOSPHERE SUPPLYING RESPIRATORS

Atmosphere supplying respirators, rather than removing the hazardous material from the air, exclude the ambient air altogether and provide clean air from an independent source. Because of this, they can be used for protection against particulates, gases, or vapors and can also be used in oxygen deficient atmospheres.

Supplied-Air Respirators

A supplied-air respirator uses a central source of breathing air that is delivered through an air supply line or hose. Because the user is completely dependent on the integrity of the air supply line or hose and damage to same might prevent his escape from a contaminated area, a supplied-air respirator cannot be used in atmospheres immediately dangerous to life or health (see combination atmosphere supplying respirator, below).

The trailing air supply hose or line can severely restrict the wearer's mobility, and can become tangled with others' lines if more than one person is using an airline respirator in the exclusion zone. This may make a supplied-air respirator unsuitable for those who must move frequently between widely separated work stations.

A great advantage of the airline respirator is that it can be used for long, continuous periods.

Airline Devices

The air source for airline devices is either compressors or air tanks. The following requirements apply to the breathing air supplied and meet the specifications for Grade D breathing air:

- The oxygen content of the compressed air should be between 19.5 to 23.5 percent oxygen and the rest mainly nitrogen;
- Hydrocarbon concentrations must not exceed 5 mg/m^3;
- The carbon monoxide concentration must not exceed 20 parts per million;
- Carbon dioxide concentrations must not exceed 1,000 parts per million; and
- There must not be any pronounced odor present.

To be assure that these conditions are met, the following steps should be taken:

- The air compressor must be located where contaminated air cannot enter the system;
- Alarms indicating compressor failure and overheating must be installed in the system;
- If the compressor is oil-lubricated, it must have a high temperature and/or carbon monoxide (CO) alarm. If there is no CO alarm, frequent carbon monoxide tests of the air must be made to insure that the CO level does not exceed 20 parts per million;

- Bottled compressed air that is obtained from a vendor must be accompanied by a certification attesting that the air meets or exceeds Grade D specifications; and

- All airline couplings must be incompatible with couplings/fixtures for other gas systems.

Demand Airline Devices

In a demand device, the air enters the facepiece only on "demand" of the wearer, *i.e.*, when the person inhales. This is due to the nature of the valve and pressure regulator. During inhalation there is a negative pressure in the mask, so if there is leakage, contaminated air may enter the mask and be breathed by the user. The leakage problem is a major drawback of the demand device. Demand devices are also available with a full face mask, which provides a better seal than does the standard half-mask.

DEMAND DEVICES ARE NOT TO BE USED IN VIROGROUP OPERATIONS

Pressure Demand Airline Devices

The pressure demand device has a regulator and valve design such that there is a continuous flow (until a fixed static pressure is attained) of air into the facepiece at all times, regardless of the "demand" of the user. The airflow into the mask creates a positive pressure outward. As such, there is no problem of contaminant leakage into the facepiece. This is a significant advantage of this type of device.

ONLY PRESSURE-DEMAND DEVICES ARE TO BE USED IN VIROGROUP OPERATIONS

Self-Contained Breathing Apparatus (SCBA)

The self-contained breathing apparatus (SCBA) allows the user to carry a respirable breathing supply with him and does not need a stationary air source such as a compressor to provide breathable air. The SCBAs used by ViroGroup provide a 30 minute supply of air.

Since SCBA's provide a breathing air supply which is not dependent on a trailing hose or airline, pressure demand SCBA's may be used in atmospheres immediately dangerous to life or health (IDLH). Open circuit demand (not open circuit-pressure demand) SCBA may have facepiece leakage and cannot be used in IDLH environments. Also, some devices are only approved for "escape from" and not "entry into" a hazardous atmosphere.

Open Circuit SCBA

An open circuit SCBA exhausts the exhaled air to the atmosphere instead of recirculating it. A tank of compressed air carried on the back supplies air, via a regulator, to the facepiece. Because there is no recirculation of air, the service life of the open circuit SCBA is shorter than a closed circuit system. The air supply is

limited to the amount in the cylinder and therefore, the respirator cannot be used for extended periods without recharging or replacing the cylinders. Because these respirators are bulky and heavy, they are often unsuitable for strenuous work or use in confined spaces. Two types of open circuit SCBA are available, "demand" or "pressure demand."

Demand SCBA — DEMAND SCBAS ARE NOT TO BE USED IN VIROGROUP OPERATIONS

Pressure Demand SCBA

The pressure demand open circuit SCBA has a regulator and valve design which maintains a positive pressure in the facepiece at all times regardless of "demand" of the user. As such, there is no problem of contaminant leakage into the facepiece. This is a significant advantage of the pressure demand device.

Combination Atmosphere Supplying Respirator: Supplied Air and SCBA

Designed primarily as a long duration device, the respirator combines an airline respirator with an auxiliary air supply (usually compressed air) to protect against the possible failure of the primary air supply (the airline). The additional supply can be approved for 5 to 15 minutes or even longer. The choice depends upon how long it would take to escape from the toxic atmosphere if the primary air supply failed. This type of unit may be used in IDLH environments.

Subject: Respiratory Protection Program - Qualitative Fit Test Procedures

An employee shall be allowed to use only the specific makes(s) and model(s) of air purifying respirators for which the person has obtained a satisfactory fit verified through fit testing procedures. An employee is not permitted to use any respirator not previously fit tested or if the results of the fit test indicated that the person was unable to obtain a satisfactory fit.

ViroGroup's qualitative fit test procedures involve two stages of testing. Stage I involves a simple respirator negative and positive pressure sealing check for facepiece fit. Stage II involves the exposure of the respirator wearer to a test atmosphere. This will include two separate atmosphere tests to double check the adequate fit of the respirator to the wearer.

NOTE: During any fit test, respiratory head straps must be adjusted to be as comfortable as possible. Over tightening the straps can reduce facepiece leakage, but the wearer may not be able to tolerate the mask during a typical work period.

STAGE I

Negative Pressure Sealing Checks For Tightly Fitting Air Purifying Respirators - The test begins by properly donning and adjusting the respirator. The test subject then proceeds in closing off the inlets of the cartridge(s), canister or filters by covering them with the palm(s) of the hand(s) so that air cannot pass, inhaling gently, and holding one's breath for at least ten seconds. The facepiece should collapse slightly and there should be no inward leakage of air into the facepiece is detected. Based on these results, it can be reasonably assumed that the fit of the respirator to the wearer is generally satisfactory. This is used only as a gross determination of fit when the respirator. This test shall be used during each field operation prior to entering a toxic atmosphere.

Positive Pressure Seal Check for Air Purifying Respirators with Inhalation and Exhalation Valves This test is very much like the negative pressure sealing check, described above, and is conducted by closing off the exhalation valve and exhaling gently. The fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece for at least 10 seconds without detecting any outward leakage of air between the sealing surface of the facepiece and the wearer's face. This test is also used only as a gross determination of fit and should be performed during each field operation prior to entering a toxic atmosphere.

NOTE: The positive and negative pressure sealing checks can also be used on SCBA facepieces to determine gross fit characteristics.

STAGE II

A person required to wear an air purifying respiratory also will be exposed to two test agents; isoamyl acetate (Banana oil - an odorous vapor) and stannic chloride (an irritant smoke - particulate). The respirator will be equipped with a cartridge which effectively removes the test agents from respired air. If the wearer is unable to detect penetration of the test agent into the respirator, the wearer has achieved a satisfactory fit.

Health and Safety Managers should note that there are specific fit testing protocols mandated by Federal regulations for respirator use in atmospheres containing the following substances:

- Asbestos - 29 CFR 1910.1001 and 1926.58
- Benzene - 29 CFR 1910.1028
- Lead - 29 CFR 1910.1025
- Formaldehyde - 29 CFR 1910.1048

Procedures for the Isoamyl Acetate Vapor (Banana Oil) Test

The isoamyl acetate fit test may be conducted by using a plastic bag as a test hood hung from the ceiling over a coat hanger suspended by twine. Inside the plastic bag, a piece of cloth saturated with isoamyl acetate is attached at the top of the bag. This produces a concentration of approximately 100 ppm in the test atmosphere inside the plastic bag. Most people can detect isoamyl acetate between 1 to 10 ppm. The permissible exposure is 100 ppm.

- The wearer dons the respirator in a normal manner. The respirator will be fitted with organic vapor cartridges;
- The wearer enters the test enclosure, so that the head and shoulders are well inside the bag;
- If the wearer smells banana oil, he returns to clean air and readjusts the facepiece and/or adjusts the head straps without unduly tightening them;
- The wearer repeats the second step. If he does not smell banana oil, he is assumed to have obtained a satisfactory fit. If he still smells the vapor, an attempt should be made to find the leakage point. If the leak cannot be

located, another brand of respirator with a facepiece of the same type should be tried.

- After a fit is obtained, if the respirator is an air-purifying device it must be equipped with the correct filter(s), cartridges(s), or canister for the anticipated hazard.

- During the test, the subject should make movements that approximate a normal working situation. These may include, but not necessarily be limited to, the following:
  - Normal breathing,
  - Deep breathing, as during heavy exertion. This should not be done long enough to cause hyperventilation;
  - Side-to-side and up-and-down head movements. These movements should be not be greatly exaggerated, but should approximate those that can take place on the job,
  - Talking. This is most easily accomplished by reading a prepared test, such as the "Rainbow Passage", loudly enough to be understood by someone standing nearby,
  - Other exercises may be added depending upon the situation. For example, if the wearer is going to spend a significant part of his time bent over at some task, it may desirable to include an exercise simulating this motion.

The major drawback of the isoamyl acetate test is that the odor threshold varies widely among individuals. Furthermore, the sense of smell is easily dulled and may deteriorate during the test so that the wearer can detect only high vapor concentrations. Another disadvantage is that isoamyl acetate smells pleasant, even in high concentrations. Therefore, a wearer may say that the respirator fits although it has a large leak. Therefore, check these test results out carefully and move on to the next test atmosphere.

Procedures for the Irritant Smoke (Stannic Chloride) Test

This test is similar to the isoamyl acetate test in concept. It usually involves exposing the respirator wearer to an irritating aerosol produced by commercially available smoke tubes normally used to check the quality of ventilation systems. When the tube ends are broken and air is passed through it, the material inside reacts with the moisture in the air to produce a dense, highly irritating smoke, consisting of hydrochloric acid absorbed on small solid particles. As a qualitative means of determining respirator fit, this test has a distinct advantage in that the wearer usually reacts involuntarily to leakage by coughing or sneezing. The likelihood of this giving a false indication of proper fit is greatly reduced. On the other hand, the aerosol is very irritating and must be used carefully to avoid injury. Also, it is advisable to have exhaust ventilation behind the subject to protect the person doing the testing.

This test can be used for both air-purifying and atmosphere-supplying respirators. Air-purifying respirators must be equipped with a high-efficiency filter(s) (HEPA) and organic vapor combination cartridge. After the test, it may be necessary to replace the high-efficiency filter(s) on the air-purifying respirator with another type of air-purifying element(s) depending upon the hazard to which the respirator wearer is to be exposed. This test can be used for worker training or respirator selection.

The irritant smoke test will be conducted by using a plastic bag as a test hood. The bag shall be hung from the ceiling over a coat hanger suspended by twine. A small hole is made in the top portion of the bag so that the irritant smoke can be dispensed into the bag once the test subject has entered the bag.

The irritant smoke fit test will be performed as follows:

- The wearer puts on the respirator normally, taking care not to tighten the head straps uncomfortably. Once the respirator is properly donned, the subject enters the suspended bag so that the head and shoulders are well inside the bag;

- Once the subject is inside the bag, the tester shall begin to add the irritant smoke in small quantities at first, pausing between puffs from the applicator;

- The test subject should breath normally;

- The test subject should perform deep breathing, as during heavy exertion. This should not be done long enough to cause hyperventilation;

- The test subject should move his head side-to-side and up-and-down. These movements should be not be greatly exaggerated, but should approximate those that take place on the job;

- Talking. This is most easily accomplished by reading a prepared text, such as the "Rainbow Passage", loudly enough to be understood by someone standing nearby;

- Other exercises may be added depending upon the situation. For example, if the wearer is going to spend a significant part of his time bent over at some task, it may be desirable to include an exercise simulating this motion;

- If the wearer detects no leakage, the tester may increase the smoke density, still remaining alert to the subject's reaction.

NOTE: When fit testing half-face respirators with irritant smoke, the test subject must keep his eyes tightly closed to avoid irritation. Also, the wearer should be well clear of the

test area before removing the respirator.

The Fit Testing Form and Rainbow Passage are on the following pages.

RESPIRATOR FIT TEST FORM

Next Fit Test Due Date: _____

Employee Name: _____ Date: _____

Job Title: _____ SSN: _____

Location: _____

Test/Hood Chamber used: Yes No Describe: _____

RESPIRATOR INFORMATION:

Respirator Manufacturer: _____ Model: _____

Type: FF or HF Size: Small Medium Large X-Large Other

Type of Cartridge Used: _____

FIT TESTING INFORMATION:

Testing Material Used: ___Irritant Smoke ___Banana Oil ___Other

Was testing material detected during the following activities?

Activity			Comments
Normal Breathing	Yes	No	
Deep Breathing	Yes	No	
Turning Head	Yes	No	
Nodding Head	Yes	No	
Talking(Rainbow Passage)	Yes	No	
Grimace	Yes	No	
Jogging	Yes	No	

Was respirator physically inspected? Yes No Comments _____

Instruct employee on the proper use and maintenance of their respirator.

Employee Signature: _____ Date: _____

Testing Performed By: _____ Title: _____

RAINBOW PASSAGE

When sunlight strikes the raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.