26564

REMEDIAL SITE ASSESSMENT DECISION - EPA REGION IV

Site Name: Old Startex Spartanburg County LF **EPA ID#:** SCD980558191

Alias Site Names: _____

City: Startex **County or Parish:** Spartanburg **State:** SC

Refer to Report Dated: 12/16/92 **Report type:** SIP

Report developed by: Dynamac

DECISION:

|XX| **1. Further Remedial Site Assessment under CERCLA (Superfund) is not required because:**

|XX| 1a. Site does not qualify for further remedial site assessment under CERCLA (Site Evaluation Accomplished - SEA)

| | 1b. Site may qualify for further action, but is deferred to: | | RCRA | | NRC

| | **2. Further Assessment Needed Under CERCLA:** 2a. (optional) Priority: | | Higher | | Lower

2b. Activity Type: | | PA | | SI | | ESI | | HRS evaluation

| | Other: _____

DISCUSSION/RATIONALE: Low waste quantity and waste characteristics, low groundwater and surface water pathway scores. There are very few groundwater targets. Site is an old municipal/textile industry (Lyman Dying and Finishing) landfill.
Some hits of metals and PAHs in on site soils, but nearby perinneal surface water was clean. Site is not NPL caliber. No Further Remedial Action Planned. 12/27/93. E. Bozeman

Report Reviewed and Approved by: Earl Bozeman **Signature:** Earl L Bozeman Jr **Date:** 12/27/93

Site Decision Made by: Earl Bozeman **Signature:** Earl L. Bozeman Jr **Date:** 12/27/93

EPA Form # 9100-3

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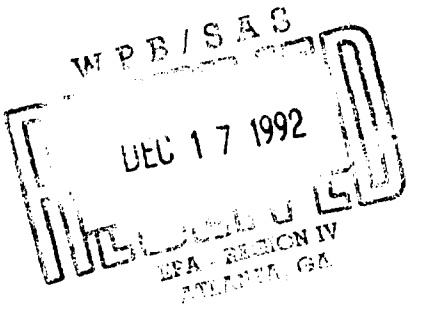

December 16, 1992

Mr. Narindar Kumar, Acting Chief
Site Assessment Section
U.S. EPA Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Re: Work Assignment C04119 - Task 5 - Site Inspection Prioritization Report - Old Startex, Spartanburg County Landfill, Startex, Spartanburg County, South Carolina
EPA ID No. SCD980558191
WASTELAN No. 3376
Document Control No. C04119-SIP-LC-130

Dear Narindar:

Enclosed please find the Site Inspection Prioritization Report for Old Startex, Spartanburg County Landfill in Startex, Spartanburg County, South Carolina. This report has been developed to fulfill requirements for TES VIII Work Assignment No. C04119, Task 5. This submittal includes a site map, supporting reference materials and a CERCLA Eligibility Form.

If you have any questions, please contact us at (404) 681-0933.

Sincerely,

DYNAMAC CORPORATION

Nilgun Akpinar
Site Manager

David L. Rusher (for)
Regional Manager

Enclosures

cc: Ken Meyer, EPA Region IV Project Officer (w/o enclosures)
Dennis Escher, Dynamac TES Program Manager (w/o enclosures)
Deborah Vaughn-Wright, EPA Region IV Work Assignment Manager
Katharine Siders Franklin, Dynamac Work Assignment Manager (w/o references)
TES WA File

TES VIII WORK ASSIGNMENT NO. C04119
SITE INSPECTION PRIORITIZATION
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA
EPA ID NO. SCD980558191
WASTELAN NO. 3376

NFRAP
12/27/93
Earl Bozeman

EPA REGION:	IV
CONTRACT NO.:	68-W9-0005; TES VIII
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DOCUMENT CONTROL NO. C04119-SIP-LC-130

Submitted to

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION IV

by

DYNAMAC CORPORATION

December 16, 1992

TES VIII WORK ASSIGNMENT NO. C04119
SITE INSPECTION PRIORITIZATION
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA
EPA ID NO. SCD980558191
WASTELAN NO. 3376

TABLE OF CONTENTS

Section	Page
Site History and Description	1
Summary of Previous Investigations	2
Hydrogeology	4
Discussion of Potential Receptors	5
Conclusion/Recommendation	8
References	9

Figures

Site Location Map (Figure 1)	12
Site Layout Map (Figure 2)	13

TES VIII WORK ASSIGNMENT NO. C04119
SITE INSPECTION PRIORITIZATION
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA
EPA ID NO. SCD980558191
WASTELAN NO. 3376

Site History and Description

The Old Startex, Spartanburg County Landfill (the landfill) is located off Finch Road, a road exiting south off old U.S. 29, in Startex, Spartanburg County, South Carolina, at coordinates 34° 56′ 25″ north latitude and 82° 06′ 25″ west longitude (Refs. 1; 2, p. 3; 3, p. 1; 5, pp. 10, 11; Figures 1 and 2). The landfill, which is approximately 30 to 40 acres in size, is located within a moderately populated area (Refs. 1; 2, p. 3). Situated in a north-south oriented ravine, the landfill is approximately 1,400 feet of the Lyman Printing and Finishing Company wastewater treatment plant and approximately 2,000 feet northeast of the Middle Tyger River (Ref. 1). An unnamed perennial creek passes within 500 feet of the east perimeter of the landfill and flows into the Middle Tyger River (Ref. 1).

During a Screening Site Inspection (SSI) which NUS Corporation (NUS) conducted on September 24, 1990, on behalf of the EPA, the entire surface of the landfill was covered with coal cinders (Ref. 5, p. 2). According to the available file material, there was no form of containment of wastes deposited during the operational history of the landfill (Ref. 2, Appendix C, p. C-3). The landfill is thought to be an area fill type due to the shallow depth to bedrock and surrounding hill topography (Refs. 1; 2, p. 3; 5, pp. 2, 16). The landfill, which is surrounded by a thick border of dense vegetation and some heavily wooded areas, is accessible by a dirt road (Refs. 2, p. 3; 5, pp. 10, 11). Although the site is not fenced, public accessibility is limited due to its location (Refs. 1; 5, pp. 10, 11). The areas surrounding the perennial creek are covered with dense vines and low-lying plants which makes foot travel virtually impossible (Ref. 7, p. 14). Orange-colored water was observed in the northwest corner of the property in an area downgradient of the landfill (Refs. 2, p. 3; 5, p. 18).

Spring Industries, formerly Lyman Printing and Finishing Company (Lyman), has owned the landfill since 1986 (Ref. 8). The landfill, although owned by Lyman, was operated by Spartanburg County from the middle to late 1960s through the early 1970s (Refs. 3, p. 3; 12, p. 2). During county operation, the landfill accepted wastes from Lyman, Spartanburg County and other industries for disposal of both domestic and industrial wastes and refuse (Ref. 3, pp. 1, 3). Because the industrial waste was not limited to that of Lyman, the exact nature and

quantity of the waste disposed on the landfill is not known (Ref. 12, p. 1). However, due to the nature of wastes generated by textile printing and finishing operations during the 1960s and 1970s, it was suspected that some of the materials buried in the landfill may have been hazardous materials (Ref. 3, pp. 1, 3). Some traditional waste types associated with textile mills involved with dyeing and printing include inorganic materials such as cobalt, manganese and lead soaps mixed with organic materials such as linolenic, naphthionic and octanoic acids (Refs. 3, p. 1; 10, p. 379; 11, p. 378).

When Spartanburg County ceased operations at the landfill, Lyman closed access of the landfill to the public and all other industries. From the early 1970s until 1981, Lyman used the landfill for disposal of only broken wooden pallets and cinders from their broiler house (Ref. 3, p. 3).

On June 22, 1981, Lyman Dyeing and Finishing Company (apparently formerly known as Lyman Printing and Finishing Company) submitted a Notification of a Hazardous Waste Site (EPA Form 8900-1) as required by Section 103(c) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980. According to the notification, no potentially hazardous materials were placed into the landfill after the 1970s. On December 19, 1979, Lyman Dyeing and Finishing Company submitted a Hazardous Waste Information report and a Notification of Hazardous Waste Activity report to the South Carolina Department of Health and Environmental Control (SCDHEC) due to its temporary storage of oil base and/or water base paint waste at the landfill. According to these reports, Lyman Dyeing and Finishing Company generated approximately 75 pounds of paint waste per year (Ref. 39, p. 5; 40, p. 1). This landfill is not classified as a Resource Conservation and Recovery Act (RCRA) facility of any type according to SCDHEC files; however, the landfill was listed with the EPA under the RCRA program (Ref. 12, p. 2).

Neither Spartanburg County nor Lyman has ever applied for a permit to operate a waste disposal landfill (Ref. 41). In 1991, Spring Industries, to avoid having to obtain a landfill permit, agreed with SCDHEC to stop using the landfill for waste disposal (Refs. 2, p. 3; 39).

Summary of Previous Investigations

On December 16, 1988, SCDHEC completed an updated Preliminary Assessment (PA) recommending that an SSI be conducted at the landfill on a medium priority basis (Ref. 12, pp. 1, 5).

The NUS Field Investigation Team (FIT) conducted an SSI during the week of September 24, 1990, on behalf of EPA Region IV. During the SSI, a total of 18 samples were collected. These samples included six surface soil samples, four subsurface soil samples, four sediment samples and four surface water samples. The surface soil and subsurface soil samples were collected from five locations along the perimeter of the landfill, including one background location. Two of the subsurface soil samples (OS-SB-04 and OS-SB-05) could not be collected due to contact with bedrock at 2 to 3 feet below land surface (bls). Two of the sediment samples were collected from the unnamed perennial stream and two were collected from the Middle Tyger River. The surface water samples were collected from the same sample locations as the sediment samples (Ref. 2, p. 11). No groundwater samples could be collected due to the shallow depth to bedrock. The nearby private wells referred to in the State PA could not be located for sampling (Ref. 13).

All samples collected during the SSI were analyzed under the Contract Laboratory Program (CLP) for the parameters listed in the Target Analyte List (TAL) and the Target Compound List (TCL) (Ref. 2, p. 16). Organic and inorganic analyses of the samples collected at the landfill detected elevated levels of hazardous constituents in several of the samples (Ref. 2, pp. 16-17, 23). The concentration of an analyte is described below as "elevated" if the concentration is greater than or equal to three times the concentration in the background or control sample or greater than or equal to the Minimum Quantitation Limit (MQL) if not detected in the background. The surface soil sample (OS-SS-01) and the subsurface soil sample (OS-SB-01) collected from the entrance to the landfill, along Finch Road, were designated as the control samples (Ref. 2, p. 12; Figure 3). A sediment sample (OS-SD-01) and surface water sample (OS-SW-01) collected on the unnamed perennial stream upgradient of the landfill were used as the control samples for this stream. Another sediment sample (OS-SD-03) and surface water sample (OS-SW-03) collected upgradient of the confluence of the unnamed perennial stream and Middle Tyger River were used as the control samples for the Middle Tyger River. Organic analysis of a surface soil sample (OS-SS-03) collected along the northwest edge of the landfill revealed elevated levels of acetone (Ref. 2, p. 18, Appendix B, p. B-75). A surface soil sample (OS-SS-02) collected from the northeast edge of the landfill contained elevated levels of several constituents including phenanthrene, fluoranthrene, pyrene, benzo(a)anthracene, chrysene and benzo(b and or k)fluoranthene (Ref. 2, p. 18, Appendix B, pp. B-53, B-66). A surface soil sample (OS-SS-03) collected from the northwest edge of the landfill contained elevated levels of diethyl phthalate (estimated value) and pyrene (estimated value) (Ref. 2, p. 18, Appendix B, pp. B-53, B-77). A surface soil sample (OS-SS-04) collected from the west edge of

the landfill contained an elevated level of bis(2-ethylhexyl)phthalate (Ref. 2, p. 18, Appendix B, pp. B-53, B-91). A subsurface soil sample (OS-SB-03) which contained elevated levels of chlorobenzene, total xylenes and ethyl benzene was collected from the northwest edge of the landfill at 3 to 6 feet bls (Ref. 2, p. 20, Appendix B, pp. B-57, B-82). Inorganic analysis of the surface soil sample (OS-SS-02) collected from the northeast edge of the landfill revealed elevated levels of cobalt, manganese and selenium (Ref. 2, p. 24, Appendix B, pp. B-55, B-69). A surface soil sample (OS-SS-03) collected from the northwest edge of the landfill contained elevated levels of barium, cobalt, manganese and nickel (Ref. 2, p. 24, Appendix B, pp. B-55, B-80). The surface soil sample (OS-SS-04) collected from the west edge of the landfill contained elevated levels of chromium (estimated value), cobalt and nickel (Ref. 2, p. 24, Appendix B, pp. B-55, B-94). The surface soil sample (OS-SS-05) collected from the southwest edge of the landfill contained elevated levels of barium, cobalt and nickel (Ref. 2, p. 24, Appendix B, pp. B-55, B-101). The surface soil sample (OS-SS-06) collected from the southeast edge of the landfill contained elevated levels of cobalt and manganese (Ref. 2, p. 24, Appendix B, pp. B-55, B-108). The subsurface soil sample (OS-SB-02) collected from the northeast edge of the landfill at 4 feet bls contained elevated levels of chromium (estimated value) and selenium (estimated value) (Ref. 2, p. 25, Appendix B, pp. B-61, B-74). The subsurface soil sample (OS-SB-06) collected from the southeast edge of the landfill at 4 to 5 feet bls contained elevated levels of chromium (estimated value) (Ref. 2, p. 25, Appendix B, pp. B-61, B-114). The sediment sample (OS-SD-02) collected from the perennial stream downgradient of the landfill contained elevated levels of iron (Ref. 2, p. 26, Appendix B, pp. B-8, B-22). The sediment sample (OS-SD-04) collected from the Middle Tyger River contained elevated levels of barium, chromium (estimated value) and copper (Ref. 2, p. 26, Appendix B, pp. B-33, B-44). Please note that copper was not detected in samples collected from the landfill.

Hydrogeology

The landfill is located in the Inner Piedmont belt of the Piedmont physiographic province of South Carolina. The Piedmont physiographic province in Spartanburg County is characterized by subdued topographic features and a moderate relief. Elevations in the county range from approximately 1,000 feet above mean sea level (msl) in the northeast to less than 600 feet above msl in the southeast (Ref. 14, p. 7). The elevation of the landfill is approximately 856 feet above msl (Ref. 1). The Piedmont bedrock geology of South Carolina is characterized by metamorphosed crystalline rock with numerous igneous intrusives. This crystalline rock is generally weathered into a soft clayey or sandy saprolite which extends from the surface to depths up to 140 feet bls (Ref. 14, p. 13).

Geologic units that underlie the landfill site include a mantle of unconsolidated material underlain by crystalline rock. The unconsolidated material consists of soil and saprolite. The saprolite is the result of in situ chemical weathering of the underlying crystalline rocks. The crystalline rocks consist of biotite gneiss and migmatite (Ref. 14, p. 12).

Groundwater in the Piedmont occurs in pore spaces in the saprolite and in secondary openings such as joints, fractures and bedding planes in the underlying crystalline rocks. Where the crystalline rocks are composed of water-soluble materials, the fractures can become enlarged by circulating groundwater. Generally, the size and frequency of the fracture openings in crystalline rocks decrease with depth. As a result, porosity and permeability of the rock also decreases with depth. Therefore, higher yielding wells in the Piedmont are generally drilled to a depth of less than 250 feet bls (Ref. 14, p. 57).

The fractured rocks of the Piedmont physiographic province in South Carolina, combined with the overlying saprolite, comprise an unconfined crystalline rock aquifer (Refs. 14, p. 58; 15, p. 380). In some areas the saprolite is less permeable than the underlying fractured bedrock. In these areas, the saprolite can act as a confining unit (Ref. 14, p. 57). The aquifers in the area are recharged primarily by precipitation that infiltrates down to the aquifer (Ref. 14, pp. 57, 58).

Discussion of Potential Receptors

Residents within a 4-mile radius of the landfill obtain potable water from the Startex, Jackson, Wellford, Duncan (SJWD) Water District; the Startex Utility System; the Spartanburg Water System (SWS); the Greer Commission of Public Works and from private wells (Refs. 1; 7; 16; 17; 18; 19; 20; 21). Except for the town of Startex, the SJWD Water District serves most of the residences and businesses in the immediate vicinity of the landfill (Refs. 1; 7; 17; 18; 19; 22).

The SJWD Water District buys water from the Spartanburg Water System and from Spring Industries. Drinking water purchased from Spring Industries is used solely for supply to the town of Lyman. Spring Industries obtains its water from the surface water intake located on the Middle Tyger River. The intake is located outside of the 15-mile surface water pathway for the landfill. The remaining connections on the SJWD Water District water supply are supplied with water purchased from the Spartanburg Water System (Refs. 18; 22). The SJWD Water District has a tie-in with the Inman-Campobello Water District which also purchases its water from the Spartanburg Water System (Ref. 18). The SJWD Water District has two auxiliary wells located in Inman, approximately 6 miles north

of the landfill (Refs. 1; 20). These wells were acquired by the SJWD Water District when it annexed the Piedmont Rural water system north and northwest of Lyman (Refs. 19; 20).

The SWS obtains all of its water from a surface water intake located on William C. Bowen Lake, on the Pacolet River, and serves the town of Spartanburg (Refs. 22; 23; 24). The SWS also sells water to the following systems: Inman-Campobello, Liberty-Chesanee-Fingerville, Woodruff-Robuck and SJWD (Ref. 23).

The Startex Utility System (SUS), which is operated by Startex Mill, buys water from Spring Industries. The water comes from the Spring Industries filter plant's surface water intake located on the Middle Tyger River in Lyman. SUS in turn sells this water to the town of Startex. According to the operator of the water system, there are no groundwater users in the area serviced by their water system (Refs. 17; 25). SWS provides water to small areas to the east and northeast of the landfill (Ref. 6, p. 18).

The Greer Commission of Public Works (CPW) supplies only a small area within the 4-mile radius of the landfill; the majority of its connections are in the town of Greer. This system obtains its water from two lakes: Lake Robinson and Lake Cunningham. Both of these lakes are in Greenville County on the South Tyger River. The Greer CPW sells water to Blue Ridge Rural Water Company (Refs. 21; 26; 27).

The water systems mentioned above do not have groundwater wells or surface water intakes within a 4-mile radius of the landfill, nor within the 15-mile surface water pathway downstream from the landfill (Refs. 17; 18; 19; 20; 21; 22; 23; 24; 25; 26; 27; 28; 29). Residents not served by these four utility companies are assumed to be using private wells for their source of potable water (Refs. 1; 24; 25; 27; 28). Based on a house count from topographic maps with water distribution lines and service areas there are approximately 117 residences who utilize private wells for drinking water within a 4-mile radius of the landfill (Ref.1). A list of multi-residence wells in the area indicates that there are also 2 wells within 4 miles of the landfill that service approximately 80 persons (Ref. 29; 38, pp. 149, 157). Using the 1990 U.S. Census Bureau population-per-household value of 2.61 for Spartanburg County, South Carolina, the estimated population using groundwater for drinking water is distributed as follows: 0 - 0.25 mile (0 persons); 0.25 - 0.50 mile (0 persons); 0.50 - 1.0 mile (0 persons); 1.0 - 2.0 miles (0 persons); 2.0 - 3.0 miles (63 persons); 3.0 - 4.0 miles (323 persons) (Refs. 1; 30).

Surface water runoff from the landfill runs into an unnamed perennial stream on the western perimeter of the landfill, which flows south into the Middle Tyger River. The stream enters the river just east of the Spring Industries wastewater treatment plant (Ref. 1). The Middle Tyger River flows to the southeast for approximately 11.75 miles, then joins the North Tyger River which flows southeast beyond the 15-mile downstream distance limit from the landfill (Ref. 1). A 30-year average flow rate for the Middle Tyger River is approximately 103 cubic feet per second (cfs). A 38-year average flow rate for the Middle Tyger River is approximately 63.8 cfs (Ref. 31).

According to a nearby resident in the area, no fishing occurs in the unnamed perennial stream (Ref. 32). However, recreational fishing and boating does occur in the North and Middle Tyger Rivers. Some species of fish found in these rivers include bullhead, carp, largemouth bass, blue gill and redbreast (Refs. 32; 33; 34). A wetland area is located along a 3.25-mile stretch of the Middle and North Tyger Rivers. This wetland area begins approximately 11 miles downstream of the landfill and ends nearly 14.5 miles downstream of the landfill (Ref. 1). There are no officially endangered or threatened species in the stream or the Middle Tyger River along the 15-mile surface water pathway (Refs. 35, 36). There is, however, the intmed enchanters nightshade (Circaea lutetieana ssp canadensis), a plant which is unofficially listed as of concern in the State, located within the 4-mile radius of the landfill but not along the 15-mile downstream study area from the landfill (Ref. 36, p. 9).

Based on a house count from topographic maps of the area, information from the SSI and the 1990 U.S. Census Bureau county conversion factor of 2.61 persons per household for Spartanburg County, the population distribution within a 4-mile radius of the landfill is estimated to be as follows: onsite (0 persons); 0 - 0.25 mile (42 persons); 0.25 - 0.50 mile (295 persons); 0.50 - 1.0 mile (2,808 persons); 1.0 - 2.0 miles (8,081 persons); 2.0 - 3.0 miles 10,213 persons); 3.0 - 4.0 miles (12,507 persons) (Refs. 1; 5; 30).

According to available file material and minimal target population, there are no recreational areas or parks near the landfill. The nearest residences are approximately 1,000 feet to the east of the landfill. The nearest school is located approximately 0.75 mile southeast of the landfill (Ref. 1). Most of the land surrounding the site or within 1 mile of the landfill have cattle grazing upon it. Fescue is also grown for use as cattle feed on much of the pasture land in the area (Ref. 5, p. 20).

Conclusion/Recommendation

Based on the available file material, it does not appear that the site has affected nearby target popoulations. It is concluded that the site evaluation has been accomplished.

References

1. U.S. Geological Survey, 7.5 minute series Topographical Quadrangle Maps of South Carolina: Wellford, Provisional Edition 1983, Greer, Provisional Edition 1983, Inman Provisional Edition 1983, Campobello Provisional Edition 1983, scale 1:24,000.

2. NUS Corporation, Superfund Division, Final Report Screening Site Inspection, Phase II, Old Startex, Spartanburg County Landfill, Startex, Spartanburg County, South Carolina, Revision 0, prepared under TDD No. F4-9007-22 for the Waste Management Division of the EPA (March 1991).

3. EPA Notification of Hazardous Waste Site (EPA Form 8900-1) for Old Startex, Spartanburg County Landfill, Startex, South Carolina, filed by Lamar Oxford, Vice President, Lyman Dyeing and Finishing Company, June 22, 1981.

4. Deleted.

5. NUS Corporation Field Logbook No. F4-2550 for Old Startex Landfill, TDD No. F4-9007-22. Documentation of facility reconnaissance, September 24-26, 1990.

6. HALLIBURTON NUS Environmental Corporation, Superfund Division, Site Inspection, Final Report, Old Lyman Dump, Lyman, Spartanburg County, South Carolina, Revision 0, prepared under TDD No. F4-9007-23 for the Waste Management Division of the EPA (September 1991).

7. NUS Corporation Field Logbook No. F4-2429 for Old Lyman Dump, TDD No. F4-9007-23. Documentation of facility reconnaissance, August 14-16, 1990.

8. Diane Walker, Tax Clerk, Spartanburg County Accessor's Office, telephone conversation with Nilgun Akpinar, Dynamac Corporation, July 28, 1992. Subject: Ownership history of Old Startex, Spartanburg County Landfill.

9. Deleted.

10. Bodan Burachinsky, et al., "Inks", Kirk-Othmer Encyclopedia of Chemical Technology, 3rd ed., Vol. 13 (New York: John Wiley & Sons, 1981).

11. Elliott, John, et al., "Dyes Reactive", Kirk-Othmer Encyclopedia of Chemical Technology, 3rd ed., Vol. 8 (New York: John Wiley & Sons, 1979).

12. Updated Preliminary Assessment for Old Startex, Spartanburg County Landfill, EPA ID No. SCD980558191, Startex, Spartanburg County, South Carolina, prepared by Gerald Stewart, South Carolina Department of Health and Environmental Control, December 16, 1988.

13. Cathy Amoroso, EPA Region IV - Site Assessment Division, telephone conversation with Terry Ryland, NUS Corporation, March 13, 1991. Subject: Groundwater sampling of Old Startex, Spartanburg County Landfill and private well use near the landfill. (Note: see Reference 28 for affiliation of Cathy Amoroso).

14. W. M. Bloxham, George E. Siple and T. Ray Cummings, Water Resources of Spartanburg County, South Carolina, Water Resources Commission Report No. 3 (Columbia, South Carolina, 1970), excerpts, 14 pages.

15. U.S. Geological Survey, National Water Summary 1984, Hydrologic Events, Selected Water-Quality Trends, and Ground-Water Resources, Water Supply Paper 2275 (1984), excerpts, 7 pages.

16. NUS Corporation Field Logbook No. F4-2416 for Chemical Leaman Tank Lines, Inc., TDD No. F4-9005-63. Documentation of facility reconnaissance, July 17-18, 1990.

17. Bill Blackwood, Blackwood and Associates, telephone conversation with John Schendel, NUS Corporation, February 25, 1991. Subject: Drinking water service areas and sources for the Startex Water System.

18. Larry Plemmons, Engineer, Startex-Jackson-Welford-Duncan Water System, telephone conversation with John Schendel, NUS Corporation, July 31, 1990. Subject: Public and private water use and distribution in and around Lyman, South Carolina.

19. Larry Plemmons, Engineer, Startex-Jackson-Welford-Duncan Water System, telephone conversation with John Schendel, NUS Corporation, February 26, 1991. Subject: Information on the Piedmont Rural water system annex and on proposed changes in the town of Lyman's water source.

20. NUS Corporation Field Logbook No. F4-1439 for Safety Kleen, TDD No. F4-8904-15, Documentation of facility reconnaissance, May 31 - June 1, 1989.

21. Buddy Cudd, Greer Commission of Public Works, telephone conversation with John Schendel, NUS Corporation, February 25, 1991. Subject: Drinking water distribution lines and sources of water for the Greer Commission of Public Works.

22. Danny Blackwell, General Manager, Startex-Jackson-Wellford-Duncan (SJWD) Water District, telephone conversation with Coby C. Dolan, Dynamac Corporation, July 20, 1992. Subject: Surfaces water uses in Spartanburg County, South Carolina.

23. A. John Baron, Drafting Technician, Spartanburg Water System, telephone conversation with Coby C. Dolan, Dynamac Corporation, July 20, 1992. Subject: Surface water uses in Spartanburg County, South Carolina.

24. A. John Baron, Drafting Technician, Spartanburg Water System, letter to Coby C. Dolan, Dynamac Corporation, August 3, 1992. Subject: Drinking water service areas and sources for the Spartanburg Water System and residential customers served.

25. Ron Turner, Operator, Startex Water System, telephone conversation with Nilgun Akpinar, Dynamac Corporation, July 22, 1992. Subject: Startex Water System.

26. Brentley Thomas, Technician, Greer Commission of Public Works, telephone conversation with Nilgun Akpinar, Dynamac Corporation, July 20, 1992. Subject: Information of Greer Commission of Public Works.

27. Buddy Cudd, Water Superintendent, Greer Commission of Public Works, telephone conversation with Nilgun Akpinar, Dynamac Corporation, July 21, 1992. Subject: Greer Commission of Public Works.

28. Coby C. Dolan, Dynamac Corporation, project note to the Old Lyman Dump file, August 12, 1992. Subject: Drinking water service areas for the Startex-Jackson-Wellford-Duncan (SJWD) Water District.

29. Leonard J. Dangerfield, Coordinator, EPA Region IV - Water Management Division, telephone conversation with Coby C. Dolan, Dynamac Corporation, July 14, 1992. Subject: Surface and ground water use in Spartanburg County, South Carolina, FERD Report attached.

30. U.S. Department of Commerce, Proof Copy of table generated for 1990 CPH-1: Summary Population and Housing Characteristics, issued by Bureau of the Census (April 1991), excerpt.

31. Buddy Atkins, Water Resources Engineer, South Carolina Water Resources Commission, Surface Water Division, telephone conversation with Coby C. Dolan, Dynamac Corporation, July 13, 1992. Subject: Water flow of the Middle Tyger and the North Tyger River.

32. Butch Lynn, property owner, Lyman, South Carolina, telephone conversation with Coby C. Dolan, Dynamac Corporation, July 21, 1992. Subject: Unnamed creek running through the property in between Mr. Lynn's farm and the Lyman Wastewater Treatment Plant.

33. Randy Geddings, Wildlife Biologist, South Carolina Wildlife and Marine Resources Department, telephone conversation with Coby C. Dolan, Dynamac Corporation, July 14, 1992. Subject: Surface water uses in Spartanburg, South Carolina.

34. Clayburn Stone, Conservation Officer, South Carolina Department of Health and Environmental Control, telephone conversation with Coby C. Dolan, Dynamac Corporation, July 16, 1992. Subject: Surface water uses in Spartanburg County, South Carolina.

35. Katherine Boyle, Data Manager, South Carolina Wildlife and Marine Resources Department, letter to Nilgun Akpinar, Dynamac Corporation, July 17, 1992. Subject: List of threatened or endangered species in Spartanburg County, South Carolina.

36. Katherine Boyle, Data Manager, South Carolina Wildlife and Marine Resources Department, letter to Coby C. Dolan, Dynamac Corporation, July 28, 1992. Subject: Occurrences in Spartanburg County of threatened or endangered species.

37. Deleted.

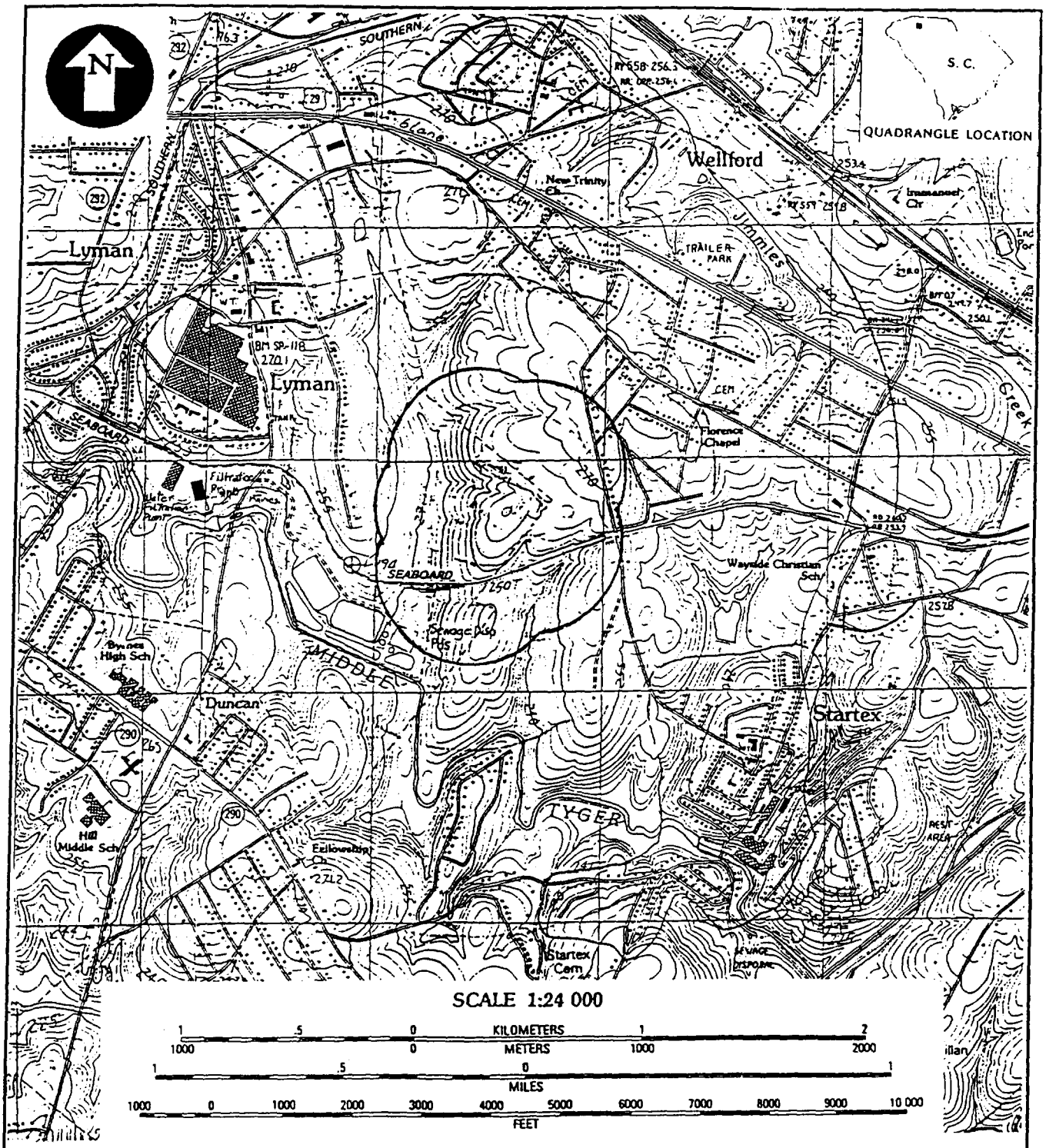
38. Len Dangerfield, FOIA Coordinator, EPA Region IV - Water Management Division, letter to David L. Rusher, Regional Manager, Dynamac Corporation, July 27, 1992. Subject: 4-RIN-02308-92 with enclosure.

39. South Carolina Department of Health and Environmental Control, Solid Waste Management Division, Notification of Hazardous Waste Activity for Lyman Printing and Finishing, Lyman, South Carolina, December 19, 1979.

40. South Carolina Department of Health and Environmental Control, Solid Waste Management Division, Notification of Hazardous Waste Information for Lyman Printing and Finishing, Lyman, South Carolina, December 19, 1979 (see Reference 39 for agency letterhead).

41. Gerald Stewart, South Carolina Department of Health and Environmental Control, telephone conversation with Terry Ryland, NUS Corporation, February 20, 1991. Subject: RCRA history or permitting of Old Startex Spartanburg County Landfill.

SITE LOCATION MAP

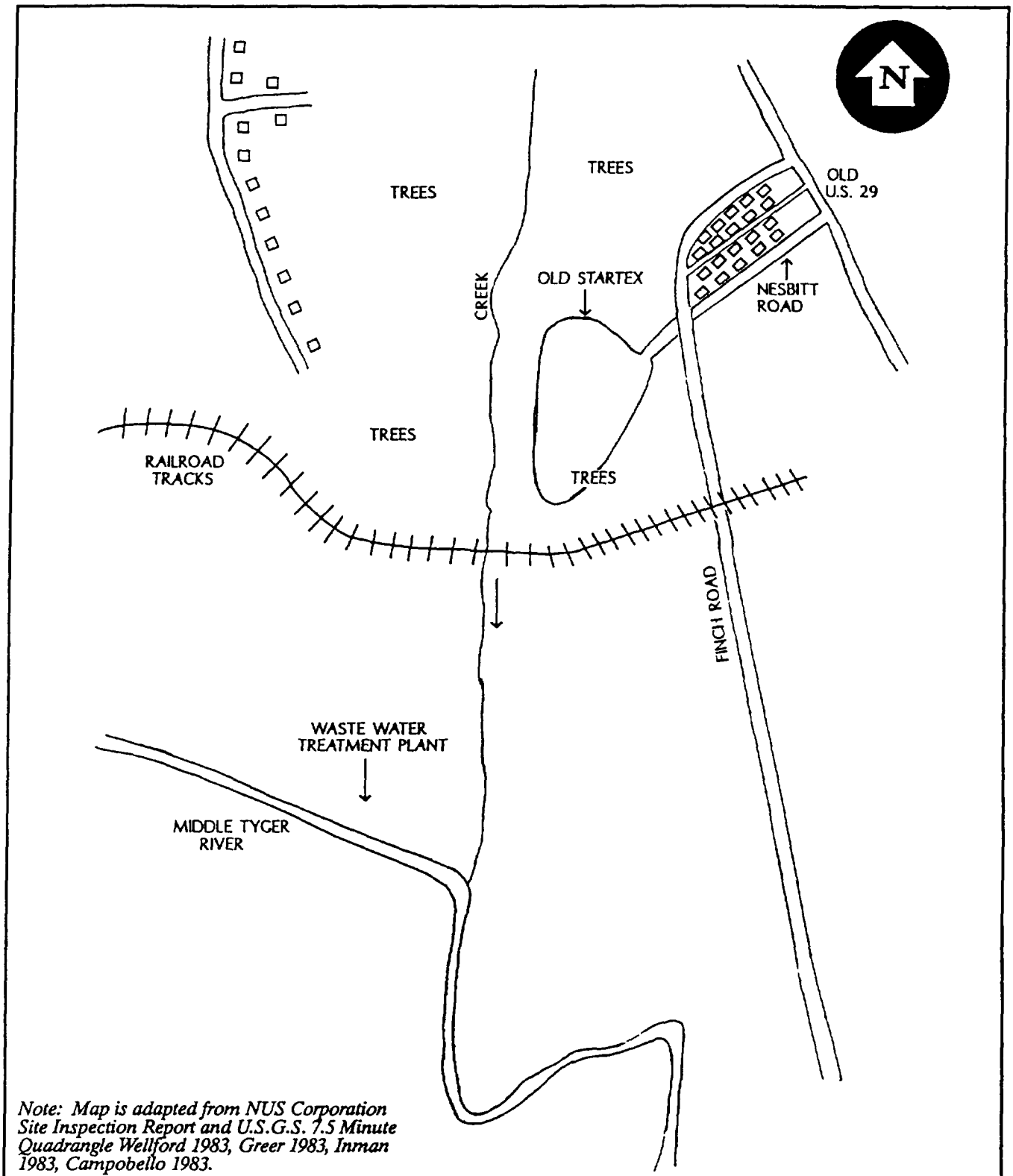


Note: Base Map is a portion of the U.S.G.S. 7.5 Minute Quadrangle Map of Greer, South Carolina, 1983 and Wellford, South Carolina, 1983.

DYNAMAC CORPORATION
Environmental Services

Figure 1 : Site Location Map
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
Spartex, Spartanburg County, South Carolina

SITE LAYOUT MAP



Note: Map is adapted from NUS Corporation Site Inspection Report and U.S.G.S. 7.5 Minute Quadrangle Wellford 1983, Greer 1983, Inman 1983, Campobello 1983.

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Environmental Services

Figure 2 : Site Layout Map
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
Spartex, Spartanburg County, South Carolina

DRAFT

CONFIDENTIAL

HAZARD RANKING SYSTEM PRELIMINARY SCORE
FOR
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA
EPA ID NO. SCD980558191
WASTELAN NO. 3376

Pathways evaluated were groundwater, surface water, soil exposure and air. Draft Site Inspection (SI) Worksheets were used to complete this evaluation.

S_{gw} = 0.79
S_{sw} = 6.0
S_{ss} = 0.06
S_{air} = 1.58

OVERALL SCORE 3.13

The above score was calculated using a waste quantity of 100 because the source is a 30- to 40-acre landfill. There were no groundwater samples collected because bedrock was reached at a shallow depth. No private wells in the area were sampled to analyze the groundwater. The groundwater pathway scored low due to the low number of targets. The nearest well to the landfill is located 2.75 miles west of the landfill.

Hazardous constituents were detected at the landfill at elevated levels; however, due to the lack of detection of these same constituents in the stream onsite, the surface water pathway score is low. Barium and nickel were detected at elevated levels in several surface soil samples collected from the perimeter of the landfill. Chromium was detected at an elevated level in two subsurface soil samples collected from the landfill. Barium and chromium were detected at elevated levels in a sediment sample collected from the Middle Tyger River, but they were not detected at elevated levels from sediment or surface water samples collected from the unnamed creek onsite. Bis(2-ethylhexyl) phthalate was detected at an elevated level in one surface soil sample collected from the landfill and was used to calculate the potential environmental threat as a worst-case scenario; however, bis(2-ethylhexyl) phthalate is a common lab contaminant and cannot be attributed to wastes disposed at the landfill (from available file material).

Also, the soil exposure pathway and air pathway scored low due to a low number of targets.

Site Name: Old Startex Spartanburg County Landfill
Location: Startex, Spartanburg County Landfill

DRAFT

GROUND WATER MIGRATION PATHWAY SCORESHEET

Factor Categories and Factors

	Likelihood of Release to an Aquifer	Maximum Value	Value Assigned	
1.	Observed Release	550	-	
2.	Potential to Release			
	2a. Containment	10	-	
	2b. Net Precipitation	10	-	
	2c. Depth to Aquifer	5	-	
	2d. Travel Time	35	-	
	2e. Potential to Release [lines 2a x (2b + 2c + 2d)]	500	500	
3.	Likelihood of Release (higher of lines 1 and 2e)	550		500
	Waste Characteristics			
4.	Toxicity/Mobility	a	100	
5.	Hazardous Waste Quantity	a	100	
6.	Waste Characteristics	100		10
	Targets			
7.	Nearest Well	50	3	
8.	Population			
	8a. Level I Concentrations	b	0	
	8b. Level II Concentrations	b	0	
	8c. Potential Contamination	b	5	
	8d. Population (lines 8a + 8b + 8c)	b	5	
9.	Resources	5	5	
10.	Wellhead Protection Area	20	0	
11.	Targets (lines 7 + 8d + 9 + 10)	b		13
	Ground Water Migration Score for an Aquifer			
12.	Aquifer Score [(lines 3 x 6 x 11)/82,500][c]	100		0.79
	Ground Water Migration Pathway Score			
13.	Pathway Score (S_{gw}), (highest value from line 12 for all aquifers evaluated)[c]	100		0.79

[a] Maximum value applies to waste characteristics category.
[b] Maximum value not applicable.
[c] Do not round to nearest integer.

DRAFT

Site Name: Old Startex Spartanburg County Landfill
Location: Startex, Spartanburg County Landfill

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

Factor Categories and Factors		Maximum Value	Value Assigned	
DRINKING WATER THREAT				
	Likelihood of Release			
1.	Observed Release	550	-	
2.	Potential to Release by Overland Flow			
	2a. Containment	10	-	
	2b. Runoff	25	-	
	2c. Distance to Surface Water	25	-	
	2d. Potential to Release by Overland Flow (lines 2a x [2b + 2c])	500	-	
3.	Potential to Release by Flood			
	3a. Containment (Flood)	10	-	
	3b. Flood Frequency	50	-	
	3c. Potential to Release by Flood (lines 3a x 3b)	500	-	
4.	Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	500	
5.	Likelihood of Release (higher of lines 1 and 4)	550		500
	Waste Characteristics			
6.	Toxicity/Persistence	a	10,000	
7.	Hazardous Waste Quantity	a	100	
8.	Waste Characteristics	100		32
	Targets			
9.	Nearest Intake	50	0	
10.	Population			
	10a. Level I Concentrations	b	0	
	10b. Level II Concentrations	b	0	
	10c. Potential Contamination	b	0	
	10d. Population (lines 10a + 10b + 10c)	b	0	
11.	Resources	5	5	
12.	Targets (lines 9 + 10d + 11)	b		5

Site Name: Old Startex Spartanburg County Landfill
Location: Startex, Spartanburg County Landfill

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET, Continued

Factor Categories and Factors	Maximum Value	Value Assigned	
DRINKING WATER THREAT (Concluded)			
Drinking Water Threat Score			
13. Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)	100		0.97
HUMAN FOOD CHAIN THREAT			
Likelihood of Release			
14. Likelihood of Release (same value as line 5)	550		500
Waste Characteristics			
15. Toxicity/Persistence/Bioaccumulation	a	$5x10^8$	
16. Hazardous Waste Quantity	a	100	
17. Waste Characteristics	1,000		320
Targets			
18. Food Chain Individual	50	0	
19. Population			
19a. Level I Concentrations	b	0	
19b. Level II Concentrations	b	0	
19c. Potential Human Food Chain Contamination	b	2	
19d. Population (lines 19a + 19b + 19c)	b	2	
20. Targets (lines 18 + 19d)	b		2
Human Food Chain Threat Score			
21. Human Food Chain Threat Score ([lines 14 x 17 x 20]/82,500, subject to a maximum of 100)	100		3.88
ENVIRONMENTAL THREAT			
Likelihood of Release			
22. Likelihood of Release (same value as line 5)	550		500

Site Name: Old Startex Spartanburg County Landfill
Location: Startex, Spartanburg County Landfill

DRAFT

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET, Concluded

Factor Categories and Factors	Maximum Value	Value Assigned	
ENVIRONMENTAL THREAT, (Concluded)			
Waste Characteristics			
23. Ecosystem Toxicity/Persistence/ Bioaccumulation	a	$5x10^7$	
24. Hazardous Waste Quantity	a	100	
25. Waste Characteristics	1,000		180
Targets			
26. Sensitive Environments			
26a. Level I Concentrations	b	0	
26b. Level II Concentrations	b	0	
26c. Potential Contamination	b	1.05	
26d. Sensitive Environments (lines 26a + 26b + 26c)	b	1.05	
27. Targets (value from line 26d)	b		1.05
Environmental Threat Score			
28. Environmental Threat Score ([lines 22 x 25 x 27]/82,500, subject to a maximum of 60)	60		1.15
SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE FOR A WATERSHED			
29. Watershed Score[c] (lines 13 + 21 + 28, subject to a maximum of 100)	100		6.0
SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE			
30. Component Score (S_{of})[c] (highest score from line 29 for all watersheds evaluated, subject to a maximum of 100)	100		6.0

[a] Maximum value applies to waste characteristics category.
[b] Maximum value not applicable.
[c] Do not round to nearest integer.

OVERSIZED

DOCUMENT

REFERENCE NO. 2

R-586-3-1-38

DATE REPORT ACCEPTED 4/17/91

DISPOSITION Recommended SIP-Low

SAM SIGNATURE

FINAL REPORT

SCREENING SITE INSPECTION, PHASE II
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA
EPA ID #: SCD980558191

Prepared Under
TDD No. F4-9007-22
CONTRACT NO. 68-01-7346

Revision 0

FOR THE

WASTE MANAGEMENT DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY

MARCH 20, 1991

NUS CORPORATION
SUPERFUND DIVISION

Prepared By	Reviewed By	Approved By
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NOTICE

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TABLE OF CONTENTS

Section No.		Page
EXECUTIVE SUMMARY		ES-1
1.0	INTRODUCTION	1
1.1	Objectives	1
1.2	Scope of Work	1
2.0	SITE CHARACTERIZATION	3
2.1	Site Background and History	3
2.2	Site Description	3
	2.2.1 Site Features	3
	2.2.2 Waste Characteristics	6
3.0	REGIONAL POPULATIONS AND ENVIRONMENTS	7
3.1	Population and Land Use	7
	3.1.1 Demography	7
	3.1.2 Land Use	7
3.2	Surface Water	7
	3.2.1 Climatology	7
	3.2.2 Overland Drainage	8
	3.2.3 Potentially Affected Water Bodies	8
3.3	Groundwater	9
	3.3.1 Hydrogeology	9
	3.3.2 Aquifer Use	9
3.4	Summary of Potentially Affected Populations and Environments	10
4.0	FIELD INVESTIGATION	11
4.1	Sample Collection	11
	4.1.1 Sample Collection Methodology	11
	4.1.2 Duplicate Samples	11
	4.1.3 Sample Codes, Descriptions, Locations, and Rationale	11
	4.1.4 Field Measurements	11
4.2	Sample Analysis	16
	4.2.1 Analytical Support and Methodology	16
	4.2.2 Analytical Data Quality	16
	4.2.3 Presentation of Analytical Results	16
5.0	SUMMARY	28
REFERENCES		29
APPENDIX A	Topographic Map	
APPENDIX B	Analytical Results	
APPENDIX C	Site Inspection Report	

TABLES

Number		Page
Table 1	Sample Codes, Descriptions, Locations, and Rationale	12
Table 2	Surface Water Samples, Field Measurements	15
Table 3	Summary of Organic Analytical Results, Surface Soil Samples	18
Table 4	Summary of Organic Analytical Results, Subsurface Soil Samples	20
Table 5	Summary of Organic Analytical Results, Sediment Samples	21
Table 6	Summary of Organic Analytical Results, Surface Water Samples	22
Table 7	Summary of Inorganic Analytical Results, Surface Soil Samples	24
Table 8	Summary of Inorganic Analytical Results, Subsurface Soil Samples	25
Table 9	Summary of Inorganic Analytical Results, Sediment Samples	26
Table 10	Summary of Inorganic Analytical Results, Surface Water Samples	27

FIGURES

Figure 1	Site Location Map	4
Figure 2	Site Layout Map	5
Figure 3	Sample Location Map	14

1.0 INTRODUCTION

The NUS Corporation Region 4 Field Investigation Team (FIT) was tasked by the U.S. Environmental Protection Agency (EPA), Waste Management Division to conduct a Screening Site Inspection (SSI) at the Old Startex, Spartanburg County Landfill site in Startex, Spartanburg County, South Carolina. The investigation was performed under the authority of the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). The task was performed to satisfy the requirements stated in Technical Directive Document (TDD) number F4-9007-22. The field investigation was conducted on September 24, 1990.

1.1 OBJECTIVES

The objectives of this inspection were to determine the nature of contaminants present at the site and to determine if a release of these substances has occurred or may occur. Further, this inspection sought to determine the possible pathways by which contamination could migrate from the site and the populations and environments it would potentially affect. Through these objectives, a recommendation was made regarding future activities at the site.

1.2 SCOPE OF WORK

The objectives were achieved through the completion of a number of specific tasks. These activities were to:

- Obtain and review background material relevant to HRS scoring of site.
- Obtain topographic maps of site.
- Evaluate target populations associated with the groundwater, surface water, air, and onsite exposure pathways.
- Conduct a survey of private wells.
- Determine location and distance to nearest potable well.

- Develop a site sketch.

- Collect 18 environmental samples.

2.0 SITE CHARACTERIZATION

2.1 SITE BACKGROUND AND HISTORY

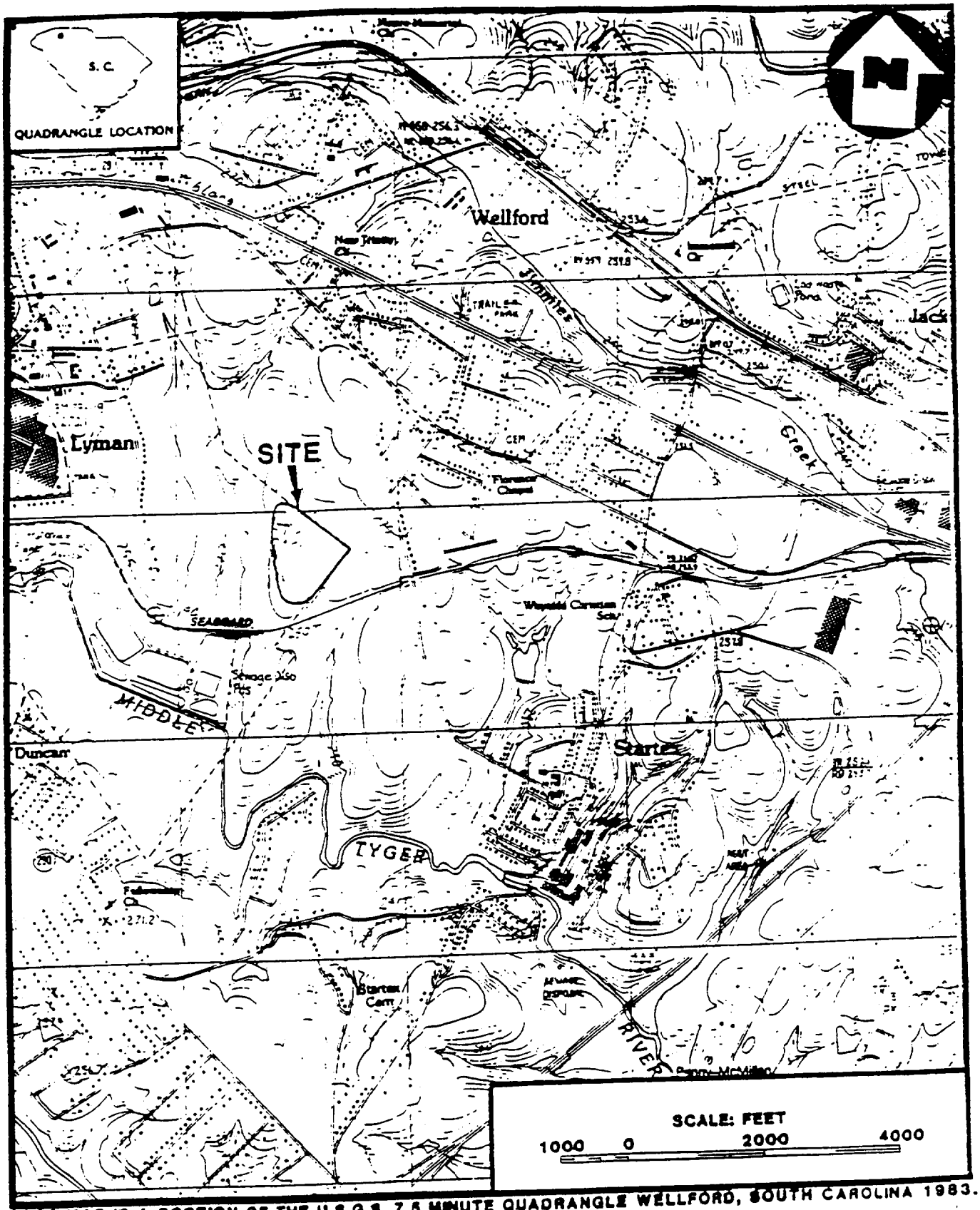
The Old Startex, Spartanburg County Landfill is located off Finch Road in Startex, Spartanburg County, South Carolina (Figure 1). The landfill, although owned by Lyman Printing and Finishing Company, was operated by Spartanburg County from the mid to late 1960s through the early 1970s. During this time, the landfill accepted wastes from Lyman Printing and Finishing Company, Spartanburg County, and other industries for disposal of household and industrial waste or refuse (Ref. 1). When Spartanburg County ceased operations at the site, Lyman Printing and Finishing Company closed access of the site to the public and other industries. Since that time, Lyman Printing and Finishing Company (now Springs Industries) has used the site for disposal of coal cinders from their furnace (Refs. 1, 2).

Neither Spartanburg County nor Lyman Printing and Finishing Company ever applied for a permit to operate a waste disposal landfill. Springs Industries has recently agreed with the South Carolina Department of Health and Environmental Control to stop using the landfill for waste disposal in an effort to avoid having to get the landfill permitted (Ref. 3).

2.2 SITE DESCRIPTION

2.2.1 Site Features

The site is approximately 30 to 40 acres in size (Ref. 1). Its entire surface area is covered with coarse to fine coal cinders. No other waste type was observed at the site. The landfill is thought to be an area fill type of landfill due to the shallow depth to bedrock and surrounding rolling hill topography. A thick border of dense vegetation and some heavily wooded areas surround the site. There was no evidence of any stressed vegetation or odor within the area. Leachate was observed in the northwest corner of the property in an area downgradient of the landfill. The leachate was orange to red in color and seemed to be stagnant in small pools. A dirt road, with a gate at the entrance, leads to the site. The site itself is not fenced, but accessibility by the public is limited due to its location (Ref. 2, Figure 2).



BASE MAP IS A PORTION OF THE U.S.G.S. 7.5 MINUTE QUADRANGLE WELLFORD, SOUTH CAROLINA 1983.

SITE LOCATION MAP
OLD STARTEX, SPARTANBURG COUNTY LANDFIILL
STARTEX, SOUTH CAROLINA

FIGURE 1

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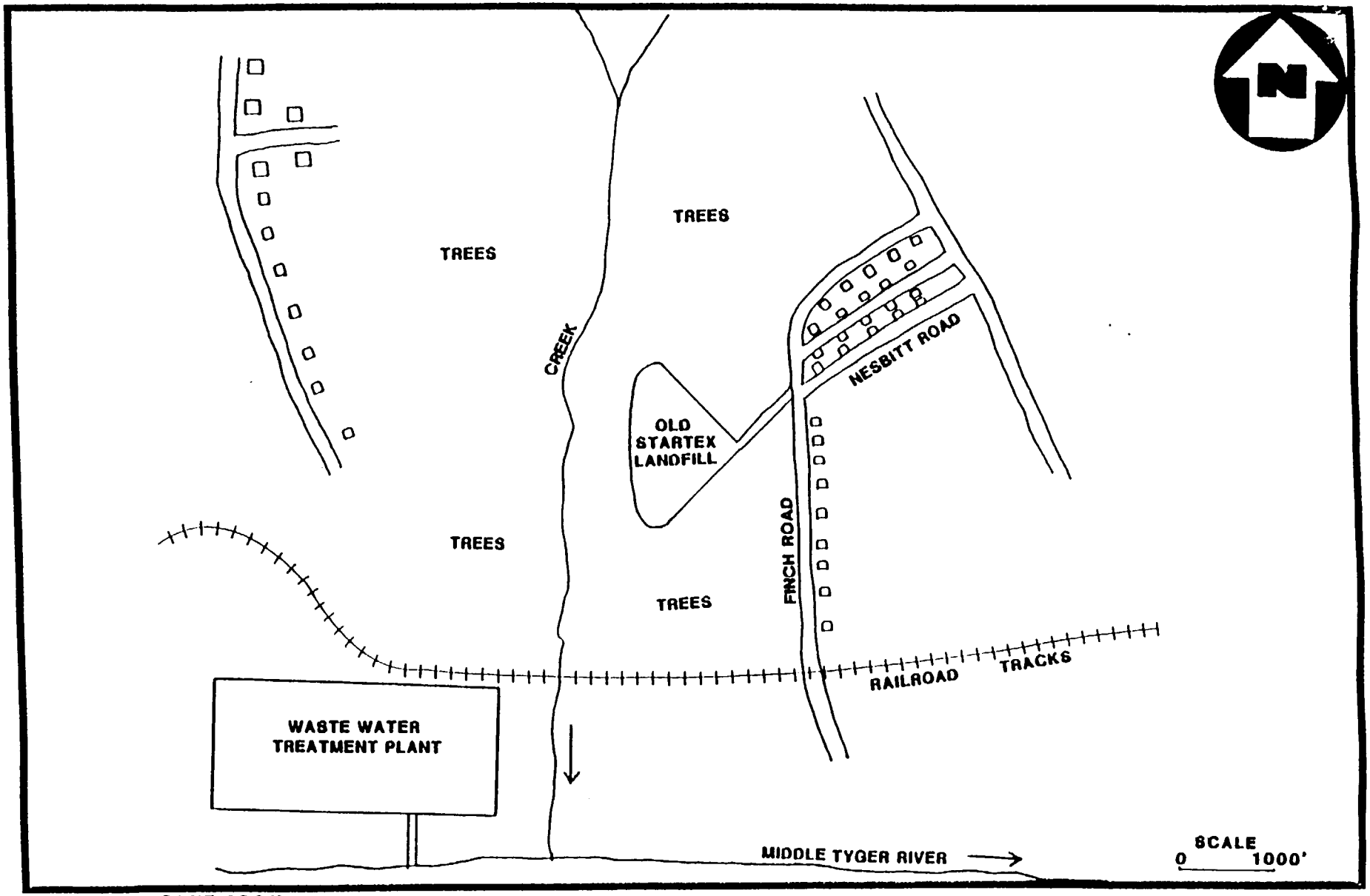


SITE LAYOUT MAP
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SOUTH CAROLINA

FIGURE 2

NUS CORPORATION

2.2.2 Waste Characteristics

It is unknown as to the exact amount and type of waste buried in the landfill, since it received waste from various sources (Ref. 1). The landfill is thought to have received a minimum amount of liquid organic and inorganic waste from Lyman Printing and Finishing Company, as stated in the 103(c) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) notification submitted by Lyman Dyeing and Finishing Company in June 1981 (Ref. 1). Most chemical wastes generated by local industry were typically drained into the wastewater treatment system. Other waste types possibly associated with this type of landfill are textile rags, cardboard, brick, blocks, and fly ash (Ref. 4).

Some of the waste types commonly associated with printing and dyeing facilities are soaps of cobalt, manganese, and lead formed with organic acids such as linolenic, naphthenic, and octanoic acids (Ref. 5, p. 379). Other waste types include metal-complex dyes made with chromium, copper, cobalt, and nickel (Ref. 6, p. 378). Solvents associated with inks include alcohols, aliphatic naphthas, aromatic hydrocarbons, esters, glycol ethers, ketones, and nitroparaffin (Ref. 5, p. 387).

3.0 REGIONAL POPULATIONS AND ENVIRONMENTS

3.1 POPULATION AND LAND USE

3.1.1 Demography

The site is located in a small, rural area between the cities of Startex, Wellford, Lyman, and Duncan, South Carolina. These cities are all within a 0.5- to 1-mile radius of the site. The nearest residence to the site is 800 feet east along Finch Road (Appendix A). Population within a 1-mile radius is 3,077, within a 4-mile radius is 10,965 (Ref. 7).

3.1.2 Land Use

Land use within a 4-mile radius of the site is a mixture of rural and residential with commercial property scattered throughout the communities (Appendix A). Much of the rural land is used for raising cattle and growing fescue for winter feed (Ref. 2). Numerous schools and churches are located within a 2-mile radius of the site (Appendix A). There are no land-related sensitive environments or endangered species associated specifically with Spartanburg County. Some species of mammals and birds are endangered throughout the state (Ref. 8).

3.2 SURFACE WATER

3.2.1 Climatology

The climate of Spartanburg County is described as mild. Summers range from May to September with average temperatures of 90°F or higher. Fall lasts from September to November and contains some of the most pleasant weather of the year with light rainfall, plenty of sunshine, and moderate temperatures. Winters are mild and relatively short with approximately 60 days of the season consisting of temperatures at freezing or below. Spring begins during the month of March and continues through to May. It frequently consists of cold and windy days followed by warmer, more pleasant days (Ref. 9, pp. 76, 77). Spartanburg County receives a net annual precipitation of 12 inches and a 1-year, 24-hour rainfall of 3.5 inches (Refs. 10, pp. 29, 39; 11, p. 93).

3.2.2 Overland Drainage

There are no distinct overland drainage pathways at the site. All precipitation is absorbed by the highly permeable, surficial coal cinders. The western outer edge of the landfill dips gently to the west for approximately 1,000 feet to an unnamed stream. The stream flows south for 2,000 feet then flows into the Middle Tyger River. This river continues flowing in a southeasterly direction for 12 miles before converging with the North Tyger River. The North Tyger River continues in a southeasterly direction for the remainder of the surface water pathway (Appendix A).

3.2.3 Potentially Affected Water Bodies

The Middle Tyger and North Tyger rivers are the primary water bodies encountered along a 15-mile, surface water pathway from the site. At the city of Lyman, upgradient of any influence from the site, the Middle Tyger River is an effluent receiving source for the city's waste treatment plant which treats domestic and industrial waste. The discharge of 8,000,000 gallons has resulted in a serious degradation of the scenic and aesthetic values of the river as well as a reduction in the fisheries population (Refs. 2, 12). This river is not used for any type of fishing or recreation from the discharge pipe of the Lyman Waste Plant to the city of Startex. From there, the river becomes cleaner as the heavy silt from the waste treatment plant settles out. Fishing and recreation along the Middle Tyger River restores and continues into the North Tyger River (Ref. 13).

The only surface water intake on the Middle Tyger River is located upstream of the waste treatment plant and the perennial stream which passes near the site. This intake serves the city of Lyman (Ref. 2). There are no other known surface water intakes along the Middle Tyger or North Tyger rivers (Ref. 14).

All other surrounding communities within a 4-mile radius of the site obtain potable water from various sources. The Greer Water Department has one intake located at the eastern end of Lake Cunningham, which is outside of any influence from the site. The cities of Startex, Jackson, Wellford, and Duncan formed the SJWD Water Corporation which has two wells located in Inman and buys water from Spartanburg. SJWD supplies water to most of the area surrounding the site. Spartanburg obtains its water from a surface water intake on William C. Bowen Lake which is located outside of any influence from the site (Ref. 15, Appendix A).

3.4 SUMMARY OF POTENTIALLY AFFECTED POPULATIONS AND ENVIRONMENTS

The primary pathways of concern at the site are groundwater and surface water. Contaminants from the landfill could leach into the shallow water table. There are approximately 204 homes (976 people) with private wells within a 3-mile radius of the site that use groundwater as their source of potable water. The surface water pathway is also of concern, since the Middle Tyger and the North Tyger rivers are used for fishing and recreation. The air and onsite exposure pathways are also of concern because of the potential for contaminated airborne particles to come in contact with anyone present at the site.

There are no known federally listed endangered species or sensitive environments located along the Middle Tyger or North Tyger rivers for 15 stream miles from the site (Ref. 8).

3.3 GROUNDWATER

3.3.1 Hydrogeology

The Old Startex Spartanburg County Landfill is located within the Piedmont physiographic province of northwestern South Carolina, which is characterized by a series of complexly fractured and folded metamorphic rocks containing numerous igneous intrusions. The facility lies within the Inner Piedmont Belt, which is composed of highly metamorphosed gneisses and schists of Pre-Cambrian age, intruded in many areas by younger granites (Ref. 16, p. 13). The topography of the area is regionally mature, consisting of a broad plateau dissected by streams that generally trend southeast (Ref. 16, pp. 9, 10). The land surface has moderate relief, with generally subdued topographic features such as well-rounded hills with no prominent peaks or ridges (Ref. 16, p. 7).

Locally, the soils around the facility consist of moderately permeable sandy clay and clay loams of the Davidson series (Ref. 9, pp. 14, 64-65, sheet 28). Soils of this series are formed from the weathering of gabbro, diorite, and hornblende schists or gneisses. These soils are typically deep and well-drained (Ref. 9, pp. 14). Davidson series soils are generally greater than 15 feet thick and have an estimated hydraulic conductivity of 1.0×10^{-4} to 1.0×10^{-7} cm/sec (Refs. 9, pp. 14; 17, p. 2).

Depth to groundwater at the facility is estimated to be 20 feet below land surface, and the predominant direction of groundwater flow is to the west toward the Middle Tyger River (Refs. 17, p. 2). Both water-table and artesian conditions can be found in the general area, since the regolith may locally have low permeability and act as a confining layer, but water-table conditions are most likely (Ref. 16, p. 58).

3.3.2 Aquifer Use

The only known users of groundwater within a 4-mile radius of the site are those houses which are not located near water supply lines. There are 204 houses (775 people based on 3.8 per house), all within a 3-mile radius and an additional 257 houses (976 people) between a 3- to 4-mile radius of the site which are thought to use private wells for drinking water. The nearest well is located 0.3 mile east of the site (Ref. 17, p. 2).

4.0 FIELD INVESTIGATION

4.1 SAMPLE COLLECTION

4.1.1 Sample Collection Methodology

All sample collection, sample preservation, and chain-of-custody procedures used during this investigation were in accordance with the standard operating procedures as specified in Sections 3 and 4 of the Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual; United States Environmental Protection Agency, Region IV, Environmental Services, Division, April 1, 1986.

4.1.2 Duplicate Samples

Vince Blount, a geologist with Universal Engineering Sciences, Orlando, Florida, accepted split samples on behalf of Alan McManus, Environmental Manager, Springs Industries (Ref. 2).

4.1.3 Description of Samples and Sample Locations

Eighteen environmental samples were collected during the investigation. Sample locations and rationale are shown in Table 1. Sample locations are mapped on Figure 3. Six surface soil samples were collected: one background and five from various locations along the perimeter of the landfill. Four subsurface samples were collected from the same sampling locations as the surface soils. Samples OS-SB-04 and OS-SB-05 were not collected due to contact with bedrock at shallow depths. Four sediment samples were collected in all: two from an unnamed perennial stream near the site and two from the Middle Tyger River. One sample was collected on the unnamed stream upgradient of the site for background. Another sample was collected on the same stream downgradient of the site. One sample was collected upgradient of the confluence of the unnamed stream and the Middle Tyger River. The other sample was collected downgradient of that confluence. Four surface water samples were collected from the same sample locations as the sediments.

4.1.4 Field Measurements

Field measurements were taken on all surface water samples. Samples were measured for pH, conductivity, and temperature. Measurements are shown in Table 2.

TABLE 1

SAMPLE CODES, DESCRIPTIONS, LOCATIONS, AND RATIONALE
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Sample Type	Location	Rationale
OS-SS-01	Surface Soil	Entrance to landfill, along Finch Road	Control sample
OS-SS-02	Surface Soil	Northeast edge of landfill	Detection around landfill perimeter
OS-SS-03	Surface Soil	Northwest edge of landfill	Detection around landfill perimeter
OS-SS-04	Surface Soil	West edge of landfill	Detection around landfill perimeter
OS-SS-05	Surface Soil	Southwest corner of landfill	Detection around landfill perimeter
OS-SS-06	Surface Soil	Southeast edge of landfill	Detection around landfill perimeter
OS-SB-01	Subsurface Soil	Same as SS-01, collected at 6-7' below land surface (bls)	Control sample
OS-SB-02	Subsurface Soil	Same as SS-02, collected at landfill perimeter 4' bls	To determine presence or absence of contamination
OS-SB-03	Subsurface Soil	Same as SS-03, collected at landfill perimeter 3-6' bls	To determine presence or absence of contamination
OS-SB-04	Subsurface Soil	Not Collected	Hit bedrock at 1' bls
OS-SB-05	Subsurface Soil	Not Collected	Hit bedrock at 2' bls
OS-SB-06	Subsurface Soil	Same as SS-06, collected at landfill perimeter 4-5' bls	To determine presence or absence of contamination
OS-SD-01	Sediment	Background	Control sample for perennial stream
OS-SD-02	Sediment	On site, downgradient sediment along perennial stream	To determine presence or absence of contamination
OS-SD-03	Sediment	Background	Control sample for Tyger River
OS-SD-04	Sediment	On site	Downgradient on Tyger River

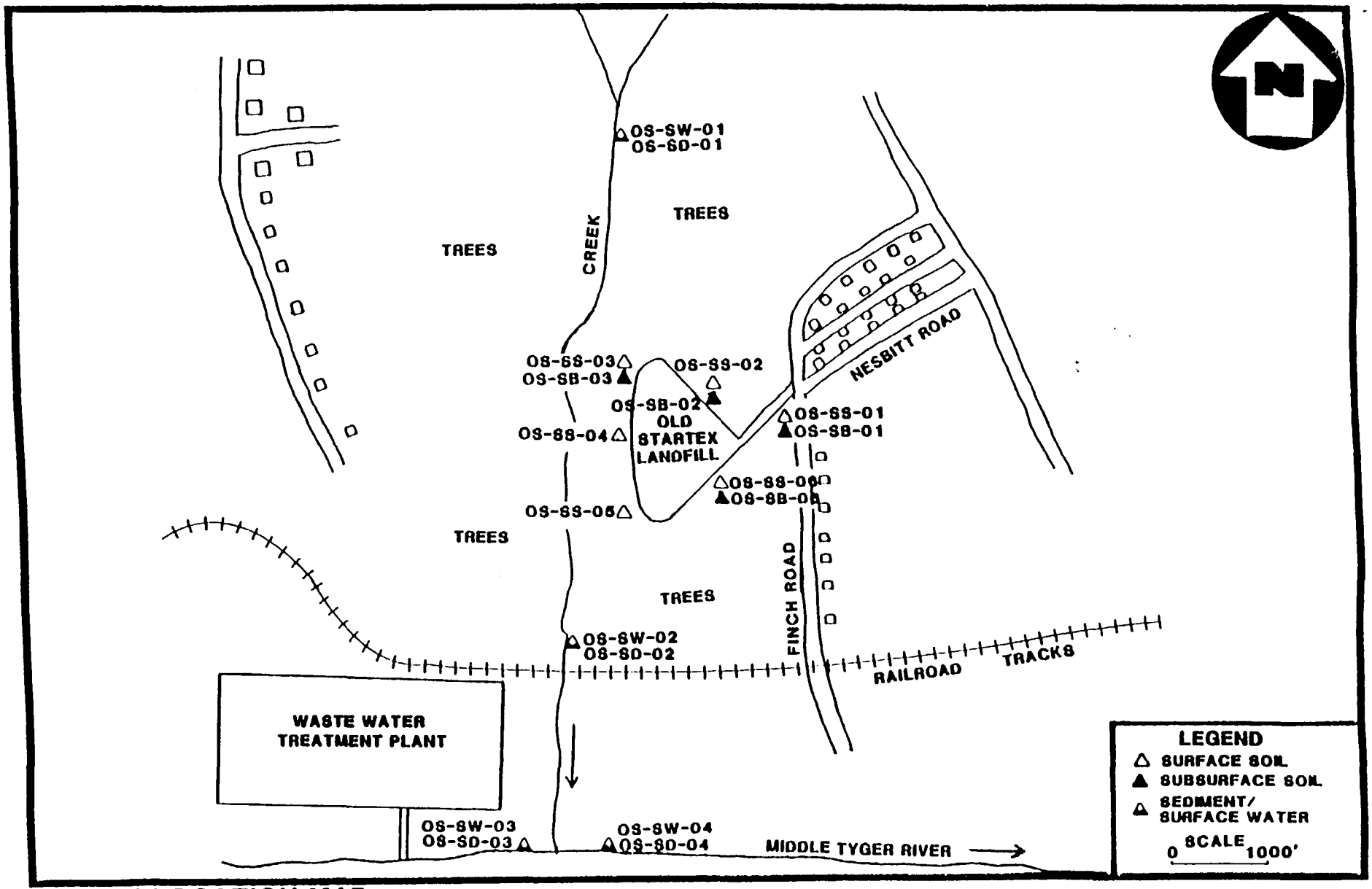
OS - Old Startex
SS - Surface Soil
SB - Subsurface Soil
SD - Sediment
SW - Surface Water

TABLE 1

SAMPLE CODES, DESCRIPTIONS, LOCATIONS, AND RATIONALE
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Sample Type	Location	Rationale
OS-SW-01	Surface Water	Background	Control sample for perennial stream
OS-SW-02	Surface Water	Downgradient along perennial stream	To determine presence or absence of contamination
OS-SW-03	Surface Water	Background	Control sample for Middle Tyger River
OS-SW-04	Surface Water	Downgradient of perennial stream confluence with Middle Tyger River	To determine presence or absence of contamination

OS - Old Startex
SS - Surface Soil
SB - Subsurface Soil
SD - Sediment
SW - Surface Water



SAMPLE LOCATION MAP
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SOUTH CAROLINA

FIGURE 3

NUS CORPORATION

TABLE 2

FIELD MEASUREMENTS
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Date (1990)	Time	pH	Temp. (°C)	Conductivity (umhos/cm)
OS-SW-01	9/25	855	6.14	15	70.0
OS-SW-02	9/25	1050	6.84	17	46.1
OS-SW-03	9/25	1250	7.7	25	506
OS-SW-04	9/25	1245	7.61	24	383

OS - Old Startex
SW - Surface Water

4.2 SAMPLE ANALYSIS

4.2.1 Analytical Support and Methodology

All samples collected were analyzed under the Contract Laboratory Program (CLP) and analyzed for all parameters listed in the Target Compound List (TCL). Organic analysis of soil and water samples was performed by Gulf South Research Institute (GULF), New Orleans, Louisiana. Inorganic analysis of soil and water was performed by Silver Valley (SILVER), Kellogg, Indiana.

All laboratory analyses and laboratory quality assurance procedures used during this investigation were in accordance with standard procedures and protocols as specified in the Analytical Support Branch Operations and Quality Assurance Manual, United States Environmental Protection Agency, Region IV, Environmental Services Division, revised June 1, 1985; or as specified by the existing United States Environmental Protection Agency standard procedures and protocols for the contract analytical laboratory program.

4.2.2 Analytical Data Quality

All analytical data were subjected to a quality assurance review as described in the EPA Environmental Services Division laboratory data guidelines. In the tables, some of the concentrations of the organic and inorganic parameters have been flagged with a "J". This indicates that the qualitative analysis was acceptable, but the quantitative value has been estimated. A few other compounds are flagged with an "N", indicating that they were detected based on the presumptive evidence of their presence. This means that the compound was tentatively identified, and its detection cannot be used as a positive identification as to its presence. The complete analytical data sheets are provided in Appendix B.

4.2.3 Presentation of Analytical Results

Throughout the following discussion of analytical results, the concentrations of some of the contaminants have been described as "elevated". This means that the concentration was either three times that found in the background sample, or it was three times the minimum quantitation limit (MQL) of that contaminant in the background sample.

Table 3 presents a summary of organic results for the soil trip blank (analyzed for purgeable organics only) and six surface soil samples. Concentrations are compared to the background surface soil

sample, OS-SS-01. Elevated organic contamination was found in sample OS-SS-02 (from the northeast edge of the landfill) and OS-SS-03 (from the northwest edge of the landfill). Acetone was found in surface soil OS-SS-03, at over 50 times the MQL. (Acetone is commonly used in laboratories.) Several tentatively identified compounds (TICs) were reported in this sample: levels of benzothiazolone, hexadecanoic acid, and butoxyethanol phosphate were estimated to range from 2,000 to 4,000 ug/kg. Phosphate esters, particularly butoxyethanol phosphate (also known as tris(butoxyethyl) phosphate), are used as plasticizers and leveling agents (Ref. 18, p. 323). Fifteen unidentified compounds, estimated total of 90,000 ug/kg, were also reported. Petroleum product was tentatively identified in this sample and in OS-SS-06, which also contained 10 unidentified compounds totaling 10,000 ug/kg.

Diethyl phthalate was found in sample OS-SS-03 (less than twice background), and bis(2-ethylhexyl)phthalate was found in OS-SS-04 (five times background). Both are commonly used as plasticizers. The only other surface soil sample showing elevated organic contamination was OS-SS-02, which contained 12 different polynuclear aromatic hydrocarbon (PAH) compounds. Most levels were near or below MQLs except for fluoranthene and pyrene, which exceeded background MQLs by almost three times.

The results of the organic analysis of the four subsurface soil samples are summarized in Table 4. The only sample showing significant contamination was OS-SB-03. The volatile compounds chlorobenzene, ethyl benzene, xylenes, and ethylmethyl benzene (TIC) were reported at low levels ranging from near background MQLs to almost four times background MQLs. Typical occurrences of this type of compound are as solvents or components of gasoline.

The analysis of sample OS-SB-03 for extractable compounds revealed several compounds that were tentatively identified or unidentified. Banzothiozalone and butoxyethanolphosphate were tentatively identified, both at an estimated concentration of 2,000 ug/kg. (Both of these compounds were also reported in surface soil OS-SS-03). Also, fourteen unidentified compounds were reported at an estimated total of 10,000 ug/kg.

Organic results from sediment and surface water samples are summarized in Tables 5 and 6. The only organic compounds reported in any of the four sediment samples were estimated low levels of unidentified compounds and tetramethylbutane (TIC). Fluoranthene and pyrene were found in surface water sample OS-SW-04, at 2 to 3 ug/l, well under the background MQLs of 10 ug/l.

Tetramethylbutane was reported in the soil trip blank, in all six surface soil samples, in two (of four) subsurface soil samples, and in three (or four) sediment samples (a total of 11 out of 14 soil/sediment

TABLE 3

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SURFACE SOIL SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/kg)	Soil Trip Blank	Background	Landfill Perimeter				
			Northeast	Northwest	West	Southwest	Southeast
	OS-TB-01S	OS-SS-01	OS-SS-02	OS SS 03	OS-SS-04	OS-SS-05	OS-SS-06
PURGEABLE COMPOUNDS							
ACETONE	-	11U	-	63J	-	-	-
TETRAMETHYLBUTANE[1]	20JN	40JN	50JN	80JN	20JN	30JN	60JN
PROPADIENE[1]						4JN	
EXTRACTABLE COMPOUNDS							
DIETHYL PHTHALATE		380U	-	600J		-	-
PHENANTHRENE	-	380U	520		-	-	-
ANTHRACENE	-	380U	100J	-	-	-	-
FLUORANTHENE	-	380U	1100	210J	76J	-	-
PYRENE	-	380U	1100	380J	110J	-	-
BENZO(A)ANTHRACENE	-	380U	430	-	-	-	-
CHRYSENE	-	380U	570	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE		380U	-	-	1900	-	-
BENZO(B AND/OR K)FLUORANTHENE	-	380U	770J	-	-	-	-
BENZO-A-PYRENE	-	380U	370J	-	-	-	-
INDENO (1,2,3-CD) PYRENE		380U	230J		-	-	-

- Material analyzed for but not detected above minimum quantitation limit (MQL)
J Estimated value
N Presumptive evidence of presence of material
U Material was analyzed for but not detected. The number given is the MQL
[1] Tentatively identified compound. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.

TABLE 3

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SURFACE SOIL SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/kg)	Soil Trip Blank	Background	Landfill Perimeter				
			Northeast	Northwest	West	Southwest	Southeast
	OS-TB-01S	OS-SS-01	OS-SS-02	OS-SS-03	OS-SS-04	OS-SS-05	OS-SS-06
DIBENZO(A,H)ANTHRACENE	-	380U	130J		-	-	-
BENZO(GHI)PERYLENE	-	380U	260J	-	-	-	-
BENZOFLUORANTHENE(NOT B OR K)(1)			200JN				
PINENE(1)			500JN				
UNIDENTIFIED COMPOUNDS/NO			400J/1	90,000J/15	3000J/6	800J/1	10,000J/10
PETROLEUM PRODUCT(1)				N			N
BENZOTHIAZOLONE(1)				2000JN			
HEXADECANOIC ACID(1)				4000JN			1000JN
BUTOXYETHANOLPHOSPHATE(1)				3000JN			

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value.
N Presumptive evidence of presence of material.
UJ Material was analyzed for but not detected. The number given is the MQL.
(1) Tentatively identified compound. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.

TABLE 4

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SUBSURFACE SOIL SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/kg)	Soil Trip Blank	Background	Landfill Perimeter		Landfill Perimeter
			Northeast	Northwest	Southeast
	OS-TB-01S	OS-SB-01	OS-SB-02	OS-SB-03*	OS-SB-06
PURGEABLE COMPOUNDS					
CHLOROBENZENE	-	6U	-	19	-
ETHYL BENZENE	-	6U	-	9	-
TOTAL XYLENES		6U		22	
TETRAMETHYLBUTANE(1)	20JN	90JN		10JN	
ETHYLMETHYLBENZENE(1)				100JN	
UNIDENTIFIED COMPOUNDS/NO					20J/1
EXTRACTABLE COMPOUNDS					
BIS(2-ETHYLHEXYL) PHTHALATE	-	900	-	-	-
UNIDENTIFIED COMPOUNDS/NO				10,000J/4	
BENZOTHIAZOLONE(1)				2000JN	
BUTOXYETHANOLPHOSPHATE(1)				2000JN	

- Material analyzed for but not detected above minimum quantitation limit (MQL)
J Estimated value.
N Presumptive evidence of presence of material.
U Material was analyzed for but not detected. The number given is the MQL.
(1) Tentatively identified compound. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.
* Samples OS-SB-04 and OS-SB-05 were not collected.

TABLE 5

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SEDIMENT SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/kg)	Background Upgradient OS-SD-01	Downgradient of Landfill OS-SD-02	Background Upgradient OS-SD-03	Downgradient of Landfill OS-SD-04
PURGEABLE COMPOUNDS				
TETRAMETHYLBUTANE (1)		10JN	20JN	20JN
UNIDENTIFIED COMPOUND NO.	50J3			

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value.
N Presumptive evidence of presence of material.
(1) Tentatively identified compound. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.

TABLE 6

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SURFACE WATER SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/l)	Trip Blank OS-TB-01	Background Upgradient OS-SW-01	Downgradient of Landfill OS-SW-02	Background Upgradient OS-SW-03	Downgradient of Landfill OS-SW-04
EXTRACTABLE COMPOUNDS					
FLUORANTHENE	-	-	-	10U	2J
PYRENE	-	-	-	10U	3J
HEXANEDIOIC ACID ETHYLHEXYLESTER(1)		4JN			

- \- Material analyzed for but not detected above minimum quantitation limit (MQL).
- J Estimated value.
- N Presumptive evidence of presence of material.
- U Material was analyzed for but not detected. The number given is the MQL.
- (1) Tentatively identified compound. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.

samples). Concentrations ranged from 10 to 90 ug/kg. Because of its appearance in the trip blank and background samples, it is probably not attributable to the site. Tetramethylbutane is very similar to iso-octane, a common lab solvent (both are 8-carbon alkanes).

Table 7 presents inorganic results for the six surface soil samples. Cobalt was present in OS-SS-03 at 100 times the background MQL. In samples OS-SS-04, OS-SS-05, and OS-SS-06, cobalt levels exceeded background MQLs by factors of three to four. In OS-SS-03, levels of eight additional metals exceeded background levels by factors of three to 10.

Table 8 presents inorganic results for the four subsurface soil samples. Calcium levels exceeded the background MQL for all three onsite subsurface samples (OS-SB-02, OS-SB-03, and OS-SB-06), by factors of 10 to 17. Estimated values for chromium were also detected in samples OS-SB-02 and OS-SB-06 at elevated levels.

Results of inorganic analysis of the four sediment samples are summarized in Table 9. Several results are marginally elevated. Sediment OS-SD-02 contains almost four times as much iron and vanadium as the upstream background at OS-SD-01. For OS-SD-04, levels of aluminum, barium, chromium, copper, lead, magnesium, and vanadium exceeded background levels (based on OS-SD-03, upstream), by three to five times.

The results of inorganic analysis of the four surface water samples are summarized in Table 10. OS-SW-02 is compared to the upstream background at OS-SW-01, and OS-SW-04 is compared to the upstream background at OS-SW-03. For all inorganic parameters measured for these surface water samples, differences were negligible.

TABLE 7

SUMMARY OF INORGANIC ANALYTICAL RERSULTS
SURFACE SOIL SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

	Background	Landfill Perimeter				
		Northeast	Northwest	West	Southwest	Southeast
PARAMETERS (mg/kg)	OS-SS-01	OS-SS-02	OS-SS-03	OS-SS-04	OS-SS-05	OS-SS-06
ALUMINUM	89.000	21.000	33.000	61.000	11.000	26.000
ARSENIC	13J	2.6J	-	-	1.1J	-
BARIUM	52	54	230	110	200	140
CALCIUM	430	480	2000	790	4400	3100
CHROMIUM	65J	54J	44J	88J	13J	44J
COBALT	2.3U	5.2	240	9	8	7.4
COPPER	32	17	38	40	35	23
IRON	73.000	24.000	100.000	63.000	10.000	28.000
LEAD	58J	18J	51J	34J	11J	33J
MAGNESIUM	490	410	1600	2000	760	1000
MANGANESE	130	390	1400	170	65	450
NICKEL	9.1U	7.8	30	19	16	-
POTASSIUM	290U	-	1400	2100	-	-
SELENIUM	0.98UJ	1.9	-	-	-	-
SILVER	1.3U	-	-	-	-	2.9N
SODIUM	30U	-	150	-	190	
VANADIUM	220	64	80	180	44	73
ZINC	29	73	120	33	-	38

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value.
N Presumptive evidence of presence of material.
U Material was analyzed for but not detected. The number given is the MQL.

TABLE 8

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SUBSURFACE SOIL SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

	Background	Landfill Perimeter		Landfill Perimeter
		Northeast	Northwest	Southeast
PARAMETERS (mg/kg)	OS-SB-01	OS-SB-02	OS-SB-03*	OS-SB-06
ALUMINUM	61,000	80,000	6500	39,000
BARIUM	180	60	52	75
CALCIUM	20U	200	350	330
CHROMIUM	40J	130J	18J	140J
COBALT	18	9.5	48	6
COPPER	92	71	2 8	29
IRON	68,000	94,000	4300	37,000
LEAD	39J	[illegible]	9 8J	16J
MAGNESIUM	7700	800	290	880
MANGANESE	410	400	900	290
NICKEL	17	28	-	7 5
POTASSIUM	6800	-	-	-
SELENIUM	0.70U	3.7J	-	-
SILVER	0.93U	-	-	3 7JN
VANADIUM	170	250	16	100
ZINC	87	45	-	27

- Material analyzed for but not detected above minimum quantitation limit (MQL).

J Estimated value.

N Presumptive evidence of presence of material.

U Material was analyzed for but not detected. The number given is the MQL.

* OS-SB-04 and OS-SB-05 were not collected.

TABLE 9

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SEDIMENT SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (mg/kg)	Background Upgradient OS-SD-01	Downgradient of Landfill OS-SD-02	Background Upgradient OS-SD-03	Downgradient of Landfill OS-SD-04
ALUMINUM	6500	6100	1900	6600
BARIUM	34	18	9.6	29
CALCIUM	98	56	50U	99
CHROMIUM	46J	100J	4.6J	19J
COBALT	-	-	1.8U	2.4
COPPER	9.6	-	2U	8.5
IRON	7900	29,000	3200	7800
LEAD	8J	5.8J	2.5J	7.4J
MAGNESIUM	1000	380	130	650
MANGANESE	76	75	160	130
SODIUM	30U	-	27	23
VANADIUM	22	84	7.1	18

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value
U Material was analyzed for but not detected. The number given is the MQL.

TABLE 10

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SURFACE WATER SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/l)	Trip Blank OS-TB-01	Background Upgradient OS-SW-01	Downgradient of Landfill OS-SW-02	Background Upgradient OS-SW-03	Downgradient of Landfill OS-SW-04
BARIUM	-	22	19	16	18
CALCIUM	-	2800	2900	2600	2600
COPPER	-	-	-	40	39
IRON	-	-	-	650	750
MAGNESIUM	-	1300	1400	1900	1900
MANGANESE	-	83	30	83	83
NICKEL	-	-	-	28U	38
POTASSIUM	-	-	-	5600	5100
SODIUM	-	2800	2900	86,000	85,000
VANADIUM	-	-	-	11	14
ZINC	-	-	-	110	110

- Material analyzed for but not detected above minimum quantitation limit (MQL).
U Material was analyzed for but not detected. The number given is the MQL.

5.0 SUMMARY

There are approximately 775 people located within the 3-mile radius of the facility who are presumed to use private wells for drinking water. All other residents in the area obtain their water from surface water, an alternate, unthreatened source.

Eighteen environmental samples were collected during the investigation. Six surface soil, four subsurface soil, four sediment, and four surface water samples. Low levels of organics were found in some of the surface and subsurface soil samples. Surface water samples showed no elevated levels of organics.

Various levels of inorganics such as aluminum, barium, chromium, cobalt, copper, lead, magnesium, manganese, and vanadium, were found in surface, subsurface, and sediment soil samples. Some of these elements such as chromium, cobalt, copper, lead, and manganese are used in the production of inks and dyes. The presence of these metals could possibly be associated with waste disposal activities at the landfill by the Lyman Printing and Finishing Company. No elevated levels of inorganics were found in surface water samples.

Based upon the limited targets in the area and low concentrations of isolated contaminants detected during this investigation, FIT 4 recommends no further remedial action be planned for the Old Startex, Spartanburg County Landfill. However, FIT 4 does recommend that applicable state and/or county agencies monitor several of the closest private wells to the landfill due to groundwater depth and the presence of several polynuclear aromatic hydrocarbons detected in surface soil samples.

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16. W.M. Bloxham, George E. Siple, and T. Ray Cummings, Water Resources of Spartanburg County, South Carolina, South Carolina Water Resources Commission Report No. 3 (Spartanburg, South Carolina: U.S. Geological Survey, 1970).

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APPENDIX B

Analytical Results

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01 COLLECTION START: 09/25/90 0800 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y275

UG/L	ANALYTICAL RESULTS
10U	CHLOROMETHANE
10U	BROMOMETHANE
10U	VINYL CHLORIDE
10U	CHLOROETHANE
70U	METHYLENE CHLORIDE
10U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
10UR	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
10U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/L	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
10U	METHYL ISOBUTYL KETONE
10U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

B-1

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01 COLLECTION START: 09/25/90 0800 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y275

UG/L	ANALYTICAL RESULTS
10U	PHENOL
10U	BIS(2-CHLOROETHYL) ETHER
10U	2-CHLOROPHENOL
10U	1,3-DICHLOROBENZENE
10U	1,4-DICHLOROBENZENE
10U	BENZYL ALCOHOL
10U	1,2-DICHLOROBENZENE
10U	2-METHYLPHENOL
10U	BIS(2-CHLOROISOPROPYL) ETHER
10U	(3-AND/OR 4-)METHYLPHENOL
10U	N-NITROSODI-N-PROPYLAMINE
10U	HEXACHLOROETHANE
10U	NITROBENZENE
10U	ISOPHORONE
10U	2-NITROPHENOL
10U	2,4-DIMETHYLPHENOL
50U	BENZOIC ACID
10U	BIS(2-CHLOROETHOXY) METHANE
10U	2,4-DICHLOROPHENOL
10U	1,2,4-TRICHLOROBENZENE
10U	NAPHTHALENE
10U	4-CHLOROANILINE
10U	HEXACHLOROBUTADIENE
10U	4-CHLORO-3-METHYLPHENOL
10U	2-METHYLNAPHTHALENE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)
10U	2,4,6-TRICHLOROPHENOL
50U	2,4,5-TRICHLOROPHENOL
10U	2-CHLORONAPHTHALENE
50U	2-NITROANILINE
10U	DIMETHYL PHTHALATE
10U	ACENAPHTHYLENE
10U	2,6-DINITROTOLUENE

UG/L	ANALYTICAL RESULTS
50U	3-NITROANILINE
10U	ACENAPHTHENE
50U	2,4-DINITROPHENOL
50U	4-NITROPHENOL
10U	DIBENZOFURAN
10U	2,4-DINITROTOLUENE
10U	DIETHYL PHTHALATE
10U	4-CHLOROPHENYL PHENYL ETHER
10U	FLUORENE
50U	4-NITROANILINE
50U	2-METHYL-4,6-DINITROPHENOL
10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	4-BROMOPHENYL PHENYL ETHER
10U	HEXACHLOROBENZENE (HCB)
50U	PENTACHLOROPHENOL
10U	PHENANTHRENE
10U	ANTHRACENE
10UJ	DI-N-BUTYLPHTHALATE
10U	FLUORANTHENE
10U	PYRENE
10U	BENZYL BUTYL PHTHALATE
20U	3,3'-DICHLOROBENZIDINE
10U	BENZO(A)ANTHRACENE
10U	CHRYSENE
10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	DI-N-OCTYLPHTHALATE
10U	BENZO(B AND/OR K)FLUORANTHENE
10U	BENZO-A-PYRENE
10U	INDENO (1,2,3-CD) PYRENE
10U	DIBENZO(A,H)ANTHRACENE
10U	BENZO(GHI)PERYLENE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01 COLLECTION START: 09/25/90 0800 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y275

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.
*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS. GA.

METALS DATA REPORT 11/13/90

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01 COLLECTION START: 09/25/90 0800 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y275

UG/L	ANALYTICAL RESULTS
40U	ALUMINUM
29U	ANTIMONY
3U	ARSENIC
4U	BARIUM
1U	BERYLLIUM
4U	CADMIUM
21U	CALCIUM
5U	CHROMIUM
7U	COBALT
4U	COPPER
40U	IRON
1U	LEAD
31U	MAGNESIUM

UG/L	ANALYTICAL RESULTS
3U	MANGANESE
.20U	MERCURY
28U	NICKEL
770U	POTASSIUM
3U	SELENIUM
4U	SILVER
90U	SODIUM
2U	THALLIUM
NA	TIN
4U	VANADIUM
6U	ZINC

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01 COLLECTION START: 09/25/90 0800 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y275 MD NO: Y275

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y278

UG/KG	ANALYTICAL RESULTS
400U	PHENOL
400U	BIS(2-CHLOROETHYL) ETHER
400U	2-CHLOROPHENOL
400U	1,3-DICHLOROBENZENE
400U	1,4-DICHLOROBENZENE
400U	BENZYL ALCOHOL
400U	1,2-DICHLOROBENZENE
400U	2-METHYLPHENOL
400UR	BIS(2-CHLOROISOPROPYL) ETHER
400U	(3-AND/OR 4-)METHYLPHENOL
400U	N-NITROSODI-N-PROPYLAMINE
400U	HEXACHLOROETHANE
400U	NITROBENZENE
400U	ISOPHORONE
400U	2-NITROPHENOL
400U	2,4-DIMETHYLPHENOL
1900U	BENZOIC ACID
400U	BIS(2-CHLOROETHOXY) METHANE
400U	2,4-DICHLOROPHENOL
400UR	1,2,4-TRICHLOROBENZENE
400U	NAPHTHALENE
400U	4-CHLOROANILINE
400U	HEXACHLOROBUTADIENE
400U	4-CHLORO-3-METHYLPHENOL
400U	2-METHYLNAPHTHALENE
400U	HEXACHLOROCYCLOPENTADIENE (HCCP)
400U	2,4,6-TRICHLOROPHENOL
1900U	2,4,5-TRICHLOROPHENOL
400UR	2-CHLORONAPHTHALENE
1900U	2-NITROANILINE
400U	DIMETHYL PHTHALATE
400U	ACENAPHTHYLENE
400U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1900U	3-NITROANILINE
400U	ACENAPHTHENE
1900U	2,4-DINITROPHENOL
1900U	4-NITROPHENOL
400U	DIBENZOFURAN
400U	2,4-DINITROTOLUENE
400U	DIETHYL PHTHALATE
400U	4-CHLOROPHENYL PHENYL ETHER
400U	FLUORENE
1900U	4-NITROANILINE
1900U	2-METHYL-4,6-DINITROPHENOL
400U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
400U	4-BROMOPHENYL PHENYL ETHER
400U	HEXACHLOROBENZENE (HCB)
1900UJ	PENTACHLOROPHENOL
400U	PHENANTHRENE
400U	ANTHRACENE
400U	DI-N-BUTYLPHTHALATE
400U	FLUORANTHENE
400U	PYRENE
400U	BENZYL BUTYL PHTHALATE
800U	3,3'-DICHLOROBENZIDINE
400U	BENZO(A)ANTHRACENE
400U	CHRYSENE
400U	BIS(2-ETHYLHEXYL) PHTHALATE
400U	DI-N-OCTYLPHTHALATE
400U	BENZO(B AND/OR K)FLUORANTHENE
400U	BENZO-A-PYRENE
400U	INDENO (1,2,3-CD) PYRENE
400U	DIBENZO(A,H)ANTHRACENE
400U	BENZO(GHI)PERYLENE
17	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-01
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 0855 STOP: 00/00/00
D. NUMBER: Y278

UG/KG	ANALYTICAL RESULTS
9.6U	ALPHA-BHC
9.6U	BETA-BHC
9.6U	DELTA-BHC
9.6U	GAMMA-BHC (LINDANE)
9.6U	HEPTACHLOR
9.6U	ALDRIN
9.6U	HEPTACHLOR EPOXIDE
9.6U	ENDOSULFAN I (ALPHA)
19U	DIELDRIN
19U	4,4'-DDE (P,P'-DDE)
19U	ENDRIN
19U	ENDOSULFAN II (BETA)
19U	4,4'-DDD (P,P'-DDD)
19U	ENDOSULFAN SULFATE
19U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
96U	METHOXYCHLOR
19U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
96U	GAMMA-CHLORDANE /2
96U	ALPHA-CHLORDANE /2
190U	TOXAPHENE
96U	PCB-1016 (AROCLOR 1016)
96U	PCB-1221 (AROCLOR 1221)
96U	PCB-1232 (AROCLOR 1232)
96U	PCB-1242 (AROCLOR 1242)
96U	PCB-1248 (AROCLOR 1248)
190U	PCB-1254 (AROCLOR 1254)
190U	PCB-1260 (AROCLOR 1260)
17	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.
*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y278

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
6500	ALUMINUM	76	MANGANESE
20U	ANTIMONY	.18U	MERCURY
3UJ	ARSENIC	20U	NICKEL
34	BARIUM	1400U	POTASSIUM
.36U	BERYLLIUM	1.1U	SELENIUM
1.5U	CADMIUM	1.5U	SILVER
98	CALCIUM	30U	SODIUM
46J	CHROMIUM	.73U	THALLIUM
2.6U	COBALT	NA	TIN
9.6	COPPER	22	VANADIUM
7900	IRON	20U	ZINC
8J	LEAD	45	PERCENT MOISTURE
1000	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y278 MD NO: Y278

RESULTS	UNITS	PARAMETER
1.8U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y278

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
200U	METHYLENE CHLORIDE
12U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
17	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50958	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SD-01			COLLECTION START 09/25/90 0855 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y278 MD NO: Y278

ANALYTICAL RESULTS UG/KG

50J 3 UNIDENTIFIED COMPOUNDS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA
SOURCE: OLD STARTEX SPARTANB
STATION ID: SW-01

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 0855 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y279

UG/L	ANALYTICAL RESULTS
10U	CHLOROMETHANE
10U	BROMOMETHANE
10U	VINYL CHLORIDE
10U	CHLOROETHANE
20U	METHYLENE CHLORIDE
100U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
10UR	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
10U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/L	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
10U	METHYL ISOBUTYL KETONE
10U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS, GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y279

UG/L	ANALYTICAL RESULTS
10U	PHENOL
10U	BIS(2-CHLOROETHYL) ETHER
10U	2-CHLOROPHENOL
10U	1,3-DICHLOROBENZENE
10U	1,4-DICHLOROBENZENE
10U	BENZYL ALCOHOL
10U	1,2-DICHLOROBENZENE
10U	2-METHYLPHENOL
10U	BIS(2-CHLOROISOPROPYL) ETHER
10U	(3-AND/OR 4-)METHYLPHENOL
10U	N-NITROSODI-N-PROPYLAMINE
10U	HEXACHLOROETHANE
10U	NITROBENZENE
10U	ISOPHORONE
10U	2-NITROPHENOL
10U	2,4-DIMETHYLPHENOL
50U	BENZOIC ACID
10U	BIS(2-CHLOROETHOXY) METHANE
10U	2,4-DICHLOROPHENOL
10U	1,2,4-TRICHLOROBENZENE
10U	NAPHTHALENE
10U	4-CHLOROANILINE
10U	HEXACHLOROBUTADIENE
10U	4-CHLORO-3-METHYLPHENOL
10U	2-METHYLNAPHTHALENE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)
10U	2,4,6-TRICHLOROPHENOL
50U	2,4,5-TRICHLOROPHENOL
10U	2-CHLORONAPHTHALENE
50U	2-NITROANILINE
10U	DIMETHYL PHTHALATE
10U	ACENAPHTHYLENE
10U	2,6-DINITROTOLUENE

UG/L	ANALYTICAL RESULTS
50U	3-NITROANILINE
10U	ACENAPHTHENE
50U	2,4-DINITROPHENOL
50U	4-NITROPHENOL
10U	DIBENZOFURAN
10U	2,4-DINITROTOLUENE
10U	DIETHYL PHTHALATE
10U	4-CHLOROPHENYL PHENYL ETHER
10U	FLUORENE
50U	4-NITROANILINE
50U	2-METHYL-4,6-DINITROPHENOL
10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	4-BROMOPHENYL PHENYL ETHER
10U	HEXACHLOROBENZENE (HCB)
50U	PENTACHLOROPHENOL
10U	PHENANTHRENE
10U	ANTHRACENE
10UJ	DI-N-BUTYLPHTHALATE
10U	FLUORANTHENE
10U	PYRENE
10U	BENZYL BUTYL PHTHALATE
20U	3,3'-DICHLOROBENZIDINE
10U	BENZO(A)ANTHRACENE
10U	CHRYSENE
10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	DI-N-OCTYLPHTHALATE
10U	BENZO(B AND/OR K)FLUORANTHENE
10U	BENZO-A-PYRENE
10U	INDENO (1,2,3-CD) PYRENE
10U	DIBENZO(A,H)ANTHRACENE
10U	BENZO(GHI)PERYLENE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50959	SAMPLE TYPE: SURFACEWA	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SW-01			COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y279 MD NO: Y279

ANALYTICAL RESULTS UG/L

4JN HEXANEDIOIC ACID, ETHYLHEXYLESTER

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA
SOURCE: OLD STARTEX SPARTANB
STATION ID: SW-01
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 0855 STOP: 00/00/00
D. NUMBER: Y279

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y279

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
130U	ALUMINUM	13	MANGANESE
29U	ANTIMONY	.20U	MERCURY
3U	ARSENIC	28U	NICKEL
22	BARIUM	1100U	POTASSIUM
1U	BERYLLIUM	3U	SELENIUM
4U	CADMIUM	4U	SILVER
2800	CALCIUM	2800	SODIUM
5U	CHROMIUM	2U	THALLIUM
7U	COBALT	NA	TIN
4U	COPPER	4U	VANADIUM
270U	IRON	8U	ZINC
3UJ	LEAD		
1300	MAGNESIUM		

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y279 MD NO: Y279

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-02 COLLECTION START: 09/25/90 1040 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y280

UG/KG	ANALYTICAL RESULTS
410U	PHENOL
410U	BIS(2-CHLOROETHYL) ETHER
410U	2-CHLOROPHENOL
410U	1,3-DICHLOROBENZENE
410U	1,4-DICHLOROBENZENE
410U	BENZYL ALCOHOL
410U	1,2-DICHLOROBENZENE
410U	2-METHYLPHENOL
410UR	BIS(2-CHLOROISOPROPYL) ETHER
410U	(3-AND/OR 4-)METHYLPHENOL
410U	N-NITROSODI-N-PROPYLAMINE
410U	HEXACHLOROETHANE
410U	NITROBENZENE
410U	ISOPHORONE
410U	2-NITROPHENOL
410U	2,4-DIMETHYLPHENOL
2000U	BENZOIC ACID
410U	BIS(2-CHLOROETHOXY) METHANE
410U	2,4-DICHLOROPHENOL
410UR	1,2,4-TRICHLOROBENZENE
410U	NAPHTHALENE
410U	4-CHLOROANILINE
410U	HEXACHLOROBUTADIENE
410U	4-CHLORO-3-METHYLPHENOL
410U	2-METHYLNAPHTHALENE
410U	HEXACHLOROCYCLOPENTADIENE (HCCP)
410U	2,4,6-TRICHLOROPHENOL
2000U	2,4,5-TRICHLOROPHENOL
410UR	2-CHLORONAPHTHALENE
2000U	2-NITROANILINE
410U	DIMETHYL PHTHALATE
410U	ACENAPHTHYLENE
410U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2000U	3-NITROANILINE
410U	ACENAPHTHENE
2000U	2,4-DINITROPHENOL
2000U	4-NITROPHENOL
410U	DIBENZOFURAN
410U	2,4-DINITROTOLUENE
410U	DIETHYL PHTHALATE
410U	4-CHLOROPHENYL PHENYL ETHER
410U	FLUORENE
2000U	4-NITROANILINE
2000U	2-METHYL-4,6-DINITROPHENOL
410U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
410U	4-BROMOPHENYL PHENYL ETHER
410U	HEXACHLOROBENZENE (HCB)
2000UJ	PENTACHLOROPHENOL
410U	PHENANTHRENE
410U	ANTHRACENE
410U	DI-N-BUTYLPHTHALATE
410U	FLUORANTHENE
410U	PYRENE
410U	BENZYL BUTYL PHTHALATE
820U	3,3'-DICHLOROBENZIDINE
410U	BENZO(A)ANTHRACENE
410U	CHRYSENE
410U	BIS(2-ETHYLHEXYL) PHTHALATE
410U	DI-N-OCTYLPHTHALATE
410U	BENZO(B AND/OR K)FLUORANTHENE
410U	BENZO-A-PYRENE
410U	INDENO (1,2,3-CD) PYRENE
410U	DIBENZO(A,H)ANTHRACENE
410U	BENZO(GHI)PERYLENE
19	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-02

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1040 STOP: 00/00/00

D. NO.: Y280

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
20U	METHYLENE CHLORIDE
20U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
19	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50960	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SD-02			COLLECTION START: 09/25/90 1040 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y280 MD NO: Y280

ANALYTICAL RESULTS UG/KG

10JN	TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-02
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1040 STOP: 00/00/00
D. NUMBER: Y280

UG/KG	ANALYTICAL RESULTS
9.9U	ALPHA-BHC
9.9U	BETA-BHC
9.9U	DELTA-BHC
9.9U	GAMMA-BHC (LINDANE)
9.9U	HEPTACHLOR
9.9U	ALDRIN
9.9U	HEPTACHLOR EPOXIDE
9.9U	ENDOSULFAN I (ALPHA)
20U	DIELDRIN
20U	4,4'-DDE (P,P'-DDE)
20U	ENDRIN
20U	ENDOSULFAN II (BETA)
20U	4,4'-DDD (P,P'-DDD)
20U	ENDOSULFAN SULFATE
20U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
99U	METHOXYCHLOR
20U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
99U	GAMMA-CHLORDANE /2
99U	ALPHA-CHLORDANE /2
200U	TOXAPHENE
99U	PCB-1016 (AROCLOR 1016)
99U	PCB-1221 (AROCLOR 1221)
99U	PCB-1232 (AROCLOR 1232)
99U	PCB-1242 (AROCLOR 1242)
99U	PCB-1248 (AROCLOR 1248)
200U	PCB-1254 (AROCLOR 1254)
200U	PCB-1260 (AROCLOR 1260)
19	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-02
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1040 STOP: 00/00/00
MD NUMBER: Y280

MG/KG	ANALYTICAL RESULTS
6100	ALUMINUM
8.8U	ANTIMONY
.91UR	ARSENIC
18	BARIUM
.30U	BERYLLIUM
1.2U	CADMIUM
56	CALCIUM
100J	CHROMIUM
2.1U	COBALT
6U	COPPER
29000	IRON
5.8J	LEAD
380	MAGNESIUM
75	MANGANESE
.15U	MERCURY
8.5U	NICKEL
710U	POTASSIUM
.91U	SELENIUM
1.2U	SILVER
30U	SODIUM
.61U	THALLIUM
NA	TIN
84	VANADIUM
8U	ZINC
34	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-02 COLLECTION START: 09/25/90 1040 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y280 MD NO: Y280

RESULTS	UNITS	PARAMETER
1.5U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS. GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE: PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: CITY: STARTEX ST: SC
STATION ID: SW-02 COLLECTION START: 09/25/90 1050 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y281

UG/L	ANALYTICAL RESULTS
10U	CHLOROMETHANE
10U	BROMOMETHANE
10U	VINYL CHLORIDE
10U	CHLOROETHANE
30U	METHYLENE CHLORIDE
30U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
10UR	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
10U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/L	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
10U	METHYL ISOBUTYL KETONE
10U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS. GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE: PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: CITY: STARTEX ST: SC
STATION ID: SW-02 COLLECTION START: 09/25/90 1050 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y281

UG/L	ANALYTICAL RESULTS
10U	PHENOL
10U	BIS(2-CHLOROETHYL) ETHER
10U	2-CHLOROPHENOL
10U	1,3-DICHLOROBENZENE
10U	1,4-DICHLOROBENZENE
10U	BENZYL ALCOHOL
10U	1,2-DICHLOROBENZENE
10U	2-METHYLPHENOL
10U	BIS(2-CHLOROISOPROPYL) ETHER
10U	(3-AND/OR 4-)METHYLPHENOL
10U	N-NITROSODI-N-PROPYLAMINE
10U	HEXACHLOROETHANE
10U	NITROBENZENE
10U	ISOPHORONE
10U	2-NITROPHENOL
10U	2,4-DIMETHYLPHENOL
50U	BENZOIC ACID
10U	BIS(2-CHLOROETHOXY) METHANE
10U	2,4-DICHLOROPHENOL
10U	1,2,4-TRICHLOROBENZENE
10U	NAPHTHALENE
10U	4-CHLOROANILINE
10U	HEXACHLOROBUTADIENE
10U	4-CHLORO-3-METHYLPHENOL
10U	2-METHYLNAPHTHALENE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)
10U	2,4,6-TRICHLOROPHENOL
50U	2,4,5-TRICHLOROPHENOL
10U	2-CHLORONAPHTHALENE
50U	2-NITROANILINE
10U	DIMETHYL PHTHALATE
10U	ACENAPHTHYLENE
10U	2,6-DINITROTOLUENE

UG/L	ANALYTICAL RESULTS
50U	3-NITROANILINE
10U	ACENAPHTHENE
50U	2,4-DINITROPHENOL
50U	4-NITROPHENOL
10U	DIBENZOFURAN
10U	2,4-DINITROTOLUENE
10U	DIETHYL PHTHALATE
10U	4-CHLOROPHENYL PHENYL ETHER
10U	FLUORENE
50U	4-NITROANILINE
50U	2-METHYL-4,6-DINITROPHENOL
10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	4-BROMOPHENYL PHENYL ETHER
10U	HEXACHLOROBENZENE (HCB)
50U	PENTACHLOROPHENOL
10U	PHENANTHRENE
10U	ANTHRACENE
10UJ	DI-N-BUTYLPHTHALATE
10U	FLUORANTHENE
10U	PYRENE
10U	BENZYL BUTYL PHTHALATE
20U	3,3'-DICHLOROBENZIDINE
10U	BENZO(A)ANTHRACENE
10U	CHRYSENE
10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	DI-N-OCTYLPHTHALATE
10U	BENZO(B AND/OR K)FLUORANTHENE
10U	BENZO-A-PYRENE
10U	INDENO (1,2,3-CD) PYRENE
10U	DIBENZO(A,H)ANTHRACENE
10U	BENZO(GHI)PERYLENE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE:
SOURCE:
STATION ID: SW-02
CASE NUMBER: 14949 SAS NUMBER:
PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1050 STOP: 00/00/00
D. NUMBER: Y281

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS

REMARKS

FOOTNOTES
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*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-02 COLLECTION START: 09/25/90 1050 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y281

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
120U	ALUMINUM	30	MANGANESE
29U	ANTIMONY	.20U	MERCURY
3U	ARSENIC	28U	NICKEL
19	BARIUM	1400U	POTASSIUM
1U	BERYLLIUM	3U	SELENIUM
4U	CADMIUM	4U	SILVER
2900	CALCIUM	2900	SODIUM
5U	CHROMIUM	2U	THALLIUM
7U	COBALT	NA	TIN
4U	COPPER	4U	VANADIUM
320U	IRON	6U	ZINC
2UJ	LEAD		
1400	MAGNESIUM		

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-02 COLLECTION START: 09/25/90 1050 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y281 MD NO: Y281

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS. GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-03

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1250 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y282

UG/KG	ANALYTICAL RESULTS
13U	CHLOROMETHANE
13U	BROMOMETHANE
13U	VINYL CHLORIDE
13U	CHLOROETHANE
30U	METHYLENE CHLORIDE
13U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
13U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
13U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
13U	METHYL ISOBUTYL KETONE
13U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
22	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50962	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SD-03			COLLECTION START. 09/25/90 1250 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y282 MD NO: Y282

ANALYTICAL RESULTS UG/KG

20JN	TETRAMETHYLBUTANE	

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-03

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1250 STOP: 00/00/00

D. NO.: Y282

UG/KG	ANALYTICAL RESULTS
420U	PHENOL
420U	BIS(2-CHLOROETHYL) ETHER
420U	2-CHLOROPHENOL
420U	1,3-DICHLOROBENZENE
420U	1,4-DICHLOROBENZENE
420U	BENZYL ALCOHOL
420U	1,2-DICHLOROBENZENE
420U	2-METHYLPHENOL
420UR	BIS(2-CHLOROISOPROPYL) ETHER
420U	(3-AND/OR 4-)METHYLPHENOL
420U	N-NITROSODI-N-PROPYLAMINE
420U	HEXACHLOROETHANE
420U	NITROBENZENE
420U	ISOPHORONE
420U	2-NITROPHENOL
420U	2,4-DIMETHYLPHENOL
2100U	BENZOIC ACID
420U	BIS(2-CHLOROETHOXY) METHANE
420U	2,4-DICHLOROPHENOL
420UR	1,2,4-TRICHLOROBENZENE
420U	NAPHTHALENE
420U	4-CHLOROANILINE
420U	HEXACHLOROBUTADIENE
420U	4-CHLORO-3-METHYLPHENOL
420U	2-METHYLNAPHTHALENE
420U	HEXACHLOROCYCLOPENTADIENE (HCCP)
420U	2,4,6-TRICHLOROPHENOL
2100U	2,4,5-TRICHLOROPHENOL
420UR	2-CHLORONAPHTHALENE
2100U	2-NITROANILINE
420U	DIMETHYL PHTHALATE
420U	ACENAPHTHYLENE
420U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2100U	3-NITROANILINE
420U	ACENAPHTHENE
2100U	2,4-DINITROPHENOL
2100U	4-NITROPHENOL
420U	DIBENZOFURAN
420U	2,4-DINITROTOLUENE
420U	DIETHYL PHTHALATE
420U	4-CHLOROPHENYL PHENYL ETHER
420U	FLUORENE
2100U	4-NITROANILINE
2100U	2-METHYL-4,6-DINITROPHENOL
420U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
420U	4-BROMOPHENYL PHENYL ETHER
420U	HEXACHLOROBENZENE (HCB)
2100UJ	PENTACHLOROPHENOL
420U	PHENANTHRENE
420U	ANTHRACENE
420U	DI-N-BUTYLPHTHALATE
420U	FLUORANTHENE
420U	PYRENE
420U	BENZYL BUTYL PHTHALATE
850U	3,3'-DICHLOROBENZIDINE
420U	BENZO(A)ANTHRACENE
420U	CHRYSENE
420U	BIS(2-ETHYLHEXYL) PHTHALATE
420U	DI-N-OCTYLPHTHALATE
420U	BENZO(B AND/OR K)FLUORANTHENE
420U	BENZO-A-PYRENE
420U	INDENO (1,2,3-CD) PYRENE
420U	DIBENZO(A,H)ANTHRACENE
420U	BENZO(GHI)PERYLENE
22	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-03 COLLECTION START: 09/25/90 1250 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y282

UG/KG	ANALYTICAL RESULTS
10U	ALPHA-BHC
10U	BETA-BHC
10U	DELTA-BHC
10U	GAMMA-BHC (LINDANE)
10U	HEPTACHLOR
10U	ALDRIN
10U	HEPTACHLOR EPOXIDE
10U	ENDOSULFAN I (ALPHA)
21U	DIELDRIN
21U	4,4'-DDE (P,P'-DDE)
21U	ENDRIN
21U	ENDOSULFAN II (BETA)
21U	4,4'-DDD (P,P'-DDD)
21U	ENDOSULFAN SULFATE
21U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
100U	METHOXYCHLOR
21U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
100U	GAMMA-CHLORDANE /2
100U	ALPHA-CHLORDANE /2
210U	TOXAPHENE
100U	PCB-1016 (AROCLOR 1016)
100U	PCB-1221 (AROCLOR 1221)
100U	PCB-1232 (AROCLOR 1232)
100U	PCB-1242 (AROCLOR 1242)
100U	PCB-1248 (AROCLOR 1248)
210U	PCB-1254 (AROCLOR 1254)
210U	PCB-1260 (AROCLOR 1260)
22	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-03 COLLECTION START: 09/25/90 1250 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y282

MG/KG	ANALYTICAL RESULTS
1900	ALUMINUM
7.5U	ANTIMONY
2UJ	ARSENIC
9.6	BARIUM
.26U	BERYLLIUM
1U	CADMIUM
50U	CALCIUM
4.6J	CHROMIUM
1.8U	COBALT
2U	COPPER
3200	IRON
2.5J	LEAD
130	MAGNESIUM
160	MANGANESE
.13U	MERCURY
7.2U	NICKEL
200U	POTASSIUM
.78U	SELENIUM
1U	SILVER
27	SODIUM
.52U	THALLIUM
NA	TIN
7.1	VANADIUM
9U	ZINC
23	PERCENT MOISTURE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-03 COLLECTION START: 09/25/90 1250 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y282 MD NO: Y282

RESULTS	UNITS	PARAMETER
1.3U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-03 COLLECTION START: 09/25/90 1300 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y283

UG/L	ANALYTICAL RESULTS
10U	CHLOROMETHANE
10U	BROMOMETHANE
10U	VINYL CHLORIDE
10U	CHLOROETHANE
30U	METHYLENE CHLORIDE
30U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
10UR	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
10U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/L	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
10U	METHYL ISOBUTYL KETONE
10U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS. GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA
SOURCE: OLD STARTEX SPARTANB
STATION ID: SW-03

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1300 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y283

UG/L	ANALYTICAL RESULTS
10U	PHENOL
10U	BIS(2-CHLOROETHYL) ETHER
10U	2-CHLOROPHENOL
10U	1,3-DICHLOROBENZENE
10U	1,4-DICHLOROBENZENE
10U	BENZYL ALCOHOL
10U	1,2-DICHLOROBENZENE
10U	2-METHYLPHENOL
10U	BIS(2-CHLOROISOPROPYL) ETHER
10U	(3-AND/OR 4-)METHYLPHENOL
10U	N-NITROSODI-N-PROPYLAMINE
10U	HEXACHLOROETHANE
10U	NITROBENZENE
10U	ISOPHORONE
10U	2-NITROPHENOL
10U	2,4-DIMETHYLPHENOL
50U	BENZOIC ACID
10U	BIS(2-CHLOROETHOXY) METHANE
10U	2,4-DICHLOROPHENOL
10U	1,2,4-TRICHLOROBENZENE
10U	NAPHTHALENE
10U	4-CHLOROANILINE
10U	HEXACHLOROBUTADIENE
10U	4-CHLORO-3-METHYLPHENOL
10U	2-METHYLNAPHTHALENE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)
10U	2,4,6-TRICHLOROPHENOL
50U	2,4,5-TRICHLOROPHENOL
10U	2-CHLORONAPHTHALENE
50U	2-NITROANILINE
10U	DIMETHYL PHTHALATE
10U	ACENAPHTHYLENE
10U	2,6-DINITROTOLUENE

UG/L	ANALYTICAL RESULTS
50U	3-NITROANILINE
10U	ACENAPHTHENE
50U	2,4-DINITROPHENOL
50U	4-NITROPHENOL
10U	DIBENZOFURAN
10U	2,4-DINITROTOLUENE
10U	DIETHYL PHTHALATE
10U	4-CHLOROPHENYL PHENYL ETHER
10U	FLUORENE
50U	4-NITROANILINE
50U	2-METHYL-4,6-DINITROPHENOL
10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	4-BROMOPHENYL PHENYL ETHER
10U	HEXACHLOROBENZENE (HCB)
50U	PENTACHLOROPHENOL
10U	PHENANTHRENE
10U	ANTHRACENE
10UJ	DI-N-BUTYLPHTHALATE
10U	FLUORANTHENE
10U	PYRENE
10U	BENZYL BUTYL PHTHALATE
20U	3,3'-DICHLOROBENZIDINE
10U	BENZO(A)ANTHRACENE
10U	CHRYSENE
10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	DI-N-OCTYLPHTHALATE
10U	BENZO(B AND/OR K)FLUORANTHENE
10U	BENZO-A-PYRENE
10U	INDENO (1,2,3-CD) PYRENE
10U	DIBENZO(A,H)ANTHRACENE
10U	BENZO(GHI)PERYLENE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-03 COLLECTION START: 09/25/90 1300 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y283

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-03 COLLECTION START: 09/25/90 1300 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y283

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
200U	ALUMINUM	83	MANGANESE
29U	ANTIMONY	.20U	MERCURY
3U	ARSENIC	28U	NICKEL
16	BARIUM	5600	POTASSIUM
1U	BERYLLIUM	4U	SELENIUM
4U	CADMIUM	4U	SILVER
2600	CALCIUM	86000	SODIUM
6U	CHROMIUM	4U	THALLIUM
7U	COBALT	NA	TIN
40	COPPER	11	VANADIUM
650	IRON	110	ZINC
3UJ	LEAD		
1900	MAGNESIUM		

REMARKS ***REMARKS***
HOLDING TIME EXCEEDED-CN

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-03 COLLECTION START: 09/25/90 1300 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y283 MD NO: Y283

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-04 COLLECTION START: 09/25/90 1240 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y284

UG/KG	ANALYTICAL RESULTS	UG/KG	ANALYTICAL RESULTS
13U	CHLOROMETHANE	7U	1,2-DICHLOROPROPANE
13U	BROMOMETHANE	7U	CIS-1,3-DICHLOROPROPENE
13U	VINYL CHLORIDE	7U	TRICHLOROETHENE(TRICHLOROETHYLENE)
13U	CHLOROETHANE	7U	DIBROMOCHLOROMETHANE
9U	METHYLENE CHLORIDE	7U	1,1,2-TRICHLOROETHANE
30U	ACETONE	7U	BENZENE
7U	CARBON DISULFIDE	7U	TRANS-1,3-DICHLOROPROPENE
7U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)	7U	BROMOFORM
7U	1,1-DICHLOROETHANE	13U	METHYL ISOBUTYL KETONE
7U	1,2-DICHLOROETHENE (TOTAL)	13U	METHYL BUTYL KETONE
7U	CHLOROFORM	7U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
7U	1,2-DICHLOROETHANE	7U	1,1,2,2-TETRACHLOROETHANE
13U	METHYL ETHYL KETONE	7U	TOLUENE
7U	1,1,1-TRICHLOROETHANE	7U	CHLOROBENZENE
7U	CARBON TETRACHLORIDE	7U	ETHYL BENZENE
13U	VINYL ACETATE	7U	STYRENE
7U	BROMODICHLOROMETHANE	7U	TOTAL XYLENES
		25	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS. GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50964	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SD-04			COLLECTION START: 09/25/90 1240 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y284 MD NO: Y284

ANALYTICAL RESULTS UG/KG

20JN	TETRAMETHYLBUTANE	

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-04

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1240 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y284

UG/KG	ANALYTICAL RESULTS
440U	PHENOL
440U	BIS(2-CHLOROETHYL) ETHER
440U	2-CHLOROPHENOL
440U	1,3-DICHLOROBENZENE
440U	1,4-DICHLOROBENZENE
440U	BENZYL ALCOHOL
440U	1,2-DICHLOROBENZENE
440U	2-METHYLPHENOL
440UR	BIS(2-CHLOROISOPROPYL) ETHER
440U	(3-AND/OR 4-)METHYLPHENOL
440U	N-NITROSODI-N-PROPYLAMINE
440U	HEXACHLOROETHANE
440U	NITROBENZENE
440U	ISOPHORONE
440U	2-NITROPHENOL
440U	2,4-DIMETHYLPHENOL
2100U	BENZOIC ACID
440U	BIS(2-CHLOROETHOXY) METHANE
440U	2,4-DICHLOROPHENOL
440UR	1,2,4-TRICHLOROBENZENE
440U	NAPHTHALENE
440U	4-CHLOROANILINE
440U	HEXACHLOROBUTADIENE
440U	4-CHLORO-3-METHYLPHENOL
440U	2-METHYLNAPHTHALENE
440U	HEXACHLOROCYCLOPENTADIENE (HCCP)
440U	2,4,6-TRICHLOROPHENOL
2100U	2,4,5-TRICHLOROPHENOL
440UR	2-CHLORONAPHTHALENE
2100U	2-NITROANILINE
440U	DIMETHYL PHTHALATE
440U	ACENAPHTHYLENE
440U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2100U	3-NITROANILINE
440U	ACENAPHTHENE
2100U	2,4-DINITROPHENOL
2100U	4-NITROPHENOL
440U	DIBENZOFURAN
440U	2,4-DINITROTOLUENE
440U	DIETHYL PHTHALATE
440U	4-CHLOROPHENYL PHENYL ETHER
440U	FLUORENE
2100U	4-NITROANILINE
2100U	2-METHYL-4,6-DINITROPHENOL
440U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
440U	4-BROMOPHENYL PHENYL ETHER
440U	HEXACHLOROBENZENE (HCB)
2100UJ	PENTACHLOROPHENOL
440U	PHENANTHRENE
440U	ANTHRACENE
440U	DI-N-BUTYLPHTHALATE
440U	FLUORANTHENE
440U	PYRENE
440U	BENZYL BUTYL PHTHALATE
880U	3,3'-DICHLOROBENZIDINE
440U	BENZO(A)ANTHRACENE
440U	CHRYSENE
440U	BIS(2-ETHYLHEXYL) PHTHALATE
440U	DI-N-OCTYLPHTHALATE
440U	BENZO(B AND/OR K)FLUORANTHENE
440U	BENZO-A-PYRENE
440U	INDENO (1,2,3-CD) PYRENE
440U	DIBENZO(A,H)ANTHRACENE
440U	BENZO(GHI)PERYLENE
25	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-04
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1240 STOP: 00/00/00
D. NUMBER: Y284

UG/KG	ANALYTICAL RESULTS
11U	ALPHA-BHC
11U	BETA-BHC
11U	DELTA-BHC
11U	GAMMA-BHC (LINDANE)
11U	HEPTACHLOR
11U	ALDRIN
11U	HEPTACHLOR EPOXIDE
11U	ENDOSULFAN I (ALPHA)
21U	DIELDRIN
21U	4,4'-DDE (P,P'-DDE)
21U	ENDRIN
21U	ENDOSULFAN II (BETA)
21U	4,4'-DDD (P,P'-DDD)
21U	ENDOSULFAN SULFATE
21U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
110U	METHOXYCHLOR
21U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
110U	GAMMA-CHLORDANE /2
110U	ALPHA-CHLORDANE /2
210U	TOXAPHENE
110U	PCB-1016 (AROCLOR 1016)
110U	PCB-1221 (AROCLOR 1221)
110U	PCB-1232 (AROCLOR 1232)
110U	PCB-1242 (AROCLOR 1242)
110U	PCB-1248 (AROCLOR 1248)
210U	PCB-1254 (AROCLOR 1254)
210U	PCB-1260 (AROCLOR 1260)
25	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-04 COLLECTION START: 09/25/90 1240 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y284

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
6600	ALUMINUM	130	MANGANESE
7.8U	ANTIMONY	.13U	MERCURY
2U	ARSENIC	7.5U	NICKEL
29	BARIUM	1000U	POTASSIUM
.27U	BERYLLIUM	.80U	SELENIUM
1.1U	CADMIUM	1.1U	SILVER
99	CALCIUM	23	SODIUM
19J	CHROMIUM	.54U	THALLIUM
2.4	COBALT	NA	TIN
8.5	COPPER	18	VANADIUM
7800	IRON	20U	ZINC
7.4J	LEAD	25	PERCENT MOISTURE
650	MAGNESIUM		

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-04 COLLECTION START: 09/25/90 1240 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y284 MD NO: Y284

RESULTS	UNITS	PARAMETER
1.3U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMEN
EPA-REGION IV ESD, ATHENS,

PURGEABLE ORGANICS DATA REPORT

** PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE: PROG ELEM:
** SOURCE: CITY: STARTE.
** STATION ID: SW-04 COLLECTION ST.
**
** CASE NO.: 14949 SAS NO.: D. NO.: Y285

UG/L	ANALYTICAL RESULTS	UG/L	
10U	CHLOROMETHANE	5U	1,2-DICHLOROP
10U	BROMOMETHANE	5U	CIS-1,3-DICHLO
10U	VINYL CHLORIDE	5U	TRICHLOROETHENE
10U	CHLOROETHANE	5U	DIBROMOCHLOROMETH
20U	METHYLENE CHLORIDE	5U	1,1,2-TRICHLOROETH
20U	ACETONE	5U	BENZENE
5U	CARBON DISULFIDE	5U	TRANS-1,3-DICHLOROP
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)	5U	BROMOFORM
5U	1,1-DICHLOROETHANE	10U	METHYL ISOBUTYL KETONE
5U	1,2-DICHLOROETHENE (TOTAL)	10U	METHYL BUTYL KETONE
5U	CHLOROFORM	5U	TETRACHLOROETHENE(TETRAC
5U	1,2-DICHLOROETHANE	5U	1,1,2,2-TETRACHLOROETHANE
10UR	METHYL ETHYL KETONE	5U	TOLUENE
5U	1,1,1-TRICHLOROETHANE	5U	CHLOROBENZENE
5U	CARBON TETRACHLORIDE	5U	ETHYL BENZENE
10U	VINYL ACETATE	5U	STYRENE
5U	BROMODICHLOROMETHANE	5U	TOTAL XYLENES

REMARKS ***REMARKS***

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE:
SOURCE:
STATION ID: SW-04

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1245 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y285

UG/L	ANALYTICAL RESULTS
10U	PHENOL
10U	BIS(2-CHLOROETHYL) ETHER
10U	2-CHLOROPHENOL
10U	1,3-DICHLOROBENZENE
10U	1,4-DICHLOROBENZENE
10U	BENZYL ALCOHOL
10U	1,2-DICHLOROBENZENE
10U	2-METHYLPHENOL
10U	BIS(2-CHLOROISOPROPYL) ETHER
10U	(3-AND/OR 4-)METHYLPHENOL
10U	N-NITROSODI-N-PROPYLAMINE
10U	HEXACHLOROETHANE
10U	NITROBENZENE
10U	ISOPHORONE
10U	2-NITROPHENOL
10U	2,4-DIMETHYLPHENOL
50U	BENZOIC ACID
10U	BIS(2-CHLOROETHOXY) METHANE
10U	2,4-DICHLOROPHENOL
10U	1,2,4-TRICHLOROBENZENE
10U	NAPHTHALENE
10U	4-CHLOROANILINE
10U	HEXACHLOROBUTADIENE
10U	4-CHLORO-3-METHYLPHENOL
10U	2-METHYLNAPHTHALENE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)
10U	2,4,6-TRICHLOROPHENOL
50U	2,4,5-TRICHLOROPHENOL
10U	2-CHLORONAPHTHALENE
50U	2-NITROANILINE
10U	DIMETHYL PHTHALATE
10U	ACENAPHTHYLENE
10U	2,6-DINITROTOLUENE

UG/L	ANALYTICAL RESULTS
50U	3-NITROANILINE
10U	ACENAPHTHENE
50U	2,4-DINITROPHENOL
50U	4-NITROPHENOL
10U	DIBENZOFURAN
10U	2,4-DINITROTOLUENE
10U	DIETHYL PHTHALATE
10U	4-CHLOROPHENYL PHENYL ETHER
10U	FLUORENE
50U	4-NITROANILINE
50U	2-METHYL-4,6-DINITROPHENOL
10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	4-BROMOPHENYL PHENYL ETHER
10U	HEXACHLOROBENZENE (HCB)
50U	PENTACHLOROPHENOL
10U	PHENANTHRENE
10U	ANTHRACENE
10UJ	DI-N-BUTYLPHTHALATE
2J	FLUORANTHENE
3J	PYRENE
10U	BENZYL BUTYL PHTHALATE
20U	3,3'-DICHLOROBENZIDINE
10U	BENZO(A)ANTHRACENE
10U	CHRYSENE
10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	DI-N-OCTYLPHTHALATE
10U	BENZO(B AND/OR K)FLUORANTHENE
10U	BENZO-A-PYRENE
10U	INDENO (1,2,3-CD) PYRENE
10U	DIBENZO(A,H)ANTHRACENE
10U	BENZO(GHI)PERYLENE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE:
SOURCE:
STATION ID: SW-04
CASE NUMBER: 14949 SAS NUMBER:
PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1245 STOP: 00/00/00
D. NUMBER: Y285

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS ***REMARKS***

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

METALS DATA REPORT 11/13/90

PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-04 COLLECTION START: 09/25/90 1245 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y285

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
230U	ALUMINUM	83	MANGANESE
29U	ANTIMONY	.20U	MERCURY
3U	ARSENIC	38	NICKEL
18	BARIUM	5100	POTASSIUM
1U	BERYLLIUM	3U	SELENIUM
4U	CADMIUM	4U	SILVER
2600	CALCIUM	85000	SODIUM
5U	CHROMIUM	4U	THALLIUM
7U	COBALT	NA	TIN
39	COPPER	14	VANADIUM
750	IRON	110	ZINC
4UJ	LEAD		
1900	MAGNESIUM		

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-04 COLLECTION START: 09/25/90 1245 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y285 MD NO: Y285

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-01

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 0845 STOP: 00/00/00

D. NO.: Y286

UG/KG	ANALYTICAL RESULTS
11U	CHLOROMETHANE
11U	BROMOMETHANE
11U	VINYL CHLORIDE
11U	CHLOROETHANE
9U	METHYLENE CHLORIDE
11U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
11U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
11U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
11U	METHYL ISOBUTYL KETONE
11U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
13	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50966	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SS-01			COLLECTION START: 09/26/90 0845 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y286 MD NO: Y286

ANALYTICAL RESULTS UG/KG

4OJN	TETRAMETHYLBUTANE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-01 COLLECTION START: 09/26/90 0845 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y286

UG/KG	ANALYTICAL RESULTS
380U	PHENOL
380U	BIS(2-CHLOROETHYL) ETHER
380U	2-CHLOROPHENOL
380U	1,3-DICHLOROBENZENE
380U	1,4-DICHLOROBENZENE
380U	BENZYL ALCOHOL
380U	1,2-DICHLOROBENZENE
380U	2-METHYLPHENOL
380UR	BIS(2-CHLOROISOPROPYL) ETHER
380U	(3-AND/OR 4-)METHYLPHENOL
380U	N-NITROSODI-N-PROPYLAMINE
380U	HEXACHLOROETHANE
380U	NITROBENZENE
380U	ISOPHORONE
380U	2-NITROPHENOL
380U	2,4-DIMETHYLPHENOL
1800U	BENZOIC ACID
380U	BIS(2-CHLOROETHOXY) METHANE
380U	2,4-DICHLOROPHENOL
380UR	1,2,4-TRICHLOROBENZENE
380U	NAPHTHALENE
380U	4-CHLOROANILINE
380U	HEXACHLOROBUTADIENE
380U	4-CHLORO-3-METHYLPHENOL
380U	2-METHYLNAPHTHALENE
380U	HEXACHLOROCYCLOPENTADIENE (HCCP)
380U	2,4,6-TRICHLOROPHENOL
1800U	2,4,5-TRICHLOROPHENOL
380UR	2-CHLORONAPHTHALENE
1800U	2-NITROANILINE
380U	DIMETHYL PHTHALATE
380U	ACENAPHTHYLENE
380U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1800U	3-NITROANILINE
380U	ACENAPHTHENE
1800U	2,4-DINITROPHENOL
1800U	4-NITROPHENOL
380U	DIBENZOFURAN
380U	2,4-DINITROTOLUENE
380U	DIETHYL PHTHALATE
380U	4-CHLOROPHENYL PHENYL ETHER
380U	FLUORENE
1800U	4-NITROANILINE
1800U	2-METHYL-4,6-DINITROPHENOL
380U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
380U	4-BROMOPHENYL PHENYL ETHER
380U	HEXACHLOROBENZENE (HCB)
1800UJ	PENTACHLOROPHENOL
380U	PHENANTHRENE
380U	ANTHRACENE
380U	DI-N-BUTYLPHTHALATE
380U	FLUORANTHENE
380U	PYRENE
380U	BENZYL BUTYL PHTHALATE
760U	3,3'-DICHLOROBENZIDINE
380U	BENZO(A)ANTHRACENE
380U	CHRYSENE
380U	BIS(2-ETHYLHEXYL) PHTHALATE
380U	DI-N-OCTYLPHTHALATE
380U	BENZO(B AND/OR K)FLUORANTHENE
380U	BENZO-A-PYRENE
380U	INDENO (1,2,3-CD) PYRENE
380U	DIBENZO(A,H)ANTHRACENE
380U	BENZO(GHI)PERYLENE
13	PERCENT MOISTURE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-01
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 0845 STOP: 00/00/00
D. NUMBER: Y286

UG/KG	ANALYTICAL RESULTS
9.2U	ALPHA-BHC
9.2U	BETA-BHC
9.2U	DELTA-BHC
9.2U	GAMMA-BHC (LINDANE)
9.2U	HEPTACHLOR
9.2U	ALDRIN
9.2U	HEPTACHLOR EPOXIDE
9.2U	ENDOSULFAN I (ALPHA)
18U	DIELDRIN
18U	4,4'-DDE (P,P'-DDE)
18U	ENDRIN
18U	ENDOSULFAN II (BETA)
18U	4,4'-DDD (P,P'-DDD)
18U	ENDOSULFAN SULFATE
18U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
92U	METHOXYCHLOR
18U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
92U	GAMMA-CHLORDANE /2
92U	ALPHA-CHLORDANE /2
180U	TOXAPHENE
92U	PCB-1016 (AROCLOR 1016)
92U	PCB-1221 (AROCLOR 1221)
92U	PCB-1232 (AROCLOR 1232)
92U	PCB-1242 (AROCLOR 1242)
92U	PCB-1248 (AROCLOR 1248)
180U	PCB-1254 (AROCLOR 1254)
180U	PCB-1260 (AROCLOR 1260)
13	PERCENT MOISTURE

REMARKS ***REMARKS***

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-01 COLLECTION START: 09/26/90 0845 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y286

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
89000	ALUMINUM	130	MANGANESE
20U	ANTIMONY	.16U	MERCURY
13J	ARSENIC	9.1U	NICKEL
52	BARIUM	290U	POTASSIUM
.33U	BERYLLIUM	.98UJ	SELENIUM
1.3U	CADMIUM	1.3U	SILVER
430	CALCIUM	30U	SODIUM
65J	CHROMIUM	.65U	THALLIUM
2.3U	COBALT	NA	TIN
32	COPPER	220	VANADIUM
73000	IRON	29	ZINC
58J	LEAD	38	PERCENT MOISTURE
490	MAGNESIUM		

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-01 COLLECTION START: 09/26/90 0845 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y286 MD NO: Y286

RESULTS	UNITS	PARAMETER
1.6U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-01 COLLECTION START: 09/26/90 0905 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y287

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
20U	METHYLENE CHLORIDE
30U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
14	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50967	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SB-01			COLLECTION START: 09/26/90 0905 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y287 MD NO: Y287

ANALYTICAL RESULTS UG/KG

90JN	TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-01

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 0905 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y287

UG/KG	ANALYTICAL RESULTS
380U	PHENOL
380U	BIS(2-CHLOROETHYL) ETHER
380U	2-CHLOROPHENOL
380U	1,3-DICHLOROBENZENE
380U	1,4-DICHLOROBENZENE
380U	BENZYL ALCOHOL
380U	1,2-DICHLOROBENZENE
380U	2-METHYLPHENOL
380UR	BIS(2-CHLOROISOPROPYL) ETHER
380U	(3-AND/OR 4-)METHYLPHENOL
380U	N-NITROSODI-N-PROPYLAMINE
380U	HEXACHLOROETHANE
380U	NITROBENZENE
380U	ISOPHORONE
380U	2-NITROPHENOL
380U	2,4-DIMETHYLPHENOL
1900U	BENZOIC ACID
380U	BIS(2-CHLOROETHOXY) METHANE
380U	2,4-DICHLOROPHENOL
380UR	1,2,4-TRICHLOROBENZENE
380U	NAPHTHALENE
380U	4-CHLOROANILINE
380U	HEXACHLOROBUTADIENE
380U	4-CHLORO-3-METHYLPHENOL
380U	2-METHYLNAPHTHALENE
380U	HEXACHLOROCYCLOPENTADIENE (HCCP)
380U	2,4,6-TRICHLOROPHENOL
1900U	2,4,5-TRICHLOROPHENOL
380UR	2-CHLORONAPHTHALENE
1900U	2-NITROANILINE
380U	DIMETHYL PHTHALATE
380U	ACENAPHTHYLENE
380U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1900U	3-NITROANILINE
380U	ACENAPHTHENE
1900U	2,4-DINITROPHENOL
1900U	4-NITROPHENOL
380U	DIBENZOFURAN
380U	2,4-DINITROTOLUENE
380U	DIETHYL PHTHALATE
380U	4-CHLOROPHENYL PHENYL ETHER
380U	FLUORENE
1900U	4-NITROANILINE
1900U	2-METHYL-4,6-DINITROPHENOL
380U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
380U	4-BROMOPHENYL PHENYL ETHER
380U	HEXACHLOROBENZENE (HCB)
1900UJ	PENTACHLOROPHENOL
380U	PHENANTHRENE
380U	ANTHRACENE
380U	DI-N-BUTYLPHTHALATE
380U	FLUORANTHENE
380U	PYRENE
380U	BENZYL BUTYL PHTHALATE
770U	3,3'-DICHLOROBENZIDINE
380U	BENZO(A)ANTHRACENE
380U	CHRYSENE
900	BIS(2-ETHYLHEXYL) PHTHALATE
380U	DI-N-OCTYLPHTHALATE
380U	BENZO(B AND/OR K)FLUORANTHENE
380U	BENZO-A-PYRENE
380U	INDENO (1,2,3-CD) PYRENE
380U	DIBENZO(A,H)ANTHRACENE
380U	BENZO(GHI)PERYLENE
14	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-01
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 0905 STOP: 00/00/00
D. NUMBER: Y287

UG/KG	ANALYTICAL RESULTS
9.3U	ALPHA-BHC
9.3U	BETA-BHC
9.3U	DELTA-BHC
9.3U	GAMMA-BHC (LINDANE)
9.3U	HEPTACHLOR
9.3U	ALDRIN
9.3U	HEPTACHLOR EPOXIDE
9.3U	ENDOSULFAN I (ALPHA)
19U	DIELDRIN
19U	4,4'-DDE (P,P'-DDE)
19U	ENDRIN
19U	ENDOSULFAN II (BETA)
19U	4,4'-DDD (P,P'-DDD)
19U	ENDOSULFAN SULFATE
19U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
93U	METHOXYCHLOR
19U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
93U	GAMMA-CHLORDANE /2
93U	ALPHA-CHLORDANE /2
190U	TOXAPHENE
93U	PCB-1016 (AROCLOR 1016)
93U	PCB-1221 (AROCLOR 1221)
93U	PCB-1232 (AROCLOR 1232)
93U	PCB-1242 (AROCLOR 1242)
93U	PCB-1248 (AROCLOR 1248)
190U	PCB-1254 (AROCLOR 1254)
190U	PCB-1260 (AROCLOR 1260)
14	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.
*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-01 COLLECTION START: 09/26/90 0905 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y287

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
61000	ALUMINUM	410	MANGANESE
20U	ANTIMONY	.12U	MERCURY
.70UR	ARSENIC	17	NICKEL
180	BARIUM	6800	POTASSIUM
.23U	BERYLLIUM	.70U	SELENIUM
.93U	CADMIUM	.93U	SILVER
20U	CALCIUM	20U	SODIUM
40J	CHROMIUM	.47U	THALLIUM
18	COBALT	NA	TIN
92	COPPER	170	VANADIUM
68000	IRON	87	ZINC
39J	LEAD	14	PERCENT MOISTURE
7700	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-01 COLLECTION START: 09/26/90 0905 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y287 MD NO: Y287

RESULTS	UNITS	PARAMETER
1.2U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE: SOIL
PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB
CITY: STARTEX ST: SC
STATION ID: SB-02
COLLECTION START: 09/26/90 1000 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.:
D. NO.: Y289 MD NO: Y289

RESULTS	UNITS	PARAMETER
1.2U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-02 COLLECTION START: 09/26/90 0930 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y288

UG/KG	ANALYTICAL RESULTS
11U	CHLOROMETHANE
11U	BROMOMETHANE
11U	VINYL CHLORIDE
11U	CHLOROETHANE
20U	METHYLENE CHLORIDE
11U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
11U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
11U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
11U	METHYL ISOBUTYL KETONE
11U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
12	PERCENT MOISTURE

REMARKS ***REMARKS***

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-02 COLLECTION START 09/26/90 0930 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y288 MD NO: Y288

ANALYTICAL RESULTS UG/KG

50JN TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-02

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 0930 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y288

UG/KG	ANALYTICAL RESULTS
380U	PHENOL
380U	BIS(2-CHLOROETHYL) ETHER
380U	2-CHLOROPHENOL
380U	1,3-DICHLOROBENZENE
380U	1,4-DICHLOROBENZENE
380U	BENZYL ALCOHOL
380U	1,2-DICHLOROBENZENE
380U	2-METHYLPHENOL
380UR	BIS(2-CHLOROISOPROPYL) ETHER
380U	(3-AND/OR 4-)METHYLPHENOL
380U	N-NITROSODI-N-PROPYLAMINE
380U	HEXACHLOROETHANE
380U	NITROBENZENE
380U	ISOPHORONE
380U	2-NITROPHENOL
380U	2,4-DIMETHYLPHENOL
1800U	BENZOIC ACID
380U	BIS(2-CHLOROETHOXY) METHANE
380U	2,4-DICHLOROPHENOL
380UR	1,2,4-TRICHLOROBENZENE
380U	NAPHTHALENE
380U	4-CHLOROANILINE
380U	HEXACHLOROBUTADIENE
380U	4-CHLORO-3-METHYLPHENOL
380U	2-METHYLNAPHTHALENE
380U	HEXACHLOROCYCLOPENTADIENE (HCCP)
380U	2,4,6-TRICHLOROPHENOL
1800U	2,4,5-TRICHLOROPHENOL
380UR	2-CHLORONAPHTHALENE
1800U	2-NITROANILINE
380U	DIMETHYL PHTHALATE
380U	ACENAPHTHYLENE
380U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1800U	3-NITROANILINE
380U	ACENAPHTHENE
1800U	2,4-DINITROPHENOL
1800U	4-NITROPHENOL
380U	DIBENZOFURAN
380U	2,4-DINITROTOLUENE
380U	DIETHYL PHTHALATE
380U	4-CHLOROPHENYL PHENYL ETHER
380U	FLUORENE
1800U	4-NITROANILINE
1800U	2-METHYL-4,6-DINITROPHENOL
380U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
380U	4-BROMOPHENYL PHENYL ETHER
380U	HEXACHLOROBENZENE (HCB)
1800UJ	PENTACHLOROPHENOL
520	PHENANTHRENE
100J	ANTHRACENE
380U	DI-N-BUTYLPHTHALATE
1100	FLUORANTHENE
1100	PYRENE
380U	BENZYL BUTYL PHTHALATE
760U	3,3'-DICHLOROBENZIDINE
430	BENZO(A)ANTHRACENE
570	CHRYSENE
380U	BIS(2-ETHYLHEXYL) PHTHALATE
380U	DI-N-OCTYLPHTHALATE
770J	BENZO(B AND/OR K)FLUORANTHENE
370J	BENZO-A-PYRENE
230J	INDENO (1,2,3-CD) PYRENE
130J	DIBENZO(A,H)ANTHRACENE
260J	BENZO(GHI)PERYLENE
12	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50968	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SS-02			COLLECTION START: 09/26/90 0930 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y288 MD NO: Y288

ANALYTICAL RESULTS UG/KG

200JN	BENZOFLUORANTHENE (NOT B OR K)
500JN	PINENE
400J	1 UNIDENTIFIED COMPOUND

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-02
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 0930 STOP: 00/00/00
D. NUMBER: Y288

UG/KG	ANALYTICAL RESULTS
9.1U	ALPHA-BHC
9.1U	BETA-BHC
9.1U	DELTA-BHC
9.1U	GAMMA-BHC (LINDANE)
9.1U	HEPTACHLOR
9.1U	ALDRIN
9.1U	HEPTACHLOR EPOXIDE
9.1U	ENDOSULFAN I (ALPHA)
18U	DIELDRIN
18U	4,4'-DDE (P,P'-DDE)
18U	ENDRIN
18U	ENDOSULFAN II (BETA)
18U	4,4'-DDD (P,P'-DDD)
18U	ENDOSULFAN SULFATE
18U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
91U	METHOXYCHLOR
18U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
91U	GAMMA-CHLORDANE /2
91U	ALPHA-CHLORDANE /2
180U	TOXAPHENE
91U	PCB-1016 (AROCLOR 1016)
91U	PCB-1221 (AROCLOR 1221)
91U	PCB-1232 (AROCLOR 1232)
91U	PCB-1242 (AROCLOR 1242)
91U	PCB-1248 (AROCLOR 1248)
180U	PCB-1254 (AROCLOR 1254)
180U	PCB-1260 (AROCLOR 1260)
12	PERCENT MOISTURE

REMARKS ***REMARKS***

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.
*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-02 COLLECTION START: 09/26/90 0930 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y288

MG/KG	ANALYTICAL RESULTS
21000	ALUMINUM
6.6U	ANTIMONY
2.6J	ARSENIC
54	BARIUM
.23U	BERYLLIUM
.91U	CADMIUM
480	CALCIUM
54J	CHROMIUM
5.2	COBALT
17	COPPER
24000	IRON
18J	LEAD
410	MAGNESIUM
390	MANGANESE
.11U	MERCURY
7.8	NICKEL
580U	POTASSIUM
1.9	SELENIUM
.91U	SILVER
18U	SODIUM
.46U	THALLIUM
NA	TIN
64	VANADIUM
73	ZINC
12	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-02 COLLECTION START: 09/26/90 0930 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y288 MD NO: Y288

RESULTS	UNITS	PARAMETER
1.1U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE:
SOURCE:
STATION ID: SB-02

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1000 STOP: 00/00/00

D. NO.: Y289

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
20U	METHYLENE CHLORIDE
12U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
14	PERCENT MOISTURE

REMARKS ***REMARKS***

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE: PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: CITY: STARTEX ST: SC
STATION ID: SB-02 COLLECTION START: 09/26/90 1000 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y289

UG/KG	ANALYTICAL RESULTS
390U	PHENOL
390U	BIS(2-CHLOROETHYL) ETHER
390U	2-CHLOROPHENOL
390U	1,3-DICHLOROBENZENE
390U	1,4-DICHLOROBENZENE
390U	BENZYL ALCOHOL
390U	1,2-DICHLOROBENZENE
390U	2-METHYLPHENOL
390UR	BIS(2-CHLOROISOPROPYL) ETHER
390U	(3-AND/OR 4-)METHYLPHENOL
390U	N-NITROSODI-N-PROPYLAMINE
390U	HEXACHLOROETHANE
390U	NITROBENZENE
390U	ISOPHORONE
390U	2-NITROPHENOL
390U	2,4-DIMETHYLPHENOL
1900U	BENZOIC ACID
390U	BIS(2-CHLOROETHOXY) METHANE
390U	2,4-DICHLOROPHENOL
390UR	1,2,4-TRICHLOROBENZENE
390U	NAPHTHALENE
390U	4-CHLOROANILINE
390U	HEXACHLOROBUTADIENE
390U	4-CHLORO-3-METHYLPHENOL
390U	2-METHYLNAPHTHALENE
390U	HEXACHLOROCYCLOPENTADIENE (HCCP)
390U	2,4,6-TRICHLOROPHENOL
1900U	2,4,5-TRICHLOROPHENOL
390UR	2-CHLORONAPHTHALENE
1900U	2-NITROANILINE
390U	DIMETHYL PHTHALATE
390U	ACENAPHTHYLENE
390U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1900U	3-NITROANILINE
390U	ACENAPHTHENE
1900U	2,4-DINITROPHENOL
1900U	4-NITROPHENOL
390U	DIBENZOFURAN
390U	2,4-DINITROTOLUENE
390U	DIETHYL PHTHALATE
390U	4-CHLOROPHENYL PHENYL ETHER
390U	FLUORENE
1900U	4-NITROANILINE
1900U	2-METHYL-4,6-DINITROPHENOL
390U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
390U	4-BROMOPHENYL PHENYL ETHER
390U	HEXACHLOROBENZENE (HCB)
1900UJ	PENTACHLOROPHENOL
390U	PHENANTHRENE
390U	ANTHRACENE
390U	DI-N-BUTYLPHTHALATE
390U	FLUORANTHENE
390U	PYRENE
390U	BENZYL BUTYL PHTHALATE
770U	3,3'-DICHLOROBENZIDINE
390U	BENZO(A)ANTHRACENE
390U	CHRYSENE
390U	BIS(2-ETHYLHEXYL) PHTHALATE
390U	DI-N-OCTYLPHTHALATE
390U	BENZO(B AND/OR K)FLUORANTHENE
390U	BENZO-A-PYRENE
390U	INDENO (1,2,3-CD) PYRENE
390U	DIBENZO(A,H)ANTHRACENE
390U	BENZO(GHI)PERYLENE
14	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE:
SOURCE:
STATION ID: SB-02
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1000 STOP: 00/00/00
D. NUMBER: Y289

UG/KG	ANALYTICAL RESULTS
9.3U	ALPHA-BHC
9.3U	BETA-BHC
9.3U	DELTA-BHC
9.3U	GAMMA-BHC (LINDANE)
9.3U	HEPTACHLOR
9.3U	ALDRIN
9.3U	HEPTACHLOR EPOXIDE
9.3U	ENDOSULFAN I (ALPHA)
19U	DIELDRIN
19U	4,4'-DDE (P,P'-DDE)
19U	ENDRIN
19U	ENDOSULFAN II (BETA)
19U	4,4'-DDD (P,P'-DDD)
19U	ENDOSULFAN SULFATE
19U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
93U	METHOXYCHLOR
19U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
93U	GAMMA-CHLORDANE /2
93U	ALPHA-CHLORDANE /2
190U	TOXAPHENE
93U	PCB-1016 (AROCLOR 1016)
93U	PCB-1221 (AROCLOR 1221)
93U	PCB-1232 (AROCLOR 1232)
93U	PCB-1242 (AROCLOR 1242)
93U	PCB-1248 (AROCLOR 1248)
190U	PCB-1254 (AROCLOR 1254)
190U	PCB-1260 (AROCLOR 1260)
14	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-02 COLLECTION START: 09/26/90 1000 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y289

MG/KG	ANALYTICAL RESULTS
80000	ALUMINUM
6.9U	ANTIMONY
2UJ	ARSENIC
60	BARIUM
.24U	BERYLLIUM
.95U	CADMIUM
200	CALCIUM
130J	CHROMIUM
8.5	COBALT
71	COPPER
94000	IRON
24J	LEAD
800	MAGNESIUM

MG/KG	ANALYTICAL RESULTS
400	MANGANESE
.12U	MERCURY
28	NICKEL
980U	POTASSIUM
3.7J	SELENIUM
.95U	SILVER
20U	SODIUM
.47U	THALLIUM
NA	TIN
250	VANADIUM
45	ZINC
16	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS. GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL
SOURCE:
STATION ID: SS-03

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1030 STOP: 00/00/00

D. NO.: Y290

UG/KG	ANALYTICAL RESULTS
48U	CHLOROMETHANE
48U	BROMOMETHANE
48U	VINYL CHLORIDE
48U	CHLOROETHANE
60U	METHYLENE CHLORIDE
630	ACETONE
24U	CARBON DISULFIDE
24U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
24U	1,1-DICHLOROETHANE
24U	1,2-DICHLOROETHENE (TOTAL)
24U	CHLOROFORM
24U	1,2-DICHLOROETHANE
48U	METHYL ETHYL KETONE
24U	1,1,1-TRICHLOROETHANE
24U	CARBON TETRACHLORIDE
48U	VINYL ACETATE
24U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
24U	1,2-DICHLOROPROPANE
24U	CIS-1,3-DICHLOROPROPENE
24U	TRICHLOROETHENE(TRICHLOROETHYLENE)
24U	DIBROMOCHLOROMETHANE
24U	1,1,2-TRICHLOROETHANE
24U	BENZENE
24U	TRANS-1,3-DICHLOROPROPENE
24U	BROMOFORM
48U	METHYL ISOBUTYL KETONE
48U	METHYL BUTYL KETONE
24U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
24U	1,1,2,2-TETRACHLOROETHANE
24U	TOLUENE
29	CHLOROBENZENE
24U	ETHYL BENZENE
24U	STYRENE
24U	TOTAL XYLENES
79	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50970	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE:			CITY: STARTEX ST: SC
STATION ID: SS-03			COLLECTION START: 09/26/90 1030 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y290 MD NO: Y290

ANALYTICAL RESULTS UG/KG

80JN	TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL
SOURCE:
STATION ID: SS-03

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1030 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y290

UG/KG	ANALYTICAL RESULTS
1600U	PHENOL
1600U	BIS(2-CHLOROETHYL) ETHER
1600U	2-CHLOROPHENOL
1600U	1,3-DICHLOROBENZENE
1600U	1,4-DICHLOROBENZENE
1600U	BENZYL ALCOHOL
1600U	1,2-DICHLOROBENZENE
1600U	2-METHYLPHENOL
1600UR	BIS(2-CHLOROISOPROPYL) ETHER
1600U	(3-AND/OR 4-)METHYLPHENOL
1600U	N-NITROSODI-N-PROPYLAMINE
1600U	HEXACHLOROETHANE
1600U	NITROBENZENE
1600U	ISOPHORONE
1600U	2-NITROPHENOL
1600U	2,4-DIMETHYLPHENOL
7600U	BENZOIC ACID
1600U	BIS(2-CHLOROETHOXY) METHANE
1600U	2,4-DICHLOROPHENOL
1600UR	1,2,4-TRICHLOROBENZENE
1600U	NAPHTHALENE
1600U	4-CHLOROANILINE
1600U	HEXACHLOROBUTADIENE
1600U	4-CHLORO-3-METHYLPHENOL
1600U	2-METHYLNAPHTHALENE
1600U	HEXACHLOROCYCLOPENTADIENE (HCCP)
1600U	2,4,6-TRICHLOROPHENOL
7600U	2,4,5-TRICHLOROPHENOL
1600UR	2-CHLORONAPHTHALENE
7600U	2-NITROANILINE
1600U	DIMETHYL PHTHALATE
1600U	ACENAPHTHYLENE
1600U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
7600U	3-NITROANILINE
1600U	ACENAPHTHENE
7600U	2,4-DINITROPHENOL
7600U	4-NITROPHENOL
1600U	DIBENZOFURAN
1600U	2,4-DINITROTOLUENE
600J	DIETHYL PHTHALATE
1600U	4-CHLOROPHENYL PHENYL ETHER
1600U	FLUORENE
7600U	4-NITROANILINE
7600U	2-METHYL-4,6-DINITROPHENOL
1600U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
1600U	4-BROMOPHENYL PHENYL ETHER
1600U	HEXACHLOROBENZENE (HCB)
7600UJ	PENTACHLOROPHENOL
1600U	PHENANTHRENE
1600U	ANTHRACENE
1600U	DI-N-BUTYLPHTHALATE
210J	FLUORANTHENE
380J	PYRENE
1600U	BENZYL BUTYL PHTHALATE
3100U	3,3'-DICHLOROBENZIDINE
1600U	BENZO(A)ANTHRACENE
1600U	CHRYSENE
1600U	BIS(2-ETHYLHEXYL) PHTHALATE
1600U	DI-N-OCTYLPHTHALATE
1600U	BENZO(B AND/OR K)FLUORANTHENE
1600U	BENZO-A-PYRENE
1600U	INDENO (1,2,3-CD) PYRENE
1600U	DIBENZO(A,H)ANTHRACENE
1600U	BENZO(GHI)PERYLENE
79	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50970	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE:			CITY: STARTEX ST: SC
STATION ID: SS-03			COLLECTION START: 09/26/90 1030 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y290 MD NO: Y290

ANALYTICAL RESULTS UG/KG

90000J	15 UNIDENTIFIED COMPOUNDS
N	PETROLEUM PRODUCT
2000JN	BENZOTHIAZOLONE
4000JN	HEXADECANOIC ACID
3000JN	BUTOXYETHANOLPHOSPHATE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL
SOURCE:
STATION ID: SS-03
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1030 STOP: 00/00/00
D. NUMBER: Y290

UG/KG	ANALYTICAL RESULTS
38U	ALPHA-BHC
38U	BETA-BHC
38U	DELTA-BHC
38U	GAMMA-BHC (LINDANE)
38U	HEPTACHLOR
38U	ALDRIN
38U	HEPTACHLOR EPOXIDE
38U	ENDOSULFAN I (ALPHA)
76U	DIELDRIN
76U	4,4'-DDE (P,P'-DDE)
76U	ENDRIN
76U	ENDOSULFAN II (BETA)
76U	4,4'-DDD (P,P'-DDD)
76U	ENDOSULFAN SULFATE
76U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
380U	METHOXYCHLOR
76U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
380U	GAMMA-CHLORDANE /2
380U	ALPHA-CHLORDANE /2
760U	TOXAPHENE
380U	PCB-1016 (AROCLOR 1016)
380U	PCB-1221 (AROCLOR 1221)
380U	PCB-1232 (AROCLOR 1232)
380U	PCB-1242 (AROCLOR 1242)
380U	PCB-1248 (AROCLOR 1248)
760U	PCB-1254 (AROCLOR 1254)
760U	PCB-1260 (AROCLOR 1260)
79	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.
*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-03 COLLECTION START: 09/26/90 1030 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y290

MG/KG	ANALYTICAL RESULTS
33000	ALUMINUM
30U	ANTIMONY
8UJ	ARSENIC
230	BARIUM
.96U	BERYLLIUM
3.8U	CADMIUM
2000	CALCIUM
44J	CHROMIUM
240	COBALT
38	COPPER
100000	IRON
51J	LEAD
1600	MAGNESIUM
1400	MANGANESE
.48U	MERCURY
30	NICKEL
1400	POTASSIUM
2.9U	SELENIUM
3.8U	SILVER
150	SODIUM
1.9U	THALLIUM
NA	TIN
80	VANADIUM
120	ZINC
79	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-03 COLLECTION START: 09/26/90 1030 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y290 MD NO: Y290

RESULTS	UNITS	PARAMETER
4.8U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-03

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1055 STOP: 00/00/00

D. NO.: Y291

UG/KG	ANALYTICAL RESULTS
15U	CHLOROMETHANE
15U	BROMOMETHANE
15U	VINYL CHLORIDE
15U	CHLOROETHANE
20U	METHYLENE CHLORIDE
50U	ACETONE
7U	CARBON DISULFIDE
7U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
7U	1,1-DICHLOROETHANE
7U	1,2-DICHLOROETHENE (TOTAL)
7U	CHLOROFORM
7U	1,2-DICHLOROETHANE
15U	METHYL ETHYL KETONE
7U	1,1,1-TRICHLOROETHANE
7U	CARBON TETRACHLORIDE
15U	VINYL ACETATE
7U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
7U	1,2-DICHLOROPROPANE
7U	CIS-1,3-DICHLOROPROPENE
7U	TRICHLOROETHENE(TRICHLOROETHYLENE)
7U	DIBROMOCHLOROMETHANE
7U	1,1,2-TRICHLOROETHANE
7U	BENZENE
7U	TRANS-1,3-DICHLOROPROPENE
7U	BROMOFORM
15U	METHYL ISOBUTYL KETONE
15U	METHYL BUTYL KETONE
7U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
7U	1,1,2,2-TETRACHLOROETHANE
7U	TOLUENE
19	CHLOROBENZENE
9	ETHYL BENZENE
7U	STYRENE
22	TOTAL XYLENES
33	PERCENT MOISTURE

REMARKS ***REMARKS***

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50971	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SB-03			COLLECTION START: 09/26/90 1055 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y291 MD NO: Y291

ANALYTICAL RESULTS UG/KG

10JN	TETRAMETHYLBUTANE
100JN	ETHYLMETHYBENZENE (2 ISOMERS)

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS, GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-03

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1055 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y291

UG/KG	ANALYTICAL RESULTS
490U	PHENOL
490U	BIS(2-CHLOROETHYL) ETHER
490U	2-CHLOROPHENOL
490U	1,3-DICHLOROBENZENE
490U	1,4-DICHLOROBENZENE
490U	BENZYL ALCOHOL
490U	1,2-DICHLOROBENZENE
490U	2-METHYLPHENOL
490UR	BIS(2-CHLOROISOPROPYL) ETHER
490U	(3-AND/OR 4-)METHYLPHENOL
490U	N-NITROSODI-N-PROPYLAMINE
490U	HEXACHLOROETHANE
490U	NITROBENZENE
490U	ISOPHORONE
490U	2-NITROPHENOL
490U	2,4-DIMETHYLPHENOL
2400U	BENZOIC ACID
490U	BIS(2-CHLOROETHOXY) METHANE
490U	2,4-DICHLOROPHENOL
490UR	1,2,4-TRICHLOROBENZENE
490U	NAPHTHALENE
490U	4-CHLOROANILINE
490U	HEXACHLOROBUTADIENE
490U	4-CHLORO-3-METHYLPHENOL
490U	2-METHYLNAPHTHALENE
490U	HEXACHLOROCYCLOPENTADIENE (HCCP)
490U	2,4,6-TRICHLOROPHENOL
2400U	2,4,5-TRICHLOROPHENOL
490UR	2-CHLORONAPHTHALENE
2400U	2-NITROANILINE
490U	DIMETHYL PHTHALATE
490U	ACENAPHTHYLENE
490U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2400U	3-NITROANILINE
490U	ACENAPHTHENE
2400U	2,4-DINITROPHENOL
2400U	4-NITROPHENOL
490U	DIBENZOFURAN
490U	2,4-DINITROTOLUENE
490U	DIETHYL PHTHALATE
490U	4-CHLOROPHENYL PHENYL ETHER
490U	FLUORENE
2400U	4-NITROANILINE
2400U	2-METHYL-4,6-DINITROPHENOL
490U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
490U	4-BROMOPHENYL PHENYL ETHER
490U	HEXACHLOROBENZENE (HCB)
2400UJ	PENTACHLOROPHENOL
490U	PHENANTHRENE
490U	ANTHRACENE
490U	DI-N-BUTYLPHTHALATE
490U	FLUORANTHENE
490U	PYRENE
490U	BENZYL BUTYL PHTHALATE
990U	3,3'-DICHLOROBENZIDINE
490U	BENZO(A)ANTHRACENE
490U	CHRYSENE
490U	BIS(2-ETHYLHEXYL) PHTHALATE
490U	DI-N-OCTYLPHTHALATE
490U	BENZO(B AND/OR K)FLUORANTHENE
490U	BENZO-A-PYRENE
490U	INDENO (1,2,3-CD) PYRENE
490U	DIBENZO(A,H)ANTHRACENE
490U	BENZO(GHI)PERYLENE
33	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-03 COLLECTION START 09/26/90 1055 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y291 MD NO: Y291

ANALYTICAL RESULTS UG/KG

2000JN	BUTOXYETHANOLPHOSPHATE
2000JN	BENZOTHIAZOLONE
10000J	14 UNIDENTIFIED COMPOUNDS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-03 COLLECTION START: 09/26/90 1055 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y291

UG/KG	ANALYTICAL RESULTS
12U	ALPHA-BHC
12U	BETA-BHC
12U	DELTA-BHC
12U	GAMMA-BHC (LINDANE)
12U	HEPTACHLOR
12U	ALDRIN
12U	HEPTACHLOR EPOXIDE
12U	ENDOSULFAN I (ALPHA)
24U	DIELDRIN
24U	4,4'-DDE (P,P'-DDE)
24U	ENDRIN
24U	ENDOSULFAN II (BETA)
24U	4,4'-DDD (P,P'-DDD)
24U	ENDOSULFAN SULFATE
24U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
120U	METHOXYCHLOR
24U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
120U	GAMMA-CHLORDANE /2
120U	ALPHA-CHLORDANE /2
240U	TOXAPHENE
120U	PCB-1016 (AROCLOR 1016)
120U	PCB-1221 (AROCLOR 1221)
120U	PCB-1232 (AROCLOR 1232)
120U	PCB-1242 (AROCLOR 1242)
120U	PCB-1248 (AROCLOR 1248)
240U	PCB-1254 (AROCLOR 1254)
240U	PCB-1260 (AROCLOR 1260)
33	PERCENT MOISTURE

REMARKS ***REMARKS***

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-03
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1055 STOP: 00/00/00
MD NUMBER: Y291

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
6500	ALUMINUM	900	MANGANESE
9.2U	ANTIMONY	.16U	MERCURY
.95UR	ARSENIC	8.9U	NICKEL
52	BARIUM	250U	POTASSIUM
.32U	BERYLLIUM	.95U	SELENIUM
1.3U	CADMIUM	1.3U	SILVER
350	CALCIUM	25U	SODIUM
18J	CHROMIUM	.63U	THALLIUM
48	COBALT	NA	TIN
2.8	COPPER	16	VANADIUM
4300	IRON	7U	ZINC
9.8J	LEAD	37	PERCENT MOISTURE
290	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-03 COLLECTION START: 09/26/90 1055 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y291 MD NO: Y291

RESULTS	UNITS	PARAMETER
1.6U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-04 COLLECTION START: 09/26/90 1205 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y292

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
7U	METHYLENE CHLORIDE
12U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
19	PERCENT MOISTURE

REMARKS ***REMARKS***

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-04 COLLECTION START 09/26/90 1205 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y292 MD NO: Y292

ANALYTICAL RESULTS UG/KG

20JN TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-04

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1205 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y292

UG/KG	ANALYTICAL RESULTS
410U	PHENOL
410U	BIS(2-CHLOROETHYL) ETHER
410U	2-CHLOROPHENOL
410U	1,3-DICHLOROBENZENE
410U	1,4-DICHLOROBENZENE
410U	BENZYL ALCOHOL
410U	1,2-DICHLOROBENZENE
410U	2-METHYLPHENOL
410UR	BIS(2-CHLOROISOPROPYL) ETHER
410U	(3-AND/OR 4-)METHYLPHENOL
410U	N-NITROSODI-N-PROPYLAMINE
410U	HEXACHLOROETHANE
410U	NITROBENZENE
410U	ISOPHORONE
410U	2-NITROPHENOL
410U	2,4-DIMETHYLPHENOL
2000U	BENZOIC ACID
410U	BIS(2-CHLOROETHOXY) METHANE
410U	2,4-DICHLOROPHENOL
410UR	1,2,4-TRICHLOROBENZENE
410U	NAPHTHALENE
410U	4-CHLOROANILINE
410U	HEXACHLOROBUTADIENE
410U	4-CHLORO-3-METHYLPHENOL
410U	2-METHYLNAPHTHALENE
410U	HEXACHLOROCYCLOPENTADIENE (HCCP)
410U	2,4,6-TRICHLOROPHENOL
2000U	2,4,5-TRICHLOROPHENOL
410UR	2-CHLORONAPHTHALENE
2000U	2-NITROANILINE
410U	DIMETHYL PHTHALATE
410U	ACENAPHTHYLENE
410U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2000U	3-NITROANILINE
410U	ACENAPHTHENE
2000U	2,4-DINITROPHENOL
2000U	4-NITROPHENOL
410U	DIBENZOFURAN
410U	2,4-DINITROTOLUENE
410U	DIETHYL PHTHALATE
410U	4-CHLOROPHENYL PHENYL ETHER
410U	FLUORENE
2000U	4-NITROANILINE
2000U	2-METHYL-4,6-DINITROPHENOL
410U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
410U	4-BROMOPHENYL PHENYL ETHER
410U	HEXACHLOROBENZENE (HCB)
2000UJ	PENTACHLOROPHENOL
410U	PHENANTHRENE
410U	ANTHRACENE
410U	DI-N-BUTYLPHTHALATE
76J	FLUORANTHENE
110J	PYRENE
410U	BENZYL BUTYL PHTHALATE
820U	3,3'-DICHLOROBENZIDINE
410U	BENZO(A)ANTHRACENE
410U	CHRYSENE
1900	BIS(2-ETHYLHEXYL) PHTHALATE
410U	DI-N-OCTYLPHTHALATE
410U	BENZO(B AND/OR K)FLUORANTHENE
410U	BENZO-A-PYRENE
410U	INDENO (1,2,3-CD) PYRENE
410U	DIBENZO(A,H)ANTHRACENE
410U	BENZO(GHI)PERYLENE
19	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50972	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SS-04			COLLECTION START: 09/26/90 1205 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y292 MD NO: Y292

ANALYTICAL RESULTS UG/KG

3000J 6 UNIDENTIFIED COMPOUNDS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-04
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1205 STOP: 00/00/00
D. NUMBER: Y292

UG/KG	ANALYTICAL RESULTS
9.9U	ALPHA-BHC
9.9U	BETA-BHC
9.9U	DELTA-BHC
9.9U	GAMMA-BHC (LINDANE)
9.9U	HEPTACHLOR
9.9U	ALDRIN
9.9U	HEPTACHLOR EPOXIDE
9.9U	ENDOSULFAN I (ALPHA)
20U	DIELDRIN
20U	4,4'-DDE (P,P'-DDE)
20U	ENDRIN
20U	ENDOSULFAN II (BETA)
20U	4,4'-DDD (P,P'-DDD)
20U	ENDOSULFAN SULFATE
20U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
99U	METHOXYCHLOR
20U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
99U	GAMMA-CHLORDANE /2
99U	ALPHA-CHLORDANE /2
200U	TOXAPHENE
99U	PCB-1016 (AROCLOR 1016)
99U	PCB-1221 (AROCLOR 1221)
99U	PCB-1232 (AROCLOR 1232)
99U	PCB-1242 (AROCLOR 1242)
99U	PCB-1248 (AROCLOR 1248)
200U	PCB-1254 (AROCLOR 1254)
200U	PCB-1260 (AROCLOR 1260)
19	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS, GA. 11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-04
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1205 STOP: 00/00/00
MD NUMBER: Y292

MG/KG	ANALYTICAL RESULTS
61000	ALUMINUM
8.4U	ANTIMONY
.87UR	ARSENIC
110	BARIUM
.29U	BERYLLIUM
1.2U	CADMIUM
790	CALCIUM
88J	CHROMIUM
9	COBALT
40	COPPER
63000	IRON
34J	LEAD
2000	MAGNESIUM

MG/KG	ANALYTICAL RESULTS
170	MANGANESE
.14U	MERCURY
19	NICKEL
2100	POTASSIUM
.87U	SELENIUM
1.2U	SILVER
30U	SODIUM
.58U	THALLIUM
NA	TIN
180	VANADIUM
33	ZINC
31	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-04 COLLECTION START: 09/26/90 1205 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y292 MD NO: Y292

RESULTS	UNITS	PARAMETER
1.4U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-05 COLLECTION START: 09/26/90 1225 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y293

UG/KG	ANALYTICAL RESULTS
14U	CHLOROMETHANE
14U	BROMOMETHANE
14U	VINYL CHLORIDE
14U	CHLOROETHANE
30U	METHYLENE CHLORIDE
14U	ACETONE
7U	CARBON DISULFIDE
7U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
7U	1,1-DICHLOROETHANE
7U	1,2-DICHLOROETHENE (TOTAL)
7U	CHLOROFORM
7U	1,2-DICHLOROETHANE
14U	METHYL ETHYL KETONE
7U	1,1,1-TRICHLOROETHANE
7U	CARBON TETRACHLORIDE
14U	VINYL ACETATE
7U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
7U	1,2-DICHLOROPROPANE
7U	CIS-1,3-DICHLOROPROPENE
7U	TRICHLOROETHENE(TRICHLOROETHYLENE)
7U	DIBROMOCHLOROMETHANE
7U	1,1,2-TRICHLOROETHANE
7U	BENZENE
7U	TRANS-1,3-DICHLOROPROPENE
7U	BROMOFORM
14U	METHYL ISOBUTYL KETONE
14U	METHYL BUTYL KETONE
7U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
7U	1,1,2,2-TETRACHLOROETHANE
7U	TOLUENE
7U	CHLOROBENZENE
7U	ETHYL BENZENE
7U	STYRENE
7U	TOTAL XYLENES
26	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50973	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SS-05			COLLECTION START. 09/26/90 1225 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y293 MD NO: Y293

ANALYTICAL RESULTS UG/KG

30JN	TETRAMETHYLBUTANE
4JN	PROPADIENE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-05

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1225 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y293

UG/KG	ANALYTICAL RESULTS
450U	PHENOL
450U	BIS(2-CHLOROETHYL) ETHER
450U	2-CHLOROPHENOL
450U	1,3-DICHLOROBENZENE
450U	1,4-DICHLOROBENZENE
450U	BENZYL ALCOHOL
450U	1,2-DICHLOROBENZENE
450U	2-METHYLPHENOL
450UR	BIS(2-CHLOROISOPROPYL) ETHER
450U	(3-AND/OR 4-)METHYLPHENOL
450U	N-NITROSODI-N-PROPYLAMINE
450U	HEXACHLOROETHANE
450U	NITROBENZENE
450U	ISOPHORONE
450U	2-NITROPHENOL
450U	2,4-DIMETHYLPHENOL
2200U	BENZOIC ACID
450U	BIS(2-CHLOROETHOXY) METHANE
450U	2,4-DICHLOROPHENOL
450UR	1,2,4-TRICHLOROBENZENE
450U	NAPHTHALENE
450U	4-CHLOROANILINE
450U	HEXACHLOROBUTADIENE
450U	4-CHLORO-3-METHYLPHENOL
450U	2-METHYLNAPHTHALENE
450U	HEXACHLOROCYCLOPENTADIENE (HCCP)
450U	2,4,6-TRICHLOROPHENOL
2200U	2,4,5-TRICHLOROPHENOL
450UR	2-CHLORONAPHTHALENE
2200U	2-NITROANILINE
450U	DIMETHYL PHTHALATE
450U	ACENAPHTHYLENE
450U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2200U	3-NITROANILINE
450U	ACENAPHTHENE
2200U	2,4-DINITROPHENOL
2200U	4-NITROPHENOL
450U	DIBENZOFURAN
450U	2,4-DINITROTOLUENE
450U	DIETHYL PHTHALATE
450U	4-CHLOROPHENYL PHENYL ETHER
450U	FLUORENE
2200U	4-NITROANILINE
2200U	2-METHYL-4,6-DINITROPHENOL
450U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
450U	4-BROMOPHENYL PHENYL ETHER
450U	HEXACHLOROBENZENE (HCB)
2200UJ	PENTACHLOROPHENOL
450U	PHENANTHRENE
450U	ANTHRACENE
450U	DI-N-BUTYLPHTHALATE
450U	FLUORANTHENE
450U	PYRENE
450U	BENZYL BUTYL PHTHALATE
890U	3,3'-DICHLOROBENZIDINE
450U	BENZO(A)ANTHRACENE
450U	CHRYSENE
450U	BIS(2-ETHYLHEXYL) PHTHALATE
450U	DI-N-OCTYLPHTHALATE
450U	BENZO(B AND/OR K)FLUORANTHENE
450U	BENZO-A-PYRENE
450U	INDENO (1,2,3-CD) PYRENE
450U	DIBENZO(A,H)ANTHRACENE
450U	BENZO(GHI)PERYLENE
26	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-05 COLLECTION START: 09/26/90 1225 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y293 MD NO: Y293

ANALYTICAL RESULTS UG/KG

800J 1 UNIDENTIFIED COMPOUND

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-05
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1225 STOP: 00/00/00
D. NUMBER: Y293

UG/KG	ANALYTICAL RESULTS
11U	ALPHA-BHC
11U	BETA-BHC
11U	DELTA-BHC
11U	GAMMA-BHC (LINDANE)
11U	HEPTACHLOR
11U	ALDRIN
11U	HEPTACHLOR EPOXIDE
11U	ENDOSULFAN I (ALPHA)
22U	DIELDRIN
22U	4,4'-DDE (P,P'-DDE)
22U	ENDRIN
22U	ENDOSULFAN II (BETA)
22U	4,4'-DDD (P,P'-DDD)
22U	ENDOSULFAN SULFATE
22U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
110U	METHOXYCHLOR
22U	ENDRIN KETONE
--	CHLORDANE (TECH. MIXTURE) /1
110U	GAMMA-CHLORDANE /2
110U	ALPHA-CHLORDANE /2
220U	TOXAPHENE
110U	PCB-1016 (AROCLOR 1016)
110U	PCB-1221 (AROCLOR 1221)
110U	PCB-1232 (AROCLOR 1232)
110U	PCB-1242 (AROCLOR 1242)
110U	PCB-1248 (AROCLOR 1248)
220U	PCB-1254 (AROCLOR 1254)
220U	PCB-1260 (AROCLOR 1260)
26	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-05
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1225 STOP: 00/00/00
MD NUMBER: Y293

MG/KG	ANALYTICAL RESULTS
11000	ALUMINUM
7.8U	ANTIMONY
11J	ARSENIC
200	BARIUM
2U	BERYLLIUM
1.1U	CADMIUM
4400	CALCIUM
13J	CHROMIUM
8	COBALT
35	COPPER
10000	IRON
11J	LEAD
760	MAGNESIUM
65	MANGANESE
.14U	MERCURY
16	NICKEL
900U	POTASSIUM
2U	SELENIUM
1.1U	SILVER
190	SODIUM
1U	THALLIUM
NA	TIN
44	VANADIUM
20U	ZINC
26	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-05 COLLECTION START: 09/26/90 1225 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y293 MD NO: Y293

RESULTS	UNITS	PARAMETER
1.4U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-06

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1250 STOP: 00/00/00

D. NO.: Y294

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
20U	METHYLENE CHLORIDE
12U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
17	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS. GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50974	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SS-06			COLLECTION START: 09/26/90 1250 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y294 MD NO: Y294

ANALYTICAL RESULTS UG/KG

60JN	TETRAMETHYLBUTANE	

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-06

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1250 STOP: 00/00/00

D. NO.: Y294

UG/KG	ANALYTICAL RESULTS
400U	PHENOL
400U	BIS(2-CHLOROETHYL) ETHER
400U	2-CHLOROPHENOL
400U	1,3-DICHLOROBENZENE
400U	1,4-DICHLOROBENZENE
400U	BENZYL ALCOHOL
400U	1,2-DICHLOROBENZENE
400U	2-METHYLPHENOL
400UR	BIS(2-CHLOROISOPROPYL) ETHER
400U	(3-AND/OR 4-)METHYLPHENOL
400U	N-NITROSODI-N-PROPYLAMINE
400U	HEXACHLOROETHANE
400U	NITROBENZENE
400U	ISOPHORONE
400U	2-NITROPHENOL
400U	2,4-DIMETHYLPHENOL
1900U	BENZOIC ACID
400U	BIS(2-CHLOROETHOXY) METHANE
400U	2,4-DICHLOROPHENOL
400UR	1,2,4-TRICHLOROBENZENE
400U	NAPHTHALENE
400U	4-CHLOROANILINE
400U	HEXACHLOROBUTADIENE
400U	4-CHLORO-3-METHYLPHENOL
400U	2-METHYLNAPHTHALENE
400U	HEXACHLOROCYCLOPENTADIENE (HCCP)
400U	2,4,6-TRICHLOROPHENOL
1900U	2,4,5-TRICHLOROPHENOL
400UR	2-CHLORONAPHTHALENE
1900U	2-NITROANILINE
400U	DIMETHYL PHTHALATE
400U	ACENAPHTHYLENE
400U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1900U	3-NITROANILINE
400U	ACENAPHTHENE
1900U	2,4-DINITROPHENOL
1900U	4-NITROPHENOL
400U	DIBENZOFURAN
400U	2,4-DINITROTOLUENE
400U	DIETHYL PHTHALATE
400U	4-CHLOROPHENYL PHENYL ETHER
400U	FLUORENE
1900U	4-NITROANILINE
1900U	2-METHYL-4,6-DINITROPHENOL
400U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
400U	4-BROMOPHENYL PHENYL ETHER
400U	HEXACHLOROBENZENE (HCB)
1900UJ	PENTACHLOROPHENOL
400U	PHENANTHRENE
400U	ANTHRACENE
400U	DI-N-BUTYLPHTHALATE
400U	FLUORANTHENE
400U	PYRENE
400U	BENZYL BUTYL PHTHALATE
800U	3,3'-DICHLOROBENZIDINE
400U	BENZO(A)ANTHRACENE
400U	CHRYSENE
400U	BIS(2-ETHYLHEXYL) PHTHALATE
400U	DI-N-OCTYLPHTHALATE
400U	BENZO(B AND/OR K)FLUORANTHENE
400U	BENZO-A-PYRENE
400U	INDENO (1,2,3-CD) PYRENE
400U	DIBENZO(A,H)ANTHRACENE
400U	BENZO(GHI)PERYLENE
17	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50974	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SS-06			COLLECTION START: 09/26/90 1250 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y294 MD NO: Y294

ANALYTICAL RESULTS UG/KG

10000J	10 UNIDENTIFIED COMPOUNDS
N	PETROLEUM PRODUCT
1000JN	HEXADECANOIC ACID

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-06
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1250 STOP: 00/00/00
D. NUMBER: Y294

UG/KG	ANALYTICAL RESULTS
9.6U	ALPHA-BHC
9.6U	BETA-BHC
9.6U	DELTA-BHC
9.6U	GAMMA-BHC (LINDANE)
9.6U	HEPTACHLOR
9.6U	ALDRIN
9.6U	HEPTACHLOR EPOXIDE
9.6U	ENDOSULFAN I (ALPHA)
19U	DIELDRIN
19U	4,4'-DDE (P,P'-DDE)
19U	ENDRIN
19U	ENDOSULFAN II (BETA)
19U	4,4'-DDD (P,P'-DDD)
19U	ENDOSULFAN SULFATE
19U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
96U	METHOXYCHLOR
19U	ENDRIN KETONE
--	CHLORDANE (TECH. MIXTURE) /1
96U	GAMMA-CHLORDANE /2
96U	ALPHA-CHLORDANE /2
190U	TOXAPHENE
96U	PCB-1016 (AROCLOR 1016)
96U	PCB-1221 (AROCLOR 1221)
96U	PCB-1232 (AROCLOR 1232)
96U	PCB-1242 (AROCLOR 1242)
96U	PCB-1248 (AROCLOR 1248)
190U	PCB-1254 (AROCLOR 1254)
190U	PCB-1260 (AROCLOR 1260)
17	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-06 COLLECTION START: 09/26/90 1250 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y294

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
26000	ALUMINUM	450	MANGANESE
7.2U	ANTIMONY	.12U	MERCURY
3UJ	ARSENIC	7U	NICKEL
140	BARIUM	1200U	POTASSIUM
.25U	BERYLLIUM	.75U	SELENIUM
1U	CADMIUM	2.9JN	SILVER
3100	CALCIUM	20U	SODIUM
44J	CHROMIUM	.50U	THALLIUM
7.4	COBALT	NA	TIN
23	COPPER	73	VANADIUM
28000	IRON	38	ZINC
33J	LEAD	20	PERCENT MOISTURE
1000	MAGNESIUM		

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTAN8 CITY: STARTEX ST: SC
STATION ID: SS-06 COLLECTION START: 09/26/90 1250 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y294 MD NO: Y294

RESULTS	UNITS	PARAMETER
1.2U	MG/KG	CYANIDE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-06 COLLECTION START: 09/26/90 1315 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y295

UG/KG	ANALYTICAL RESULTS
11U	CHLOROMETHANE
11U	BROMOMETHANE
11U	VINYL CHLORIDE
11U	CHLOROETHANE
50U	METHYLENE CHLORIDE
11U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
11U	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
11U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
11U	METHYL ISOBUTYL KETONE
11U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES
7	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS. GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50975	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SB-06			COLLECTION START 09/26/90 1315 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y295 MD NO: Y295

ANALYTICAL RESULTS UG/KG

20J	1	UNIDENTIFIED COMPOUND

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS. GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-06

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1315 STOP: 00/00/00

D. NO.: Y295

UG/KG	ANALYTICAL RESULTS
350U	PHENOL
350U	BIS(2-CHLOROETHYL) ETHER
350U	2-CHLOROPHENOL
350U	1,3-DICHLOROBENZENE
350U	1,4-DICHLOROBENZENE
350U	BENZYL ALCOHOL
350U	1,2-DICHLOROBENZENE
350U	2-METHYLPHENOL
350UR	BIS(2-CHLOROISOPROPYL) ETHER
350U	(3-AND/OR 4-)METHYLPHENOL
350U	N-NITROSODI-N-PROPYLAMINE
350U	HEXACHLOROETHANE
350U	NITROBENZENE
350U	ISOPHORONE
350U	2-NITROPHENOL
350U	2,4-DIMETHYLPHENOL
1700U	BENZOIC ACID
350U	BIS(2-CHLOROETHOXY) METHANE
350U	2,4-DICHLOROPHENOL
350UR	1,2,4-TRICHLOROBENZENE
350U	NAPHTHALENE
350U	4-CHLOROANILINE
350U	HEXACHLOROBUTADIENE
350U	4-CHLORO-3-METHYLPHENOL
350U	2-METHYLNAPHTHALENE
350U	HEXACHLOROCYCLOPENTADIENE (HCCP)
350U	2,4,6-TRICHLOROPHENOL
1700U	2,4,5-TRICHLOROPHENOL
350UR	2-CHLORONAPHTHALENE
1700U	2-NITROANILINE
350U	DIMETHYL PHTHALATE
350U	ACENAPHTHYLENE
350U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1700U	3-NITROANILINE
350U	ACENAPHTHENE
1700U	2,4-DINITROPHENOL
1700U	4-NITROPHENOL
350U	DIBENZOFURAN
350U	2,4-DINITROTOLUENE
350U	DIETHYL PHTHALATE
350U	4-CHLOROPHENYL PHENYL ETHER
350U	FLUORENE
1700U	4-NITROANILINE
1700U	2-METHYL-4,6-DINITROPHENOL
350U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
350U	4-BROMOPHENYL PHENYL ETHER
350U	HEXACHLOROBENZENE (HCB)
1700UJ	PENTACHLOROPHENOL
350U	PHENANTHRENE
350U	ANTHRACENE
350U	DI-N-BUTYLPHTHALATE
350U	FLUORANTHENE
350U	PYRENE
350U	BENZYL BUTYL PHTHALATE
710U	3,3'-DICHLOROBENZIDINE
350U	BENZO(A)ANTHRACENE
350U	CHRYSENE
350U	BIS(2-ETHYLHEXYL) PHTHALATE
350U	DI-N-OCTYLPHTHALATE
350U	BENZO(B AND/OR K)FLUORANTHENE
350U	BENZO-A-PYRENE
350U	INDENO (1,2,3-CD) PYRENE
350U	DIBENZO(A,H)ANTHRACENE
350U	BENZO(GHI)PERYLENE
7	PERCENT MOISTURE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-06
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1315 STOP: 00/00/00
D. NUMBER: Y295

UG/KG	ANALYTICAL RESULTS
8.6U	ALPHA-BHC
8.6U	BETA-BHC
8.6U	DELTA-BHC
8.6U	GAMMA-BHC (LINDANE)
8.6U	HEPTACHLOR
8.6U	ALDRIN
8.6U	HEPTACHLOR EPOXIDE
8.6U	ENDOSULFAN I (ALPHA)
17U	DIELDRIN
17U	4,4'-DDE (P,P'-DDE)
17U	ENDRIN
17U	ENDOSULFAN II (BETA)
17U	4,4'-DDD (P,P'-DDD)
17U	ENDOSULFAN SULFATE
17U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
86U	METHOXYCHLOR
17U	ENDRIN KETONE
--	CHLORDANE (TECH. MIXTURE) /1
86U	GAMMA-CHLORDANE /2
86U	ALPHA-CHLORDANE /2
170U	TOXAPHENE
86U	PCB-1016 (AROCLOR 1016)
86U	PCB-1221 (AROCLOR 1221)
86U	PCB-1232 (AROCLOR 1232)
86U	PCB-1242 (AROCLOR 1242)
86U	PCB-1248 (AROCLOR 1248)
170U	PCB-1254 (AROCLOR 1254)
170U	PCB-1260 (AROCLOR 1260)
7	PERCENT MOISTURE

REMARKS ***REMARKS***

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-06 COLLECTION START: 09/26/90 1315 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y295

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
39000	ALUMINUM	290	MANGANESE
6.3U	ANTIMONY	.11U	MERCURY
2UJ	ARSENIC	7.5	NICKEL
75	BARIUM	920U	POTASSIUM
1U	BERYLLIUM	.65U	SELENIUM
.87U	CADMIUM	3.7JN	SILVER
330	CALCIUM	20U	SODIUM
140J	CHROMIUM	.44U	THALLIUM
6	COBALT	NA	TIN
29	COPPER	100	VANADIUM
37000	IRON	27	ZINC
16J	LEAD	08	PERCENT MOISTURE
880	MAGNESIUM		

FOOTNOTES
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*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-06 COLLECTION START: 09/26/90 1315 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y295 MD NO: Y295

RESULTS	UNITS	PARAMETER
1.1U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50976 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01S COLLECTION START: 09/24/90 0830 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y300

UG/KG	ANALYTICAL RESULTS
11U	CHLOROMETHANE
11U	BROMOMETHANE
11U	VINYL CHLORIDE
11U	CHLOROETHANE
8U	METHYLENE CHLORIDE
20U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
11U	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
11U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
11U	METHYL ISOBUTYL KETONE
11U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES
9	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50976	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: TB-01S			COLLECTION START: 09/24/90 0830 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y300 MD NO:

ANALYTICAL RESULTS UG/KG

20JN	TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

[redacted]

REFERENCE NO. 2

APPENDIX C

APPENDIX C

Site Inspection Report

Site Inspection Report

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 1 - SITE LOCATION AND INSPECTION INFORMATION

EPA

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCD	980558191

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site)	02 STREET, ROUTE NO. OR SPECIFIC LOCATION IDENTIFIER
Old Startex, Spartanburg County Landfill	Off Finch Road near Nesbitt Road

03 CITY	04 STATE	05 ZIP CODE	06 COUNTY	07 COUNTY CODE	08 CONG. DIST.
Startex	SC	29377	Spartanburg		

09 COORDINATES LATITUDE	LONGITUDE
34 56 30.0	082 06 35.0

10 TYPE OF OWNERSHIP (Check one)
X A. PRIVATE ☐ B. FEDERAL _____ ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL
☐ F. OTHER _____ ☐ G. UNKNOWN

III. INSPECTION INFORMATION

01 DATE OF INSPECTION (MONTH DAY YEAR)	02 SITE STATUS	03 YEARS OF OPERATION (BEGINNING YEAR / ENDING YEAR)
9 25 90	☐ ACTIVE ☐ INACTIVE	Mid 1960's / present ☐ UNKNOWN

04 AGENCY PERFORMING INSPECTION (Check all that apply)
☐ A. EPA X B. EPA CONTRACTOR NUS Corp. (Name of firm) ☐ C. MUNICIPAL ☐ D. MUNICIPAL CONTRACTOR _____ (Name of firm)
☐ E. STATE ☐ F. STATE CONTRACTOR _____ (Name of firm) ☐ G. OTHER _____ (Specify)

05 CHIEF INSPECTOR	06 TITLE	07 ORGANIZATION	08 TELEPHONE NO
Terry Ryland	Geologists	NUS	404/938-7710
09 OTHER INSPECTORS	10 TITLE	11 ORGANIZATION	12 TELEPHONE NO
Willie Smitherman	Sample custodian	"	( ) "
Maurice Rowan	Sampler	"	( ) "
Tim Philips	"	"	( ) "
Sam McIver	"	"	( ) "
Alvin Williams	"	"	( ) "

13 SITE REPRESENTATIVES INTERVIEWED	14 TITLE	15 ADDRESS	16 TELEPHONE NO
Alan McManus	Environmentalists	Springs Ind.	( )
			( )
			( )
			( )
			( )
			( )

17 ACCESS GAINED BY (Check one)	18 TIME OF INSPECTION	19 WEATHER CONDITIONS
X PERMISSION ☐ WARRANT	8:00 AM	clear sky with light coal breeze

IV. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)	03 TELEPHONE NO
Earl Bozeman	EPA	(404)347-5065

04 PERSON RESPONSIBLE FOR SITE INSPECTION FORM	05 AGENCY	06 ORGANIZATION	07 TELEPHONE NO.	08 DATE (MONTH DAY YEAR)
Terry Ryland		NUS Corp	404 938-7710	1/17/91

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCD	980558191

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)
A SOLID
B POWDER, FINES
C SLUDGE
D OTHER (Specify)
E SLURRY
X F LIQUID
G GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)
TONS
CUBIC YARDS unknown
NO OF DRUMS

03 WASTE CHARACTERISTICS (Check all that apply)
X A TOXIC
B CORROSIVE
C RADIOACTIVE
X D PERSISTENT
E SOLUBLE
F INFECTIOUS
X G FLAMMABLE
X H IGNITABLE
X I HIGHLY VOLATILE
J EXPLOSIVE
K REACTIVE
L INCOMPATIBLE
M NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			
OLW	OILY WASTE			
SOL	SOLVENTS	✓		amounts of wastes disposed in landfill is unknown
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS	✓		
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS	✓		

IV. HAZARDOUS SUBSTANCES See Appendix for most frequently cited CAS Numbers.

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION
SOL	Acetone	75-86-5	surface soil	630 ug/kg	
OCC	Phenanthrene		" "	520	ug/kg
	Fluoranthene		" "	1100	ug/kg
	Pyrene		" "	1100	ug/kg
	Bis(2-Ethylhexyl)Phthalate		surface + Subsurface soil	900-1900	" "
MES	Barium	21109-95-5	surface soil	230	mg/kg
	Cobalt	7440-48-4	" "	240	" "
	Magnesium		" "	410-2000	" "
	Manganese		" "	65-1400	" "
	Nickel	7440-02-0	" "	7.8-30	" "

V. FEEDSTOCKS See Appendix for CAS Numbers

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Analytical data, sampling sheets

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
SCD	980558191

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 ☐ J DAMAGE TO FLORA — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

none known or observed during investigation

01 ☐ K DAMAGE TO FAUNA — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION (include name(s) of species)

none known or observed during investigation

01 ☐ L CONTAMINATION OF FOOD CHAIN — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

unknown

01 ☐ M UNSTABLE CONTAINMENT OF WASTES (Spills, Runoff, Standing liquids, Leaking drums) — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 204 homes — 04 NARRATIVE DESCRIPTION

landfill has no known containment methods

01 ☐ N DAMAGE TO OFFSITE PROPERTY — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

no offsite property was sampled during investigation

01 ☐ O CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

No sewers or storm drains located near the site.

01 ☐ P ILLEGAL/UNAUTHORIZED DUMPING — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

unknown

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS

Potential contamination of groundwater by the various organic compounds detected in the soil samples.

III. TOTAL POPULATION POTENTIALLY AFFECTED: 775

IV. COMMENTS

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

EPA + state files

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
SCD	980558191

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 ☐ A GROUNDWATER CONTAMINATION — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

Groundwater was not sampled because of depth to groundwater.

01 ☐ B SURFACE WATER CONTAMINATION — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

No contaminants from the site were detected in any of the nearby surface water bodies/streams.

01 ☐ C CONTAMINATION OF AIR — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

Air quality was not sampled.

01 ☐ D FIRE EXPLOSIVE CONDITIONS — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

None expected due to sufficient cover on landfill.

01 ☐ E DIRECT CONTACT — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

Some low levels of organics were detected near the edges of the landfill.

01 ☐ F CONTAMINATION OF SOIL — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 AREA POTENTIALLY AFFECTED _____ (Acres) 04 NARRATIVE DESCRIPTION

Surface + Subsurface soil samples did detect various concentrations of organic and inorganic compounds.

01 ☐ G DRINKING WATER CONTAMINATION — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

Not sampled, unknown.

01 ☐ H WORKER EXPOSURE INJURY — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 WORKERS POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

No workers observed at landfill except for occasional truck dumping cinders from Springs Ind.

01 ☐ I POPULATION EXPOSURE INJURY — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

None suspected or known of.

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION
PART 4 - PERMIT AND DESCRIPTIVE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCD	980558191

II. PERMIT INFORMATION

01 TYPE OF PERMIT ISSUED (Enter all that apply)	02 PERMIT NUMBER	03 DATE ISSUED	04 EXPIRATION DATE	05 COMMENTS
A. NPDES				
B. UIC				
C. AIR				
D. RCRA				
E. RCRA INTERIM STATUS				
F. SPCC PLAN				unknown
G. STATE (Specify)				
H. LOCAL (Specify)				
I. OTHER (Specify)				
J. NONE				

III. SITE DESCRIPTION

01 STORAGE/DISPOSAL (Check all that apply)	02 AMOUNT	03 UNIT OF MEASURE
A. SURFACE IMPOUNDMENT		
B. PILES		
C. DRUMS, ABOVE GROUND		
D. TANK, ABOVE GROUND		
E. TANK, BELOW GROUND		
X F. LANDFILL	unknown	
G. LANDFARM		
H. OPEN DUMP		
I. OTHER (Specify)		

04 TREATMENT (Check all that apply)

- A. INCENERATION
- B. UNDERGROUND INJECTION
- C. CHEMICAL/PHYSICAL
- D. BIOLOGICAL
- E. WASTE OIL PROCESSING
- F. SOLVENT RECOVERY
- G. OTHER RECYCLING/RECOVERY
- X H. OTHER (Specify) None

05 OTHER

- A. BUILDINGS ON SITE

06 AREA OF SITE

30 - 40 Acres

07 COMMENTS

IV. CONTAINMENT

01 CONTAINMENT OF WASTES (Check one)

A. ADEQUATE, SECURE | B. MODERATE | C. INADEQUATE, POOR | X D. INSECURE, UNSOUND, DANGEROUS

02 DESCRIPTION OF DRUMS, DIKING, LINERS, BARRIERS, ETC.

V. ACCESSIBILITY

01 WASTE EASILY ACCESSIBLE X YES ☐ NO

02 COMMENTS

Although easily accessible it is unlikely because of its remote location.

VI. SOURCES OF INFORMATION (Cite specific references, e.g. state files, sample analysis, reports)

EPA + state files

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCD	980558191

II. DRINKING WATER SUPPLY

01 TYPE OF DRINKING SUPPLY (Check as applicable)

	SURFACE	WELL
COMMUNITY	A [X]	B [X]
NON-COMMUNITY	C [ ]	D [ ]

02 STATUS

ENDANGERED	AFFECTED	MONITORED
A [ ]	B [ ]	C [ ]
D [ ]	E [ ]	F [ ]

03 DISTANCE TO SITE

A _____ (mi)

B _____ (mi)

III. GROUNDWATER

01 GROUNDWATER USE IN VICINITY (Check one)

[ ] A ONLY SOURCE FOR DRINKING [X] B DRINKING (Other sources available) COMMERCIAL INDUSTRIAL IRRIGATION (No other water sources available) [ ] C COMMERCIAL INDUSTRIAL IRRIGATION (Limited other sources available) [ ] D NOT USED UNUSEABLE

02 POPULATION SERVED BY GROUND WATER 775

03 DISTANCE TO NEAREST DRINKING WATER WELL not known (mi)

04 DEPTH TO GROUNDWATER	05 DIRECTION OF GROUNDWATER FLOW	06 DEPTH TO AQUIFER OF CONCERN	07 POTENTIAL YIELD OF AQUIFER	08 SOLE SOURCE AQUIFER
20 (ft)	west	20 (ft)	_____ (gpd)	[ ] YES [X] NO

09 DESCRIPTION OF WELLS (Including usage, depth, and location relative to population and buildings)

10 RECHARGE AREA		11 DISCHARGE AREA	
[X] YES [ ] NO	COMMENTS All surface soil is a recharge area.	[X] YES [ ] NO	COMMENTS Possible downgradient into nearby stream.

IV. SURFACE WATER

01 SURFACE WATER USE (Check one)

[ ] A RESERVOIR, RECREATION, DRINKING WATER SOURCE [ ] B IRRIGATION, ECONOMICALLY IMPORTANT RESOURCES [ ] C COMMERCIAL, INDUSTRIAL [X] D NOT CURRENTLY USED

02 AFFECTED (POTENTIALLY AFFECTED) BODIES OF WATER

NAME	AFFECTED	DISTANCE TO SITE
Middle Tyger River	[ ]	2000' (mi)
	[ ]	_____ (mi)
	[ ]	_____ (mi)

V. DEMOGRAPHIC AND PROPERTY INFORMATION

01 TOTAL POPULATION WITHIN

ONE (1) MILE OF SITE	TWO (2) MILES OF SITE	THREE (3) MILES OF SITE
A 3077 NO. OF PERSONS	B _____ NO. OF PERSONS	C. _____ NO. OF PERSONS

02 DISTANCE TO NEAREST POPULATION

800' (mi)

03 NUMBER OF BUILDINGS WITHIN TWO (2) MILES OF SITE

Entire town

04 DISTANCE TO NEAREST OFF-SITE BUILDING

800' (mi)

05 POPULATION WITHIN VICINITY OF SITE (Provide narrative description of nature of population within vicinity of site (e.g., rural village, densely populated urban area))

The site is located in a rural area ± 800' feet off a country road where a few houses are located.

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCD	980558191

VI. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE (Check one)

X A. 10^{-6} – 10^{-4} cm/sec ☐ B. 10^{-4} – 10^{-6} cm/sec ☐ C. 10^{-4} – 10^{-3} cm/sec ☐ D. GREATER THAN 10^{-3} cm/sec

02 PERMEABILITY OF BEDROCK (Check one)

☐ A. IMPERMEABLE (Less than 10^{-6} cm/sec) ☐ B. RELATIVELY IMPERMEABLE (10^{-4} – 10^{-6} cm/sec) ☐ C. RELATIVELY PERMEABLE (10^{-2} – 10^{-4} cm/sec) ☐ D. VERY PERMEABLE (Greater than 10^{-2} cm/sec)

03 DEPTH TO BEDROCK	04 DEPTH OF CONTAMINATED SOIL ZONE	05 SOIL pH
1 - 20 (ft)	unknown (ft)	

06 NET PRECIPITATION	07 ONE YEAR 24 HOUR RAINFALL	08 SLOPE: SITE SLOPE	DIRECTION OF SITE SLOPE	TERRAIN AVERAGE SLOPE
12 (in)	3.5 (in)	20 %	west	2.0 %

09 FLOOD POTENTIAL

SITE IS IN _____ YEAR FLOODPLAIN

10 ☐ SITE IS ON BARRIER ISLAND, COASTAL HIGH HAZARD AREA, RIVERINE FLOODWAY

11 DISTANCE TO WETLANDS (5 acre minimum)

ESTUARINE A _____ (mi) OTHER B _____ (mi)

12 DISTANCE TO CRITICAL HABITAT (of endangered species) _____ (mi)

ENDANGERED SPECIES _____

13 LAND USE IN VICINITY

DISTANCE TO

COMMERCIAL INDUSTRIAL	RESIDENTIAL AREAS, NATIONAL STATE PARKS, FORESTS, OR WILDLIFE RESERVES	AGRICULTURAL LANDS: PRIME AG LAND	AGRICULTURAL LANDS: AG LAND
A 1 (mi)	B _____ (mi)	C <1 (mi)	D <1 (mi)

14 DESCRIPTION OF SITE IN RELATION TO SURROUNDING TOPOGRAPHY

Site located in rural area between 3 or 4 small towns. Small stream located on west side of site. Area has gentle rolling hills nearby but site is relatively level.

VII. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

NUS Field logbook

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 6 - SAMPLE AND FIELD INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
SCD	980558191

II. SAMPLES TAKEN

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 SAMPLES SENT TO	03 ESTIMATED DATE RESULTS AVAILABLE
GROUNDWATER	none		
SURFACE WATER	4	CLP labs	
WASTE			
AIR			
RUNOFF			
SPILL			
SOIL	14	CLP labs	
VEGETATION			
OTHER			

III. FIELD MEASUREMENTS TAKEN

01 TYPE	02 COMMENTS
Surface water	4 surface water samples were collected and measured for pH, conductivity, Temp (°C). Results are shown in Table 2 of report.

IV. PHOTOGRAPHS AND MAPS

01 TYPE X GROUND ☐ AERIAL — 02 IN CUSTODY OF NUS Corp. (Name of organization or individual)

03 MAPS X YES ☐ NO — 04 LOCATION OF MAPS NUS Corp.

V. OTHER FIELD DATA COLLECTED (Provide narrative description)

VI. SOURCES OF INFORMATION (Cite specific references, e.g. state files, sample analysis, reports)

NUS Field logbook

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 7 - OWNER INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCD	980 558 191

II. CURRENT OWNER(S)

01 NAME	02 D+B NUMBER	04 SIC CODE
Springs Ind.		
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE
Startex	S.C.	29377

01 NAME	02 D+B NUMBER	04 SIC CODE
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER	04 SIC CODE
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE

PARENT COMPANY (If applicable)

08 NAME	09 D+B NUMBER	11 SIC CODE
Springs Ind.		
10 STREET ADDRESS (P.O. Box, RFD #, etc.)		
12 CITY	13 STATE	14 ZIP CODE

08 NAME	09 D+B NUMBER	11 SIC CODE
10 STREET ADDRESS (P.O. Box, RFD #, etc.)		
12 CITY	13 STATE	14 ZIP CODE

08 NAME	09 D+B NUMBER	11 SIC CODE
10 STREET ADDRESS (P.O. Box, RFD #, etc.)		
12 CITY	13 STATE	14 ZIP CODE

III. PREVIOUS OWNER(S) (List most recent first)

01 NAME	02 D+B NUMBER	04 SIC CODE
Lyman Dying + Finishing		
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE
Startex		

01 NAME	02 D+B NUMBER	04 SIC CODE
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER	04 SIC CODE
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE

IV. REALTY OWNER(S) (If applicable, list most recent first)

01 NAME	02 D+B NUMBER	04 SIC CODE
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER	04 SIC CODE
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER	04 SIC CODE
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

EPA + State files

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 8 - OPERATOR INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCD	980 558 191

II. CURRENT OPERATOR (Provide if different from owner)

01 NAME	02 D+B NUMBER
Springs Ind	

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE
Startex	S.C.	

08 YEARS OF OPERATION	09 NAME OF OWNER

OPERATOR'S PARENT COMPANY (If applicable)

10 NAME	11 D+B NUMBER

12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE

14 CITY	15 STATE	16 ZIP CODE

III. PREVIOUS OPERATOR(S) (List most recent first; provide only if different from owner)

PREVIOUS OPERATORS' PARENT COMPANIES (If applicable)

01 NAME	02 D+B NUMBER	10 NAME	11 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE

05 CITY	06 STATE	07 ZIP CODE	14 CITY	15 STATE	16 ZIP CODE

08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

01 NAME	02 D+B NUMBER	10 NAME	11 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE

05 CITY	06 STATE	07 ZIP CODE	14 CITY	15 STATE	16 ZIP CODE

08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

01 NAME	02 D+B NUMBER	10 NAME	11 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE

05 CITY	06 STATE	07 ZIP CODE	14 CITY	15 STATE	16 ZIP CODE

08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

IV. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

EPA + state files

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 9 - GENERATOR/TRANSPORTER INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCO	980558191

II. ON-SITE GENERATOR

01 NAME	02 D+B NUMBER	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	
05 CITY	06 STATE / 07 ZIP CODE	

III. OFF-SITE GENERATOR(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE
01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE

IV. TRANSPORTER(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE
01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE

V. SOURCES OF INFORMATION *(Cite specific references, e.g., state files, sample analysis, reports.)*

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
SCD	980558191

II. PAST RESPONSE ACTIVITIES

01 ☐ A. WATER SUPPLY CLOSED 04 DESCRIPTION No	02 DATE	03 AGENCY
01 ☐ B. TEMPORARY WATER SUPPLY PROVIDED 04 DESCRIPTION No	02 DATE	03 AGENCY
01 ☐ C. PERMANENT WATER SUPPLY PROVIDED 04 DESCRIPTION No	02 DATE	03 AGENCY
01 ☐ D. SPILLED MATERIAL REMOVED 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ E. CONTAMINATED SOIL REMOVED 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ F. WASTE REPACKAGED 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ G. WASTE DISPOSED ELSEWHERE 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ H. ON SITE BURIAL 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ I. IN SITU CHEMICAL TREATMENT 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ J. IN SITU BIOLOGICAL TREATMENT 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ K. IN SITU PHYSICAL TREATMENT 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ L. ENCAPSULATION 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ M. EMERGENCY WASTE TREATMENT 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ N. CUTOFF WALLS 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ O. EMERGENCY DIKING SURFACE WATER DIVERSION 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ P. CUTOFF TRENCHES SUMP 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ Q. SUBSURFACE CUTOFF WALL 04 DESCRIPTION unknown	02 DATE	03 AGENCY

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCD	980558191

II PAST RESPONSE ACTIVITIES (Continued)

01 ☐ R. BARRIER WALLS CONSTRUCTED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
unknown

01 ☐ S. CAPPING COVERING — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
unknown

01 ☐ T. BULK TANKAGE REPAIRED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
No

01 ☐ U. GROUT CURTAIN CONSTRUCTED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
No

01 ☐ V. BOTTOM SEALED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
No

01 ☐ W. GAS CONTROL — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
No

01 ☐ X. FIRE CONTROL — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
No

01 ☐ Y. LEACHATE TREATMENT — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
No

01 ☐ Z. AREA EVACUATED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
unknown

01 ☐ 1. ACCESS TO SITE RESTRICTED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
Yes, gate at front entrance

01 ☐ 2. POPULATION RELOCATED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
No

01 ☐ 3. OTHER REMEDIAL ACTIVITIES — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
None known

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

EPA + State files

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 11 - ENFORCEMENT INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
SCD	980 558 191

II. ENFORCEMENT INFORMATION

01 PAST REGULATORY ENFORCEMENT ACTION YES X NO

02 DESCRIPTION OF FEDERAL, STATE, LOCAL REGULATORY ENFORCEMENT ACTION

None known

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports.)

EPA + state files

EPA FORM 2070-13 (7-81)

APPENDIX

I. FEEDSTOCKS

CAS Number	Chemical Name
1. 7664-41-7	Ammonia
2. 7440-36-0	Antimony
3. 1309-64-4	Antimony Trioxide
4. 7440-38-2	Arsenic
5. 1327-53-3	Arsenic Trioxide
6. 21109-95-5	Barium Sulfide
7. 7726-95-6	Bromine
8. 106-99-0	Butadiene
9. 7440-43-9	Cadmium
10. 7782-50-5	Chlorine
11. 12737-27-8	Chromite
12. 7440-47-3	Chromium
13. 7440-48-4	Cobalt
14. 1317-38-0	Cupric Oxide
15. 7758-98-7	Cupric Sulfate
16. 1317-39-1	Cuprous Oxide
17. 74-85-1	Ethylene
18. 7647-01-0	Hydrochloric Acid
19. 7664-39-3	Hydrogen Fluoride
20. 1335-25-7	Lead Oxide
21. 7439-97-6	Mercury
22. 74-82-8	Methane
23. 91-20-3	Napthalene
24. 7440-02-0	Nickel
25. 7697-37-2	Nitric Acid
26. 7723-14-0	Phosphorus
27. 7778-50-9	Potassium Dichromate
28. 1310-58-3	Potassium Hydroxide
29. 115-07-1	Propylene
30. 10588-01-9	Sodium Dichromate
31. 1310-73-2	Sodium Hydroxide
32. 7646-78-8	Stannic Chloride
33. 7772-99-8	Stannous Chloride
34. 7664-93-9	Sulfuric Acid
35. 108-88-3	Toluene
36. 1330-20-7	Xylene
37. 7646-85-7	Zinc Chloride
38. 7733-02-0	Zinc Sulfate

II. HAZARDOUS SUBSTANCES

CAS Number	Chemical Name
1. 75-07-0	Acetaldehyde
2. 64-19-7	Acetic Acid
3. 108-24-7	Acetic Anhydride
4. 75-86-5	Acetone Cyanohydrin
5. 506-96-7	Acetyl Bromide
6. 75-36-5	Acetyl Chloride
7. 107-02-8	Acrolein
8. 107-13-1	Acrylonitrile
9. 124-04-9	Adipic Acid
10. 309-00-2	Aldrin
11. 10043-01-3	Aluminum Sulfate
12. 107-18-6	Allyl Alcohol
13. 107-05-1	Allyl Chloride
14. 7664-41-7	Ammonia
15. 631-61-8	Ammonium Acetate
16. 1863-63-4	Ammonium Benzoate
17. 1066-33-7	Ammonium Bicarbonate
18. 7789-09-5	Ammonium Bichromate
19. 1341-49-7	Ammonium Bifluoride
20. 10192-30-0	Ammonium Bisulfite
21. 1111-78-0	Ammonium Carbamate
22. 12125-02-9	Ammonium Chloride
23. 7788-98-9	Ammonium Chromate
24. 3012-65-5	Ammonium Citrate, Dibasic
25. 13826-83-0	Ammonium Fluoborate
26. 12125-01-8	Ammonium Fluoride
27. 1336-21-6	Ammonium Hydroxide
28. 6009-70-7	Ammonium Oxalate
29. 16919-19-0	Ammonium Silicofluoride
30. 7773-06-0	Ammonium Sulfamate
31. 12135-76-1	Ammonium Sulfide
32. 10196-04-0	Ammonium Sulfite
33. 14307-43-8	Ammonium Tartrate
34. 1762-95-4	Ammonium Thiocyanate
35. 7783-18-8	Ammonium Thiosulfate
36. 628-63-7	Amyl Acetate
37. 62-53-3	Aniline
38. 7647-18-9	Antimony Pentachloride
39. 7789-61-9	Antimony Tribromide
40. 10025-91-9	Antimony Trichloride
41. 7783-56-4	Antimony Trifluoride
42. 1309-64-4	Antimony Trioxide
43. 1303-32-8	Arsenic Disulfide
44. 1303-28-2	Arsenic Pentoxide
45. 7784-34-1	Arsenic Trichloride
46. 1327-53-3	Arsenic Trioxide
47. 1303-33-9	Arsenic Trisulfide
48. 542-62-1	Barium Cyanide
49. 71-43-2	Benzene
50. 65-85-0	Benzoic Acid
51. 100-47-0	Benzonitrile
52. 98-88-4	Benzoyl Chloride
53. 100-44-7	Benzyl Chloride
54. 7440-41-7	Beryllium
55. 7787-47-5	Beryllium Chloride
56. 7787-49-7	Beryllium Fluoride
57. 13597-99-4	Beryllium Nitrate
58. 123-86-4	Butyl Acetate
59. 84-74-2	n-Butyl Phthalate
60. 109-73-9	Butylamine
61. 107-92-6	Butyric Acid
62. 543-90-8	Cadmium Acetate
63. 7789-42-6	Cadmium Bromide
64. 10108-64-2	Cadmium Chloride
65. 7778-44-1	Calcium Arsenate
66. 52740-16-6	Calcium Arsenite
67. 75-20-7	Calcium Carbide
68. 13765-19-0	Calcium Chromate
69. 592-01-8	Calcium Cyanide
70. 26264-06-2	Calcium Dodecylbenzene Sulfonate
71. 7778-54-3	Calcium Hypochlorite
72. 133-06-2	Captan
73. 63-25-2	Carbaryl
74. 1563-66-2	Carbofuran
75. 75-15-0	Carbon Disulfide
76. 56-23-5	Carbon Tetrachloride
77. 57-74-9	Chlordane
78. 7782-50-5	Chlorine
79. 108-90-7	Chlorobenzene
80. 67-66-3	Chloroform
81. 7790-94-5	Chlorosulfonic Acid
82. 2921-88-2	Chlorpyrifos
83. 1066-30-4	Chromic Acetate
84. 7738-94-5	Chromic Acid
85. 10101-53-8	Chromic Sulfate
86. 10049-05-5	Chromous Chloride
87. 544-18-3	Cobaltous Formate
88. 14017-41-5	Cobaltous Sulfamate
89. 56-72-4	Coumaphos
90. 1319-77-3	Cresol
91. 4170-30-3	Crotonaldehyde
92. 142-71-2	Cupric Acetate
93. 12002-03-8	Cupric Acetoarsenite
94. 7447-39-4	Cupric Chloride
95. 3251-23-8	Cupric Nitrate
96. 5893-66-3	Cupric Oxalate
97. 7758-98-7	Cupric Sulfate
98. 10380-29-7	Cupric Sulfate Ammoniated
99. 815-82-7	Cupric Tartrate
100. 506-77-4	Cyanogen Chloride
101. 110-82-7	Cyclohexane
102. 94-75-7	2,4-D Acid
103. 94-11-1	2,4-D Esters
104. 50-29-3	DDT
105. 333-41-5	Diazinon
106. 1918-00-9	Dicamba
107. 1194-65-6	Dichlobenil
108. 117-80-6	Dichlone
109. 25321-22-6	Dichlorobenzene (all isomers)
110. 266-38-19-7	Dichloropropane (all isomers)
111. 26952-23-8	Dichloropropene (all isomers)
112. 8003-19-8	Dichloropropene-Dichloropropane Mixture
113. 75-99-0	2-2-Dichloropropionic Acid
114. 62-73-7	Dichlorvos
115. 60-57-1	Dieldrin
116. 109-89-7	Diethylamine
117. 124-40-3	Dimethylamine
118. 25154-54-5	Dinitrobenzene (all isomers)
119. 51-28-5	Dinitrophenol
120. 25321-14-6	Dinitrotoluene (all isomers)
121. 85-00-7	Diquat
122. 298-04-4	Disulfoton
123. 330-54-1	Diuron
124. 27176-87-0	Dodecylbenzenesulfonic Acid
125. 115-29-7	Endosulfan (all isomers)
126. 72-20-8	Endrin and Metabolites
127. 106-89-8	Epichlorohydrin
128. 563-12-2	Ethion
129. 100-41-4	Ethyl Benzene
130. 107-15-3	Ethylenediamine
131. 106-93-4	Ethylene Dibromide
132. 107-06-2	Ethylene Dichloride
133. 60-00-4	EDTA
134. 1185-57-5	Ferric Ammonium Citrate
135. 2944-67-4	Ferric Ammonium Oxalate
136. 7705-08-0	Ferric Chloride

II. HAZARDOUS SUBSTANCES

CAS Number	Chemical Name
137. 7783-50-8	Ferric Fluoride
138. 10421-48-4	Ferric Nitrate
139. 10028-22-5	Ferric Sulfate
140. 10045-89-3	Ferrous Ammonium Sulfate
141. 7758-94-3	Ferrous Chloride
142. 7720-78-7	Ferrous Sulfate
143. 206-44-0	Fluoranthene
144. 50-00-0	Formaldehyde
145. 64-18-6	Formic Acid
146. 110-17-8	Fumaric Acid
147. 98-01-1	Furfural
148. 86-50-0	Guthion
149. 76-44-8	Heptachlor
150. 118-74-1	Hexachlorobenzene
151. 87-68-3	Hexachlorobutadiene
152. 67-72-1	Hexachloroethane
153. 70-30-4	Hexachlorophene
154. 77-47-4	Hexachlorocyclopentadiene
155. 7647-01-0	Hydrochloric Acid (Hydrogen Chloride)
156. 7664-39-3	Hydrofluoric Acid (Hydrogen Fluoride)
157. 74-90-8	Hydrogen Cyanide
158. 7783-06-4	Hydrogen Sulfide
159. 78-79-5	Isoprene
160. 42504-46-1	Isopropanolamine Dodecylbenzenesulfonate
161. 115-32-2	Kelthane
162. 143-50-0	Kepone
163. 301-04-2	Lead Acetate
164. 3687-31-8	Lead Arsenate
165. 7758-95-4	Lead Chloride
166. 13814-96-5	Lead Fluoborate
167. 7783-46-2	Lead Fluoride
168. 10101-63-0	Lead Iodide
169. 18256-98-9	Lead Nitrate
170. 7428-48-0	Lead Stearate
171. 15739-80-7	Lead Sulfate
172. 1314-87-0	Lead Sulfide
173. 592-87-0	Lead Thiocyanate
174. 58-89-9	Lindane
175. 14307-35-8	Lithium Chromate
176. 121-75-5	Malthion
177. 110-16-7	Maleic Acid
178. 108-31-6	Maleic Anhydride
179. 2032-65-7	Mercaptodimethur
180. 592-04-1	Mercuric Cyanide
181. 10045-94-0	Mercuric Nitrate
182. 7783-35-9	Mercuric Sulfate
183. 592-85-8	Mercuric Thiocyanate
184. 10415-75-5	Mercurous Nitrate
185. 72-43-5	Methoxychlor
186. 74-93-1	Methyl Mercaptan
187. 80-62-6	Methyl Methacrylate
188. 298-00-0	Methyl Parathion
189. 7786-34-7	Mevinphos
190. 315-18-4	Mexacarbate
191. 75-04-7	Monoethylamine
192. 74-89-5	Monomethylamine
193. 300-76-5	Naled
194. 91-20-3	Naphthalene
195. 1338-24-5	Naphthenic Acid
196. 7440-02-0	Nickel
197. 15699-18-0	Nickel Ammonium Sulfate
198. 37211-05-5	Nickel Chloride
199. 12054-48-7	Nickel Hydroxide
200. 14216-75-2	Nickel Nitrate
201. 7786-81-4	Nickel Sulfate
202. 7697-37-2	Nitric Acid
203. 98-95-3	Nitrobenzene
204. 10102-44-0	Nitrogen Dioxide
205. 25154-55-6	Nitrophenol (all isomers)
206. 1321-12-6	Nitrotoluene
207. 30525-89-4	Paraformaldehyde
208. 56-38-2	Parathion
209. 608-93-5	Pentachlorobenzene
210. 87-86-5	Pentachlorophenol
211. 85-01-8	Phenanthrene
212. 108-95-2	Phenol
213. 75-44-5	Phosgene
214. 7664-38-2	Phosphoric Acid
215. 7723-14-0	Phosphorus
216. 10025-87-3	Phosphorus Oxychloride
217. 1314-80-3	Phosphorus Pentasulfide
218. 7719-12-2	Phosphorus Trichloride
219. 7784-41-0	Potassium Arsenate
220. 10124-50-2	Potassium Arsenite
221. 7778-50-9	Potassium Bichromate
222. 7789-00-6	Potassium Chromate
223. 7722-64-7	Potassium Permanganate
224. 2312-35-8	Propargite
225. 79-09-4	Propionic Acid
226. 123-62-6	Propionic Anhydride
227. 1336-36-3	Polychlorinated Biphenyls
228. 151-50-8	Potassium Cyanide
229. 1310-58-3	Potassium Hydroxide
230. 75-56-9	Propylene Oxide
231. 121-29-9	Pyrethrins
232. 91-22-5	Quinoline
233. 108-46-3	Resorcinol
234. 7446-08-4	Selenium Oxide
235. 7761-88-8	Silver Nitrate
236. 7631-89-2	Sodium Arsenate
237. 7784-46-5	Sodium Arsenite
238. 10588-01-9	Sodium Bichromate
239. 1333-83-1	Sodium Bifluoride
240. 7631-90-5	Sodium Bisulfite
241. 7775-11-3	Sodium Chromate
242. 143-33-9	Sodium Cyanide
243. 25155-30-0	Sodium Dodecylbenzene Sulfonate
244. 7681-49-4	Sodium Fluoride
245. 16721-80-5	Sodium Hydrosulfide
246. 1310-73-2	Sodium Hydroxide
247. 7681-52-9	Sodium Hypochlorite
248. 124-41-4	Sodium Methylate
249. 7632-00-0	Sodium Nitrate
250. 7558-79-4	Sodium Phosphate, Dibasic
251. 7601-54-9	Sodium Phosphate, Tribasic
252. 10102-18-8	Sodium Selenite
253. 7789-06-2	Strontium Chromate
254. 57-24-9	Strychnine and Salts
255. 100-420-5	Styrene
256. 12771-08-3	Sulfur Monochloride
257. 7664-93-9	Sulfuric Acid
258. 93-76-5	2,4,5-T Acid
259. 2008-46-0	2,4,5-T Amines
260. 93-79-8	2,4,5-T Esters
261. 13560-99-1	2,4,5-T Salts
262. 93-72-1	2,4,5-TP Acid
263. 32534-95-5	2,4,5-TP Acid Esters
264. 72-54-8	TDE
265. 95-94-3	Tetrachlorobenzene
266. 127-18-4	Tetrachloroethane
267. 78-00-2	Tetraethyl Lead
268. 107-49-3	Tetraethyl Pyrophosphate
269. 7446-18-6	Thallium (I) Sulfate
270. 108-88-3	Toluene
271. 8001-35-2	Toxaphene
272. 12002-48-1	Trichlorobenzene (all isomers)
273. 52-68-6	Trichlorfon
274. 25323-89-1	Trichloroethane (all isomers)
275. 79-01-6	Trichloroethylene
276. 25167-82-2	Trichlorophenol (all isomers)
277. 27323-41-7	Triethanolamine Dodecylbenzenesulfonate
278. 121-44-8	Triethylamine
279. 75-50-3	Trimethylamine
280. 541-09-3	Uranyl Acetate
281. 10102-06-4	Uranyl Nitrate
282. 1314-62-1	Vanadium Pentoxide
283. 27774-13-6	Vanadyl Sulfate
284. 108-05-4	Vinyl Acetate
285. 75-35-4	Vinylidene Chloride
286. 1300-71-6	Xylenol
287. 557-34-6	Zinc Acetate
288. 52628-25-8	Zinc Ammonium Chloride
289. 1332-07-6	Zinc Borate
290. 7699-45-8	Zinc Bromide
291. 3486-35-9	Zinc Carbonate
292. 7646-85-7	Zinc Chloride
293. 557-21-1	Zinc Cyanide
294. 7783-49-3	Zinc Fluoride
295. 557-41-5	Zinc Formate
296. 7779-86-4	Zinc Hydrosulfite
297. 7779-88-6	Zinc Nitrate
298. 127-82-2	Zinc Phenolsulfonate
299. 1314-84-7	Zinc Phosphide
300. 16871-71-9	Zinc Silicofluoride
301. 7733-02-0	Zinc Sulfate
302. 13746-89-9	Zirconium Nitrate
303. 16923-95-8	Zirconium Potassium Fluoride
304. 14644-61-2	Zirconium Sulfate
305. 10026-11-6	Zirconium Tetrachloride

EPA Notification o[illegible] [illegible]zardous Waste Site

United Sta[illegible] Environm[illegible] Agency Washingt[illegible]

R

This initial notification inform[illegible] required by Section 103(c) of t[illegible] hensive Environmental Respor[illegible] sation, and Liability Act of 1980 and must be mailed by June 9, 1981.

REFERENCE NO. 3 — 810609

which applies.

SCS000001103

A Person Required to Notify:

Enter the name and address of the person or organization required to notify.

Name: Lyman Dyeing and Finishing Co.

Street: Pacific Street

City: Lyman State: S.C. Zip Code: 29365

B Site Location:

Enter the common name (if known) and actual location of the site.

SCD980558191

Name of Site: Old Startex Spartanburg County Landfill

Street: End of road going south off old US 29 at Walt Moore's Stc

City: Startex County: Spartanburg State: S. C. Zip Code: 29377

C Person to Contact:

Enter the name, title (if applicable), and business telephone number of the person to contact regarding information submitted on this form.

Name (Last First and Title): Holsten, John - Director of Regulatory Affairs

Phone: 803/433-4113

D Dates of Waste Handling:

Enter the years that you estimate waste treatment, storage, or disposal began and ended at the site.

From (Year): 1966-68 To (Year): ~~present~~ 1981

E Waste Type: Choose the option you prefer to complete

Option I: Select general waste types and source categories. If you do not know the general waste types or sources, you are encouraged to describe the site in Item I—Description of Site.

General Type of Waste: Place an X in the appropriate boxes. The categories listed overlap. Check each applicable category.

1. ☒ Organics
2. ☒ Inorganics
3. ☐ Solvents
4. ☐ Pesticides
5. ☐ Heavy metals
6. ☐ Acids
7. ☐ Bases
8. ☐ PCBs
9. ☒ Mixed Municipal Waste
10. ☒ Unknown
11. ☐ Other (Specify)

Source of Waste: Place an X in the appropriate boxes.

1. ☐ Mining
2. ☐ Construction
3. ☒ Textiles
4. ☐ Fertilizer
5. ☐ Paper/Printing
6. ☐ Leather Tanning
7. ☐ Iron/Steel Foundry
8. ☐ Chemical, General
9. ☐ Plating/Polishing
10. ☐ Military/Ammunition
11. ☐ Electrical Conductors
12. ☐ Transformers
13. ☐ Utility Companies
14. ☒ Sanitary/Refuse
15. ☐ Photofinish
16. ☐ Lab/Hospital
17. ☒ Unknown
18. ☐ Other (Specify)

Option 2: This option is available to persons familiar with the Resource Conservation and Recovery Act (RCRA) Section 3001 regulations (40 CFR Part 261).

Specific Type of Waste: EPA has assigned a four-digit number to each hazardous waste listed in the regulations under Section 3001 of RCRA. Enter the appropriate four-digit number in the boxes provided. A copy of the list of hazardous wastes and codes can be obtained by contacting the EPA Region serving the State in which the site is located.

RECEIVED EPA/REGION IV JUN 24 11 11 AM '81 ENVIRONMENT DIVISION

RECEIVED EPA/REGION IV JUN 8 12 32 PM '81 ENVIRONMENT DIVISION

0901760 00311

Form Approved OMB No. 2000-0138

EPA Form 8900-1

F. Waste Quantity:

Place an X in the appropriate boxes to indicate the facility types found at the site.

In the "total facility waste amount" space give the estimated combined quantity (volume) of hazardous wastes at the site using cubic feet or gallons.

In the "total facility area" space, give the estimated area size which the facilities occupy using square feet or acres.

Facility Type

1. ☐ Piles
2. ☐ Land Treatment
3. ☒ Landfill
4. ☐ Tanks
5. ☐ Impoundment
6. ☐ Underground Injection
7. ☐ Drums, Above Ground
8. ☐ Drums, Below Ground
9. ☐ Other (Specify) _____

Total Facility Waste Amount C

cubic feet 13 26 million

gallons

Total Facility Area

square feet

acres ~~30~~ 40 A

G Known, Suspected or Likely Releases to the Environment:

Place an X in the appropriate boxes to indicate any known, suspected, or likely releases of wastes to the environment.

☐ Known ☒ Suspected ☐ Likely ☐ Nc

Note: Items H and I are optional. Completing these items will assist EPA and State and local governments in locating and assess hazardous waste sites. Although completing the items is not required, you are encouraged to do so.

H Sketch Map of Site Location: (Optional)

Sketch a map showing streets, highways, routes or other prominent landmarks near the site. Place an X on the map to indicate the site location. Draw an arrow showing the direction north. You may substitute a publishing map showing the site location.

I Description of Site: (Optional)

Describe the history and present conditions of the site. Give directions to the site and describe any nearby wells, springs, lakes, or housing. Include such information as how waste was disposed and where the waste came from. Provide any other information or comments which may help describe the site conditions.

(see attachment)

J Signature and Title:

The person or authorized representative (such as plant managers, superintendents, trustees or attorneys) of persons required to notify must sign the form and provide a mailing address (if different than address in item A). For other persons providing notification, the signature is optional. Check the boxes which best describe the relationship to the site of the person required to notify. If you are not required to notify check "Other".

Lamar T. Oxford

Name Lamar T. Oxford, Vice President

Street

City State Zip Code

Signature Date 6/22/81

☒ Owner, Prese
☐ Owner, Past
☐ Transporter
☐ Operator, Pre
☐ Operator, Pas
☐ Other

I. The Old Startex Spartanburg County Landfill was opened in the middle-to-late 1960's, probably some time between 1966-1968. This land was and is owned by Lyman Printing & Finishing Company but was operated for several years by Spartanburg County with the understanding that Lyman P&F Co. could use the dump at no charge. Spartanburg County operated the dump site from its opening until some time in the early 1970's. During county operation the site was used for landfill disposal of domestic and industrial wastes or refuse. Industrial wastes were not limited to those originating from Lyman P&F Co. The identity and quantity of industrial wastes disposed of at this dump by Lyman P&F Co. during county operation are not known, but it is possible, because of the nature of the wastes generated by textile printing and finishing operations of that time, that some of those wastes would be classified as "hazardous" under current definitions. When Spartanburg County ceased operations at the site, Lyman P&F Co. closed access to the site to the public and other industries. Since that time, Lyman P&F Co. (now Lyman D&F Co.) has used the site as a disposal site for only broken wooden pallets and cinders from their boiler house.

We are reporting this site strictly because we do not know what all was dumped at the site during its active years. We know of no adverse environmental effects or of any health hazards posed by this dump.

REFERENCE NO. 5

"Rite in the Rain®"

ALL-WEATHER

LEVEL

Notebook No. 311

F4-2550

Old Stoneflex Landfill
Spartanburg County, S.C.
TDD F4-9007-22-
Terry Ryland

LOGBOOK REQUIREMENTS
REVISED - NOVEMBER 29, 1988

NOTE: ALL LANGUAGE SHOULD BE FACTUAL AND OBJECTIVE

1. Record on front cover of the Logbook. TDD No., Site Name, Site Location, Project Manager.
2. All entries are made using ink. Draw a single line through errors. Initial and date corrections.
3. Statement of Work Plan, Study Plan, and Safety Plan discussion and distribution to field team with team members' signatures.
4. Record weather conditions and general site information.
5. Sign and date each page. Project Manager is to review and sign off on each logbook daily.
6. Document all calibration and pre-operational checks of equipment. Provide serial numbers of equipment used onsite.
7. Provide reference to Sampling Field Sheets for detailed sampling information.
8. Describe sampling locations in detail and document all changes from project planning documents.
9. Provide a site sketch with sample locations and photo locations.
10. Maintain photo log by completing the stamped information at the end of the logbook.
11. If no site representative is on hand to accept the receipt for samples, an entry to that effect must be placed in the logbook.
12. Record I.D. numbers of COC and receipt for sample forms used. Also record numbers of destroyed documents.
13. Complete SMO information in the space provided.

The following people have read and understand the work plan and study plan.

Terry Ryland 9-24-90
Terry Bland
Willie Smitherman
W Dantes
Maurice Rowan
Maurice Rowan Jr.
Alvin Williams
Alvin Williams
Sam McIver
Ron McIver
John [illegible] 9/29/90

Terry Bland 9-24-90

Monday 9-24-90

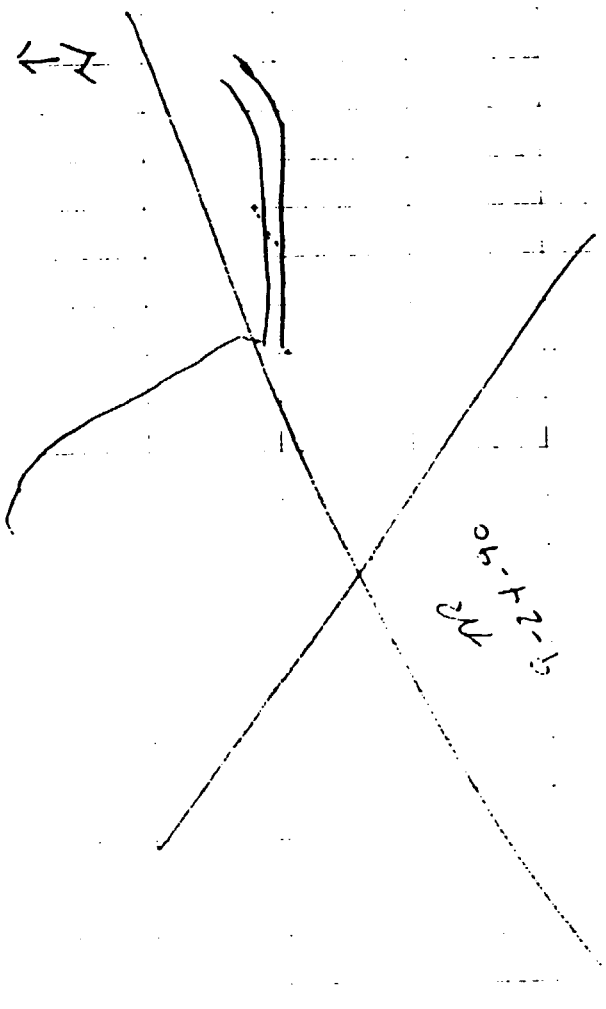
8:00 Arrived on site
Weather: clear sky with light cool breeze.

Site covered with a black to gray colored gravely material. Light weight and looks similar to lava rocks. Was informed that it is coal cinders.

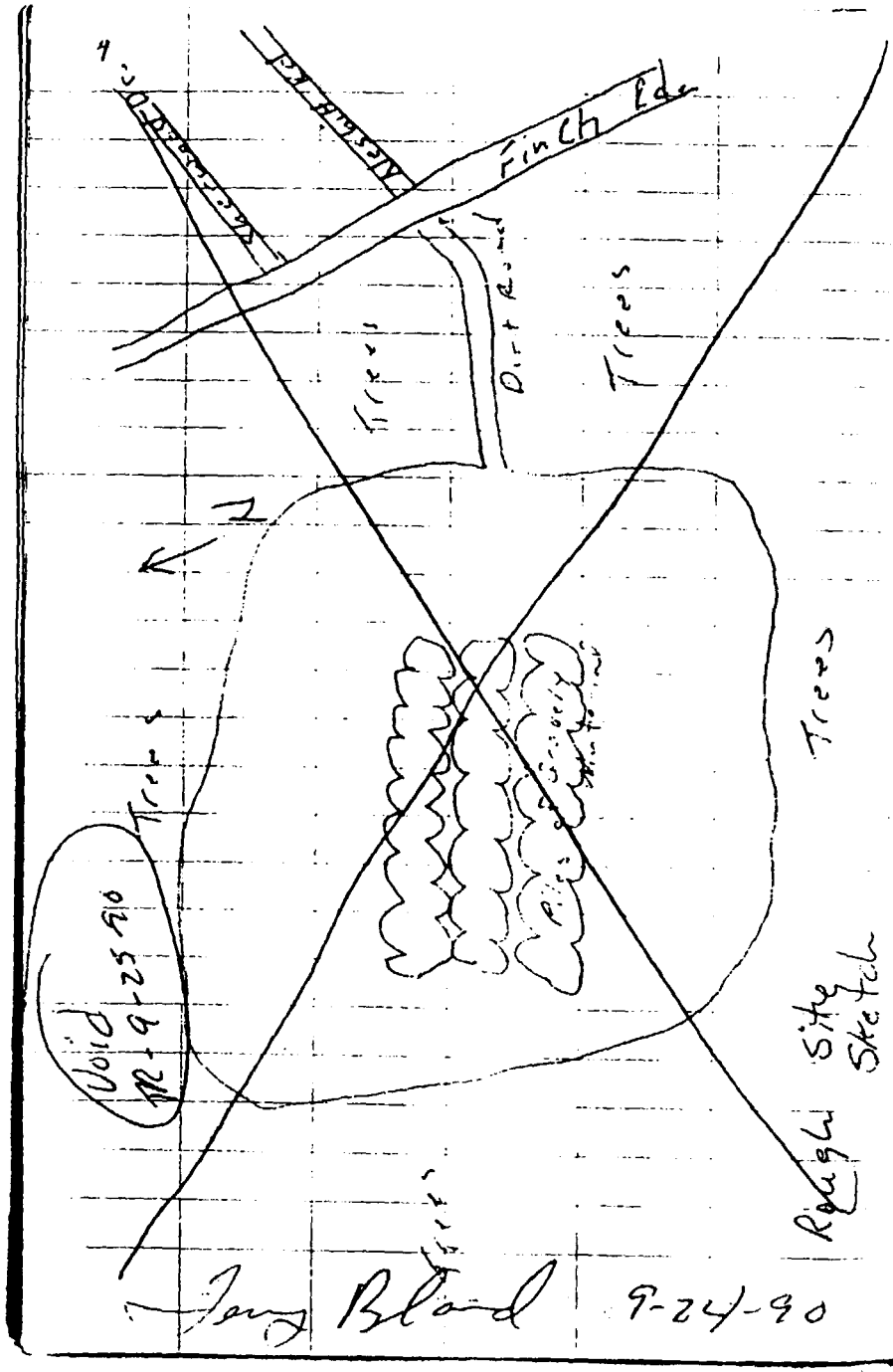
9:00 Set up near Finch Road to collect background sample.

9:15 Collected OS-SS-01
9:30 Collected OS-SB-01 at 6' bls.
9:45 Augered to 15' bls and hit a rock. Could not go deeper. No water in well. Soil, dry. Abandoned attempt for a temporary well.

Jerry Bland 9-24-90



Jerry Bland 9-24-90



Jerry Bland 9-24-90

11:00 Springs Ind. consultant arrived on site.

His name is Vince Blount - Geologists w/ Universal Engineering Sciences

3532 Maggie Blvd.
Orlando, Florida 32811
(407) 423-0504
Fax (407) 423-3106

I did not know Springs Ind. was using a consultant. Previous attempts to contact the company resulted in talking to no one associated with the landfill.

Vince wants to split samples and oversee the geophysical and FASP operations.

Jerry Bland 9-24-90

We had to disregard the previously collected background sample and recollect it tomorrow when Vince is here to watch and get his split sample.

The rest of today will be used to determine sampling locations.

John's crew went to his site to conduct the geophysical and FASP.

There are two landfills located close together, both owned by Springs Ind. or associated with Springs Incl. John Schendel is investigating one site and I the other. Geo + FASP are conducted on John's site only.

Jay Blad 9-24-90

We must wait for it to be completed of FASP and Geo before the consultant can come to my site to view the sampling of soils and sed. from old starter landfill.

12:00 leave site for lunch.

13:00
1:00pm Back from lunch

Going search out sampling locations for sed. + SW to be collected tomorrow.

15:00
3:00 P.M Sampling locations have been found. Now, going to check on the other crew's progress.

18:00 leave for the day,

Jay Blad 9-24-90

8

Tuesday 9-25-90

8:00 Arrived on site
Weather is the same as yesterday.

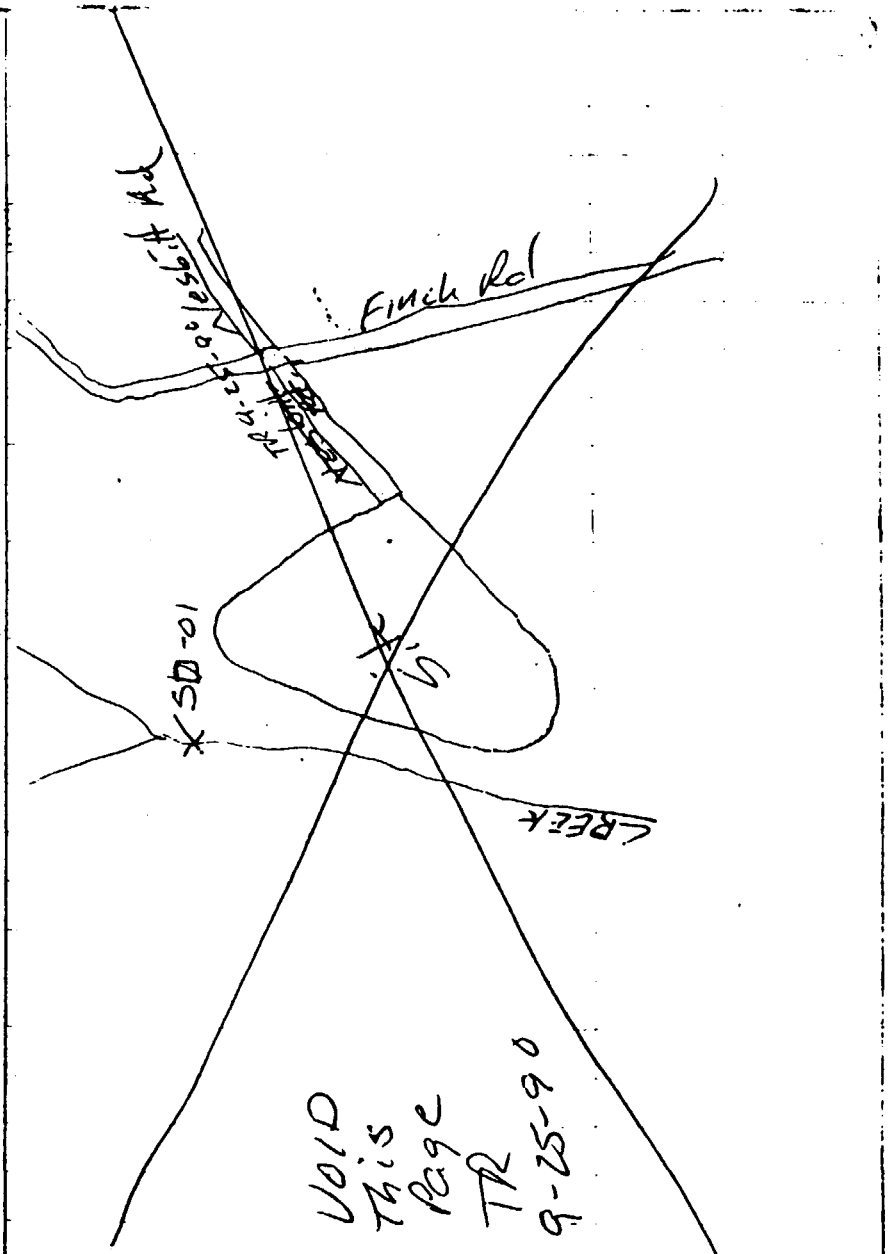
Getting things ready to collect the background sed. + surface water.

Vince will be coming with us to collect his splits.

8:55 (SD-01) collected upgradient of site along perennial stream.
(SW-01) collected at same location

9:15 Decal # 683235 pH meter calibrated by W. Smitherman

Jerry Bland 9-25-90



VOID
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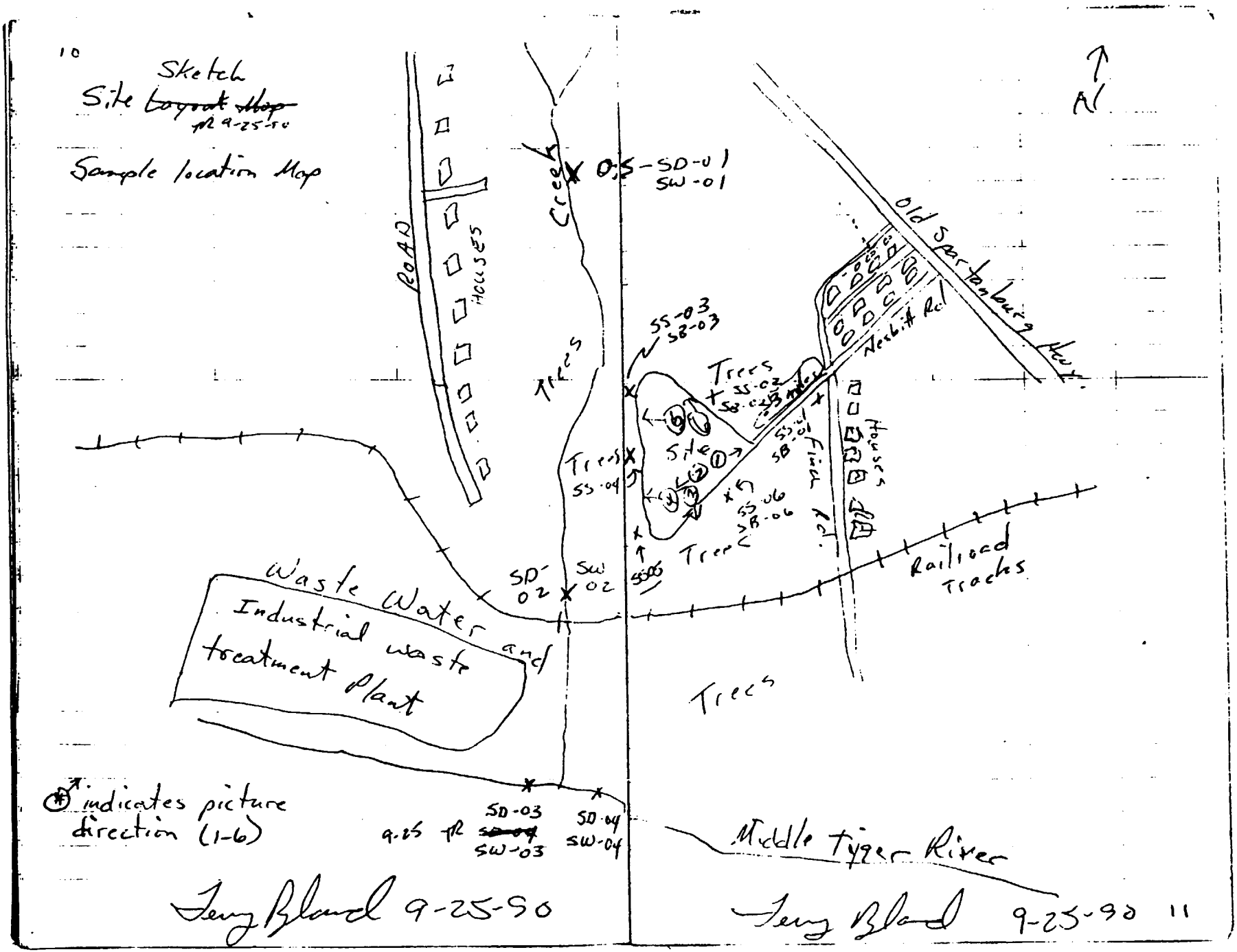
Page
TR
9-25-90

Jerry Bland 9-25-90

Sketch

Site ~~Layout Map~~ 9-25-90

Sample location Map



Terry Bland 9-25-90

Terry Bland 9-25-90

10:40 (SD-02) collected near railroad tracks, and creek. The creek flows beneath the tracks. ~~by~~ TR 4-25 Collected sample upgradient of tracks in creek bed.

10:50 (SW-02) collected from same location as SD-02.

12:40 (SD-04) collected on Middle TYGER River where the creek empties into the River. Collected downgradient of intersection ± 30 feet.

12:45 (SW-04) collected at same location as SD-04.

The creek I'm referring to is a perennial stream, indicated on Topo map, which flows south to Middle Tyger River. It also flows near the west edge of the landfill.

Jerry Bland 9-05-90

Middle Tyger River is black in water color. We are located dwn. gradient ~~from~~ TR 4-25 of a waste treatment plant where black water and sludge is visible. A plant spokesman said the plant ~~discharges~~ TR 4-25 discharges into the river.

12:50 (SD-03) collected on Middle TYGER RIVER upgradient or upstream of intersection with creek. Collected ± 30 feet upstream.

13:00 (SW-03) collected from same location as SD-03.

Field Measurements on Surface water Samples

	pH	Cond. (µmhos/cm)	Temp.
SW-01	6.14	70.0	15°C
SW-02	6.84	46.1	17°C
SW-03	7.7	5.06 *100	25°C
SW-04	7.61	383	24°C

14:00 Samples are labeled and ~~tag~~ m9-25 bagged. Vince has gone with John, Sherry, Rick Hardy to conduct Geophysical and FPSP. these ~~operations~~ should be completed today. We will resume sampling at my site tomorrow morning.

Gone to eat a late lunch.

Jerry Bland 9-25-90

Quit sampling my site for the day. Must wait for Vince to return to my site tomorrow so we can collect surface soil & sub surface soils.

Note: about the Middle Tyger River:

Just upstream of the waste treatment plant is a dam in the river. This is where the city of Lyman has a surface water intake and filtration plant. This plant serves all of Lyman. I think this plant is operated by Springs Industries. I have to take Vince there to pick-up his sample jars and Springs Ind. people and vehicles are always there. There is a large difference in water clarity before and after the waste treatment plant.

Jerry Bland 9-25-90

16 Wed. 9-26-90

8:00 Arrived on site. Weather is clear and cool.

8:20 Calibrated HNu Serial # 41539 10.2 probe 9.8 span checked out ok

8:45 SS-01 collected at land surface near entrance to landfill. Sample collected for background.

9:05 SB-01 collected at 6-7 feet below land surface. Soil is a red clay to a depth of 13 feet as seen yesterday - could not go deeper because we hit a rock or something.

Jerry Bland 9-26-90

9:30 SS-02 collected at land surface along northeastern edge of land fill. Soil appears to have a little mulch on land surface. Also consists of clay w/ a slight presence of sand. Vince says phenol is commonly associated with pine tree mulch. Many pines in this area.

HNu readings of 7-11 ppm were detected during the augering. Nothing in the breathing zone.

9:45 Augered down to 4'6" before hitting rock. ~~collected SB02 at this point~~ TR 9-26-90

Back off hole 2 feet and

Jerry Bland 9-26-90 17

auger down again to a point above rock and collect sample.

SB-02 collected

10:30 SS-03 collected in an area where orange colored water is visible on the ground. Location is on the northwest side of the landfill, down hill.

Augered down to 3 feet and detected 35 ppm w/ HNu. Ground is soft gray clay with water coming into hole. This is understandable since we're so low of the landfill.

Jerry Bland 9-26-90

10:55 SB-03 collected at same location as SS-03. Sample at 3-6 feet below land surface. Soil is a gray clay with some sand.

12:05 SS-04 collected at land surface. Red clay. Hit rock a 1 foot. Scratched SB-04. ☆

12:25 SS-05 collected at land surface. Collected some of the ash on the land surface.

☆ SB-05 not collected. Hit rock at 2 feet bls.

Alan McManus is now present during sampling.

Jerry Bland 9-26-9019

12:50 SS-06 collected at land surface. Organic type soil.

13:15 SB-06 collected at 4-5 feet b/s. Soil is very dry and clay. Red color w/ some sand.

13:25 Completed sampling of this site

Much of the land surrounding the site or within a mile of the site has cattle upon it. Fescue is also grown on much of the pasture land for cattle feed.

Jerry Gland 9-26-90

40

[illegible] 9/26/90

Chain of Custody used: 4-1444
1443
1445
1442

Fire Sheets (27)

Receipt for Sample Forms Used: 4-0362
0360

Case No. 74949

Low Concentration yes/no

Organics

	Media	Lab	Airbill No
17	Soil	[illegible]	2828495250
7	Water	[illegible]	same

Organics

	Media	Lab	Airbill No
15	Soil	Silver Valley	2828495261
7	Water	Silver Valley	same

TDD #

Date: _____ By Whom: _____

Time: _____ # keyed to map: _____

Location: _____

Picture of _____

TDD #

_____ By Whom: _____

_____ # keyed to map: _____

Picture of _____

TDD #

_____ By Whom: _____

_____ # keyed to map: _____

Picture of _____

41

TDD #
Date: By Whom:
Time: # keyed to map:
Location:
Picture of:

TDD #

TDD #

TDD # F4-9007-22
Date 9-25-90 By Whom: T. Ryland
Time 8:30 # keyed to map: 1
Location: Facing east along entrance road
Picture of: Entrance road as seen from landfill

TDD # F4-9007-22
9-25-90 T. Ryland
8:30 2
Facing west onto site from road.

TDD # F4-9007-22
9-25-90 T. Ryland
8:30 3
Starlex, S.C.
Facing ~~West~~ SW across site, coal cinders on surface)

48

TDD # F4-9007-22
Date 9-25-90 By Whom: T. Ryland
Time: 8:30 # keyed to map: #4
Location: Stactex, S.C.

Picture of: Facing west across landfill; coal cinders on land surface

TDD # F4-9007-22
Date 9-25-90 By Whom: T. Ryland
Time 8:30 # keyed to map: #5
Location Stactex, S.C.

Picture of Facing west across site

TDD # F4-9007-22
Date 9-25-90 By Whom T. Ryland
8:30 #6
Location Stactex, S.C.

Picture of Facing NW across site

STANDARD SAMPLE CODES

Water Samples	Soil Samples
PW - Private well	SS - Surface Soil
PB - Public (Municipal) Well	SB - Subsurface Soil
MW - Monitoring (Permanent) Well	SZ - Saturation Zone
TW - Temporary (Well Point) Well	SD - Sediment
IW - Industrial Well	CS - Composite Soil
SW - Surface Water	LS - Leachate Soil
SP - Spring Water	
LW - Leachate Water	

OTHER CODES

AR - Air	QC - Quality Control
SL - Sludge	AQ - Aquatic (Biological)
WA - Waste	TB - Trip Blank
DR - Drum	

For all samples that are to be analyzed by the in house FIT IV laboratory, the following deviation from the standard codes are to be used: The letter "F" (denoting FIT Lab Analysis) is to be inserted in front of the sample number.

Example: Standard Auto Sampling Investigation - Temporary Well Groundwater Sample - Number 08

Appropriate Code: SA-TW-F08

Reference No. 3

NUS CORPORATION AND SUBSIDIARIES		*TELECON NOTE*
CONTROL NO.	**DATE:** 2-20-91	**TIME:** 9:14
DISTRIBUTION: File		
BETWEEN: Gerald Stewart	**OF:** SCDHEC	**PHONE:** (803) 734-5449
AND: Terry Ryland, NUS Corporation		

DISCUSSION:

I asked Mr. Stewart about any RCRA history or permitting of the Old Startex Landfill. He told me the landfill was never permitted and that Springs Industries has recently agreed to stop using the landfill in an effort to avoid having to permit the landfill.

Reference No. 4

RECORD OF COMMUNICATION

_X_ Phone Call
_X_ Discussion
____ Field Trip
____ Conference
____ Other (Specify)

TO: Nick Odom, Env. Manager
Spring Industries Inc.

FROM: Gerald Stewart

DATE: November 28, 1988

TIME: 4:15 PM

SUBJECT: Ownership History and waste disposal practies at the Old Startex Spartanburg County Landfill and Old Lyman Dump.

SUMMARY OF COMMUNICATION

According to Nick Odom, Environmental Manager - Springs Industries Inc., Springs Industries operated the Old Lyman Dump, but the property is owned by the Town of Lyman. The Old Statex Spartanburg County Landfill is owned by Springs Industries Incorporated. Mr. Odom stated that Lyman Dyeing and Finishing Company is now owned and operated by Springs.

Historically, landfill of these types received textile rags, cardboard, brick, blocks, fly ash and a minimum amount of liquid waste, such as organics and inorganics. Most chemical waste (liquids) were drained into the wastewater treatment system.

CONCLUSIONS, ACTION TAKEN OR REQUIRED

The above information was gathered from a phone conversation with Nick Odom and Marshall Bright. Contact Address: Spring Industries Inc.; P.O. Box 70; Fort Mills, SC 29715 - ATTN: Nick Odom.

INFORMATION COPIES
TO: Old Lyman Dump File
Old Startex Spartanburg County File

R-586-9-1-27

REFERENCE NO. 6

Approved 11/22/91
Cathy Lomoro
R 7 SIP (Med)

FINAL REPORT

SITE INSPECTION
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA
EPA ID #: SCD980558183

Prepared Under
TDD No. F4-9007-23
Contract No. 68-01-7346

Revision 0

FOR THE

WASTE MANAGEMENT DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY

SEPTEMBER 19, 1991

HALLIBURTON NUS ENVIRONMENTAL CORPORATION
SUPERFUND DIVISION

Prepared By	Reviewed By	Approved By
Laura L. Neill for John Schendel Project Manager		Phil Blackwell Regional Project Manager

NOTICE

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TABLE OF CONTENTS

Section No.		Page
EXECUTIVE SUMMARY		ES-1
1.0	INTRODUCTION	1
1.1	Objectives	1
1.2	Scope of Work	1
2.0	SITE CHARACTERIZATION	3
2.1	Site History	3
2.2	Site Description	6
	2.2.1 Site Features	6
	2.2.2 Waste Characteristics	10
3.0	REGIONAL POPULATIONS AND ENVIRONMENTS	12
3.1	Population and Land Use	12
	3.1.1 Demography	12
	3.1.2 Land Use	12
3.2	Surface Water	13
	3.2.1 Climatology	13
	3.2.2 Overland Drainage	14
	3.2.3 Potentially Affected Water Bodies	14
3.3	Groundwater	16
	3.3.1 Hydrogeology	16
	3.3.2 Aquifer Use	17
4.0	FIELD INVESTIGATION	20
4.1	Geophysical Investigation	20
4.2	Field Analytical Support Project	22
4.3	Sample Collection	26
	4.3.1 Sample Collection Methodology	26
	4.3.2 Duplicate Samples	27
	4.3.3 Description of Samples and Sample Locations	27
	4.1.4 Field Measurements	36
4.4	Sample Analysis	36
	4.4.1 Analytical Support and Methodology	36
	4.4.2 Analytical Data Quality and Data Qualifiers	36
	4.4.3 Presentation of Analytical Results	38
	4.4.3.1 Surface Soil Samples	38
	4.4.3.2 Subsurface Soil Samples	51
	4.4.3.3 Groundwater Samples	52
	4.4.3.4 Sediment and Surface Water Samples	54
5.0	SUMMARY	57
REFERENCES		
APPENDIX A	Site Inspection Report	
APPENDIX B	Topographic Map	
APPENDIX C	Summary of Geophysical Methods	
APPENDIX D	Field Analytical Support Project Methodology	
APPENDIX E	Analytical Data	

TABLES

Number		Page
Table 1	Sample Codes, Descriptions, Locations, and Rationale	29
Table 2	Field Measurements	37
Table 3	Inorganic Analyses - Surface Soil Samples	39
Table 4	Organic Analyses - Surface Soil Samples	40
Table 5	Inorganic Analyses - Subsurface Soil Samples	41
Table 6	Organic Analyses - Subsurface Soil Samples	43
Table 7	Inorganic Analyses - Groundwater Samples	44
Table 8	Organic Analyses - Groundwater Samples	45
Table 9	Inorganic Analyses - Sediment Samples	46
Table 10	Organic Analyses - Sediment Samples	47
Table 11	Inorganic Analyses - Surface Water Samples	48
Table 12	Organic Analyses - Surface Water Samples	49

FIGURES

Figure 1	Site Location Map	4
Figure 2	Site Area Map	7
Figure 3	Site Layout Map	8
Figure 4	Geophysical Traverses and Magnetic Anomalies	21
Figure 5	Traverse A: Conductivity and Magnetic Intensity	23
Figure 6	Traverse B: Conductivity and Magnetic Intensity	24
Figure 7	FASP Soil Gas Sampling Locations	25
Figure 8	Sample Location Map	28

EXECUTIVE SUMMARY

Old Lyman Dump is located in the southeast portion of the town of Lyman, Spartanburg County, South Carolina. The site is situated in a north-south-oriented ravine along the eastern perimeter of Lyman's wastewater treatment plant and just north of the Middle Tyger River. The site is generally heavily wooded. Many areas of the site are littered with debris. In other areas, there are piles of earth and rocks in addition to debris. Old Lyman Dump was apparently in operation sometime between the early 1920s and the late 1960s. During much of its history, the site was apparently owned by the local textile plant in Lyman. This plant may have used Old Lyman Dump to dispose of industrial wastes such as metals, textiles, cardboard, bricks, blocks, fly ash, and organic and inorganic wastes, including organic and inorganic liquids. Because of the lack of detailed documentation on Old Lyman Dump, and because the site was presumably an uncontrolled waste dumping location for industrial as well as domestic/municipal wastes, the exact nature of wastes deposited there and their sources are unknown. Currently, the site is owned by the town of Lyman.

Old Lyman Dump lies within the Piedmont physiographic province and is underlain by a mantle of weathered rock and residual soil which overlays complexly fractured and folded metamorphic rocks. The unconfined, residual soil/crystalline rock aquifer system is the primary aquifer used by owners of private potable wells in the vicinity. An estimated 447 homes within a 4-mile radius of Old Lyman Dump are potentially using private wells for their source of potable water. The nearest house that is potentially using a private well as a potable water source is approximately 4,800 feet from the site.

Surface water originating at Old Lyman Dump reaches the Middle Tyger River via a creek that flows through the site. At present, there are no known surface water intakes lying within the 15-stream-mile surface water pathway for the site. The Middle Tyger River is used for recreational fishing and is likely used for recreational boating. Several freshwater marshes exist along the Middle Tyger River downstream of Old Lyman Dump. There is also a flat, boggy area located on the site which may be a wetland that warrants protection status.

The site is accessible to the general public. The population within 4 miles of the facility is approximately 11,349. Furthermore, the ranges of many federally and state-designated protected species include the area containing Old Lyman Dump.

The analytical results of the samples collected during the field investigation of this site indicate contamination of surface soil, subsurface soil, groundwater, and surface water at Old Lyman Dump.

Elevated levels of chromium, calcium, cadmium, copper, lead, manganese, mercury, silver, zinc, cyanide, 4,4'-DDE, and 4,4'-DDD were present in the surface and subsurface soils at the site. An elevated level of chromium was found in the groundwater beneath Old Lyman Dump. This cannot be assigned as an observed release to groundwater of contaminants originating at the site, however, because of the possibility that the contamination is migrating in the groundwater from the nearby Old Startex Spartanburg County Landfill or from some other offsite source. The analytical results also indicate a release to surface water at Old Lyman Dump of the elements aluminum, barium, cobalt, iron, lead, magnesium, manganese, nickel, potassium, and vanadium.

In addition to the finding of analytically observed elevated levels of contaminants in the surface soils, subsurface soils, and surface waters at Old Lyman Dump, this investigation has revealed new concerns, including one as to the actual extent of coverage of the dump itself. Strong evidence exists which suggests that the dump may extend farther west than was originally believed. Furthermore, some of the analytical data indicates that the Old Startex Spartanburg County Landfill may be influencing the quality of the groundwater beneath Old Lyman Dump. As these concerns were not fully addressed during this investigation, it is suggested that further work be done at Old Lyman Dump to more fully characterize the site. In conclusion, it is recommended that Old Lyman Dump be evaluated using the HRS (effective March 14, 1991).

1.0 INTRODUCTION

The HALLIBURTON NUS Environmental Corporation Region 4 Field Investigation Team (FIT) was tasked by the U.S. Environmental Protection Agency (EPA), Waste Management Division to conduct a Site Inspection (SI) at the Old Lyman Dump in Lyman, Spartanburg County, South Carolina. The investigation was performed under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). The task was performed to satisfy the requirements stated in Technical Directive Document (TDD) number F4-9007-23. The field investigation was conducted on September 24-28, 1990.

1.1 OBJECTIVES

The objectives of this inspection were to determine the nature of contaminants present at the site and to determine if a release of these substances has occurred or may occur. Further, this inspection sought to determine the possible pathways by which contamination could migrate from the site and the populations and environments it would potentially affect. Through these objectives, a recommendation has been made regarding future activities at the site.

1.2 SCOPE OF WORK

The objectives were achieved through the completion of a number of specific tasks. These activities were to:

- Obtain and review relevant background materials.
- Obtain aerial photographs and maps of site.
- Obtain information on local water systems.
- Conduct a survey of private wells.
- Determine location of and distance to nearest potable well.

- Evaluate potentially affected populations and environments associated with the groundwater, surface water, air, and onsite exposure pathways.

- Develop a site sketch.

- Conduct a geophysical screening of site to determine whether buried drums may be present.

- Utilize the services of the Field Analytical Support Project for guidance in taking environmental samples.

- Complete a Site Inspection Report, provided as Appendix A in this report.

- Collect environmental samples.

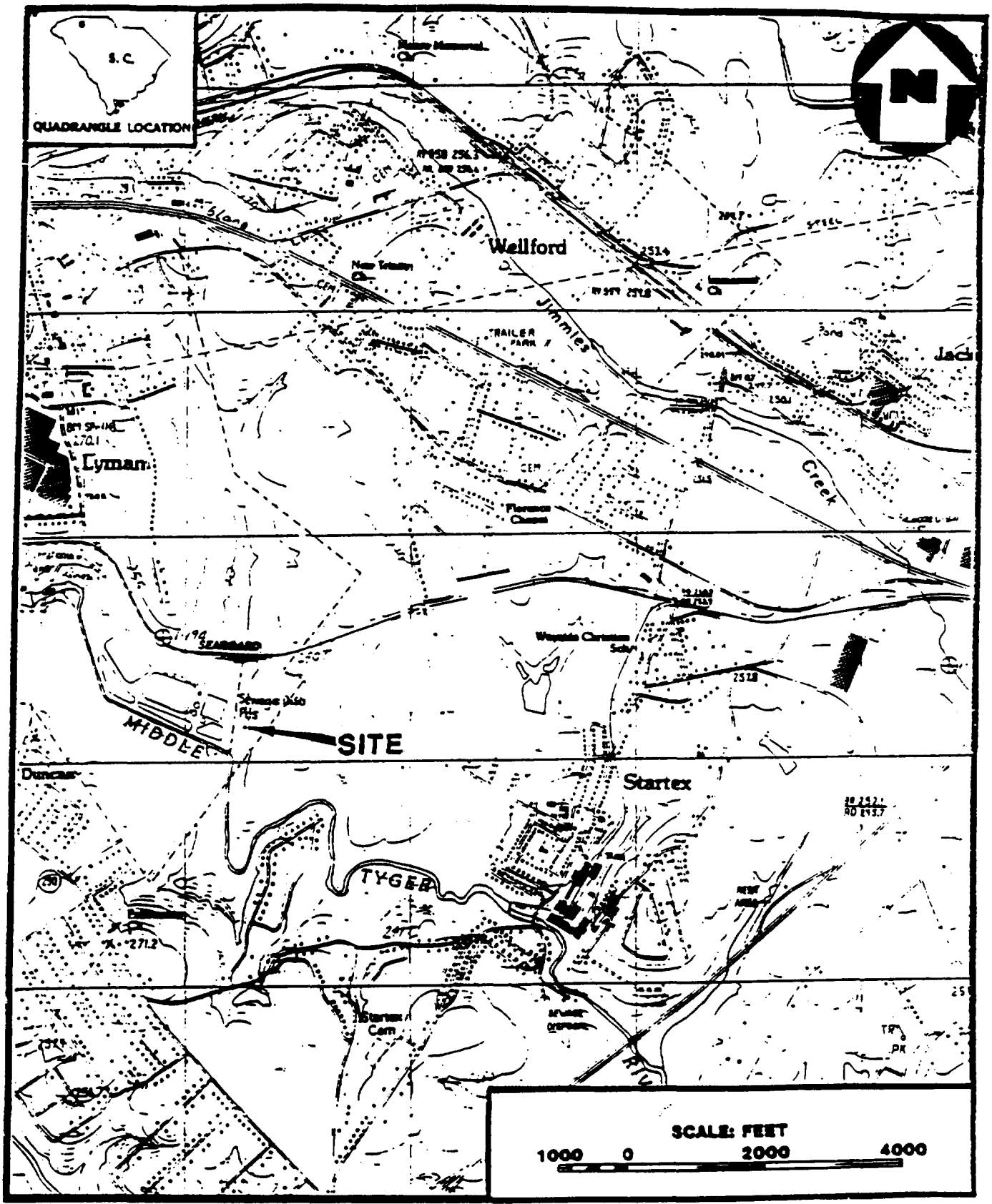
2.0 SITE CHARACTERIZATION

2.1 SITE HISTORY

The Old Lyman Dump is located in the southeast portion of the town of Lyman, Spartanburg County, South Carolina at approximately 34°56'4.5" N latitude and 82°6'46.5" W longitude (Figure 1) (Refs. 1, 2). The site is within a moderately to densely populated urban region approximately 6 miles west of the densely populated Spartanburg metropolitan area. The Old Lyman Dump is situated in a north-south oriented ravine, along the eastern perimeter of Lyman's wastewater treatment plant, and just north of the Middle Tyger River (Ref. 2).

Two other dump sites are located in the vicinity of Old Lyman Dump: the Old Startex Spartanburg County Landfill and the so-called "old dump" or "old city landfill" (Refs. 1, 3). Both dump sites are located within 1 mile of the Old Lyman Dump (Refs. 1, 2). The Old Startex Spartanburg County Landfill (EPA ID No. SCD980558191) is currently under separate investigation by the EPA (Ref. 4). The dump site known as the "old dump" or "old city landfill" was originally brought to the attention of the EPA through the issuance of a Notification of Hazardous Waste Site in 1981, in which the name "Old Lyman Dump behind new Wamsutta Dyehouse" was used for the site (Refs. 5, 6). This dump site is located along the north side of the Middle Tyger River in an area immediately west and south of the Lyman water filtration plant (Refs. 1, 2, 6). It is most likely currently owned by Springs Industries (Ref. 7). Very soon after the Notification of Hazardous Waste Site was filed (1981 or 1982), this site was assigned EPA ID No. SCD980558183 under the name Old Lyman Dump (Refs. 5, 8). Six years later, in 1988, the same name and EPA ID No. were assigned, perhaps inadvertently, to a different location: that of the dump site indicated in Figure 1 (Refs. 1, 9, 10). The question as to which of these two dump sites is officially associated with EPA ID No. SCD980558183 is not currently resolved. For the purposes of this Site Inspection, however, the site of Old Lyman Dump will be as shown in Figure 1 (Ref. 11).

Due to the confusion associated with the assignment of the name "Old Lyman Dump" and EPA ID No. SCD980558183 to two separate locations, a history of the use of the location given in Figure 1, as taken from the available file material, can be considered tentative at best. The dump was apparently in operation sometime between the early 1920s and the late 1960s (Refs. 5, 10). It may have been opened in 1924, when a textile printing and finishing plant was built in the area. This dump, along with the "old dump", or "old city landfill", likely received wastes from this plant as well as domestic wastes and refuse from the surrounding community (Refs. 5, 12). A longtime resident of



BASE MAP IS A PORTION OF THE U.S.G.S. 7.5 MINUTE QUADRANGLE WELLFORD, SOUTH CAROLINA 1963.

SITE LOCATION MAP
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY,
SOUTH CAROLINA

FIGURE 1

NUS CORPORATION

Lyman recalled that the dump was used as an "uncontrolled" dump by the textile mill and the public during the 1930s and 1940s (Ref. 13). The exact date of closure of the Old Lyman Dump is not known but may have been sometime in the mid-to-late 1960s, around the time that the Old Startex Spartanburg County Landfill was opened (Ref. 5). According to the current mayor of Lyman, the Old Lyman Dump was opened before the town was incorporated (Ref. 12). During its early years of operation, the dump likely was not overseen or regulated by any municipal government; therefore, it is impossible to know all of the sources of the waste deposited at the dump.

Old Lyman Dump may have originally been owned and operated by the textile printing and finishing plant. According to the longtime resident of Lyman, the original owner of the plant was Pacific Mills. He indicated that Pacific Mills owned the property where Old Lyman Dump is located, and, in addition to using the property as an industrial dump site, allowed the county to use it as a municipal dump. Indeed, during the field investigation performed September 24-28, 1990, survey markers with the label "Pacific Mills" were found at two locations at Old Lyman Dump (Ref. 13).

At some time since the textile plant opened, perhaps when the town of Lyman became incorporated, the plant came to be called "Lyman Dyeing and Finishing Company" (Refs. 5, 10). One of the past owners of the Lyman Dyeing and Finishing Company (presumably sometime after the term of ownership by Pacific Mills) was M. Lowenstein Corporation of Rock Hill, South Carolina (Refs. 14, 15, 16). Old Lyman Dump was owned by M. Lowenstein Corporation, and was operated by Lyman Dyeing and Finishing Company (presumably by virtue of this ownership) during at least a part of the history of the dump (Refs. 10, 12, 14, 15). M. Lowenstein Corporation was bought out by Springs Industries of Fort Mills, South Carolina in October 1985 (Refs. 15, 16). Springs Industries is the current owner and operator of Lyman Dyeing and Finishing Company (Refs. 12, 16, 17). Before the buyout, the land upon which Old Lyman Dump is located was deeded over to the town of Lyman by M. Lowenstein Corporation. Springs Industries reportedly has never owned the dump. The current owner of the Old Lyman Dump, therefore, is the town of Lyman (Refs. 12, 15, 17).

As indicated earlier, the site name "Old Lyman Dump", with EPA ID No. SCD980558183, originally appeared in environmental regulatory records in 1981-82 when a Notification of Hazardous Waste Site and a Potential Hazardous Waste Site Identification and Preliminary Assessment report were filed (Refs. 5, 8). These documents, however, referred to the dump site known as "old dump" or "old city landfill" and not to the dump site that is the focus of this investigation (Refs. 1, 5, 6, 8). The association of the name "Old Lyman Dump", with EPA ID No. SCD980558183 with the location shown in Figure 1 did not occur until 1988, when an employee of Springs Industries sent a map to the South Carolina Department of Health and Environmental Control (SCDHEC) identifying this location as

being Old Lyman Dump (Ref. 1). Based upon this map, officials of SCDHEC conducted a hydrogeologic review and prepared an updated preliminary assessment of this location (Refs. 9, 10, 18, 19).

2.2 SITE DESCRIPTION

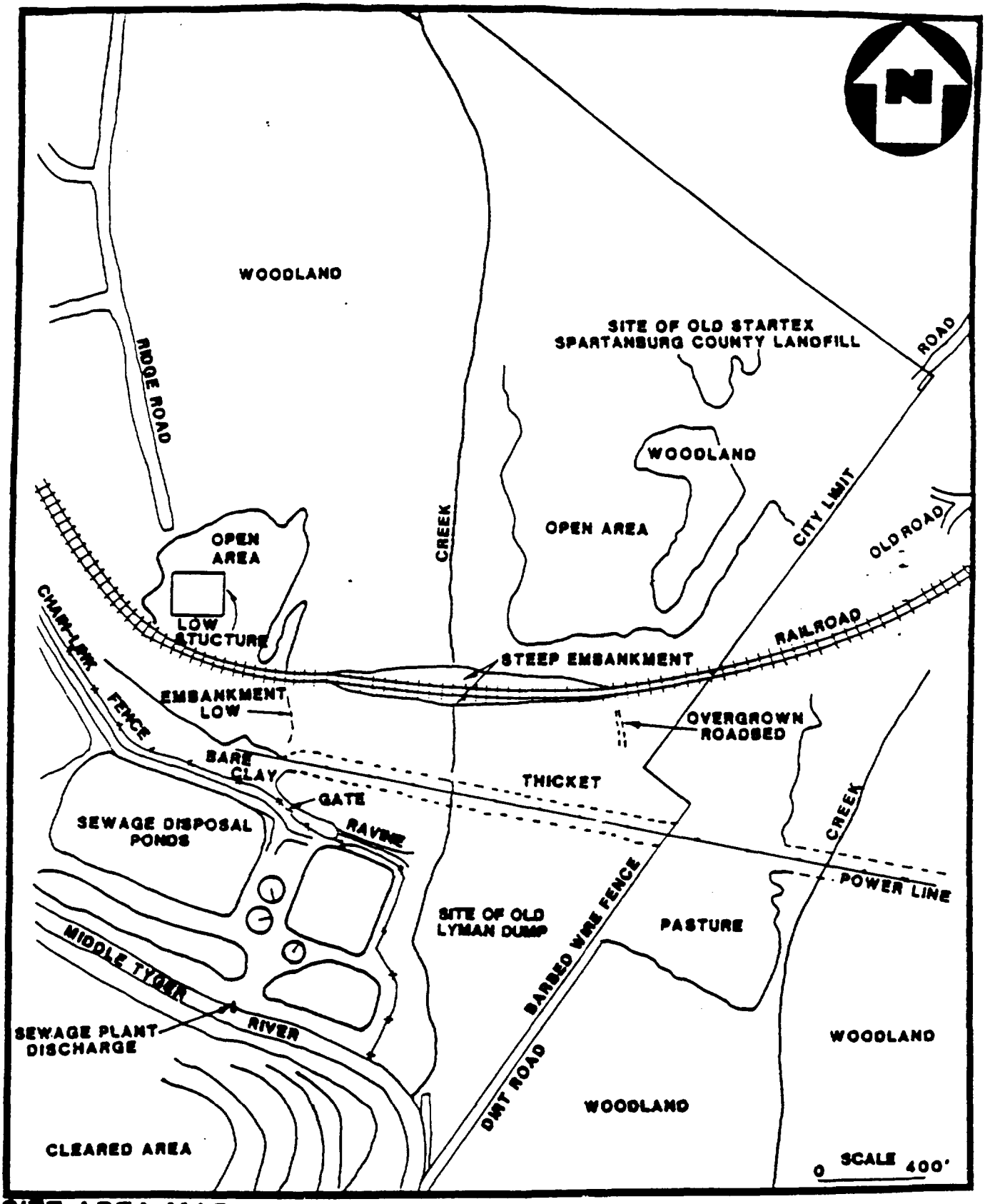
2.2.1 Site Features

The Old Lyman Dump site is bound roughly by a barbed-wire fence to the east (the Lyman city limits), a railroad track to the north, the Lyman wastewater treatment plant to the west, and the Middle Tyger River to the south (see Figures 2 and 3 and the topographic map in Appendix B of this report) (Refs. 1, 2, 12, 13). Beyond the barbed-wire fence to the east of the site is a 215-acre farm (Ref. 13). Beyond the railroad tracks (Piedmont and Northern) to the north of the site is an undeveloped area, part of which is the Old Startex Spartanburg County Landfill (Refs. 1, 4, 12, 13, 20, 20A).

The site occupies a north-south oriented ravine and contains a perennial creek that flows southward to the Middle Tyger River. The site is 1,000 feet or more wide east-to-west and 1,700 feet or more long north-to-south (Ref. 1). The site is fairly secluded, and is bounded by a fenced wastewater treatment plant, a privately-owned farm, the Middle Tyger River, and other private properties. Barbed-wire or chain-link fences border the site along its eastern perimeter and part of its western perimeter. However, the site is not guarded and could be reached on foot by approaching it from the northwest, north, or northeast (Refs. 12, 13). Hence, Old Lyman Dump should be considered accessible to the general public.

An aboveground power line traverses the northern portion of the site in an east-west orientation. Most of the site is heavily wooded. Some areas, particularly near the creek that flows through the site, are covered in dense vines and low-lying plants which make foot travel difficult. There are also large areas in the central and northern portions of the site that had apparently been cleared several years ago. Since their clearing, all of these cleared areas have become covered by dense thicket and some young trees, making foot travel difficult (Refs. 12, 13, 20A).

A dirt road follows the barbed-wire fence along the southeastern perimeter of Old Lyman Dump (see Figures 2 and 3). The southern end of this dirt road intersects a cleared truck-path which follows along the north bank of the Middle Tyger River. This truck path extends northwestward beyond the barbed-wire fence, follows along the southern perimeter of the site, and terminates at the southern end of the site creek (Ref. 20A).



SITE AREA MAP
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY,
SOUTH CAROLINA

FIGURE 2

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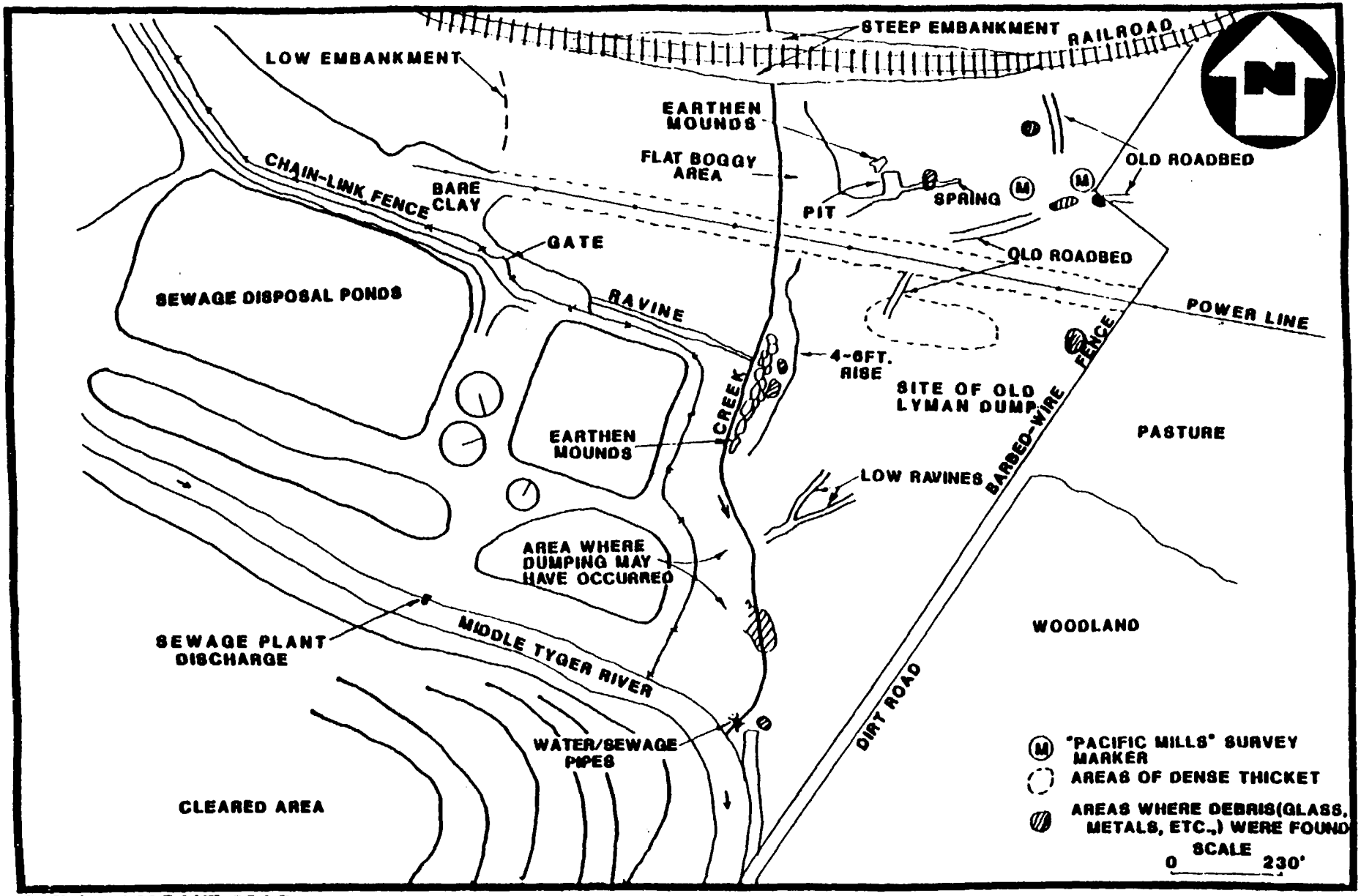


SITE LAYOUT MAP
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

FIGURE 3

NUS CORPORATION

Debris was found in the portion of the site located south of the power lines. Various kinds of debris (including glass, metal objects, brick, rock, stone slabs, and marble or slate plate) were found near the truck path in the extreme southern end of the site, in the bottom of the site creek, along portions of both the east and west banks of the site creek adjacent to the Lyman wastewater treatment plant, and in other areas (Refs. 12, 13). A string of earth mounds were seen in the west-central portion of the site, extending 100 to 200 feet along the east bank of the site creek. A relatively flat, low area parallels the mounds to the east. Some parts of this low area contain debris. Just to the east and uphill of this low area was a 4 to 6 foot rise in the ground which roughly paralleled the low area in a north-south orientation. This rise extends generally northward for approximately 400 feet and terminates near the power lines (Ref. 13).

Areas of exposed or shallow rock were seen in the north-central portion of the site, north of the power lines. A small stream, which may originate at a small spring, is located in this portion of the site. This stream flows westward for approximately 130 feet, where it discharges over the eastern edge of a pit. It is not known whether or not this stream is intermittent. Debris were found in and near the midpoint of this spring (Ref. 13). The aforementioned pit varies in depth from approximately 4 to 8 feet. The pit apparently drains through a cleft in its southwestern corner. This drainage leads to the flat, boggy area which is situated along the east bank of the site creek. Several earth mounds were also found near the northern perimeter of the pit. No relationship between these earth mounds and the pit, other than their proximity, could be determined (Refs. 12, 13). Several other debris-covered areas were found on the site north of the power lines (see Figure 3) (Refs. 12, 13). In addition, two small (4 inch by 4 inch) survey markers labeled "Pacific Mills" were also found north of the power lines in the area east of the spring or stream (Ref. 13).

Old, moderately-to-heavily overgrown roadbed-like structures were encountered at several locations on and around the site (see Figures 2 and 3) (Refs. 12, 13). Aerial photographs taken of the site vicinity in 1959 and 1963, as well as information provided by several local people, indicate that roads did enter the site from the north by crossing over the railroad tracks (Refs. 12; 13; 20, map sheet number 28). These roads reportedly continued southward through the site and eventually turned westward across the site creek toward what is now the area occupied by the Lyman wastewater treatment plant (Ref. 13). The aerial photographs also show a large cleared area in the central portion of the site (Refs. 12; 20, map sheet number 28). This area partially overlaps with the relatively clear area of thicket and young tree growth observed in August and September 1990 (Refs. 12, 13). This evidence suggests that dumping may have occurred in this portion of the site (Refs. 5, 10, 12, 13). However, potentially contradicting information provided by local residents indicates that this area may have been the location of several homes that were known to exist at the site in the past. These

local residents further indicated that dumping at the site of Old Lyman Dump did occur in an area along the west side of the site creek in an area that is now just east of and possibly even beneath the Lyman wastewater treatment plant (Ref. 13). The presence of considerable debris, earth mounds, and other physical evidence in this area supports the idea that this may have been where dumping occurred at one time (Refs. 12, 13, 20A).

2.2.2 Waste Characteristics

Little detail exists concerning the specific types, quantities, and sources of the wastes deposited at the site (Ref. 13). The Old Lyman Dump apparently received industrial wastes from the Lyman Dyeing and Finishing Company, domestic or municipal wastes and refuse from the town of Lyman and from the surrounding area (Refs. 5, 8, 12, 13, 17). Because the dump was presumably an "unofficial" and thereby fairly uncontrolled waste dumping location, it is possible that the dump may have received industrial wastes from other unknown sources, as well as domestic wastes that would be considered hazardous by today's standards (Refs. 3, 5, 8, 12, 13). Industrial wastes transported to Old Lyman Dump from Lyman Dyeing and Finishing Company may have included metals (e.g.: copper, brass, and iron), textile rags, cardboard, bricks, blocks, fly ash, and liquid organic and inorganic chemical wastes (Refs. 5, 13, 17). The dumping of the liquid organic and inorganic chemicals, in particular, was reported by an official of Springs Industries on November 28, 1988, to have been minimal in quantity, as most liquid chemical wastes were routinely disposed of by dumping them into the wastewater treatment system (Ref. 17). The probability that the Lyman Dyeing and Finishing Company disposed of hazardous wastes at Old Lyman Dump is considered to be quite high, given information provided by this same textile plant in the EPA Notification of Hazardous Waste Site form it submitted on June 22, 1981, for the original location of Old Lyman Dump, referred to as the "old dump" or "old city landfill" in this report. In an attachment to this document, it states: "The identity and quantity of the industrial wastes disposed of in this dump are not known, but it is possible because of the nature of the wastes generated by textile printing and finishing operations of that time that some of these wastes would be classified as "hazardous" under current definitions." While this document was not referring specifically to the location of Old Lyman Dump, which is the focus of this current investigation, the possibility that both locations were actively being used during the same time period, as well as the entwined recorded histories of these two locations, suggest that the statement quoted above could be equally applied to the location under current investigation (Refs. 1; 5; 13, p. 16).

Historically, the operations at the Lyman Dyeing and Finishing Company facility have included the finishing and dyeing of woven fabric, including "general shirting materials" such as cotton and polyester blends (Ref. 16). The kinds of chemicals and substances used in, and the kinds of wastes

derived from, the dyeing, printing and finishing of textiles are numerous and are dependent upon the exact processes used (Refs. 21, p. 767; 22, pp. 321, 322). The preparation of fabrics for dyeing often entails the use of chemicals such as hydrogen peroxide, sodium hydroxide, ammonia, and sodium hypochlorite (Ref. 22, pp. 295, 296). Common dyes used on cotton and polyester blends are the sulfur dyes and disperse dyes (Refs. 23, pp. 168, 183, 187; 24). Aside from the complex organic compounds which produce the specific pigmentation of individual dyes, compounds used during the dyeing process include various sodium, potassium and copper salts as well as bases and acids (Refs. 23, pp. 180-184; 24). Other organic and inorganic compounds, as well as detergents, are used in other related processes (Ref. 22, pp. 318, 322; 25). Insofar as the Old Lyman Dump was used by the textile plant in Lyman as an industrial dump, the above-listed kinds of compounds and their byproducts may have been dumped at the site. Of course, as the above description of the compounds and substances involved in the textile dyeing, printing and finishing industry is by no means all-inclusive, other unknown substances may be present at the site as well. Many of these compounds are potentially hazardous or toxic (Refs. 5; 23, p. 187; 26, p. 209).

Since Old Lyman Dump was presumably an "unofficial", uncontrolled waste dumping location, it is unlikely that any measures were taken to contain the deposited waste or to otherwise prevent the waste from migrating into surrounding areas. In particular, no mention is made in the available file material that the wastes dumped at Old Lyman Dump were covered in any way. The observation of numerous areas where waste and debris were exposed upon the open ground, during the onsite reconnaissance missions of August 14, 1990 and September 24-28, 1990, seems to show that no effort was made to effectively cover the waste placed at the site. This, coupled with the fact that the site is accessible to the general public, suggests that there is a risk to the local population of exposure to hazardous substances by direct contact with the site, or by the air transport from the site of the volatile hazardous substances which may exist at the site (Refs. 12, 13).

3.0 REGIONAL POPULATIONS AND ENVIRONMENTS

3.1 POPULATION AND LAND USE

3.1.1 Demography

Although Old Lyman Dump is located within the southeast portion of the town of Lyman, the immediate vicinity (≤ one-half mile radius) of the site is relatively undeveloped. The Lyman wastewater treatment plant occupies most of the area immediately to the west of the site (Refs. 2, 12, 13). The Old Startex Spartanburg County Landfill, as well as some undeveloped partially wooded areas, lie to the north of the site (Refs. 1, 2, 3, 4, 12). A farm lies to the east and south of the site. To the southwest of the site, across the Middle Tyger River, lies a large, cleared, undeveloped area (Refs. 2, 12, 13). A few residential areas also lie within one-half mile of Old Lyman Dump (Ref. 2). The towns of Duncan, Startex, and Wellford, as well as Lyman's urban area, all start between one-half mile and 1 mile of the site to the southwest, east-southeast, north-northeast, and northwest, respectively (Refs. 2, 12, 13). These densely populated urban areas lie almost completely within 2.5 miles of the site. Between 2.5 and 4 miles of the site, the land is generally more moderately populated, and contains large areas of cleared or forested land. However, the highly urbanized metropolitan area of Spartanburg begins approximately 6 miles east of the site (Ref. 2). The population within a 1 and 4-mile radius of the site is approximately 2,959 and 11, 349, respectively (Ref. 27).

3.1.2 Land Use

The urban areas surrounding Old Lyman Dump within a 4-mile radius contain a mixture of residential, commercial, industrial and institutional elements (Refs. 2, 12, 13). While there are no residences immediately adjacent to the site property, residential neighborhoods come to within 1,500 feet northwest of the site and to within 1,200 feet to the south-southeast of the site (Refs. 2, 12). There are at least eight schools within 4 miles of Old Lyman Dump (Ref. 2). The closest school, Byrnes High School in Duncan, is approximately 3,700 feet to the west of the site (Refs. 2, 13).

In addition to the residential neighborhoods, the urban area around Old Lyman Dump contains numerous businesses and industries. Several large textile mills lie within 4 miles of the site, including Jackson Mill to the east-northeast, Startex Mill to the southeast, and Springs Industries' Lyman Dyeing and Finishing Company (also known as the Wamsutta Dyehouse) to the northwest (Refs. 2, 5, 6,

16, 28). The Springs Industries facility in Lyman is approximately 3,300 feet from the site (Ref. 2). The nearest industry to Old Lyman Dump is the Lyman wastewater treatment plant, which borders the site to the west (Refs. 2, 12, 13). This wastewater treatment plant is owned by the town of Lyman, but is operated by Springs Industries (Ref. 12). Because Old Lyman Dump is an inactive dumping location and does not have any individuals working on the site, the people who work at the wastewater treatment plant are the closest people to the site on a routine basis and are at greatest risk to exposure to the hazardous compounds that may be at Old Lyman Dump (Refs. 5, 8, 12). In addition, some of the Old Lyman Dump may be beneath portions of the wastewater treatment plant, putting the workers at the wastewater treatment plant at an even greater risk to exposure to hazardous wastes (Refs. 1; 12; 13; 17; 20, map sheet number 28).

The more rural areas within 4 miles of Old Lyman Dump are, in part, used for agricultural purposes. The nearest active farm borders the dump to the east (Refs. 2, 12, 13). Some of the operations on this farm include raising cows (Refs. 12, 13).

The ranges of numerous federally designated endangered or threatened animal and plant species include the area within which Old Lyman Dump is located. Among these species are the bald eagle (Haliaeetus leucocephalus), the arctic peregrine falcon (Falco peregrinus tundrius), Kirtlands warbler (Dendroica kirtlandii), eastern cougar (Felis concolor cougar) (Refs. 29, 30, 31). Aside from the species with federal protection status, many species with other status levels of national, regional or state protection are known to live in the vicinity of Old Lyman Dump. For example, the intermediate enchanters nightshade (Circaea lutetiana ssp canadensis), a state-designated species of concern, has been found along the North Tyger River at a distance of approximately 2.9 miles east-northeast of Old Lyman Dump (Refs. 30, 31).

3.2 SURFACE WATER

3.2.1 Climatology

The climate in Spartanburg County, South Carolina, is considered mild, with hot summers and mild, relatively brief winters. Summer temperatures may reach 90°F or higher for an average of 50 days, and may reach 100°F on about 3 days. Winter temperatures may fall below 32°F on an average of about 60 days. The prevailing winds are generally from the southwest, with an average speed of 8 miles/hour. Rainfall is evenly distributed in occurrence throughout the year (Ref. 20, pp. 76, 77). Normal annual total precipitation is 52 inches. Subtracting from this the mean annual lake evaporation rate of 40 inches, the net annual total precipitation is found to be 12 inches (Ref. 32). The 2-year, 24-hour rainfall for the vicinity of Old Lyman Dump is 4 inches (Ref. 33, p. 95).

3.2.2 Overland Drainage

Old Lyman Dump is located in a north-south oriented ravine which slopes southward toward the Middle Tyger River (Ref. 2). A perennial stream flows along the bottom of the ravine (Refs. 2, 12, 13). Vertical relief at the site is approximately 80 feet (Ref. 2). Most of the site is gently-to-moderately sloped (Refs. 2, 12, 13). Surface water can enter the site from the Lyman wastewater treatment plant and vicinity to the west and from the farm to the east, both of which are of higher elevation than the site itself. Surface water can also enter the site from the north via the perennial stream that flows through a concrete culvert that passes beneath the railroad embankment. Surface water originating north of the railroad tracks can reach the site only via this unnamed stream, due to the presence of the railroad embankment which serves as a diversion structure. Surface water flowing onto the site or originating at the site generally moves towards the perennial stream at the bottom of the site ravine (Refs. 2, 12, 13). The section of the stream which passes through Old Lyman Dump is approximately 1,500 feet long (Ref. 2). The creek's banks rise gradually from approximately 1 to perhaps 5 or 6 feet as it flows southward. Along the west edge of the creek adjacent to the Lyman wastewater treatment plant, the bank is even higher (Refs. 12, 13). In the northern portion of the site, north of the power lines, there is an approximately 100- to 130-foot-wide flat, boggy area that is situated along the east bank of the creek.

At the southern perimeter of the site, the stream discharges into the Middle Tyger River, which is 20 to 30 feet in width. Since part of the southern boundary of Old Lyman Dump is contiguous with the Middle Tyger River, some of the surface water originating at the extreme southern end of the site may flow directly into the Middle Tyger River, without actually flowing into the site creek first (Refs. 2, 12, 13). Once combined with the Middle Tyger River, the surface water coming from the site encounters two small dams at approximately 1.5 miles and 6.1 miles downstream of the confluence of the site stream with the Middle Tyger River. At approximately 12.1 miles downstream of the site, the Middle Tyger River combines with the North Tyger River. At approximately 24 miles downstream of Old Lyman Dump, the combined Middle and North Tyger Rivers combines with the South Tyger River (Ref. 2).

3.2.3 Potentially Affected Water Bodies

With an average flow of 103 cubic feet/second at Lyman, the Middle Tyger River is considered to be a reliable source of potable surface water (Ref. 34). There is currently one surface water intake on the Middle Tyger River. This intake is operated by the Springs Industries Filter Plant, and provides potable water to the residences and businesses in the towns of Lyman and Startex. This surface water intake is

located approximately 0.85 mile upstream of the point where the site creek enters the Middle Tyger River. A dam is located just downstream of the intake. Thus, the intake would not be affected by surface water originating at Old Lyman Dump (Refs. 2, 12, 14, 28, 35).

At present, there are no known surface water intakes, domestic, industrial, agricultural or otherwise, downstream of Old Lyman Dump along the Middle Tyger River or along the combined Middle and North Tyger Rivers within the 15-stream mile surface water pathway for the site (Refs. 10, 12, 28). One of the reasons for the absence of surface water intakes in the Middle Tyger River downstream of Old Lyman Dump is the presence of two nearby wastewater treatment plants. The Lyman wastewater treatment plant is located along the Middle Tyger River just upstream of Old Lyman Dump (Refs. 2, 10, 12, 13, 28, 36). There is also a wastewater treatment plant along the Middle Tyger River at Startex, approximately 1.6 miles downstream of Old Lyman Dump (Refs. 36, 37). The two wastewater treatment plants at Lyman and Startex, combined, discharge perhaps eight millions gallons/day or more of sewage into the Middle Tyger River, precluding the use of the river as a source of potable water for a considerable distance downstream of these wastewater treatment plants (Refs. 28, 36).

The Middle Tyger River is known to contain a wide variety of fishes. The wastewater treatment plant discharges at Lyman and Startex, however, are believed to have caused significant reductions in both fish population and species diversity in that part of the river downstream of Old Lyman Dump (Ref. 36). Despite these negative effects upon the river, the Middle Tyger River and the combined Middle and North Tyger Rivers are classified as Class B rivers, under regulation 61-68 and 61-69, Water Classifications and Standards and Classified Waters, respectively, as promulgated by the South Carolina Department of Health and Environmental Control. A Class B river is defined as being suitable for, among other things, "secondary contact recreation", fishing, the "propagation of a balanced indigenous aquatic community of fauna and flora", and industrial and agricultural use (Ref. 38). Recreational fishing occurs in the Middle Tyger River, as well as in the North and South Tyger rivers (Ref. 38A). These factors suggest that recreational boating probably occurs along the 15-stream-mile surface water pathway downstream of Old Lyman Dump (Refs. 10, 36, 38, 38A).

The flat, boggy area located along the site creek in the northern portion of Old Lyman Dump may be a wetland that warrants protection status (Refs. 12, 13). Freshwater marshes of considerable size occur along the Middle Tyger River and along the combined Middle and North Tyger Rivers, between 11.0 and 14.4 stream-miles downstream of Old Lyman Dump (Ref. 2). As the majority of the land areas surrounding the Middle and North Tyger Rivers along the 15-stream-mile surface water pathway downstream of Old Lyman Dump are fairly undeveloped, it is possible that some of the animal and plant species of federal, state, or other protection status may come into contact with or live along this 15-stream-mile surface water pathway (Refs. 2, 29, 30, 31). This may especially be true

of the several species of federally designated endangered or threatened birds, including the bald eagle (Haliaeetus leucocephalus), which may prey upon fish that live within the 15-stream-mile surface water pathway downstream of Old Lyman Dump (Ref. 29).

3.3 GROUNDWATER

3.3.1 Hydrogeology

The Old Lyman Dump is located within the Piedmont physiographic province of northwestern South Carolina, which is characterized by a series of complexly fractured and folded metamorphic rocks containing numerous igneous intrusions. The facility lies within the Inner Piedmont Belt, which is composed of highly metamorphosed gneisses and schists of Pre-Cambrian age, intruded in many areas by younger granites (Ref. 39, p. 13). The topography of the area is regionally mature, consisting of a broad plateau dissected by streams that generally trend southeast (Ref. 39, pp. 9, 10). The land surface has moderate relief, with generally subdued topographic features such as well-rounded hills with no prominent peaks or ridges (Ref. 39, p. 7).

The source of groundwater in the area is the unconfined residual soil/crystalline rock aquifer system. Water is stored in this aquifer system within the fractures of the crystalline bedrock, and within the pore spaces of the overlying mantle of weathered rock and residual soil, or regolith. The availability of water in the aquifer is controlled primarily by the intensity of jointing and fracturing of the bedrock and by the thickness and areal extent of the regolith (Ref. 39, p. 57). Within the Inner Piedmont, the regolith is usually highly permeable, allowing rainfall to infiltrate readily to recharge the bedrock fractures. Locally, the soils around Old Lyman Dump consist of moderately permeable sandy clay loams and clay loams of the Davidson series, as well as fine sandy loams of the Musella series (Ref. 20, pp. 14, 15, 16, 28, 29, 30, 60, 61, 62, 63, map sheet 28). Davidson series soils are formed from the weathering of hornblende gneiss, hornblende schist, and diorite, and are generally deep and well-drained (Ref. 20, pp. 14, 15). Musella series soils are formed from the weathering of schist, and are generally shallow and well-drained (Ref. 20, p. 30). Davidson series soils are generally greater than 15 feet thick, while the Musella series soils are usually only 16 to 30 inches thick above hard rock (Ref. 20, pp. 14, 29). Both types of soils have permeabilities that range from 4.4×10^{-4} to 4.4×10^{-3} cm/sec (Ref. 20, pp. 60, 61, 62, 63). Depth to groundwater in the vicinity of Old Lyman Dump ranges from approximately 16 feet near the tops of ridges to approximately 2 feet or less near the bottoms of ravines (Refs. 2, 9, 13). The predominant direction of groundwater flow at the site is to the south toward the Middle Tyger River (Refs. 2, 9). Both water-table and artesian conditions can be found in the area, since the regolith may locally have low permeability and act as a confining layer. In

fact, several springs exist in Spartanburg County. However, in most areas of the county water-table conditions predominate (Ref. 39, p. 58).

3.3.2 Aquifer Use

The aquifer of concern is the unconfined residual soil/crystalline rock aquifer system. Most residences and businesses in the vicinity of Old Lyman Dump get their potable water from one of four municipal water systems: the Startex, Jackson, Wellford, Duncan (SJWD) Water District, the Startex Utility System, Inc., the Spartanburg Water System, or the Greer Commission of Public Works (Refs. 2, 12, 14, 28, 35, 37, 40, 41, 42, 43, 44). Except for the town of Startex, the SJWD Water District serves most of the residences and businesses in the immediate vicinity of the site (Refs. 2, 12, 28, 35, 40). This system serves approximately 10,000 residential and commercial connections, with a consumption rate of 137.4 million gallons of water per month. Presently, the SJWD Water District is divided into two parts. All of the customers within the District's range of distribution, but outside of the town of Lyman's city limits (accounting for ~80% of the District's customers) are provided with water purchased from the Spartanburg Water System. The Spartanburg Water System obtains its water from Lake Bowen, on the Pacolet River (Refs. 14, 35, 41). The town of Lyman's water needs are also served by the SJWD Water District (accounting for the remaining 20% of the Districts' customers), but Lyman's water is obtained by purchase from the Springs Industries filter plant's surface water intake on the Middle Tyger River (Refs. 2, 12, 14, 35). This intake is, as previously mentioned, located upstream of Old Lyman Dump's 15-stream-mile surface water pathway (Refs. 2, 12). The SJWD Water District has a tie-in with the Inman/Campobello Water District, which purchases its water from the Spartanburg Water System as well (Ref. 35). Additionally, the SJWD Water District has two auxiliary wells located in Inman, approximately 6 miles north of Old Lyman Dump (Refs. 2, 41). These wells were acquired by the SJWD Water District when it annexed the Piedmont Rural water system north and northwest of Lyman (Refs. 40, 41).

The town of Startex' municipal water system, the Startex Utility System, Inc., is operated by the Startex Mill located in the same town (Refs. 2, 28, 37). This water system, in the past, has used water from the Springs Industries filter plant's surface water intake on the Middle Tyger River in Lyman (Refs. 12, 28, 35). However, Spring Industries planned to begin using the intake for industrial purposes only in the spring of 1991. At that time, the town of Lyman was to begin receiving potable water through the SJWD Water District by purchase from the Spartanburg Water System (Ref. 40). It is presumed that the town of Startex planned to make a similar change in its source of potable water during the same time period.

Small segments of the areas to the east and northeast of Old Lyman Dump, and within the 4-mile radius of the dump, are provided municipal water by the Spartanburg Water System (Refs. 2, 42). As previously indicated, this water system obtains its water from Lake Bowen, on the Pacolet River (Refs. 14, 35, 41).

A small part of the area to the west of Old Lyman Dump, and within the 4-mile radius of the dump, is provided municipal water by the Greer Commission of Public Works (Refs. 2, 41, 44). This water system obtains its water from surface water intakes on Lake Robinson and Lake Cunningham, both of which are on the South Tyger River (Refs. 2, 41, 43).

As the previous paragraphs indicate, municipal water distribution is fairly widespread in the vicinity of Old Lyman Dump. It is reported that 80-90% of all of the people living in Spartanburg County obtain their potable water from municipal water systems (Ref. 41). None of the municipal water systems that serve populations living within a 4-mile radius of Old Lyman Dump obtain their water from wells located within the same 4-mile radius. Historically, two or more industrial wells have been known to exist within 4 miles of the site, but it is not known whether or not they are still active (Ref. 34). Furthermore, the owner of the farm located along the eastern perimeter of Old Lyman Dump, who is one of the closest residents to the site, could not recall there being any private domestic wells in the vicinity of the site (Ref. 13). Nevertheless, it has been reported that there remain many privately-owned, domestic wells located in the rural areas surrounding Old Lyman Dump (Refs. 9, 35). From a topographic map provided with an overlay of the current extent of municipal water distribution, a house count was performed to estimate the number of residents which may be using private domestic wells. This count resulted in the finding of approximately 447 homes within a 4-mile radius of Old Lyman Dump which are potentially using private domestic wells. Specific well depths are unknown, but these wells are presumed to be dug, drilled, or bored into the surficial, unconfined residual soil/crystalline rock aquifer system (Ref. 39, p. 58). The distance from Old Lyman Dump to the closest house that is potentially using a private well as a domestic water source was estimated to be approximately 4,800 feet. This house is located due east of Old Lyman Dump (Ref. 2).

Aside from the use of the aquifer of concern as a domestic water supply for private home owners in the vicinity of Old Lyman Dump, water from this aquifer is also known to be used for commercial purposes by virtue of the presence of numerous artesian springs in the Spartanburg County area. Some of these springs have been used in the past for the development of spas or health resorts, while others have been used as water sources for bottled water businesses (Ref. 39, p. 58). It is not known whether any of the springs that may potentially exist within 4 miles of Old Lyman Dump are used for such purposes.

4.0 FIELD INVESTIGATION

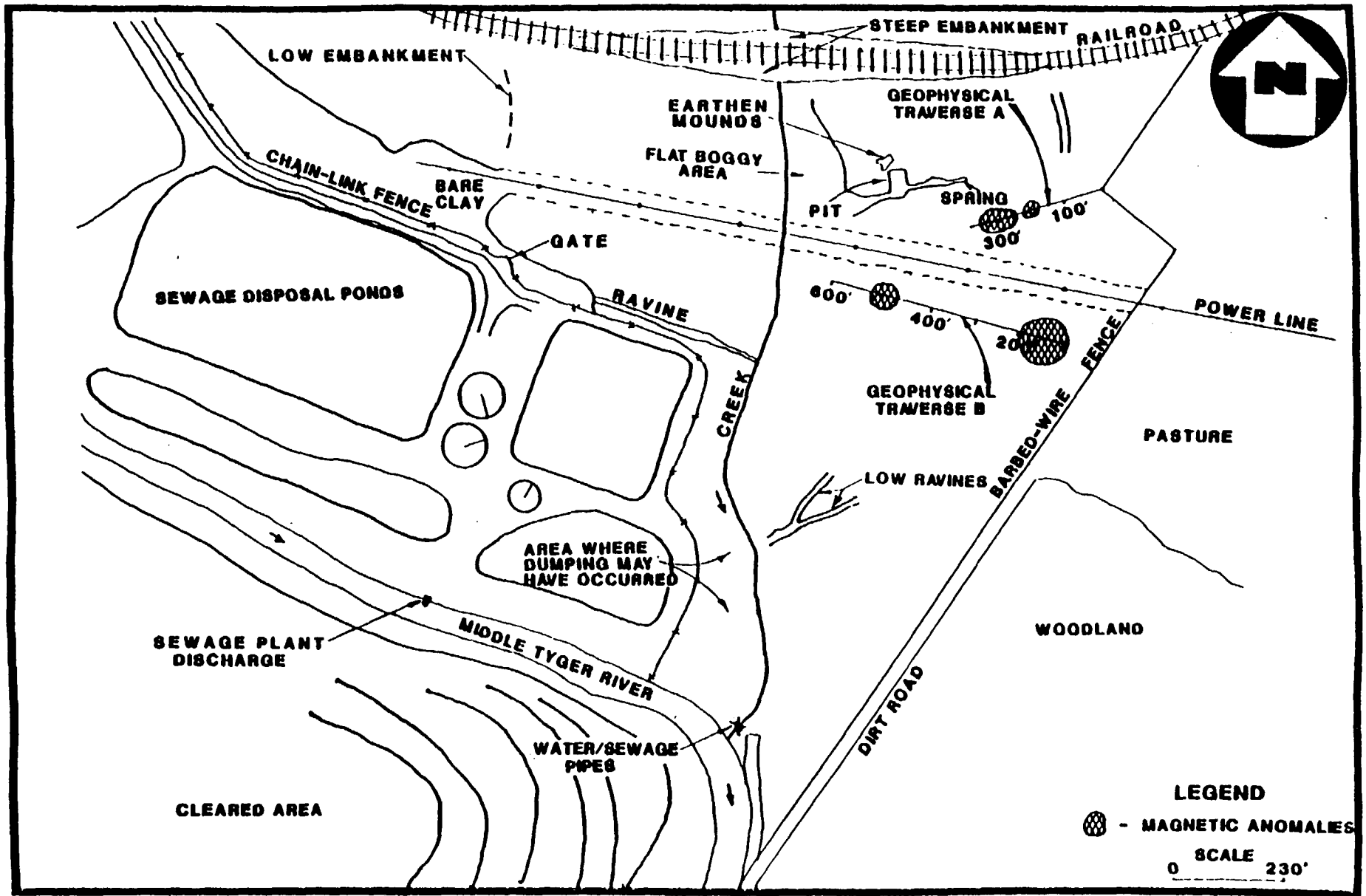
The field investigation of Old Lyman Dump occurred on September 24-28, 1990, and involved a geophysical investigation, a Field Analytical Support Project investigation, an onsite reconnaissance, the collection of environmental soil and water samples, and the associated field measurements performed on these samples (Refs. 12, 13, 45, 46).

4.1 GEOPHYSICAL INVESTIGATION

The purpose of this geophysical survey was to provide a screening technique by which localities for environmental sampling could be chosen by the sampling team. In the accomplishment of this task, an area of suspected dumping on the Old Lyman Dump property was surveyed using two geophysical techniques to produce a magnetic intensity survey and a ground conductivity survey, respectively. The area investigated using these geophysical techniques was located roughly in the central portion of the site. This is the area that appeared to be totally or partially cleared in the aerial photographs taken of the site in 1959 and 1963, as discussed in Section 2.2.1. Details of geophysical methods used in the survey occur in Appendix C.

Two geophysical instruments were utilized in this geophysical study: a proton precession magnetometer and a non-contacting ground conductivity meter. Both instruments were calibrated and put through a pre-operational check according to standard manufacturer's operational procedures. A base station was established in an area close to the dumping area in which undisturbed local field conditions were believed to exist. The base station location was flagged with a wooden stake, and measurements were taken with both instruments at this station prior to the surveys and upon their completion. Field conditions at the base station were recorded in a field logbook (Ref. 46). The average magnetic field intensity was 52,810 gammas at 3:05 P.M. on September 25, 1990, and 52,709 gammas at 4:10 P.M. on the same day. This 101 gamma variation represents the upper range of typical diurnal, ambient field fluctuations. The background conductivity level was 0.9 (mmhos/m) at and in the general vicinity of the base station, which is underlain by geologic material similar to that which occurs beneath the surveyed area.

The geophysical surveys were conducted along two linear traverses which were cut through the dense vegetation that covered much of the site. Geophysical stations were established at 50-foot intervals along the two linear traverses. The traverses are designated as "A" and "B" on Figure 4. Traverse "A" was 350 feet in length, and Traverse "B" was 550 feet in length. Data were recorded on



GEOPHYSICAL TRAVERSES AND MAGNETIC ANOMALIES
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

FIGURE 4

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geophysical field data sheets from measurements done with both geophysical instruments at each station.

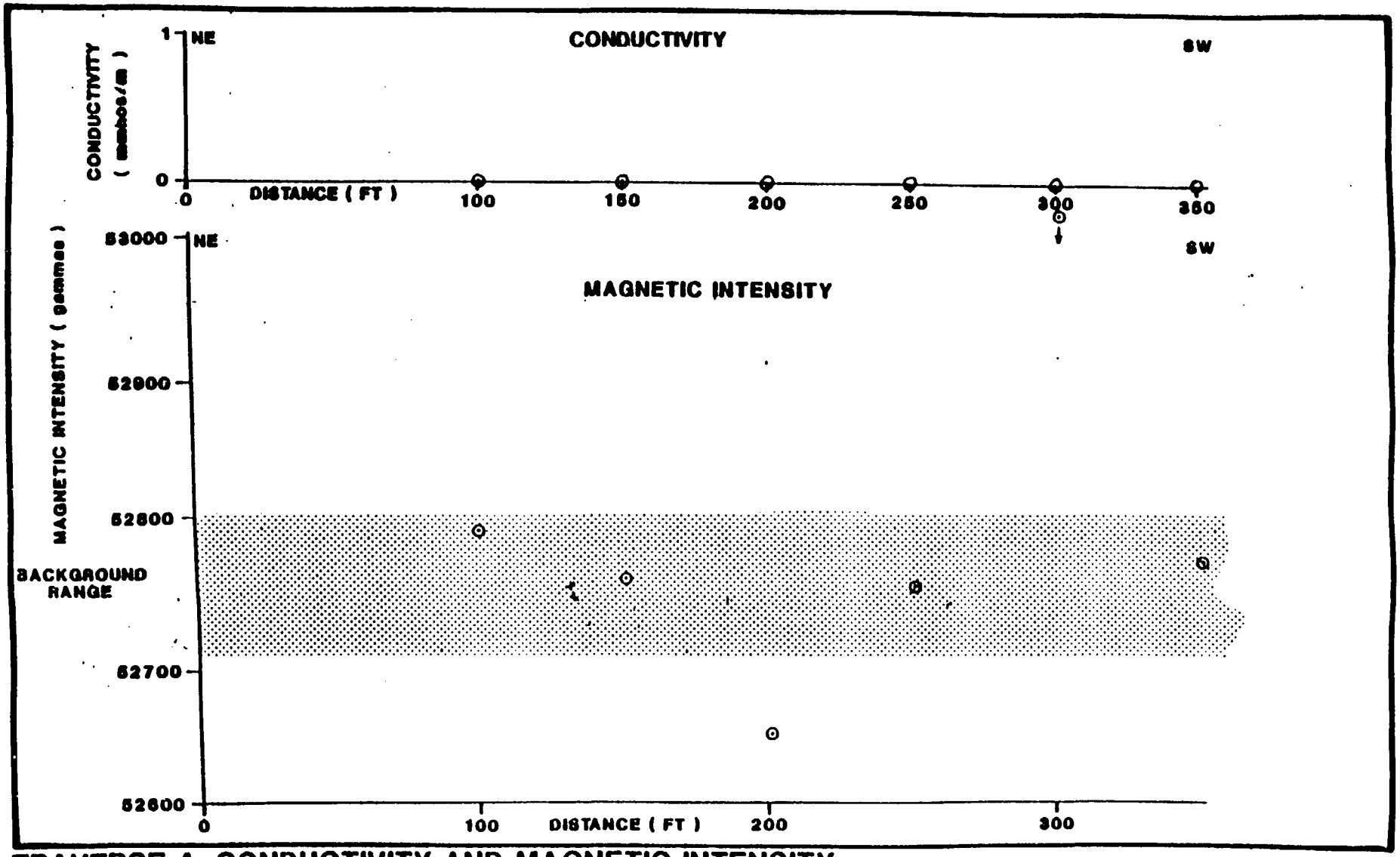
The results of the electromagnetic conductivity survey performed at 17 stations within the suspected dumping area are presented graphically (Figures 5, 6). There were no conductivity anomalies detected along either survey line. The absence of conductivity response in the surveyed areas suggests shallow bedrock or very dry soils within the upper 20 feet (approximate range of EM-31 in quadrature mode) (Ref. 46).

The magnetic intensity results are also presented graphically (Figures 5 and 6). The graphs indicate anomalous responses at Station 300 on the "A" traverse and at Stations 100, 150, 200, and to a lesser degree 500 on the "B" traverse. The anomalies range from approximately (±) 100 to 300 gammas in magnitude. Their locations are indicated on Figure 4. The magnetic intensity anomalies are of a magnitude equivalent to the response of the instrument over one to three shallowly buried drums, or some other object containing a similar mass of ferrous (iron) material (Ref. 13).

4.2 FIELD ANALYTICAL SUPPORT PROJECT (FASP)

A soil-gas survey was performed at Old Lyman Dump to aid in the selection of CLP sample locations and delineate source areas. Soil gas probes were placed along paths that were cleared for geophysical screening as well as near suspected source areas. A photoionization detector (HNu) was used as a direct reading instrument for measuring total volatile organic compounds (VOCs) present in the soil at the site. The instrument was field checked and calibrated. A background reading was taken outside the site area in a meadow. Background ambient air readings, both on and off site, remained steady at 3-4 ppm during the entire field investigation. Soil gas probes were installed at a depth of approximately 3 feet. FASP recommendations were based on relative results rather than absolute numbers. Soil gas monitoring identified "clean" or "dirty" areas in the subsurface soil. This information, along with observation, file material, drainage pathway information, geophysical screening, etc., was used to select CLP sample locations (Refs. 13, 45). The Soil Gas Survey Method is presented as Appendix D. A detailed presentation of the results of the FASP work can be found in the FASP logbook (Ref. 45).

The locations for placing soil gas probes at Old Lyman Dump were chosen based upon the results of a review of the available file material on the site and upon the results of extensive onsite reconnaissances of the site. The soil gas probes were placed in areas where hazardous wastes were suspected of being located or where these wastes may have migrated. Figure 7 shows the approximate locations of the 21 soil gas probes that were placed on the site property. Upon sampling



TRAVERSE A: CONDUCTIVITY AND MAGNETIC INTENSITY
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

FIGURE 5

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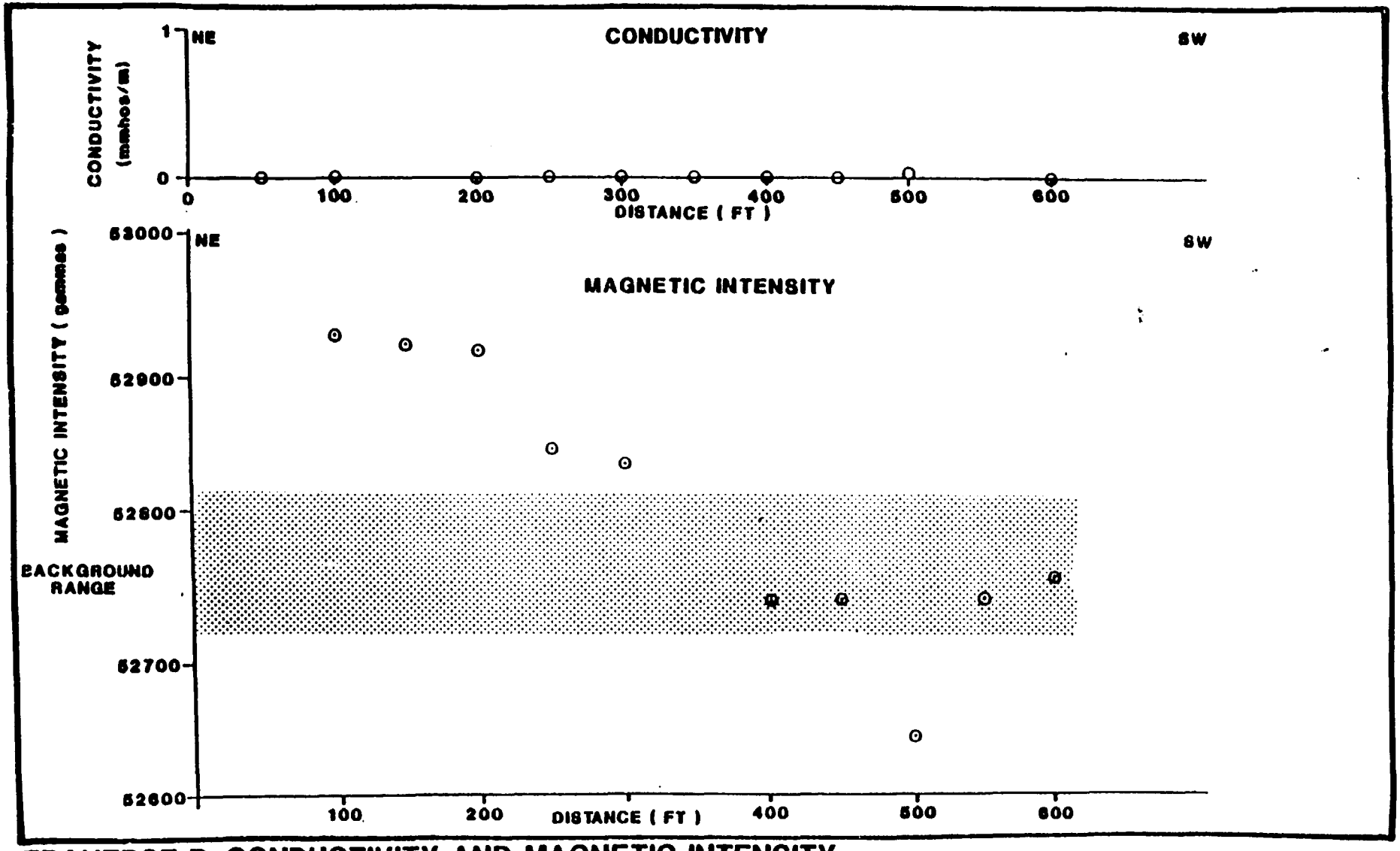

TRAVERSE B: CONDUCTIVITY AND MAGNETIC INTENSITY
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

FIGURE 6

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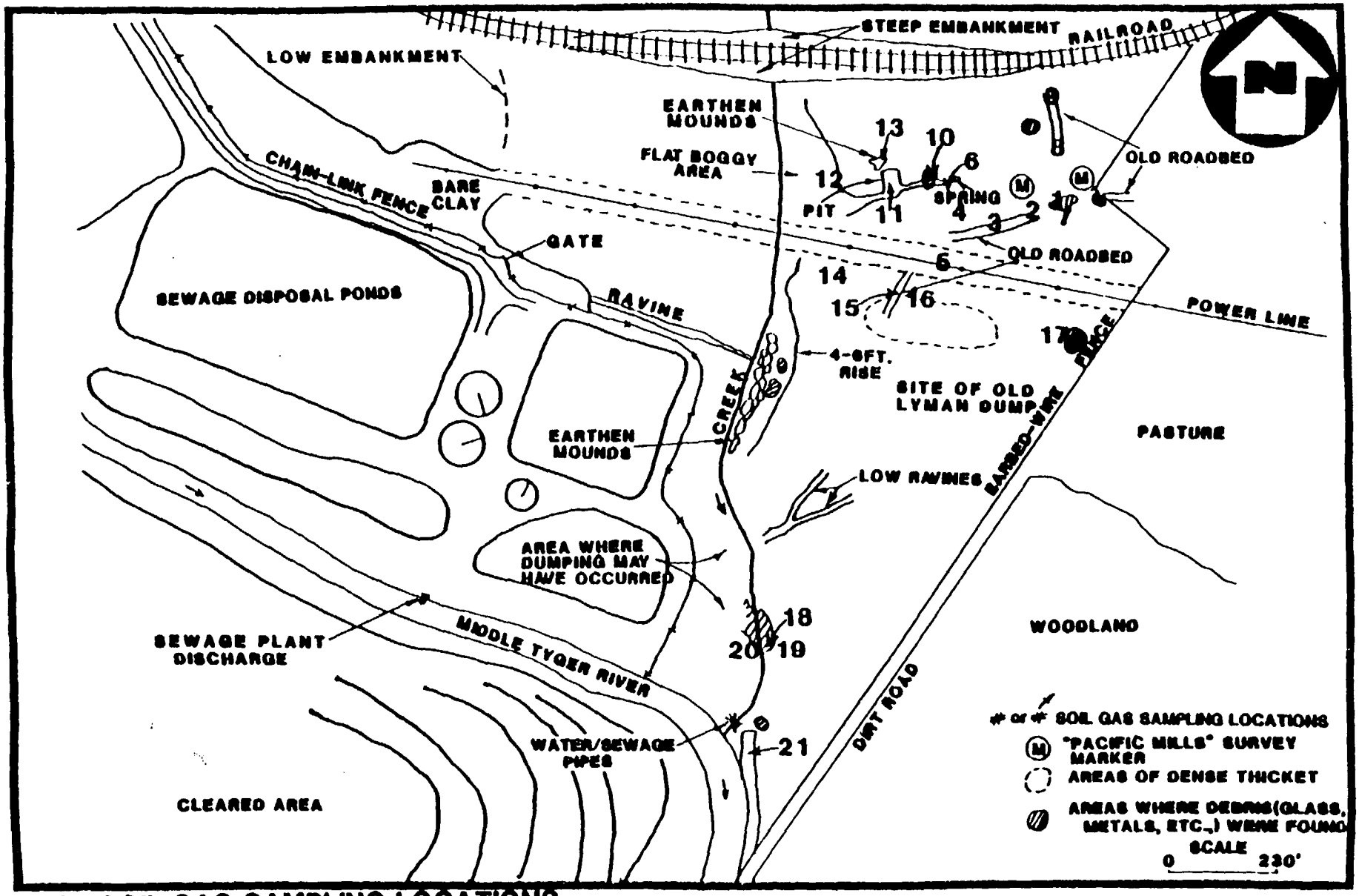

FASP SOIL GAS SAMPLING LOCATIONS
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

FIGURE 7

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the air from each of these probes with the HNu, the level of the volatile organic compounds detected in the probe was considered to be "elevated" if it was 2 to 3 times the ambient air background reading.

Thirteen soil gas probes were installed in the northern portion of the site, north of the power line. Both probes 4 and 6, located upgradient of the onsite spring and within small depressions which appeared to be old stream beds or ditches, indicated the presence of elevated levels of volatile organic compounds (VOCs). Elevated levels of VOCs were also detected from probe 10, which was placed nearer to the onsite spring (Refs. 13, 45).

Four soil gas probes were placed along an approximate east-west line that was cleared for geophysical screening just south of the power line. No elevated levels of VOCs were detected. The third area that was monitored for soil gases was near the southern tip of the property. Four soil gas probes were placed in this area. Probe 21, placed in a cleared truck path, indicated the presence of elevated levels of VOCs (Refs. 13, 45).

4.3 SAMPLE COLLECTION

During the field investigation, conducted on September 24-28, 1990, FIT 4 attempted to identify and characterize contaminants which may be present in the environment as a result of activities that were conducted at Old Lyman Dump. To accomplish this, FIT 4 collected environmental surface soil, subsurface soil, surface water, and groundwater samples from a number of strategic locations. These locations were selected based on historical information, hydrogeological data for the region and for the area of the site, direct observation at the site, and the results of geophysical and FASP investigations at the site.

4.3.1 Sample Collection Methodology

All sample collection, sample preservation, and chain-of-custody procedures used during this investigation were in accordance with the standard operating procedures as specified in Sections 3 and 4 of the Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual; United States Environmental Protection Agency, Region IV, Environmental Services Division, April 1, 1986.

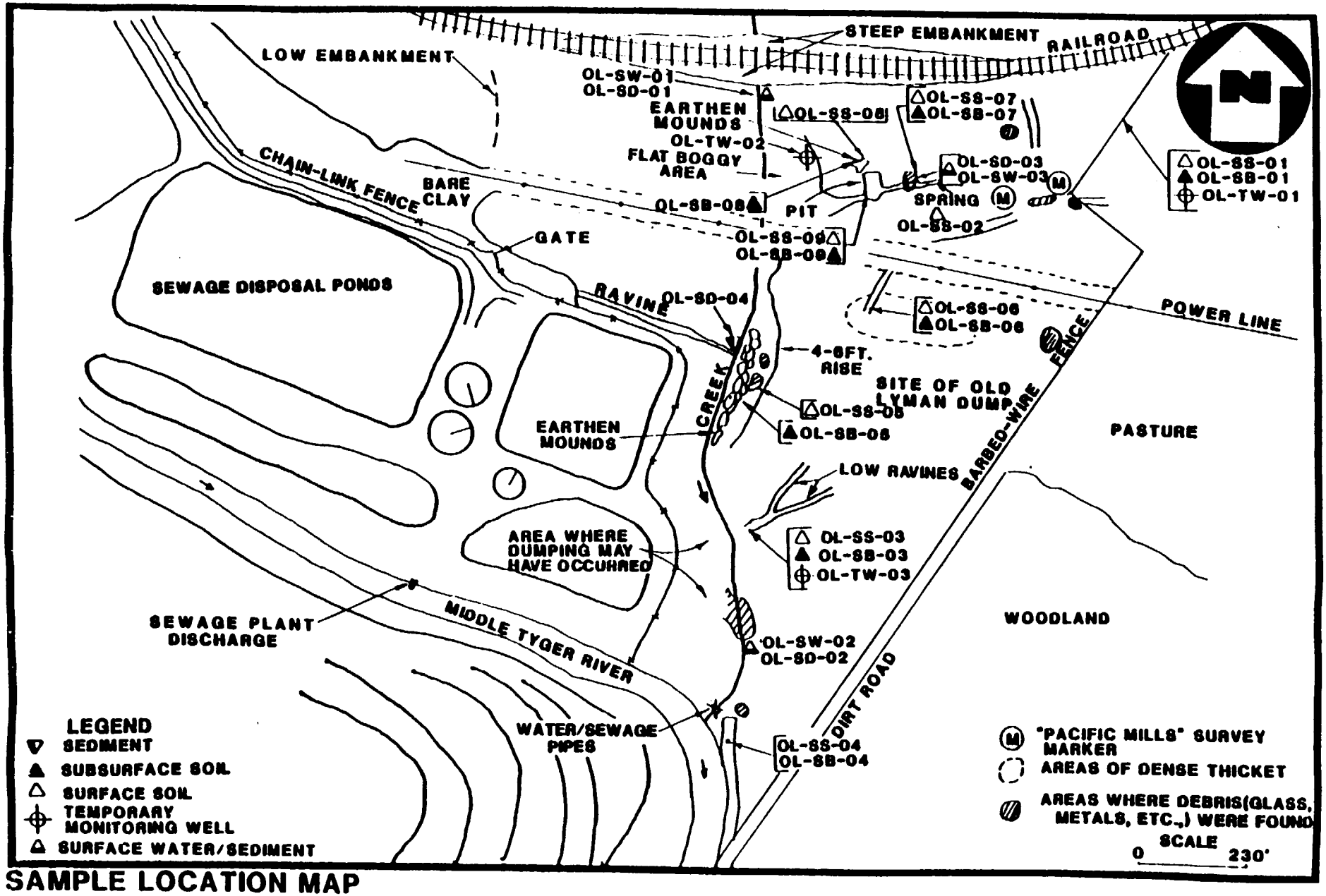
4.3.2 Duplicate Samples

Duplicate offsite background samples were offered to and declined by Butch Lynn, owner of the farm from which these samples were collected. Duplicates of all of the samples that were collected on and off site were offered to and accepted by Vince W. Blout, a geologist/project manager with Universal Engineering Sciences of Orlando, Florida. Universal Engineering Sciences was chosen to represent the town of Lyman and Springs Industries during this sampling investigation (Ref. 13). Receipt for sample forms are on file at FIT 4.

4.3.3 Description of Samples and Sample Locations

During the sampling investigation, nine surface soil, eight subsurface soil, four sediment, three surface water, and three groundwater samples were collected, for a total of 27 samples. Sample locations are shown in Figure 8. Sample codes, descriptions, locations, and rationale are provided in Table 1. Background surface soil, subsurface soil, and groundwater sample (designated OL-SS-01, OL-SB-01, and OL-TW-01) were collected upgradient from the site on Butch Lynn's farm, at a location approximately 10 feet east of the northeastern perimeter of Old Lyman Dump. Control samples (OL-SD-01, OL-SD-04, OL-SW-01, and OL-TW-02) were also collected from various locations on the site property. The remaining samples were collected from other onsite locations (Ref. 13).

The locations of several samples were chosen based upon the results of the FASP and geophysical investigations. Samples OL-SS-07 and OL-SB-07 were collected near the location of FASP soil gas probe 10 (see Figure 7), which registered elevated levels of volatile organic compounds when sampled with the HNu detector. Samples OL-SD-03 and OL-SW-03 were collected from the onsite spring located near soil gas probe 10. Samples OL-SS-04 and OL-SB-04 were collected near the location of soil gas probe 21 (see Figure 7), which also registered elevated levels of volatile organic compounds. Finally, sample OL-SS-02 was collected from a location very near soil gas probes 4 and 6 (see Figure 7), which also registered elevated levels of volatile organic compounds. The placement of sample OL-SS-02, at a location nearby geophysical line A, was also influenced by the detection of a 300 gamma magnetic anomaly at the 300-foot station of geophysical line A (see Figure 4) (Refs. 13, 45, 46).



SAMPLE LOCATION MAP
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

FIGURE 8

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TABLE 1

SAMPLE CODES, DESCRIPTIONS, LOCATIONS, AND RATIONALE
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Description	Location	Rationale
OL-SS-01	Surface Soil	At the northeastern perimeter of the site, along the fenceline, 150 feet down from the railroad tracks. The sample was taken at a point approximately 10 feet east of the fence.	Background sample.
OL-SS-02	Surface Soil	Located at a bearing of 330° and at a distance of 60 feet from the 300-foot station of geophysical line A, in the northern portion of the site. The sample was taken from a small depression that appeared to be an old ditch or an old stream bed.	Determine presence or absence of contamination. This sample location was determined from the results of the FASP and geophysical services.
OL-SS-03	Surface Soil	At a point 400 feet upstream from where a cleared truck path intersects the southern portion of the site creek. Sample was taken from a spot approximately 25 feet east of the site creek, within a mild ravine that rises toward the east-northeast.	Determine presence or absence of contamination downgradient from a possible dump area.
OL-SS-04	Surface Soil	Along the cleared truck path located in the southern portion of the site. Sample is taken from a point 215 feet up the truck path from the barbed-wire fence that borders the site to the east, and approximately 70 feet northeast of the Middle Tyger River.	Determine presence or absence of contamination. This sample location was determined from the results of the FASP work.

OL - Old Lyman Dump
SS - Surface Soil
SB - Subsurface Soil
SD - Sediment
SW - Surface Water
TW - Groundwater, Temporary Well

Though proposed in the Study Plan, samples OL-SB-02, OL-SD-05, OL-SW-04, OL-TW-04, OL-TW-05, and OL-PW-01 were not collected.

TABLE 1

SAMPLE CODES, DESCRIPTIONS, LOCATIONS, AND RATIONALE
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Description	Location	Rationale
OL-SS-05	Surface Soil	At a point approximately 720 feet upstream from where a cleared truck path intersects the southern portion of the site creek. Sample was taken from a spot approximately 25 feet east of site creek, at the base of a pile of debris. Earth mounds were also observed nearby.	Determine presence or absence of contamination from these areas of possible waste disposal.
OL-SS-06	Surface Soil	At a point just south of the power lines, and approximately 20 feet south-southwest of the 450-foot station of geophysical line B. Sample was taken from a point in the middle of what appeared to be an old roadbed.	Determine presence or absence of contamination.
OL-SS-07	Surface Soil	At a point 4 feet north of the spring where samples OL-SW-03 and OL-SD-03 were collected. This point is 75 to 100 feet east of the pit located in the northern portion of the site. An old barbed-wire fence and other debris were found near this sample location.	Determine presence or absence of contamination. This sample location was determined from the results of the FASP work.
OL-SS-08	Surface Soil	Taken from atop the easternmost of the earth mounds that are adjacent to the pit located in the northern portion of the site.	Determine presence or absence of contamination from earth mounds.
OL-SS-09	Surface Soil	Taken from the southwest corner of the pit located in the northern portion of the site, and approximately 6 feet from the cut in the pit wall which drains the pit.	Determine presence or absence of contamination in the pit.

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Though proposed in the Study Plan, samples OL-SB-02, OL-SD-05, OL-SW-04, OL-TW-04, OL-TW-05, and OL-PW-01 were not collected.

TABLE 1

SAMPLE CODES, DESCRIPTIONS, LOCATIONS, AND RATIONALE
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Description	Location	Rationale
OL-SB-01	Subsurface Soil	At the northeastern perimeter of the facility, along the fenceline, 150 feet down from the railroad tracks. The sample was taken at a point approximately 10 feet east of the fence. Sample depth: 3-4 feet.	Background sample.
OL-SB-03	Subsurface Soil	At a point 400 feet upstream from where a cleared truck path intersects the southern portion of the site creek. Sample was taken from a spot approximately 25 feet east of the site creek, within a mild ravine that rises toward the east-northeast. Sample depth: 6-7 feet, at the saturation zone.	Determine presence or absence of contamination downgradient from a possible dump area.
OL-SB-04	Subsurface Soil	Along the cleared truck path located in the southern portion of the site. Sample is taken from a point 215 feet up the truck path from the barbed-wire fence that borders the site to the east, and approximately 70 feet northeast of the Middle Tyger River. This sample was collected approximately 3 feet away from sample OL-SS-04. Sample depth: 3 feet.	Determine presence or absence of contamination. This sample location was determined from the results of the FASP work.

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Though proposed in the Study Plan, samples OL-SB-02, OL-SD-05, OL-SW-04, OL-TW-04, OL-TW-05, and OL-PW-01 were not collected.

TABLE 1

SAMPLE CODES, DESCRIPTIONS, LOCATIONS, AND RATIONALE
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Description	Location	Rationale
OL-SB-05	Subsurface Soil	At a point approximately 690 feet upstream from where a cleared truck path intersects the southern portion of the site creek. Sample was taken from a spot approximately 25 feet east of site creek, in an area of dense debris (rock, metal, brick, etc.). This sample was taken from a point approximately 30 feet south of sample OL-SS-05. Sample depth: 4 feet.	Determine presence or absence of contamination from this area of possible waste disposal.
OL-SB-06	Subsurface Soil	At a point just south of the power lines, and approximately 20 feet south-southwest of the 450-foot station of geophysical line B. Sample was taken from a point in the middle of what appeared to be an old roadbed, approximately 1 foot away from sample OL-SS-06. Sample depth: 1-2 feet.	Determine presence or absence of contamination.
OL-SB-07	Subsurface Soil	At a point 4 feet north of the spring where samples OL-SW-03 and OL-SD-03 were collected. This point is 75 to 100 feet east of the pit located in the northern portion of the site. An old barbed-wire fence and other debris were found near this sample location. Sample depth: 2.0-2.5 feet, at the saturation zone.	Determine presence or absence of contamination. This sample location was determined from the results of the FASP work.

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Though proposed in the Study Plan, samples OL-SB-02, OL-SD-05, OL-SW-04, OL-TW-04, OL-TW-05, and OL-PW-01 were not collected.

TABLE 1

SAMPLE CODES, DESCRIPTIONS, LOCATIONS, AND RATIONALE
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Description	Location	Rationale
OL-SB-08	Subsurface Soil	Taken from a spot at the western edge of the earth mounds that are adjacent to the pit located in the northern portion of the site. This sample was taken from a spot approximately 25 feet west of sample OL-SS-08. Sample depth: 2-3 feet.	Determine presence or absence of contamination from earth mounds.
OL-SB-09	Subsurface Soil	Taken from the southwest corner of the pit located in the northern portion of the site, and approximately 6 feet from the cut in the pit wall which drains the pit. Sample depth: 1 0-2.5 feet, at the saturation zone.	Determine presence or absence of contamination in the pit.
OL-SD-01	Sediment	At the north part of the site creek, just south of the railroad tracks.	Control sample.
OL-SD-02	Sediment	At the south part of the site creek, approximately 10 feet downstream of last visible debris in the area where debris are concentrated in the creek.	Determine presence or absence of contamination from site creek.
OL-SD-03	Sediment	At the midsection of the spring which flows westward toward the pit located in the northern portion of the site.	Determine presence or absence of contamination in the spring. This sample location was determined, in part, from the results of the FASP work.
OL-SD-04	Sediment	At the lower (east) end of the ravine that runs along the north side of the wastewater treatment plant. The sample was collected at approximately 10 feet west of the site creek, in the middle of the bare clay ravine.	Control sample, to isolate the effects of the wastewater treatment plant from those of the site.

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Though proposed in the Study Plan, samples OL-SB-02, OL-SD-05, OL-SW-04, OL-TW-04, OL-TW-05, and OL-PW-01 were not collected.

TABLE 1

SAMPLE CODES, DESCRIPTIONS, LOCATIONS, AND RATIONALE
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Description	Location	Rationale
OL-SW-01	Surface Water	At the north part of the site creek, just south of the railroad tracks.	Control sample.
OL-SW-02	Surface Water	At the south part of the site creek, approximately 10 feet downstream of last visible debris in the area where debris are concentrated in the creek.	Determine presence or absence of contamination from site creek.
OL-SW-03	Surface Water	At the midsection of the spring which flows westward toward the pit located in the northern portion of the site.	Determine presence or absence of contamination in the spring. This sample location was determined, in part, from the results of the FASP work.
OL-TW-01	Temporary Well	At the northeastern perimeter of the facility, along the fenceline, 150 feet down from the railroad tracks. The sample was taken at a point approximately 10 feet east of the fence. Well depth: 24 feet. Water depth: 15-17 feet.	Background sample.
OL-TW-02	Temporary Well	At a point 95 feet due west of the earthen mounds that are adjacent to the pit located in the northern portion of the site. The sample was taken at the east edge of a flat, boggy area which follows along the eastern edge of the site creek. Well depth: 4 feet. Water depth: 2 feet.	Control sample, to isolate any effects of the Old Startex Landfill from those of the site.

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TW - Groundwater, Temporary Well

Though proposed in the Study Plan, samples OL-SB-02, OL-SD-05, OL-SW-04, OL-TW-04, OL-TW-05, and OL-PW-01 were not collected.

TABLE 1

SAMPLE CODES, DESCRIPTIONS, LOCATIONS, AND RATIONALE
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Description	Location	Rationale
OL-TW-03	Temporary Well	At a point 400 feet upstream from where a cleared truck path intersects the southern portion of the site creek. Sample was taken from a spot approximately 25 feet east of the site creek, within a mild ravine that rises toward the east-northeast. Well depth: 8 feet. Water depth: approximately 6.5 feet.	Determine presence or absence of contamination downgradient from a possible dump area.

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SW - Surface Water
TW - Groundwater, Temporary Well

Though proposed in the Study Plan, samples OL-SB-02, OL-SD-05, OL-SW-04, OL-TW-04, OL-TW-05, and OL-PW-01 were not collected.

4.3.4 Field Measurements

Field measurements were performed on all of the surface water and groundwater samples. The pH, temperature, and conductivity of each sample were measured at the time of collection. The results of these measurements are given in Table 2. No field measurements were conducted on the surface soil, subsurface soil, or sediment samples collected during this investigation.

4.4 SAMPLE ANALYSIS

4.4.1 Analytical Support and Methodology

All samples collected were analyzed under the Contract Laboratory Program (CLP) and analyzed for all parameters listed in the Target Compound List (TCL). Organic analyses of soil and water samples were performed by S-Cubed of San Diego, California. Inorganic analyses of soil and water samples were performed by IT Analytical Services of Export, Pennsylvania.

All laboratory analyses and laboratory quality assurance procedures used during this investigation were in accordance with standard procedures and protocols as specified in the Laboratory Operations and Quality Control Manual, United States Environmental Protection Agency, Region IV, Environmental Services Division, issued October 24, 1990; or as specified by the existing United States Environmental Protection Agency standard procedures and protocols for the Contract Laboratory Program (CLP) Statement of Work (SOW), as applicable.

4.4.2 Analytical Data Quality and Data Qualifiers

All analytical data were subjected to a quality assurance review as described in the EPA Environmental Services Division laboratory data evaluation guidelines. In the tables, some of the concentrations of the organic and inorganic parameters have been flagged with a "J". This indicates that the qualitative analysis was acceptable, but the quantitative value has been estimated. A few other compounds are flagged with an "N", indicating that they were detected based on the presumptive evidence of their presence. This means that the compound was tentatively identified, but its detection cannot be used as positive identification of its presence. Results for some background and control samples are reported with a "U" flag. This flag means that the material was analyzed for but not detected. The reported number is the laboratory-derived minimum quantitation limit (MQL) for the compound or element in that sample. At times, miscellaneous organic compounds that do not appear on the target compound list are reported with a data set. These compounds are labeled as "JN", indicating that they are tentatively identified at estimated

TABLE 2

FIELD MEASUREMENTS
WATER SAMPLES(1)
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	pH	Temp. (°F)	Conductivity (umhos/cm)
OL-SW-01	6.51	69.4	49
OL-SW-02	6.19	67.0	49
OL-SW-03	6.44	71.0	65
OL-TW-01	5.41	70.0	68
OL-TW-02	5.49	75.2	144
OL-TW-03	5.06	69.3	49

(1) Though proposed in the Study Plan, water samples OL-SW-04, OL-TW-04, OL-TW-05, and OL-PW-01 were not collected.

quantities. Because these compounds are not routinely analyzed for or reported, background levels or MQL values are not generally available for comparison. The complete analytical data sheets are presented in Appendix E.

The water trip blank, OL-TB-01W, was found to contain one unidentified purgeable organic compound at an estimated 30ug/l, and one unidentified extractable organic compound at an estimated 20ug/l. No contaminants were detected in the soil trip blank (OL-TB-01S) or the water preservative blank (OL-PB-01).

4.4.3 Presentation of Analytical Results

This section presents a discussion of the results from the analysis of the environmental samples collected during the investigation at Old Lyman Dump. Results for inorganic and organic analyses of surface soil, subsurface soil, groundwater, sediment, and surface water samples are presented in Tables 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12. Background samples have been designated for all media. Control samples have also been designated for some of the media. Values for background samples and control sample results are presented either as concentrations detected above the minimum quantitation limit (MQL) or, if not detected above the MQL, as the MQL. Samples containing concentrations of contaminants greater than or equal to three times the appropriate background and/or control sample's concentration or the MQL of these contaminants are considered to be "elevated".

4.4.3.1 Surface Soil Samples

The summaries of the inorganic and organic analytical results for the analyses of the surface soil samples collected at Old Lyman Dump are presented in Tables 3 and 4. Sample OL-SS-01 was taken from a field on the farm east of the site, at a spot located approximately 10 feet east of the barbed-wire fence which delimits the northeastern boundary of Old Lyman Dump. This sample location was considered off site and upgradient of Old Lyman Dump and was chosen for the background/control surface soil sample.

The results of the inorganic analyses of the onsite surface soil samples revealed elevated levels of several inorganic components in sample OL-SS-03, which was collected in the southwestern portion of the site, across from the Lyman wastewater treatment plant. Chromium, copper, lead, mercury, silver, zinc, and cyanide were found at levels that ranged from approximately 3 to 125 times background concentrations or MQL levels. The ratio of the concentration of chromium in sample OL-SS-03 over the concentration for chromium in background/control sample OL-SS-01 has a value of 4.6. This ratio

TABLE 3

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SURFACE SOIL SAMPLES
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (mg/kg)	Background, Northeast of Site OL-SS-01	Near Geophysical Line A OL-SS-02	400 Feet North of Truck Path, Near Site Creek OL-SS-03	Along Truck Path OL-SS-04	In Debris Area, West-Central Portion of Site OL-SS-05	Near Geophysical Line B OL-SS-06	Along North Edge of Spring OL-SS-07	Atop Earth Mounds, Near the Pit OL-SS-08	Southwest Corner of Pit OL-SS-09
ALUMINUM	26,000J	37,000J	26,000J	23,000J	25,000J	31,000J	22,000J	32,000J	29,000J
BARIUM	140	150	99	90	110	120	120	190	180
CALCIUM	800	1300	670	300	680	220	220	1000	1400
CHROMIUM	130	39	600	25	54	55	30	41	43
COBALT	12	10	15	9	14	11	8 3	14	9 3
COPPER	20U	-	2500	-	42	-	-	-	-
IRON	26,000J	36,000J	30,000J	20,000J	31,000J	32,000J	24,000J	29,000J	26,000J
LEAD	29	25	98	14	36	18	27	21	33
MAGNESIUM	2500	2700	3100	2200	1700	2300	2200	3600	3400
MANGANESE	330	230	500	370	430	190	190	510	120
MERCURY	0 3U	-	6 4	-	-	-	-	-	-
NICKEL	14	13	16	10	10	13	9 9	17	14
POTASSIUM	2100	2800	2100	1500	1300	2300	1600	2800	2400
SILVER	0 64U	-	32	-	-	-	-	-	-
VANADIUM	60	91	74	48	76	74	60	75	84
ZINC	38	41	250	40	41	37	41	53	75
CYANIDE	0 53U	-	23	-	-	-	-	-	-

- Material analyzed for but not detected above minimum quantitation limit (MQL)
J Estimated value.
U Material was analyzed for but not detected. The number given is the MQL

TABLE 4

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SURFACE SOIL SAMPLES
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/kg)	Soil Trip Blank	Background, Northeast of Site	Near Geophysical Line A	400 Feet North of Truck Path, Near Site Creek	Along Truck Path	In Debris Area, West-Central Portion of Site	Near Geophysical Line B	Along North Edge of Spring	Atop Earth Mounds, Near the Pit	Southwest Corner of Pit
	OL-TB-01S	OL-SS-01	OL-SS-02	OL-SS-03	OL-SS-04	OL-SS-05	OL-SS-06	OL-SS-07	OL-SS-08	OL-SS-09
PURGEABLE ORGANICS										
TETRACHLOROETHENE(TETRACHLOROETHYLENE)	-	6	6 J	-	2 J	3 J	-	6 J	-	-
TOLUENE	-	5U	-	-	-	-	-	7	-	-
UNIDENTIFIED COMPOUNDS/NO (1)								10 J/1	50 J/1	
EXTRACTABLE ORGANICS										
FLUORANTHENE	-	100J	-	-	-	-	-	-	-	-
PYRENE	-	86J	-	-	-	-	-	-	-	-
CHRYSENE	-	710U	-	240J	-	-	-	-	-	-
BENZOIC ACID	-	3400U	-	-	-	-	-	-	-	490 J
HEXADECANOIC ACID(1)					300 JN					4000 JN
DIMETHYLHEXAHYDRONAPHTHYLENE(1)								1000 JN		
UNIDENTIFIED COMPOUNDS/NO (1)		3000 J/2		30,000 J/11	3000 J/2	4000 J/4	6000 J/2	20,000 J/12	10,000 J/6	70,000 J/18
PESTICIDES/PCB'S										
4,4'-DDE (P,P'-DDE)	-	17U	-	190	-	-	-	-	-	-
4,4'-DDD (P,P'-DDD)	-	17U	-	110	-	-	-	-	-	-

- Material analyzed for but not detected above minimum quantitation limit.
J Estimated value.
N Presumptive evidence of presence of material.
U Material was analyzed for but not detected. The number given is the MQL.
(1) Tentatively identified and unidentified compounds. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.

TABLE 5

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SUBSURFACE SOIL SAMPLES(1)
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (mg/kg)	Background, Northeast of Site	400 Feet North of Truck Path, Near Site Creek	Along Truck Path	In Debris Area, West-Central Portion of Site	Near Geophysical Line B	Along North Edge of Spring	Near West Edge of Earth Mounds, Near the Pit	Southwest Corner of Pit
	OL-SB-01	OL-SB-03	OL-SB-04	OL-SB-05	OL-SB-06	OL-SB-07	OL-SB-08	OL-SB-09
ALUMINUM	51,000J	27,000J	29,000J	47,000J	68,000J	25,000J	67,000J	61,000J
BARIUM	250	75	130	46	170	150	260	260
BERYLLIUM	1U	-	-	-	-	-	1.5	-
CADMIUM	0.47U	-	-	-	-	-	1.4	-
CALCIUM	80U	240	230	-	520	880	600	850
CHROMIUM	69	28	19	53	45	26	72	62
COBALT	23JN	8.4	11	14	15JN	8	76JN	16
COPPER	39	22	-	29	48	-	61	49
IRON	53,000J	21,000J	20,000J	43,000J	54,000J	21,000J	68,000J	39,000J
LEAD	22	8.7	9.8	15	18J	12	25	36
MAGNESIUM	5000	2600	2300	1200	2100	2300	11,000	4700
MANGANESE	290	250	390	220	120	110	1300	170
NICKEL	39	13	15	16	23	11	38	26
POTASSIUM	4900	2000	1100	1000	2400	1500	12,000	3400

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value.
N Presumptive evidence of presence of material.
U Material was analyzed for but not detected. The number given is the MQL.
(1) Though proposed in the Study Plan, sample OL-SB-02 was not collected.

TABLE 5

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SUBSURFACE SOIL SAMPLES(1)
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (mg/kg)	Background, Northeast of Site	400 Feet North of Truck Path, Near Site Creek	Along Truck Path	In Debris Area, West-Central Portion of Site	Near Geophysical Line B	Along North Edge of Spring	Near West Edge of Earth Mounds, Near the Pit	Southwest Corner of Pit
	OL-SB-01	OL-SB-03	OL-SB-04	OL-SB-05	OL-SB-06	OL-SB-07	OL-SB-08	OL-SB-09
SODIUM	100U	-	-	-	-	-	160	-
VANADIUM	130	62	46	110	140	55	150	130
ZINC	66	31	48	31	38	40	99	110

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value.
N Presumptive evidence of presence of material.
U Material was analyzed for but not detected. The number given is the MQL.
(1) Though proposed in the Study Plan, sample OL-SB-02 was not collected.

TABLE 6

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SUBSURFACE SOIL SAMPLES(2)
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/kg)	Soil Trip Blank	Background, Northeast of Site	400 Feet North of Truck Path, Near Site Creek	Along Truck Path	In Debris Area, West-Central Portion of Site	Near Geophysical Line B	Along North Edge of Spring	Near West Edge of Earth Mounds, Near the Pit	Southwest Corner of Pit
	OL-TB-01S	OL-SB-01	OL-SB-03	OL-SB-04	OL-SB-05	OL-SB-06	OL-SB-07	OL-SB-08	OL-SB-09
PURGEABLE ORGANICS									
TETRACHLOROETHENE(TETRACHLOROETHYLENE)	-	2J	-	-	-	2J	-	-	-
EXTRACTABLE ORGANICS									
HEXANEDIOICACIDETHYLHEXYLESTER(1)				1000JN					
UNIDENTIFIED COMPOUNDS/NO (1)							2000JN1		6000JN2

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value.
N Presumptive evidence of presence of material.
(1) Tentatively identified and unidentified compounds. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.
(2) Though proposed in the Study Plan, sample OL-SB-02 was not collected.

TABLE 7

SUMMARY OF INORGANIC ANALYTICAL RESULTS
GROUNDWATER SAMPLES(1)
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/l)	Preservative Blank OL-PB-01	Background, Northeast of Site OL-TW-01	Control Sample, West of Earth Mounds, Northern Portion of Site OL-TW-02	400 Feet North of Truck Path, Near Site Creek OL-TW-03
ALUMINUM		9800	110,000	11,000
BARIUM	-	170	280	45
CALCIUM	-	2000	5000	3000
CHROMIUM	-	5U	93	16
COBALT	-	30	67	6
COPPER	-	20U	80U	21
IRON	-	8900	94,000	11,000
LEAD	-	7	43	6
MAGNESIUM	-	3500	8900	2300
MANGANESE	-	420	1700	150
NICKEL	-	9	49	-
POTASSIUM	-	3500	6100	1700
SODIUM	-	4100	16000	3000
VANADIUM	-	19	280	30
ZINC	-	70UJ	120J	-

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value.
U Material was analyzed for but not detected. The number given is the MQL.
(1) Though proposed in the Study Plan, samples OL-TW-04, OL-TW-05, and OL-PW-01 were not collected.

TABLE 8

SUMMARY OF ORGANIC ANALYTICAL RESULTS
GROUNDWATER SAMPLES[2]
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/l)	Water Trip Blank	Background, Northeast of Site	Control Sample, West of Earth Mounds, Northern Portion of Site	400 Feet - North of Truck Path, Near Site Creek
	OL-TB-01W	OL-TW-01	OL-TW-02	OL-TW-03
PURGEABLE ORGANICS				
1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)	-	5U	5U	3J
1,1-DICHLOROETHANE	-	5U	5U	8
1,1,1-TRICHLOROETHANE	-	5U	5U	12
1,2-DICHLOROETHENE (TOTAL)	-	2 J	5U	-
UNIDENTIFIED COMPOUNDS/NO (1)	30J/1			
EXTRACTABLE ORGANICS				
UNIDENTIFIED COMPOUNDS/NO.(1)	20J/1	30J/2	20J/2	

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value.
U Material was analyzed for but not detected. The number given is the MQL.
(1) Tentatively identified and unidentified compounds. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.
(2) Though proposed in the Study Plan, samples OL-TW-04, OL-TW-05, and OL-PW-01 were not collected.

TABLE 9

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SEDIMENT SAMPLES(1)
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (mg/kg)	Control Sample North Part of Site Creek OL-SD-01	South Part of Site Creek OL-SD-02	Midsection of Spring, in Northern Portion of Site OL-SD-03	Control Sample, in Ravine Located Along North Perimeter of Wastewater Treatment Plant OL-SD-04
ALUMINUM	2600J	12.000J	8200J	30.000J
BARIUM	13	33	74	92
CALCIUM	100U	200	200	520
CHROMIUM	43	120	17	220
COBALT	2U	4.3	5.1	14
COPPER	20U	-	-	130
IRON	7900J	18.000J	15.000J	41.000J
LEAD	1.6	7	3.8	32
MAGNESIUM	260	730	1700	2300
MANGANESE	45	140	110	580
MERCURY	0.13U	-	-	0.46
NICKEL	0.99U	4.4	5.8	21
POTASSIUM	280	580	2400	2600
VANADIUM	19	42	32	87
ZINC	8U	30	22	200

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated Value.
U Material was analyzed for but not detected. The number given is the MQL.
(1) Though proposed in the Study Plan, sample OL-SD-05 was not collected.

TABLE 10

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SEDIMENT SAMPLES(2)
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/kg)	Soil Trip Blank	Control Sample, North Part of Site Creek	South Part of Site Creek	Midsection of Spring, in Northern Portion of Site	Control Sample, in Ravine Located Along North Perimeter of Wastewater Treatment Plant
	OL-TB-01S	OL-SD-01	OL-SD-02	OL-SD-03	OL-SD-04
PURGEABLE ORGANICS					
TETRACHLOROETHENE(TETRACHLOROETHYLENE)	-	6U	-	-	8
EXTRACTABLE ORGANICS					
METHYLBENZENESULFANAMIDE(1)					400JN
UNIDENTIFIED COMPOUNDS/NO (1)		2000J/1			1000J/2
PESTICIDES/PCB'S					
4,4'-DDT (P,P'-DDT)	-	20U	12J	-	20U

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value.
N Presumptive evidence of presence of material.
U Material was analyzed for but not detected. The number given is the MQL.
(1) Tentatively identified and unidentified compounds. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.
(2) Though proposed in the Study Plan, sample OL-SD-05 was not collected.

TABLE 11

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SURFACE WATER SAMPLES(1)
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/l)	Preservative Blank	Control Sample, North Part of Site Creek	South Part of Site Creek	Midsection of Spring, in Northern Portion of Site
	OL-PB-01	OL-SW-01	OL-SW-02	OL-SW-03
ALUMINUM		50U	-	11,000
BARIUM	-	20U	-	110
CALCIUM	-	3000	3100	5500
CHROMIUM	-	5U	-	8
COBALT	-	3U	-	11
IRON	-	360U	-	24,000
LEAD	-	2U	-	24
MAGNESIUM	-	1400	1400	3100
MANGANESE	-	33	55	330
POTASSIUM	-	1200	1200	2000
SODIUM	-	3100	3200	3800
VANADIUM	-	2U	-	37

- Material analyzed for but not detected above minimum quantitation limit (MQL).

U Material was analyzed for but not detected. The number given is the MQL.

(1) Though proposed in the Study Plan, sample OL-SW-04 was not collected.

TABLE 12

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SURFACE WATER SAMPLES(2)
OLD LYMAN DUMP
LYMAN, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/l)	Water Trip Blank	Control Sample, North Part of Site Creek	South Part of Site Creek	Midsection of Spring, in Northern Portion of Site
	OL-TB-01W	OL-SW-01	OL-SW-02	OL-SW-03
PURGEABLE ORGANICS				
UNIDENTIFIED COMPOUNDS/NO.(1)	30J/1			
EXTRACTABLE ORGANICS				
TETRAHYDROPYRANONE(1)		80JN	20JN	
UNIDENTIFIED COMPOUNDS/NO (1)	20J/1	100J/3	100J/2	

J Estimated value.
N Presumptive evidence of presence of material.
(1) Tentatively identified and unidentified compounds. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.
(2) Though proposed in the Study Plan, sample OL-SW-04 was not collected.

is fairly high despite the fact that sample OL-SS-01 has an unusually high concentration of chromium relative to all of the surface soil samples except for OL-SS-03. Copper is known to be used, in the form of a copper salt, in dyeing processes which may have been conducted at the Lyman Dyeing and Finishing Company. The presence of copper in sample OL-SS-03 could therefore be related to the use of Old Lyman Dump as a dump site by the local textile plant.

The organic analysis of background/control surface soil sample OL-SS-01 revealed detectable levels of the organic compounds fluoranthene, pyrene, and tetrachloroethene. Pyrene is associated with the manufacture of chemical brighteners for polyester fibers (Ref. 47). Tetrachloroethene is used widely as a solvent in textile drycleaning, as a textile processing and finishing chemical, and as a solvent in the disperse-dyeing of polyester (Refs. 22, p. 320; 48, p. 761; 49, p. 60). Because the Lyman Dyeing and Finishing Company has been involved in the finishing and dyeing of polyester blend materials and other textiles, and has also used Old Lyman Dump as an industrial waste dump, the presence of pyrene and tetrachloroethene in sample OL-SS-01 may be attributable to the textile plant.

The organic analyses of the onsite surface soil samples revealed elevated levels of 4,4'-DDE (190 ug/kg) and 4,4'-DDD (110 ug/kg) in sample OL-SS-03. The concentrations of 4,4'-DDE and 4,4'-DDD in OL-SS-03 were approximately 11 and 6 times the MQL, respectively. In addition, a relatively high total concentration for the unidentified extractable organic compounds was also found in OL-SS-03. The number of unidentified extractable compounds found in OL-SS-03 (11 compounds) is also relatively high. For the eight onsite surface soil samples collected at Old Lyman Dump, the average number of unidentified extractable organic compounds is only approximately 7.

Given the limited information available about Old Lyman Dump, no direct correlation can be made between the presence of elevated levels of metals (with the exception of copper), cyanide, and pesticides in sample OL-SS-03 and the use of the site as a domestic and industrial waste dump. Since sample OL-SS-03 was collected from an area where dumping may have likely occurred in the past, the contaminants found in OL-SS-03 may be related to wastes deposited in that area. Also, sample OL-SS-03 was taken from a shallow ravine that appeared to provide drainage to some of the central portions of Old Lyman Dump, thus the contaminants found in OL-SS-03 could also have migrated overland from upgradient waste dumping areas. The finding of the pesticide 4,4'-DDE and 4,4'-DDD in sample OL-SS-03 does suggest a possible influence from the farm, which is generally upgradient of the location for sample OL-SS-03. These pesticides were not detected, however, in the background/control sample OL-SS-01, which was collected from the farm itself.

Like sample OL-SS-03, samples OL-SS-07 and OL-SS-09 contained higher than the average number of unidentified extractable organic compounds found in the surface soil samples taken from Old Lyman Dump. Fairly high estimated levels of some tentatively identified compounds were also detected in OL-SS-07 (dimethylhexahydronaphthalene: an approximate 1000 ug/kg) and in OL-SS-09 (hexadecanoic acid: an approximate 4000 ug/kg). Both of these samples were collected from the same general area in the northern portion of the site. Sample OL-SS-09 was taken from the bottom of the pit at a location directly along the surface water flow pathway leading away from sample OL-SS-07. Therefore, there may be some connection between the results of these two samples.

One final point concerning the surface soil sample analytical results must be noted. Samples OL-SS-03 and OL-SS-04 exceeded the holding times for the analysis of extractable organic compounds (except for the analysis of chrysene in OL-SS-03). Hence, a more timely analysis of these samples may have revealed the presence of more extractable organic compounds at detectable levels.

4.4.3.2 Subsurface Soil Samples

The summaries of the results of the inorganic and organic analyses of the subsurface soil samples collected at Old Lyman Dump are presented in Tables 5 and 6. The background sample, sample OL-SB-01, was taken at a depth of 3-4 feet beneath the spot where the surface soil background/control sample (OL-SS-01) was taken.

The inorganic analyses of the onsite subsurface soil samples revealed elevated levels of cadmium and manganese in sample OL-SB-08. The concentrations of cadmium and manganese in sample OL-SB-08 were 3 and 4 times the concentrations of these elements in background/control sample OL-SB-01, respectively. Cobalt was also detected in OL-SB-08 at an elevated level, but its reported concentration must be considered an estimated value that represents only the presumptive evidence of the presence of this element. In addition, elevated levels of calcium were found in samples OL-SB-03, OL-SB-06, OL-SB-07, OL-SB-08, and OL-SB-09. No other inorganic components were detected at elevated levels in any of the subsurface soil samples. Given the limited information available about Old Lyman Dump, no direct correlation can be made between the finding of elevated levels of calcium, cadmium, cobalt, and manganese in these subsurface soil samples and the use of the site as a domestic and industrial waste dump.

The organic analyses of the onsite subsurface soil samples revealed no positively identified compounds at elevated concentrations. Of all of the subsurface soil samples, only samples OL-SB-07 and OL-SB-09 contained detectable levels of unidentified extractable organic compounds. This may

be related to the high concentrations and numbers of unidentified extractable organic compounds found in surface soil samples OL-SS-07 and OL-SS-09 (Section 4.4.3.1).

4.4.3.3 Groundwater Samples

The summaries of the inorganic and organic analytical results for the groundwater samples collected at Old Lyman Dump are presented in Tables 7 and 8, respectively. Sample OL-TW-02 was taken from a temporary well located in the northwestern portion of Old Lyman Dump. From topographic considerations alone, this temporary well was considered downgradient of the Old Startex Spartanburg County Landfill located to the northeast. Sample OL-TW-02 was therefore intended to be a control sample, the analytical results of which would aid in determining any influence by the Old Startex Spartanburg County Landfill upon the chemical content of the groundwater passing beneath Old Lyman Dump. Sample OL-TW-01 was taken from the same location as sample OL-SS-01 and OL-SB-01: in the farm field east of the site, near the northeast perimeter of Old Lyman Dump. This location was topographically upgradient of nearly the entire area that was considered to be within the realm of Old Lyman Dump. Hence, sample OL-TW-01 was intended to be the background groundwater sample for this investigation. The location of sample OL-TW-01 is topographically downgradient of the farm field located east of Old Lyman Dump and, to some degree, of Old Startex Spartanburg County Landfill. Sample OL-TW-01 may therefore also be considered to be a control sample for aiding in determining the influence of operations at these upgradient locations upon the groundwater beneath Old Lyman Dump. Sample OL-TW-03 was taken from a temporary well located near the site creek in the southern portion of Old Lyman Dump. This location is downgradient of both samples OL-TW-01 and OL-TW-02. A large portion of the area identified as being Old Lyman Dump lies between sample OL-TW-03 and samples OL-TW-01 and OL-TW-02. Therefore, the analytical results of sample OL-TW-03 should aid in determining the influence by much of Old Lyman Dump upon the chemical composition of the groundwater passing beneath Old Lyman Dump.

The inorganic analytical results for groundwater sample OL-TW-03 reveal a concentration of chromium (16 ug/l) which is elevated relative to background/control sample OL-TW-01 (the OL-TW-03/OL-TW-01 concentration ratio is approximately 3) (Table 7). There may be a connection between this finding and the finding of an elevated level of chromium in surface soil sample OL-SS-03, which was collected from the same spot as groundwater sample OL-TW-03. The concentration of chromium in sample OL-TW-03, however, is not elevated compared to the chromium concentration in control sample OL-TW-02 (the OL-TW-03/OL-TW-02 concentration ratio is approximately 0.2). Hence, these data cannot be cited as evidence of an analytically observed release of chromium to the groundwater beneath Old Lyman Dump. Because the location of sample OL-TW-03 is topographically downgradient of the location of sample OL-TW-02, the lower

groundwater concentration of chromium in sample OL-TW-03 may possibly reflect the effects of dispersion and dilution of the chromium as it was transported toward OL-TW-03 from the vicinity of sample OL-TW-02. Another possibility is that the groundwater flow at the location of sample OL-TW-03 may have been influenced by or may even have been coming from the direction of the Lyman wastewater treatment plant. This plant, located only 100 - 200 feet to the west, is built up to a level of 10 or more feet above this sample location. The groundwater beneath the wastewater treatment plant may therefore have some influence upon groundwater flow patterns near the location of sample OL-TW-03. In short, since it is not known exactly where the groundwater beneath sample OL-TW-03 is coming from, it is therefore difficult to determine the origin of the high levels of chromium found in sample OL-TW-03.

High concentrations for several metals were found in sample OL-TW-02. The OL-TW-02/OL-TW-01 concentration ratios for aluminum, chromium, iron, lead, manganese, nickel, sodium, and vanadium, range from approximately 4 to 19. Furthermore, the conductivity of sample OL-TW-02, measured in the field at 144 umhos/cm, was over twice that of sample OL-TW-01 and nearly three times that of sample OL-TW-03. Groundwater sample OL-TW-02 apparently reflects different influences than samples OL-TW-01 and OL-TW-03. These differences between the analytical data of sample OL-TW-02 and those of samples OL-TW-01 and OL-TW-03 seem to suggest the possibility that the Old Startex Spartanburg County Landfill may be influencing the groundwater passing beneath Old Lyman Dump. On the other hand, sample OL-TW-02 was taken from within Old Lyman Dump, and therefore would presumably reflect, to some degree, the influence Old Lyman Dump has on the groundwater beneath it. To explore these possibilities, a comparison was made between the inorganic analytical results of sample OL-TW-02 and the analytical results of the surface soil and subsurface soil samples collected at both Old Lyman Dump and at the Old Startex Spartanburg County Landfill during the week of September 24-28, 1990. No groundwater samples were collected at Old Startex Spartanburg County Landfill. Of the 8 metals found in sample OL-TW-02 at elevated concentrations ($\geq$ 3 times the corresponding metal concentrations in OL-TW-01), four of these metals (chromium, manganese, nickel, and sodium) were also found at elevated concentrations in the surface and subsurface soil samples taken from the Old Startex Spartanburg County Landfill. Three of the eight metals found in sample OL-TW-02 at elevated concentrations (chromium, lead, and manganese) were also found at elevated concentrations in the surface and subsurface soil samples taken from Old Lyman Dump. These results suggest only partial correlations between the results for groundwater sample OL-TW-02 and the kind of metals found in the soils at either Old Lyman Dump or Old Startex Spartanburg County Landfill (Ref. 4).

The concentration of chromium (93 ug/l) in sample OL-TW-02 is close to the Maximum Contaminant Level (MCL) in drinking water for this element established by the USEPA (Ref. 50). Furthermore, the

concentration of lead (43 ug/l) in sample OL-TW-02 exceeds the action level for lead (15 ug/l) established by the USEPA (Ref. 51). Of course, the temporary well from which sample OL-TW-02 was taken is not used as a source for potable water. However, these data are mentioned because the groundwater in the vicinity of Old Lyman Dump is used as a source of potable water by private residences.

The organic analytical results for the groundwater samples indicate that no organic compounds were found at elevated levels in any of the samples (Table 8). However, the organic analytical results for sample OL-TW-03 reveal detectable levels of 1,1-dichloroethene (an estimated 3 ug/l), 1,1-dichloroethane (8 ug/l), and 1,1,1-trichloroethane (12 ug/l). The compound 1,1,1-trichloroethane is used in the textile industry as a drycleaning solvent, as a solvent in the disperse-dyeing of polyester, and as a solvent in other textile processing and finishing techniques (Refs. 22, p. 320; 49, p. 60; 52, p. 731). Because Lyman Dyeing and Finishing Company may have used 1,1,1-trichloroethane in its operations, and this textile mill was known to have used Old Lyman Dump as an industrial waste dump for liquid organic chemicals, the 1,1,1-trichloroethane in sample OL-TW-03 may have come from Old Lyman Dump.

4.4.3.4 Sediment and Surface Water Samples

The summaries of the inorganic and organic analytical results for the sediment and surface water samples collected at Old Lyman Dump are presented in Tables 9, 10, 11, and 12. Samples OL-SD-01 and OL-SW-01 were taken from where the site creek enters Old Lyman Dump from the culvert beneath the railroad tracks in the northern portion of the site. This sampling location was the highest point along the section of this creek which passed through Old Lyman Dump. The section of the site creek that was above this sampling location flowed through or was downgradient from portions of the Old Startex Spartanburg County Landfill. Samples OL-SD-01 and OL-SW-01 therefore were intended as control samples, the analytical results of which would aid in determining the influence of the Old Startex Spartanburg County Landfill on the chemical composition of this creek. Samples OL-SD-02 and OL-SW-02 were taken from the site creek in the southern portion of Old Lyman Dump, just downstream of some debris in the creek. These samples were intended to identify the effects upon the chemical composition of this creek by Old Lyman Dump. Sample OL-SD-04 was taken from the lower (east) end of a ravine that runs along the northern perimeter of the Lyman wastewater treatment plant. This ravine drains into the site creek at a point midway between the OL-SD-01, OL-SW-01 sample location and the OL-SD-02, OL-SW-02 sample location. Sample OL-SD-04 was therefore intended as a control sample for samples OL-SD-02 and OL-SW-02. The analytical results of sample OL-SD-04 were intended to help determine any influence upon the chemical composition of the site creek by the wastewater treatment plant. Finally, samples OL-SD-03 and OL-SW-03 were

taken from the creek that flows from a spring located in the northern portion of the site. This creek flows westward into the pit, and disappears into the southeastern portion of the floor of the pit. These samples were intended to determine the presence or absence of contamination in this creek.

The inorganic results for sediment sample OL-SD-02 revealed elevated levels of aluminum, lead, manganese, nickel, and zinc, with concentrations ranging from approximately 3 to 5 times the levels of these elements found in control sample OL-SD-01 (Table 9). When the data for sample OL-SD-02 are compared to that of control sample OL-SD-04, none of the concentrations of inorganic components found in sample OL-SD-02 can be considered elevated. Hence, it appears that these data for sample OL-SD-02 cannot be cited as evidence of an analytically observed release of these metals from Old Lyman Dump to the surface water in the site creek. For virtually all of the metals analyzed for, the concentrations in sample OL-SD-04 are greater than the corresponding concentrations in any of the other sediment samples. The inorganic concentrations in sample OL-SD-04 range from approximately 3 to 25 times the levels or MQL values found for control sample OL-SD-01. Evidence exists, however, which raises questions concerning the true source of the high levels of contaminants found in sample OL-SD-04. As discussed in Section 2.2.1, there are indications that some degree of dumping at Old Lyman Dump may have occurred in the area west of the site creek, possibly in the area which is now beneath the eastern end of the Lyman wastewater treatment plant. One can conclude from this that the high levels of contamination in sample OL-SD-04 may be a result of the dumping of hazardous wastes at Old Lyman Dump, and not a result of operations at the Lyman wastewater treatment plant. Sample OL-SD-04, therefore, may not be a true control sample. If this were the case, the metals found in sample OL-SD-02, which were elevated relative to the corresponding metal concentrations in control sample OL-SD-01 but which were not elevated relative to the corresponding metal concentrations in control sample OL-SD-04, might actually represent analytically observed releases of these contaminants to surface water at Old Lyman Dump. The inorganic analytical results for surface water sample OL-SW-02 reveal no elevated levels, relative to control sample OL-SW-01, of any of the metals analyzed for (Table 11).

The inorganic analytical results for sample OL-SD-03 revealed elevated levels of aluminum, barium, magnesium, nickel, and potassium (Table 9). The OL-SD-03/OL-SD-01 concentration ratios for these metals ranged from approximately 3 to 9. The analytical data for sample Ol-SD-03 do not have to be compared with those of control sample OL-SD-04, since the sample location for sample OL-SD-03 is not downgradient of the Lyman wastewater treatment plant. The inorganic analytical results for sample OL-SW-03 revealed elevated levels of aluminum, barium, cobalt, iron, lead, manganese, and vanadium (Table 11). The OL-SW-03/OL-SW-01 concentration ratios for these metals ranged from approximately 4 to 220.

The data for samples OL-SD-03 and OL-SW-03 indicate that an analytically observed release to surface water of the elements aluminum, barium, cobalt, iron, lead, magnesium, manganese, nickel, potassium, and vanadium has occurred at Old Lyman Dump. Samples OL-SD-03 and OL-SW-03 were collected from a creek that starts at a point approximately 60 feet upstream from the sampling point. While it was not confirmed during the sampling investigation of September 24-28, 1990, this creek may actually come from a spring or from a groundwater seep. With respect to topographic groundwater flow gradients, the vicinity of this small creek is downgradient of the Old Startex Spartanburg County Landfill. If the creek is fed by groundwater, the creek might be affected by groundwater-transported contamination coming from this landfill. However, since no attempt was made to take a water sample at a point where the creek may emerge from the ground, it cannot be determined as to whether the elevated levels of contaminants found in samples OL-SD-03 and OL-SW-03 are a result of contaminated groundwater entering the creek from a spring, or, rather, a result of contaminants entering the creek via surface water run-off. To investigate the latter possibility, a comparison was made between the inorganic analytical results of samples OL-SD-03 and OL-SW-03 and the inorganic analytical results of the surface and subsurface soil samples collected at Old Lyman Dump. Of the 10 metals found in samples OL-SD-03 and OL-SW-03 at elevated concentrations, two metals (lead and manganese) were also found at elevated concentrations in the surface and subsurface soils at Old Lyman Dump. These results show only a partial correlation between the analytical data for samples OL-SD-03 and OL-SW-03, and the analytical data for the surface and subsurface soil samples taken from Old Lyman Dump.

The creek from which samples OL-SD-03 and OL-SW-03 were taken was not observed, during the sampling investigation, to reach the creek at the bottom of the site ravine before being absorbed into the ground at the floor of the pit. The possibility that this tributary creek could reach the site creek during periods of greater surface water flow, however, does exist. Evidence of gullies along the pathway leading downgradient from the point where the tributary creek disappears definitely supports this possibility. The subsequent threat of contamination of the perennial site creek by this tributary creek is quite evident.

The organic analyses of the sediment samples revealed no elevated concentrations for any of the compounds analyzed for (Table 10). The organic analytical results for the surface water samples also indicated no elevated concentrations for any of the compounds analyzed for (Table 12).

5.0 SUMMARY

The analytical results of the samples collected during the field investigation performed at Old Lyman Dump on September 24-28, 1990, indicate that elevated levels of chromium, calcium, cadmium, copper, lead, manganese, mercury, silver, zinc, cyanide, 4,4'-DDE, and 4,4'-DDD are present in the surface and subsurface soils at the site. Although chromium was found in the groundwater beneath Old Lyman Dump at a concentration elevated above the chromium concentration in the background/control sample (OL-TW-01), it is uncertain as to whether this represents an observed release to the groundwater from Old Lyman Dump, or rather, the groundwater migration of contamination from the nearby Old Startex Spartanburg County Landfill or from some other offsite source.

The analytical results also indicate a release to surface water at Old Lyman Dump of the elements aluminum, barium, cobalt, iron, lead, magnesium, manganese, nickel, potassium, and vanadium. Furthermore, several factors concerning Old Lyman Dump suggest that contaminants found in a control sample (OL-SD-04) may actually be a result of the influence of operations at Old Lyman Dump, and not of the nearby wastewater treatment plant. If this were the case, the element zinc could be added to the above list of elements released to surface waters at Old Lyman Dump.

The findings of copper and potassium at elevated levels in several of the samples collected at Old Lyman Dump are significant because these elements are known to be used in various processes related to the textile processing, dyeing and finishing industry. The presence of these contaminants at Old Lyman Dump may reflect the use of the site as an industrial waste dump by Lyman Dyeing and Finishing Company. However, because the site was used as an uncontrolled domestic and industrial waste dumping location, any of the contaminants found in the soil and water at Old Lyman Dump may be related to the use of the site as a dump.

The contaminants found in the surface soils and subsurface soils at Old Lyman Dump present an possible threat to the local population. Old Lyman Dump is only partially fenced, and is unguarded. The site is therefore accessible to the general public. The local population is therefore at risk of exposure to contaminated soils and objects on the site. In particular, workers at the Lyman wastewater treatment plant, and those who live and work on the farm adjacent to the eastern perimeter of the site, are at risk of exposure to the contaminants at the site. Others at risk include the approximately 11,349 people living within 4 miles of Old Lyman Dump who may come into contact

with the site or may be exposed to hazardous volatile substances that may be transported away from the site in the air.

The contaminated surface water found at Old Lyman Dump poses a possible threat via recreational fishing in the Middle Tyger River downstream of Old Lyman Dump. Also at risk are the numerous freshwater marshes that lie along the 15-stream-mile surface water pathway downstream of Old Lyman Dump.

Because the contaminants found at Old Lyman Dump are uncontained with respect to migration to groundwater, those private residences that draw their water from wells located in the vicinity of Old Lyman Dump are potentially at risk of exposure to contaminated groundwater. An estimated 447 homes within a 4-mile radius of Old Lyman Dump may be using private domestic wells.

Based upon analysis of the analytical data and the potentially affected targets associated with the various forms of contaminated media and their potential migration routes, it is recommended that Old Lyman Dump be evaluated using the HRS (effective March 14, 1991). Aside from the elevated levels of contaminants found in the surface soils, subsurface soils, and surface water at Old Lyman Dump, other reasons for this recommendation concern the extent to which hazardous waste contamination at Old Lyman Dump occurs on the west side of the site creek and, in particular, beneath what is now the eastern end of the Lyman wastewater treatment plant, and how much of an influence the Old Startex Spartanburg County Landfill has upon the quality of the groundwater beneath Old Lyman Dump. It is recommended that further work be done at Old Lyman Dump, perhaps in conjunction with investigations of the nearby "old dump" or "old city landfill" and the Old Startex Spartanburg County Landfill, in order to further investigate these concerns.

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REFERENCE NO. 7

"Rite in the Rain"®

ALL-WEATHER

LEVEL

Notebook No. 311

F4-2429

TDD # F4-9007-23

OLD LYMAN DUMP

LYMAN SPARTANBURG COUNTY

SOUTH CAROLINA

PROJECT MANAGER: JOHN SCHENDEL

PRE-SAMPLING ON-SITE RECONNAISSANCE

AUGUST 14, 1990

LOGBOOK REQUIREMENTS
REVISED NOVEMBER 28, 1989

ALL LANGUAGE SHOULD BE FACTUAL AND OBJECTIVE

...front cover of the Logbook: TDD No., Site Name, ... Location, Project Manager.

All ... are made using ink. Draw a single line through ... and date corrections.

...Plan ...bers'

OFFICE (803) 439-9171
HOME (803) 439-2411

...and

WILLIAM H. (BILL) GROCE
MAYOR
TOWN OF LYMAN

...of ...ite.

GROCE ROAD
LYMAN, SO. CAR. 29365
(803) 439-3453

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...log by completing the stamped information ... of the logbook.

...representative is on hand to accept the receipt for ... entry to that effect must be placed in the ...

... numbers of COC and receipt for sample forms ... record numbers of destroyed documents.

... information in the space provided.

8/14/90

The undersigned arranged to perform an onsite reconnaissance of the Old Lyman Dump in order to delineate the boundaries of the dump and to determine the appropriate sampling strategy. This arrangement was made with the knowledge and approval of both the EPA and the owner of the site, namely, the town of Lyman (represented by the Mayor, Mr. Bill Groce).

No study plan, safety plan or work plan were prepared for this phase of the investigation of Old Lyman Dump. The only person to record notes in this logbook will be John Schendel. Photo notes will be logged in at the end of the logbook. Signed,

John Schendel

JOHN SCHENDEL
8/14/90

1

2 8/14/90 - Tuesday

9:00 AM Weather - clear, hot, muggy (humid)

9:12 AM EST

John Schendel arrives at Lyman Town Hall.

Met with: Marshall Bright
Bill Grace
Allen McManus

I explained to them why I was here - to survey the Old Lyman Dump site in order to determine sampling locations. I briefly explained the process with which EPA investigates potential waste sites, namely, first an offsite reconnaissance and then "light" sampling (Phase I) etc. I mentioned that sampling would commence on Sept 24/1990. I also mentioned that Old State Dump would be under a sampling investigation the same week.

Mr. McManus, speaking for Mayor Grace, suggested that while EPA conforms the town of Lyman to allow

John Schendel

8/14/90

the investigation to proceed, the town did not want to give permission for the investigation until the sampling plan was provided to Mr. Grace. Mr. McManus said that it was their desire to work with DHES and the EPA in an amicable and friendly fashion. I assured them that this was also my desire. I informed them that, while the final word was not mine to give, a draft plan for the investigation could probably be sent to Mr. Grace by me or through the EPA.

We also discussed how split sample will be offered to Mr. Grace, and that if these samples were accepted, Mr. Grace would have to provide his own containers.

Mr. McManus asked that, for today's work, I check in with Mr. Bright (who works at the POTW) before leaving the site, and that I check in with Mr. Grace before leaving town today. Mr. McManus also spoke for

John Schendel

3

4 8/14/90

Mr. [illegible] by requesting that I have the [illegible] (through which access to the [illegible] achieved) by no later than 5:00 PM.

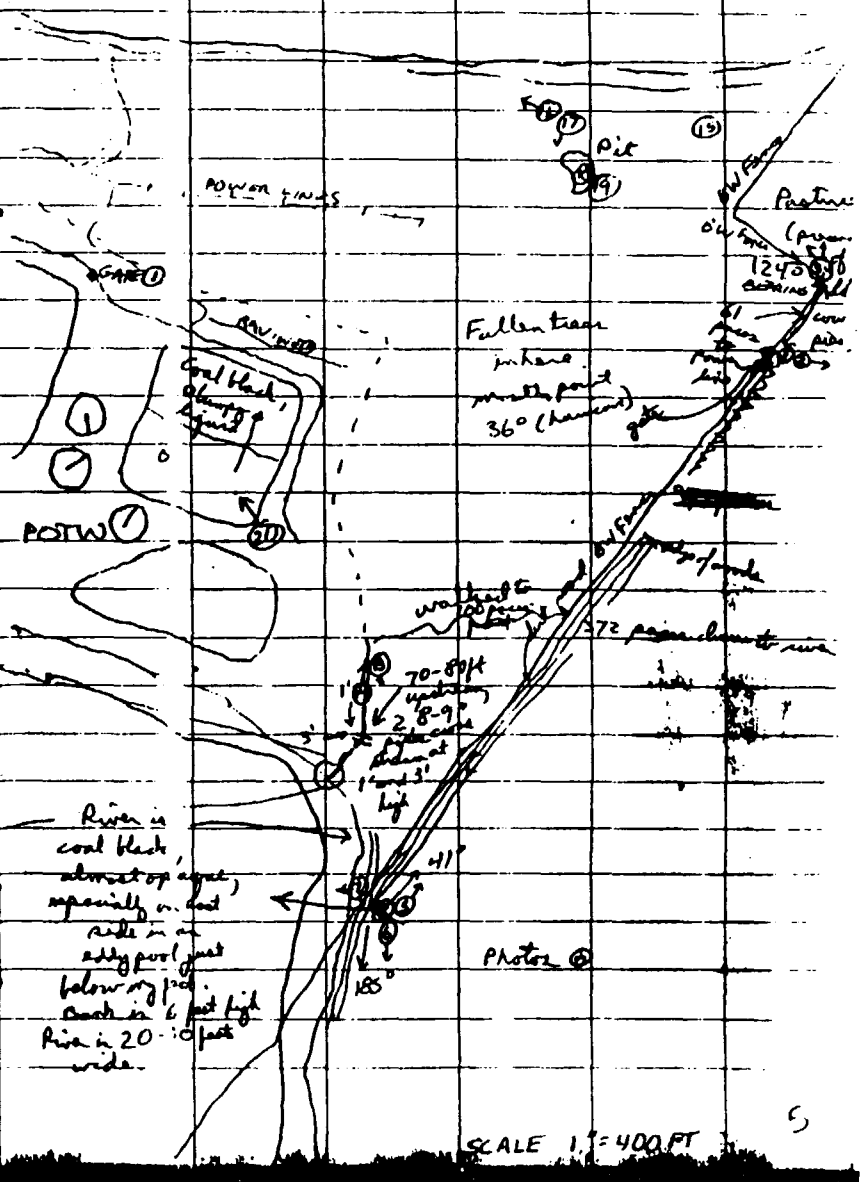
Mr. Bright also verified that the POTW was owned by the town of Lyman but operated by Spring Industries. The plant receives and processes both domestic and industrial water waste.

10:45 AM - Arrive at GATE ① (see map). [illegible] is moist but there is no flowing water

Opposite bank is shallow - perhaps 1 foot deep. Can see the bottom through brownish water. Photo ⑨ of water being dumped into M.T. River about 300 feet upstream of where the creek dumps into M.T. River.

L. Schofield

8/14/90 Joshua Schofield



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6 8/14/90

12:20PM - I just remembered something else the gentlemen said to me at this morning's meeting. Mr. Grace said that the dump was opened before the town of Lyman was ever incorporated. It was used as an industrial dump and as an unofficial public dump. It was, apparently, not run by any municipal govt, at least in the early years of operation. Also, Mr McManus said that the dump site was deeded over to the city of Lyman by M. Lowenstein, before M Lowenstein was bought out by Spring Industries.

12:45 - On creek that cuts through supposed site. At perhaps 100-150 feet up the creek from where it dumps into the Middle Tyger River, I begin to see human-derived refuse in the creek bed - bottles of large glass container
triangular piece of metal
bricks
glass jars

John Schendel

8/14/90

glass bottles
stone slabs
marble or slate (white) plates → □
→ (I see minnows in creek)
(Creek bank is perhaps 4 feet high)
I see a broken clear glass jar in ground 5 feet from eastern edge of creek. The refuse in the creek covers a large portion of creek bed for 50-75 feet upstream from original point of discovery.

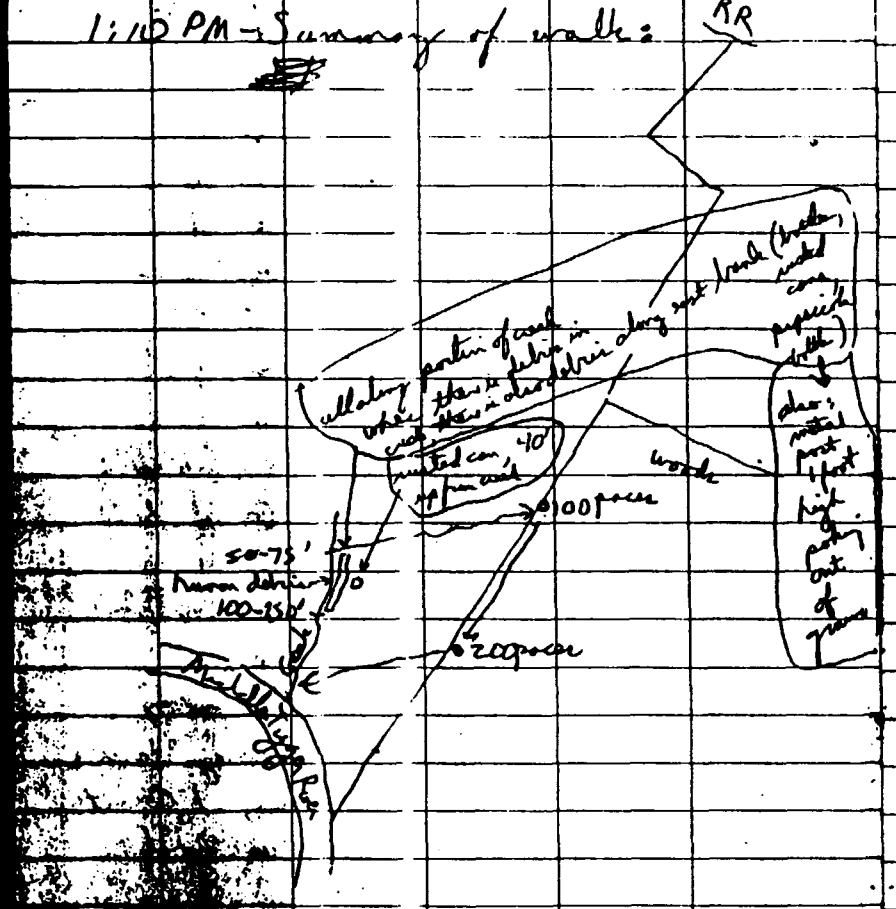
12:55 PM - arrived in dirt road after walking up woodland from creek (area where refuse is in creek

1:02 PM - arrived at 200 paces along road. Head due west, toward creek.
At 50-75 feet from creek, I found an old clear glass bottle of Laundry Starch: Texize Products For The Home, 1 Quart No bumping, No cooking. Just add. "The Mild In The Bottle"
Another brown glass bottle was found 3 feet away. Both bottles had old, rusted caps on them. Both bottles are just east of a fallen down, [illegible] pine tree.

John Schendel

8 8/14/90

1:10 PM - Summary of walk:

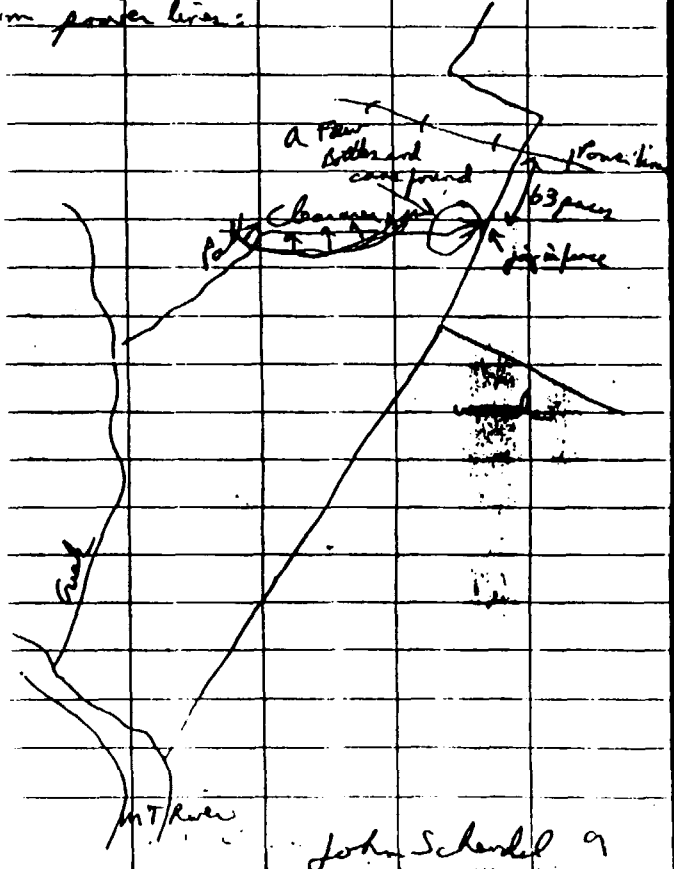


1:11 PM - Headed back up creek.

John Scherdel

8/14/90

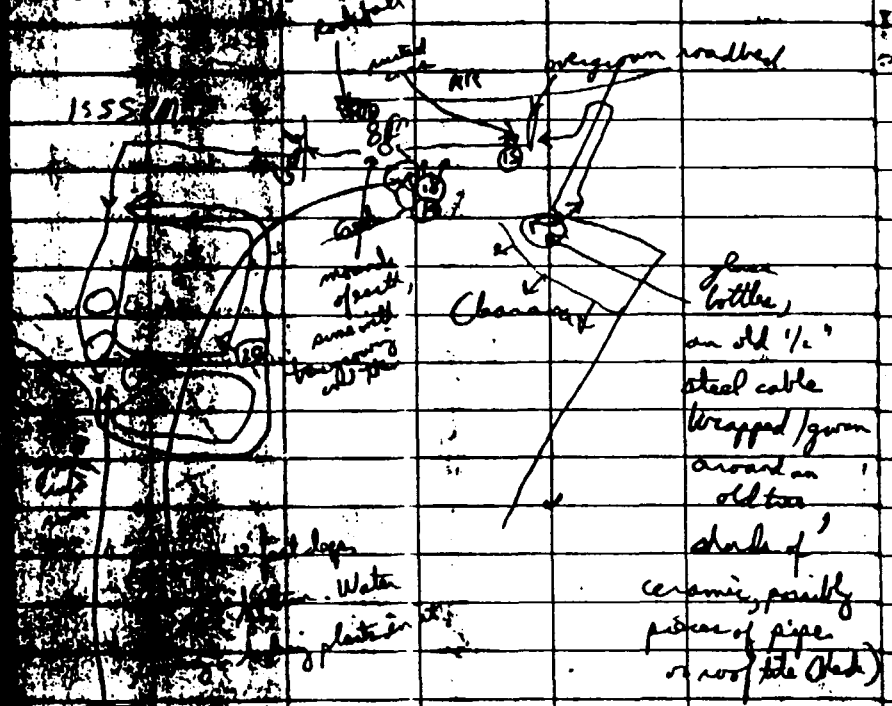
1:45 PM - Walked up, roughly due east, from creek; midway up slope discovered a relatively clear area (lots of thorns, a few trees, some shrubs and small trees). Kept heading due east. Arrived at a gate/pig in the Barbed Wire fence at edge of grass field, 63 paces down from power line:



John Scherdel 9

10

8/14/90



2:50 PM Man at POWT told me [illegible] Woodward would know about [illegible] 433-4239. He also said that the two lines that run east from [illegible] (the ones I saw running over creek) [illegible] was a water line to Startex; the [illegible] was a forced sewer line from Hardees + businesses in the area of Hardees.

John Schendel

8/14/90

3:00 PM Saw Mr Bright. He said that the Spring Industries - run POWT supplies water to Lyman and to Startex (via the 8" pipe I saw crossing the creek at the site). The SJWD supplies water to the area surrounding Lyman. Spring Industries gets its water from the Middle Tyger River, just upstream from the dam which is just upstream of the POWT.

3:45 - Arrive at SJWD Water District office on US 29 in Lyman
Danny Blackwell and Larry Plenman
Danny Blackwell: no [illegible] potable water south of [illegible] for 15 miles [illegible] No intakes [illegible] Tyger (but SJWD wants [illegible] on N. Tyger: EPA has them [illegible] due to a wetland issue). On [illegible] Tyger; Green has an intake [illegible] a dammed-up lake.
Maps 8+14 - Landmarks
Startex (Spartanburg) Bill Blackwood
Blackwood + Associates

John Schendel

8/14/90

Danny Blackwell told me these things:

① SJWD owns and operates all water lines in Lyman and outside of Lyman. The town of Lyman owns and operates its own sewer system. SJWD brings water from Spring Industries intake on the Middle Tyger River to supply the town of Lyman with water. All other areas around Lyman get water from SJWD's purchase of water from Spartanburg (Lake Bowen).

② On the water line maps I was given, I can tell which lines are Lyman Villages (water from Spring Ind) and lines that get water from Spartanburg:
On pages 8 and 14, the handwritten roads are the Village of Lyman's lines.

③ Startex gets its water from Spring Ind. To find out their distribution, call Bill Blackwood of Blackwood and Associates in Spartanburg.

John Schendel

8/14/90

The waterline map previously mentioned is presented as an attachment to this logbook. The map's official title is: Startex ~ Jackson ~ Wellford ~ Duncan Water District

John Schendel

8/16/90

The following is a summary of the reconnaissance. The information given here is taken from the previous pages and from memory.

I Please refer to MAP 1 (attachment to this logbook). 10:15 - 11:00 AM EST.

A. My first effort was to go down to the creek which cuts through the site. It was difficult to find a way down to the creek, as the thickets were quite prevalent, even under the tree canopy. Fallen trees also made the going rough. I spotted a 1-2 foot long snake (with a ~~venomous~~-looking head) along the west bank of the creek at the location of my 2nd creek encounter of this segment of the recon (where thickets were very dense - I had to crawl to get to the creek).

B. Notice the dry ravine that was just below one of the waste treatment ponds. This ravine led down to the creek, sloping toward the east.

C. The entire area west of the creek

John Schendel

sloped gently to the east toward the creek.

II. Please refer to MAP 2 (attachment to this logbook). 11:00 AM - 12:15 PM.

III Please refer to MAP 3 (attachment to this logbook). 12:15 PM - 1:10 PM.

A. Thorough recon of lower (south) portion of site.

IV. Please refer to MAP 4 (attachment to this logbook). 1:11 PM - 2:55 PM.

Thorough recon of northern portion of site and of eastern portion of waste water treatment plant.

John Schendel

40

Case No. _____

Low Concentration yes/no

Organics

No.	Media	Lab	Airbill No.
	Soil		
	Water		

Inorganics

No.	Media	Lab	Airbill No.
	Soil		
	Water		

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time: 11:15 AM # keyed to map: (1)
Location: east of site, on city limits border
Picture of: power lines stretching toward east

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time: 11:15AM # keyed to map: (2)
Location: east of site, at city limits border
Picture of: power lines stretching through site toward the west

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time: 11:20AM # keyed to map: (3)
Location: City limits, east of site
Picture of: 1/2 of panorama looking off toward north

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendl
Time: 11:20AM # keyed to map: (4)
Location: city limits, east of site.
Picture of: 1/2 of panorama looking off toward north. Old Starter dump may be in background.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendl
Time: 11:45AM # keyed to map: (5)
Location: South point of site.
Picture of: looking back up dirt road (41° bearing) from where I had come.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendl
Time: 11:45AM # keyed to map: (6)
Location: south point of site
Picture of: looking down dirt road (185° bearing) that continues southward from where it intersects Middle Tyger River.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendl
Time: 11:50AM # keyed to map: (7)
Location: Middle Tyger River, south end of site
Picture of: Middle Tyger River - notice the water is very brownish, almost opaque.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendl
Time: 11:55AM # keyed to map: (8)
Location: south point of site
Picture of: looking across Middle Tyger River toward the barren - looking hill on the other side. Looking roughly S-SW.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendl
Time: 12:15 PM # keyed to map: (9)
Location: Confluence of site creek and Middle Tyger River.
Picture of: looking up Middle Tyger River; notice dumping of effluent into river (center of photo) by sewage treatment plant.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time: 12:15PM # keyed to map: (10)
Location: Confluence of site creek and Middle Tyger River.
Picture of: looking downstream on Middle Tyger River.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time: 12:15PM # keyed to map: (11)
Location: Confluence of site creek and Middle Tyger River.
Picture of: The confluence itself; creek goes upstream toward the right.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time: 12:15PM # keyed to map: (12)
Location: Confluence of site creek and Middle Tyger River.
Picture of: looking upstream of creek from confluence.

TDD # F4-9007-23
Date 8/14/90 By Whom: (13)
Time: 12:45PM # keyed to map:
Location: Upstream on the creek that runs through the site.
Picture of: Refuse (rusty cans) on ground near east bank of creek.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time: 12:45PM # keyed to map: (14)
Location: upstream on the creek that runs through the site.
Picture of: looking up the creek; notice refuse (cans, bottles, bricks, etc.) in the creek.

TDD # F4-9007-23
Date 8/14/90 John Schendel
2:05 ~~1:15~~ PM (15)
(13)
Location: northeast end of site.
Picture of: Rusty cans on ground.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
2:15 1:20 PM # keyed to map (16)
(15)
Location: south end of site

Picture of: backfill near the railroad tracks (human-made structure of rocks used to support tracks across site ravine).

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
2:15 1:20PM # keyed to map (17)
(15)
Location: north central portion of site

Picture of: earth mounds, some with trees growing on them

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
2:20 1:20PM # keyed to map (18)
(15)
Location: "north part of site, at the pit"

Picture of: north edge of pit, looking south from inside the pit itself.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
2:12 1:30PM # keyed to map (19)
(15)
Location: "north part of site, at the pit"

Picture of: south and northwest edge of pit, taken from inside pit in same place as photo (18).

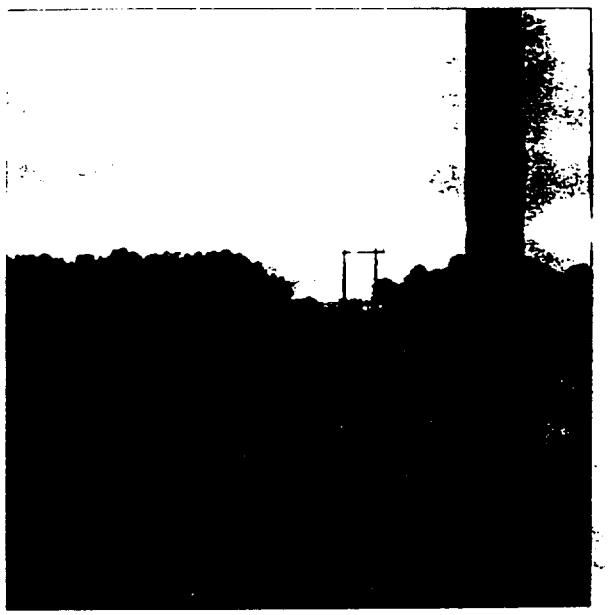
TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time 2:55PM # keyed to map: (20)
Location: at eastern edge of the sewage treatment plant

Picture of: one of the treatment ponds at the plant

TDD #
Date By Whom:
Time # keyed to map:
Location:
Picture of:

Polaroid Photos

(2)



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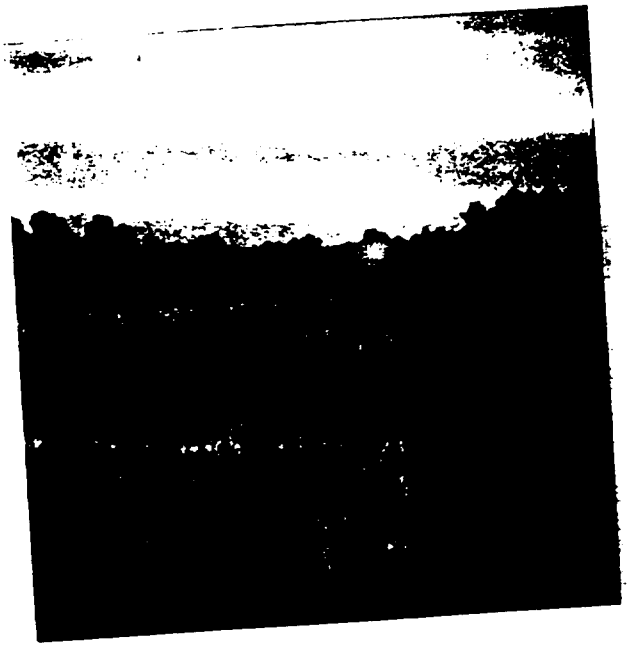

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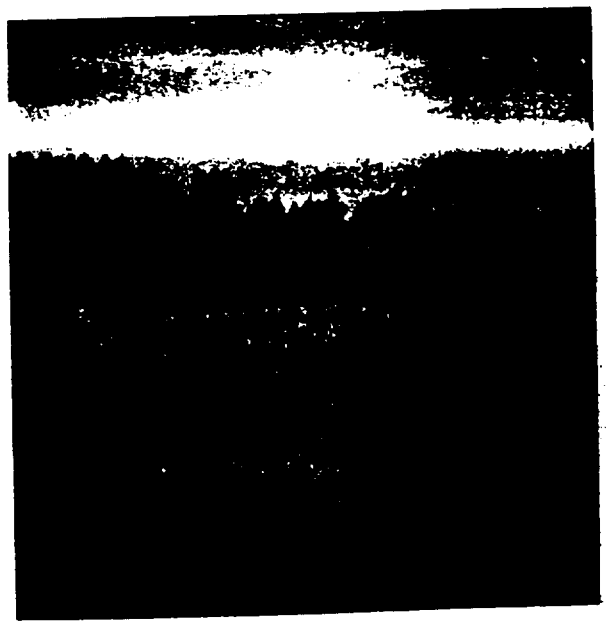

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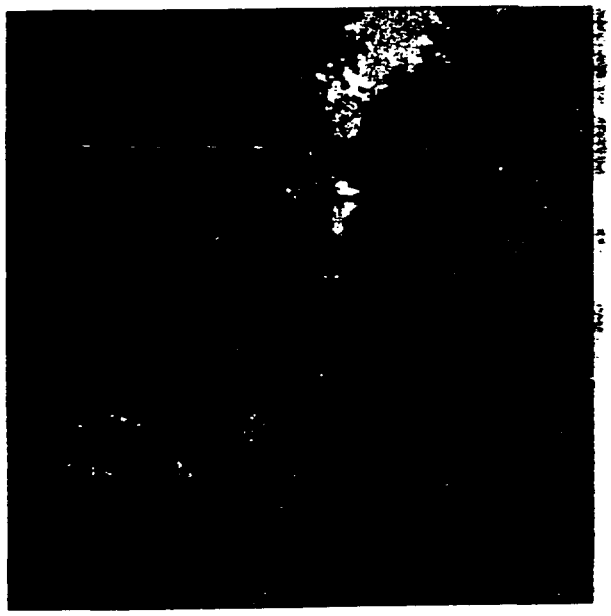

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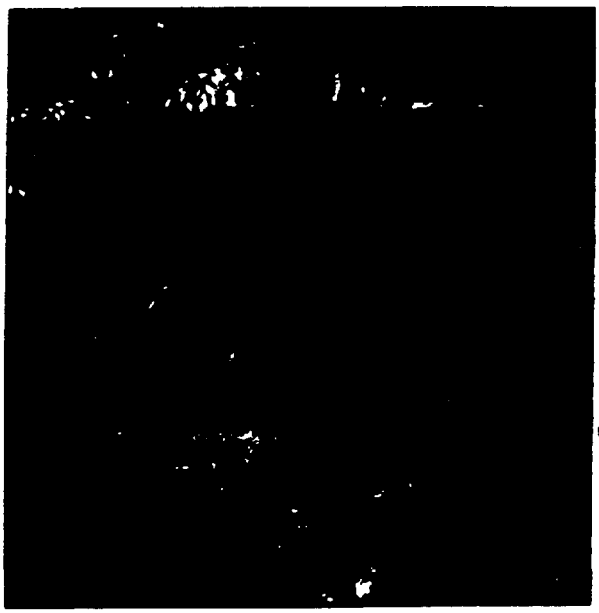
(10)

(9)

(12)



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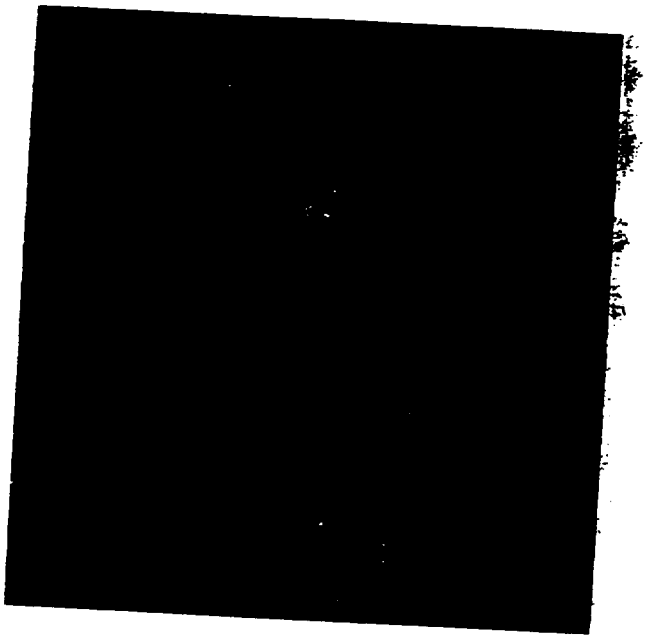

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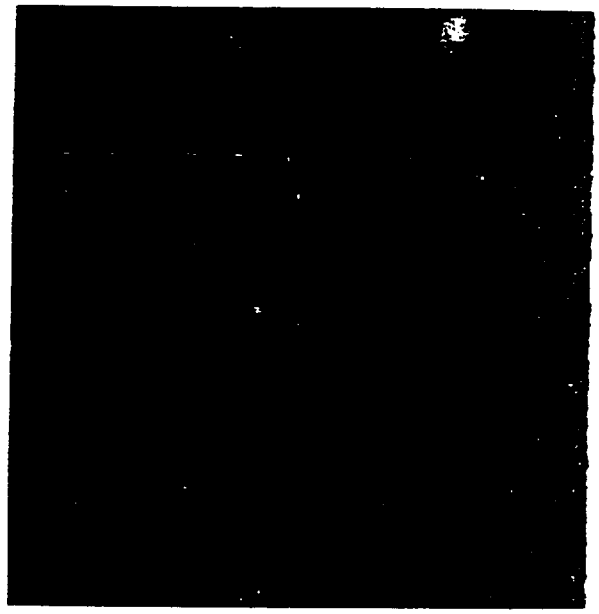

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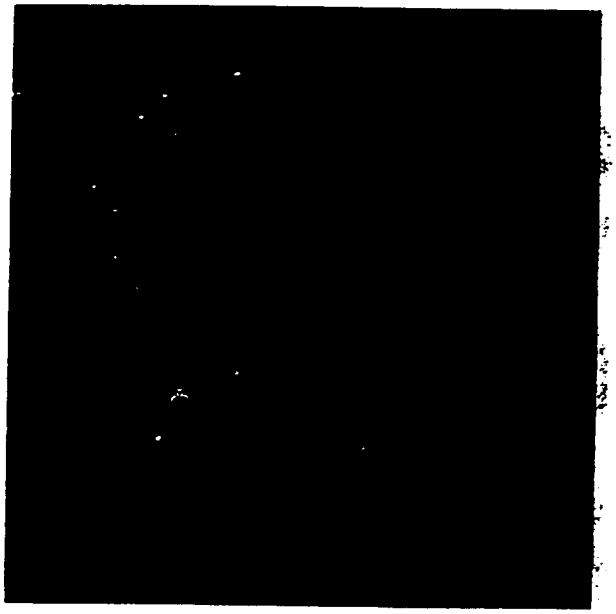

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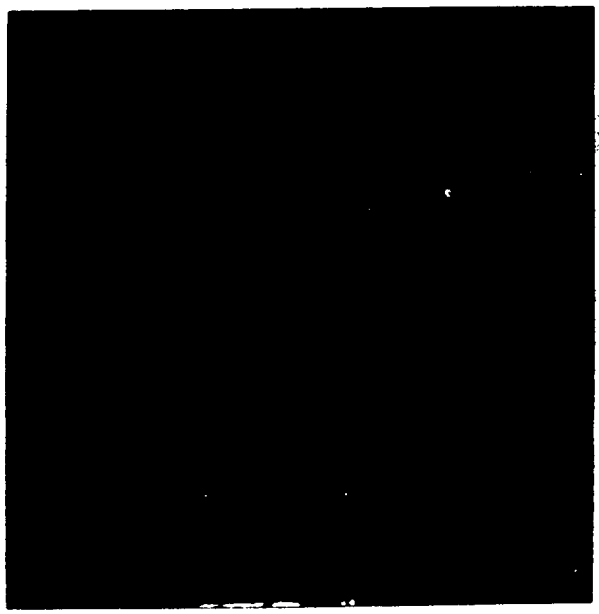

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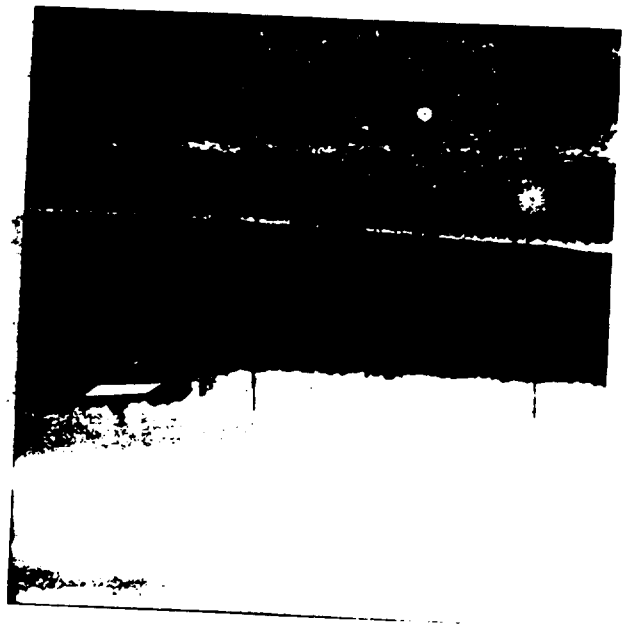

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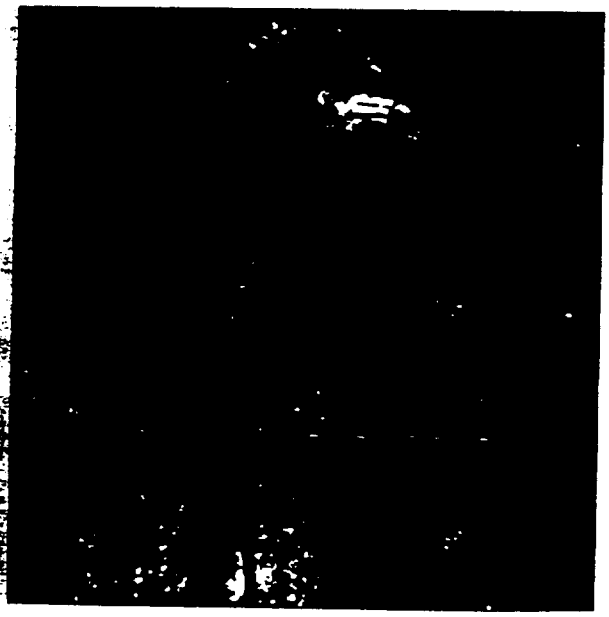

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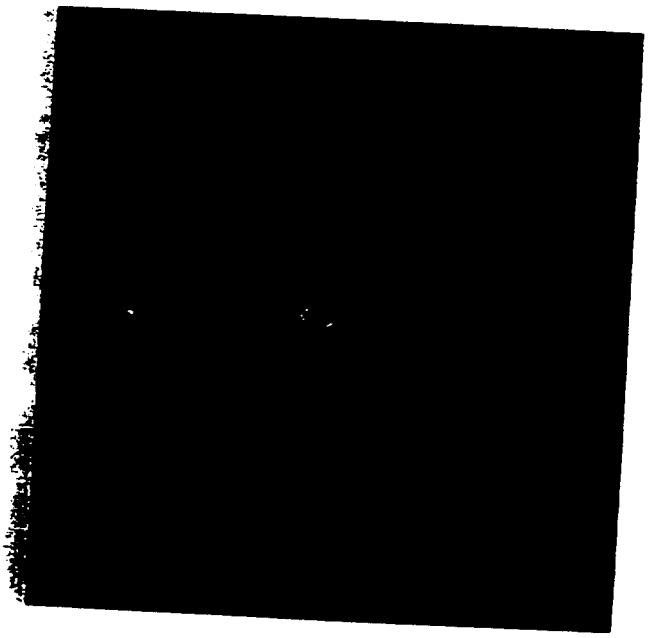

REFERENCE NO. 8

TELEPHONE CONVERSATION SUMMARY

DYNAMAC CORPORATION

Call made by: Nilgun Akpinar
Date of call: July 28, 1992
Time of call: 1540

Signature/Date: 7 28-92 Nilgun Akpinar
Facility: Old Startex,
Spartanburg County
Landfill
EPA ID No.: SCD980558191

Person(s) contacted : Diane Walker
Title/Position : Tax Clerk
Organization : Spartanburg County Accessor's Office
Telephone : (803) 596-2544
Address(city/state) : Spartanburg, South Carolina

General Subject : Ownership history of Old Startex, Spartanburg County Landfill

Summary of conversation: Ms. Walker stated that Old Startex, Spartanburg County Landfill had been owned by Spring Industries from 1986 until the present. She said Spring Industries had previously been called Lyman Printing and Finishing, and prior to that had been M. Lowenstein, Corporation. For further information she said to contact:

Spring Industries
Post Office Box 10232
Rockville, South Carolina 29730

REFERENCE NO. 10

KIRK-OTHMER

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY

THIRD EDITION

VOLUME 13

HYDROGEN-ION ACTIVITY
TO
LAMINATED MATERIALS, GLASS

A WILEY-INTERSCIENCE PUBLICATION
John Wiley & Sons
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According to most historians, writing ink was first prepared and used by the Chinese and the Egyptians as early as 2600 BC. These early inks were probably composed of carbonaceous materials such as lamp black or soot mixed with animal glue or vegetable oil vehicles. Reference is also made to the Chinese invention of solid ink blocks and pellets similar to India ink as it is known today, which had its origin during the period 220–419 AD. Writing-ink formulation became a highly developed art under the Chinese, who were printing from hand-cut blocks in the 11th century AD, 400 years before Gutenberg introduced movable type in Europe. Writing inks differ from printing inks in that the latter are generally applied to a substrate by means of a printing press. Printing inks as supplied to the graphic arts industry are used in much greater volume by far as compared to writing inks. This article is divided into a discussion of printing inks, followed by miscellaneous categories of ink, including ink for ball-point pens, with which by far the greatest amount of ink writing is done in the United States. The number of printing-ink manufacturing establishments in the United States is approximately 700. This includes some 100 captive ink plants. The value of the total printing-ink production in the United States was approximately 1×10^6 in 1979 (see also Printing processes; Reprography).

Printing Inks—General Considerations

Printing ink is a mixture of coloring matter dispersed or dissolved in a vehicle or carrier, which forms a fluid or paste which can be printed on a substrate and dried. The colorants used are generally pigments, toners, and dyes, or combinations of these materials, which are selected to provide color contrast with the background on which the ink is printed. The vehicle used acts as a carrier for the colorant during the printing operation, and in most cases, serves to bind the colorant to the substrate.

Printing inks are applied in thin films on many substrates such as paper, paperboard, metal sheets and metallic foil, plastic films and molded plastic articles, textiles, and glass (see Film and sheeting materials; Paper). Printing inks can be designed to have decorative, protective, or communicative functions. In some cases, combinations of these functions are achieved.

It is generally conceded that there are four classes of printing ink, which vary considerably in physical appearance, composition, method of application, and drying mechanism. They are letterpress and lithographic (litho) inks, which are commonly called oil inks or paste inks, usually of a pasty consistency, and flexographic (flexo) and rotogravure (gravure) inks, which are referred to as solvent or liquid inks (1–3).

Four properties of inks are of cardinal importance—drying, printability (which is largely a function of the rheology of the ink), color, and use properties. Use properties are those considerations that determine how printed substrates function throughout all processing and usage from the time of printing throughout the useful life of the printed product.

Drying. The term drying may be defined as any process that results in the transformation of a fluid-printing ink film into a more or less rigid form. An ink is considered dry when a print does not stick or transfer to another substrate placed in contact with it.

Jacket Design: Pic

Drying is accomplished by one or more of the following physical or chemical mechanisms: absorption, evaporation, precipitation, oxidation, polymerization, cold setting, gelation, and radiation curing.

Absorption. Some inks dry by penetration or absorption into the pores of the printed stock—a blotter or sponge effect. This is accomplished by the gross penetration of the ink into the large pores of the substrate; the partial separation of the vehicle from the pigment; and the diffusion of the vehicle throughout the paper.

The ability of an ink to penetrate into paper depends on the number and size of the air spaces present in the paper, the affinity or receptivity of the stock for the ink, and the mobility of the ink.

Solvent Evaporation. Drying of ink by evaporation of solvent is generally achieved by application of heat, depending upon the volatility of the solvent employed in the ink formulation. Web-offset and letterpress inks which dry by solvent evaporation are of the heat-set type. All flexographic and rotogravure inks contain more volatile solvents than the heat-set publication inks referred to above and do not require as much heat to effect drying. In either case, a balance must be maintained between satisfactory drying of the ink on the printed substrate and adequate stability, or resistance to drying, on the distributing rollers of the printing press.

Resin Precipitation. An ink may also be caused to dry by precipitation of its binder rather than by evaporation of solvent. This is accomplished by adding a diluent, such as water in the form of steam, to a hygroscopic water-miscible solvent ink system, which will cause the solubility of the resin in the ink film to decrease sharply and cause it to precipitate when its tolerance for the diluent is reached. Further drying is accomplished by absorption of the freed solvents into the stock and then by evaporation.

Oxidation. Inks that dry by oxidation behave much like paint films and dry by means of drying oils. They also contain metallic driers, which catalyze the absorption of oxygen by the drying oil (see Driers and metallic soaps; Drying oils; Paint).

Cold Setting. Hot-melt inks are applied to a substrate in a molten state and upon cooling form a dry ink film.

Gelation. Drying by gelation is accomplished by dispersing fine particles of a high molecular weight polymer, such as poly(vinyl chloride) resin, in a plasticizer for the polymer. At room temperature the dispersed polymer behaves like a pigment but at elevated temperatures it solvates, causing an immediate gel formation which is dry to the touch.

Polymerization. Thermal polymerization or curing of an ink film at elevated temperatures can follow many different chemical paths. Condensation and cross-linking reactions may be accomplished with or without the use of catalysts. However, this method of drying generally has not been used widely for printing inks, except for metal and glass decoration.

Radiation Curing. Ultraviolet and electron-beam curing of inks and coatings has progressed markedly in recent years owing largely to the fact that these drying mechanisms produce little or no effluent. They are similar processes in that both involve polymerization by a free-radical mechanism and very high rates of reaction can be achieved with relatively low energy inputs. Uv inks contain a photochemically reactive vehicle species, colorant, and a photosensitizer which initiates the reaction upon exposure to the uv radiation source. Electron-beam inks do not require a photoinitiator, the higher density-energy of the electrons is sufficient to create large numbers of free radicals in the vehicle system (see Radiation curing).

Infrared Drying. Infrared drying is used in some heat-set and evaporative solvent-ink applications where the wavelengths emitted by the radiator can, in principle, be tuned in on the optimum absorbency of the ink vehicle, thereby heating it selectively and not the substrate on which it is printed.

Radio Frequency and Microwave Drying. There are similar mechanisms differing in wavelengths generated and hardware required. Rf operates in the 30–100 MHz range and microwave drying in the 1000–3000 MHz range. Both generate electromagnetic waves which intersect and cause molecular excitation of polar molecules used in the ink film, causing rapid heating and drying to take place (4–5).

It may be noted that with the exception of oxidation- and polymerization-curing mechanisms, all other drying processes described depend upon physical phenomena. The complexity of organic reactions occurring in the nonphysical methods also appear to limit the speed of reaction which can be expected, so that the physical methods generally provide faster drying. Certain specialized methods of drying, such as ionic interaction and decomposition reactions, offer the fastest drying mechanisms but they have not been reduced to practice at this time.

Rheology. The rheology of inks is of the greatest importance. In a Newtonian liquid, any stress produces a flow, and the rate of flow is proportional to the stress. But inks are generally non-Newtonian and the most common terms used by the ink maker to describe rheology are: *viscosity* (resistance to flow); *yield value* (point at which a liquid starts to flow under stress); *thixotropy* (decreasing viscosity with increasing agitation); and *dilatancy* (opposite of thixotropy). Mayonnaise is an example of a material having a high yield value but a low viscosity (6–8).

The ink-distribution systems of flexo and gravure printing presses are very simple and do not provide the means to distribute and level highly viscous inks. Therefore, the viscosity must be low, on the order of 50–100 mPa·s (= cP). Yield value must be low also to permit pumping of ink from reservoir to fountain. Thixotropy should also be avoided for the same reason.

Letterpress and offset inks can vary in viscosity from under 500 mPa·s for a letterpress-type news ink to over 500 Pa·s (5000 P) for special litho ink formulations. The viscous nature of letterpress and litho inks has forced press designers to use a multitude of rollers in the ink distribution unit to ensure uniform and adequate transfer of ink to the printing plate.

In addition to the importance of proper ink rheology as related to roller-to-plate transfer, it is rheology, again, that controls, in large part, the fidelity of printing, drying speed, holdout, and trapping properties obtained on the substrate. In most cases, higher press speeds require lower viscosity inks and vice versa. Low viscosity ink is preferred for fine-line flexography and shallow-cell gravure printing. Printing smooth, dense solids can best be achieved using higher viscosity ink.

Rheology is also an important color-strength determinant. Over-pigmentation leads to a high yield value, thixotropic ink, thereby forcing a compromise between color intensity and rheology.

There are many varieties of instruments designed for measuring viscosity and other rheological properties of inks. These include capillary, orifice, rotational, and other miscellaneous types. Modern ink-rheology measurements are made on instruments such as the Shirley-Ferranti Cone-Plate viscometer, Brookfield Torsion viscometer, and the Haake, Laray, Interchemical, Stormer, and Band viscometers. The Inkometer and Tackoscope are also used to record tackiness as well as ink misting and roller stability (see Rheological measurements).

Color. Color is the third common denominator for all types of ink formulation and may very well be the most important one because it has such a tremendous psychological impact on the ultimate consumer. Color appears in three different dimensions referred to as hue, saturation or chroma, and value (see Color).

Coloring Materials. Pigments are used not only for color but also for other physical properties such as bulk, opacity, specific gravity, viscosity, yield value, and printing qualities. Different pigments of the same color have different permanency to light, heat, chemicals, and bleed or staining in water, oil, alcohol, fat, grease, acid, or alkali (9–10).

Judicious selection of pigment is also required, according to the use of the ink, in considering subsequent operations such as varnishing, waxing, lacquering, or laminating.

Inks make use of inorganic pigments and of dyes, most commonly in the form of pigments, that is to say, rendered insoluble in one of a number of ways (see Pigments, organic). Five dye families that are of interest to ink manufacturers are azo, triphenylmethane, anthraquinone, vat, and phthalocyanine (see Dyes and dye intermediates; Dyes—application) (11–12).

Flushed Colors. Many pigments, although dry when purchased, are prepared in a water phase and are not wetted easily by oil phases. In the process known as flushing, pigments are prepared that obviate this difficulty. Phase transfer is generally accomplished by mixing the pigment presscake with a water-immiscible vehicle in a heavy duty sigma blade (dough) mixer. Most of the water separates and can be removed, although complete dehydration requires further processing, usually heating under agitation for several hours in a vacuum.

Flushed colors result in higher gloss and color strength, and better rheology and economy than their dry-pigment counterparts. Their use is expanding constantly.

Color Concentrates, Easily Dispersible Pigments. In order to provide greater versatility and, at the same time, ease of use, pigment manufacturers offer pigments in the form of color concentrates. These are liquids or pastes with 35–65% of pigment content. Pigments in this form are very well dispersed, requiring little if any mechanical effort to achieve the desired color value or fineness of grind. The concentrates often contain monomeric and resinous dispersants plus a solvent. They are classified according to the solvent used.

Easily dispersible pigments are produced by coating freshly precipitated pigment in the slurry tank with a resinous and/or monomeric dispersant and, eventually, by drying and pulverizing the solids. Such pigments are also called stir-ins as they require minimum grinding effort in order to develop the full color value.

Toners are full strength undiluted pigments used to strengthen tinctorially weak pigments. Occasionally, dyes are utilized as toners.

The most common pigments used in ink manufacture are listed below.

Black Pigments. The only black pigment used to an appreciable extent in inks is carbon black (qv). It is used in newsprint and publication printing, and therefore, in very large quantities. Black pigments are offered in fluffy or bead form.

White Pigments. Opaque white pigments commonly used in inks (listed in order of decreasing opacity) are titanium dioxide, zinc sulfide, and zinc oxide. TiO_2 is by far the most popular white pigment. Mixtures of these are often made with the various colored pigments to add opacity or to lighten the hue.

Transparent pigments (extenders) commonly used in inks (listed in order of de-

creasing transparency) are alumina hydrate (a product of the approximate composition $5Al_2O_3.2SO_3.xH_2O$), magnesium carbonate (magnesia), calcium carbonate, blanc fixe (precipitated barium sulfate), barita (natural barium sulfate), and clay. Extenders are used to reduce the color strength and change the rheology of inks.

Inorganic Color Pigments. Chrome yellow is generally lead chromate, modified with other lead compounds to produce several shades. Chrome orange and molybdate orange are also modified lead compounds. All of the chrome colors are quite fast to light, opaque, and have high specific gravity. They, however, can be toxic and their uses are restricted. They can not be used on articles intended for use by children or in inks that could contact food.

Cadmium yellow, orange, and red are very lightfast pigments and have excellent soap and alkali resistance. Cadmium–mercury reds come in a range of shades from a bright to a deep red. Vermilion red is a brilliant mercury sulfide pigment of high specific gravity. Their use is also restricted as a result of mercury content which is considered toxic.

Iron blue (a complex cyanide) is made in a number of shades such as Milori blue, bronze blue, and Prussian blue. It has poor alkali resistance. Ultramarine blue is very permanent to light but has poor acid resistance.

Organic Color Pigments. Yellow pigments consist mainly of yellow lakes, Hansa yellows, and diarylide yellows. (Lakes are produced from dyes by depositing them on alumina hydrate.) Hansa yellows are very strong and permanent pigments. They are very resistant to most chemicals. They are produced from azo dyes in a number of hues. Diarylide yellows are also very strong, usually not as fast to light as Hansa yellows, but more transparent pigments. They are produced from 3,3′-dichlorobenzidine, a carcinogen that must be handled with care (according to EPA regulations).

Orange pigments include dianisidine orange, benzidine orange, and Persian orange lakes.

Red pigments range in shade from orange to deep maroon, from dirty reds to the very clean, brilliant reds. A few of the more common types are the following. (*1*) The para reds, toluidines, and fire reds are fairly fast to light and semitransparent. They are used in poster and label inks. (*2*) The lithol reds are available in a wide range of shades with moderate permanency to light. (*3*) Phloxine or eosine lakes are very clean, brilliant reds, not fast to light, used in process printing on books and magazines. They also represent toxicity problems owing to lead content. (*4*) Rhodamine reds are brilliant and have much better lightfastness. They are quite costly. (*5*) Red Lake C (CI Pigment Red 53; CI 15585) is used for making the very brilliant orange shades or warm reds. (*6*) Madder lakes have resistance to bleeding and permanency to light. (*7*) Watchung reds or Permanent Red 2B (CI Pigment Red 48; CI 15865) pigments are fairly clean and have fair bleed and product resistance. (*8*) Naphthol reds are relatively permanent and are soap-resistant. They are available in yellow and blue shades.

Blue Pigments. Peacock blue is a clean, brilliant, greenish shade of blue. It is fugitive and is now seldom used. The permanent types are quite expensive.

Phthalocyanine blues are the most useful of the greenish shades. They have excellent lightfastness, very good resistance to most chemicals, and are used in process work. Their precursor crude is, in part, imported.

Victoria blue is the clean, red shade royal blue. It is only moderately fast to light and not too popular an ink pigment.

Alkali blues of deep reddish shades find extensive use in all types of inks, often for toning blacks. Alkali blue toners are supplied in flushed form.

Purple Pigments. Methyl violet is the most commonly used, also for toning purposes. Dioxazine violet, an expensive color, is used where permanence and resistance properties are needed.

Green Pigments. Phthalocyanine green is a permanent and clean pigment. Green Lake is one of the triphenylmethane colors and has its disadvantages. It is difficult to grind, requires more drier to achieve scuff resistant ink film and occasionally bleeds in fat or plasticizer.

Daylight Fluorescent Pigments. These are used in silk screen, gravure, flexographic, letterpress, and offset inks. They are difficult to handle and require heavy films of ink to be effective. They are generally not very fast to light (see Luminescent materials).

Silver Powder. This is usually aluminum flake, and "gold" is generally a mixture of brass and copper flakes, and possibly other metals. The gold effect can also be achieved by toning aluminum flake with a transparent yellow pigment (diarylide yellow).

Other Ingredients

Driers (qv). These are soaps of cobalt, manganese, and lead formed with organic acids such as linolenic, naphthenic, and octanoic acids. They catalyze oxidation of drying oils, and thus should be used in inks that dry by oxidation.

Waxes (qv). These are mainly dispersions of polyethylenes, hydrocarbons, or vegetable and animal waxes in the vehicle system used. They impart slip and scuff-resistance to ink films. Lately, polyolefinic waxes are also used directly in micropulverized form.

Antioxidants (qv). Antioxidants of universal acceptance are eugenol and ionol. They retard premature oxidation of inks on the press at 1% or lower concentrations.

Miscellaneous Additives. These include lubricants, surface-energy reducing agents, thickeners, gellants, defoamers, wetting agents, and shorteners.

Letterpress, Dry Offset, and Lithograph (Paste) Inks

Historically, paste inks were developed much earlier than flexographic and rotogravure (liquid) inks. Since they utilize distinctly different solvents and application techniques, it has been customary to treat them separately.

Dry offset inks are not treated separately since they are quite similar to letterpress inks, except for 20–30% higher color strength and somewhat higher viscosity (6–8).

Table 1 summarizes properties of inks of the three classes, divided among eleven use classifications.

Letterpress and Litho Newsprint Inks. Letterpress newsprint inks are based mainly on mineral oil, which sometimes is combined with a resin. They dry by penetration into the absorbent paper stock. Most litho newsprint inks are based on vehicles that contain rosin-, fossil-, or hydrocarbon-type resins dissolved in aliphatic hydrocarbon solvents (see Hydrocarbon resins; Terpenoids; Resins, natural). The solvents used are fractions of petroleum in the 220–280°C boiling range. Mineral oil is used in these inks to a lesser extent, mainly in the nondrying versions. Mineral oil renders long press stability as it is somewhat higher boiling than the solvents. The heatset litho newsprint inks are heat-dried in ovens of various makes. HVHA (high velocity hot air) dryers

Table 1. Letterpress, Lithographic, and Dry-Offset Inks[a]

Ink type and use	Ink class, printing method	Drying manner	Application, stock feed	Ink consistency	Approx printing speed	Typical vehicle composition
news (papers and comics)	LP, litho	pen, HS	web-fed	liquid medium paste	300–450 m/min	min oil, res–S–O
publications (magazines, periodicals)	LP, litho	HS, QS, uv	web-fed, sheet-fed	soft–medium pastes, medium pastes	300–370 m/min, 3500–7500 sph	res–S–O, acr
commercial (display, document, pamphlet, label)	LP, litho	QS, Ox, ir, uv	sheet-fed	medium pastes	3500–7500 sph	res–O–S, acr
business documents and forms (duplicator, narrow web)	litho	QS, HS, ir	sheet-fed, web-fed	medium pastes	2000–4000 sph, 10–180 m/min	res–S–O, res–S–O–min. oil
folding cartons (food, soap, drug, liquid, parts, detergent)	LP, litho, DO	QS, Ox, uv	sheet-fed	medium–heavy pastes	3500–8000 sph	res–O–S, acr
containers and boxes (corrugated, linear)	LP	Ox, MS, pen, FW	sheet-fed	medium–heavy pastes	2500–5000 sph	res–O, res–G
books (school, directories, religious, library)	LP, litho, DO	Ox, pen	sheet-fed, web-fed	soft–medium pastes	2000–7000 sph, 120–240 m/min	res–O–S, res–min. oil–S
bags (paper, cloth, plastic)	LP, DO	HS, Ox, MS	web-fed	medium pastes	80–180 m/min	res–S–O, res–O, res–G
wrappers (bread, box, produce)	LP	MS, HS	web-fed	medium pastes	120–240 m/min	res–G, res–S
metal containers (beverage and food cans, pails, drums, displays)	litho, DO	HC, uv	sheet-fed, pr. can	medium–heavy pastes	2000–5000 sph, 100–500 cpm	alkyd–S, res–O–S, alkyd–amines–S, acr
plastic (cups, bottles, displays, book covers)	DO, litho	HS, Ox, uv	pr. can, sheet-fed	medium–heavy pastes	100–200 cpm, 2000–4000 sph	res–S, res–O–S, acr

[a] Abbreviations: LP, letterpress; DO, dry offset; pen, penetration; HS, heat-set; ir, infrared; Ox, oxidation; QS, quick-set; FW, fiber wetting; MS, moisture set; uv, ultraviolet; HC, heat cure; pr. can, preformed can; acr, acrylate oligomers; sph, sheets per h; cpm, containers per min; min. oil, mineral oil; res, resin; S, solvent; O, oil; G, glycol.

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are most commonly used but infrared and gas-flame types also are employed occasionally on older presses.

Rotary Heat-Set Publication and Commercial Inks. Most rotary heat-set publication inks for both letterpress and litho presses are based on vehicles containing natural or semisynthetic resins (often gilsonite–hydrocarbon resins in blacks or rosin esters with glycerol or pentaerythritol with hydrocarbon resin and occasionally phenolic modified resin in colors) dissolved in 4°C fractions of aliphatic hydrocarbons that boil between 200–280°C. 5–10% of alkyd is normally contained in the litho versions (see Alkyd resins). These inks dry in 1 s or less by solvent evaporation or by solubilization of dispersed resins at the web temperature of 90–180°C which is achieved in one of the three dryers mentioned above.

Sheet-Fed Commercial Inks. A large segment of commercial printing is done on sheet-fed presses mainly by the litho process. Inks for these presses are based on vehicles containing phenolic, maleic-modified, or rosin-ester resins dissolved in vegetable drying oils and diluted with hydrocarbon solvents. The better inks contain alkyds in place of the oils or, occasionally, these are cross-linked via diisocyanates forming urethane linkages. On coated stocks, most sheet-fed inks quick-set first to a tackfree state by coagulation and solvent separation and then fully dry by oxidation. Air (oxygen) upon reaction with unsaturated oils forms a highly cross-linked (polymerized) tough ink film. Most commonly used oils are linseed, soya, Chinawood, and tall oils. Recently, new acrylic resins have been developed for use in quickset inks. They offer nonskinning properties and prolonged press stability.

Document-Reproduction (Duplicator) and Business Form Inks. Duplicator sheet-fed machines require very press-stable, yet quick setting inks. They must also possess fine lithographic properties of high tolerance for water-fountain solution and of dense and sharp printing properties on a wide variety of papers. The inks contain drying-oil alkyds or plain bodied oils, along with lithographic-type (nonpolar) resins and high boiling (280–370°C) hydrocarbon solvents. The rubber-type inks are based on cyclized (depolymerized) synthetic rubber which exhibits exceptionally fast setting. This property results from rapid release of the solvent.

Business-form inks closely resemble the lithographic heatset news inks (first group); however, they are higher in viscosity and often contain some mineral oil. Recently, business forms have been printed by the jet-dot method (see Ink Jet Printing). The inks are based on glycols, water, and dyes.

Folding-Carton Inks. The majority of folding-carton inks are based on various quick-set vehicles (see above). However, when maximum gloss and high rub and product (ie, grease, soap) resistance are required, they contain glossy oleo–resinous vehicles. These vehicles are composed of phenolic, phenolic-modified, and maleic modified and/or esterified rosin resins which have been dissolved in drying oils or alkyds or both. These vehicles dry by oxidation to form tough, glossy films which, unfortunately, become difficult to print over at a later time. Ultraviolet-light-cured inks are also being used in litho printing of high quality folding cartons (see Uv and Electron-Beam Systems).

Corrugated and Kraft-Liner Container Inks. Ink vehicles for corrugated and kraft-liner containers often consist of oeloresinous materials. They dry by oxidation. In the instances, however, where very fast drying is required and gloss is not of major importance, moisture-set or fiber-wetting inks are employed. Moisture-set inks are based on several acid-bearing resins (fumarated rosin) or their part-esters dissolved in di-

ethylene, dipropylene, or triethylene glycols. They dry by precipitation of the resin solids upon the absorption of moisture by the hygroscopic glycols. Moisture-insensitive fiber-wetting varieties of these inks are prepared by forming alkaline salts of the acid resins. They dry by preferential wetting of the cellulose fiber by the polar glycols (hexylene, di- and tripropylene glycols).

Book, Bag, and Wrapper Inks. Vehicles in book, bag, and wrapper inks essentially are very similar to those already discussed under the commercial and publication inks.

Metal Container Inks. Ink vehicles for metal containers that are printed on special sheet-fed litho presses are based mainly on blends of oleo-resinous and heat-set varnishes containing the previously mentioned resins, alkyds, and oils (see Folding-Carton Inks). Some of these (high bake versions) are composed of nondrying alkyds and melamine resin. Metal-decorating inks dry during a 10 min cure at 150–200°C in 6–30 m gas-fired ovens. Polymerization, oxidation, and cross-linking reactions account for their drying and hardening. Ultraviolet-cured inks also have become very popular in metal decorating (see below).

Preformed Aluminum or Steel Containers. Ink vehicles for dry-offset printing of preformed aluminum or steel containers are essentially based on polyester vehicles used in conjunction with melamine cross-linkers. (Recently developed short-cycle ovens are now used which dry inks in 2–10 s at a temperature as high as 340°C.) The rheology of these inks must be adjusted to the unique geometry of the press. Ferranti, Haake, IC Rotational, or Laray viscometers are being utilized to determine the viscosity and yield value of the inks. In addition to these instruments, the Inkometer is used to determine tack value and press stability. Desired rheological properties are achieved by the use of gellants as well as pigments.

Plastics. Vehicles in inks for plastics (polyethylene, polystyrene, vinyl) are based on hard-drying oleoresinous varnishes which sometimes are diluted with hydrocarbon solvents. Dry-offset inks for polystyrene employ vehicles of somewhat more polar nature. Polyester or other synthetic resins (acrylic) dissolved in glycol ethers and/or esters represent a frequent choice. Uv inks are widely used for decoration of preformed plastic containers.

Manufacture. Paste inks are produced in two ways: (*1*) by mixing predispersed (preground) or flushed pigment concentrates with vehicles, solvents, oils, and compounds, or (*2*) by mixing dry pigments or resin coated pigments with vehicles and compounds and then grinding them on ink mills. Some typical ink formulas are given in Table 2.

Mixing is done in sigma-blade (dough) mixers of various sizes, in plain change-can mixers, or in large agitated tanks which can hold up to 4500 kg. A variety of equipment is being employed, from simple agitator to high speed, saw-bladed or concentric, double-blade dispersor in an attempt to achieve the desired dispersion. Baker-Perkins dough mixers are steam-jacketed, thus they allow hot (90–120°C) mastication mixing (see Mixing and blending).

Milling is done on three- or five-roller horizontal or vertical mills and in shot mills. Softer, more fluid inks are ground in shot mills (vertical and horizontal), in ball mills, and occasionally, in colloid mills.

The three-roller mill is commonly used for grinding viscous paste inks. Its steel rollers are polished and accurately machined to form a crown in the center. A definite speed differential exists in rotation of each of the rollers with respect to each other.

Table 2. Typical Ink Formulas[a]

LP newsprint black			*HS publication blue*		
10 or 15	carbon black		14	phthalocyanine blue	
2 or 3	induline toner		10	alumina hydrate	
85 or 67	mineral oil (1 Pa·s or 10 P)		35	pentaerythritol rosin ester–HC solvent	
3 or 15	mineral oil (low viscosity)		30	HC resin in HC solvent	
100 *100*	*Total*		6	polyethylene wax compound	
Quick-set litho black			5	aliphatic HC solvent (240°C)	
16 or 18	carbon black		*100*	*Total*	
4 or 6	alkali blue toner		*Uv cure ink*		
63 or 58	phenolic resin–oil (HC solvent 280°C)		25	permanent 2B red	
			5	clay or aluminum hydrate	
10 or 6	bodied linseed oil or alkyd		50	epoxy diacrylate oligomer	
2 or 2	cobalt linoleate		10	benzophenone	
5 or 10	aliphatic HC solvent (280°C)		5	wax compound	
			5	trimethylolpropane triacrylate	
100 *100*	*Total*		*100*	*Total*	
Lp moisture-set light blue			*Metal decorating litho white* (sheet fed)		
25	titanium dioxide		50 or 55	titanium dioxide	
3	alkali blue		45 or 25	drying alkyd	
9	iron blue		0 or 15	hard resin–linseed oil	
50	fumarated rosin–TEG		1 or 2	manganese naphthenate	
10	HC wax compound		4 or 3	aliphatic HC solvent (280°C)	
3	TEG				
100	*Total*		*100* *100*	*Total*	

[a] Abbreviations: LP, letterpress; HC, hydrocarbon, TEG, triethylene glycol; HS, heat set.

They also can be set to provide greater or lesser clearance between them. The dispersion of the pigment is accomplished by shearing forces generated by this differential speed as well as by the closeness of roller setting. The shot mills break pigment particles by hammer action of the speeding shots. The smaller the size of the shot and the higher loading and the more complex (tortuous) path in the chamber, the better the dispersion. In order to accommodate the more viscous inks, some mills have a cooled agitator shaft and are equipped with protruding fingers in the chamber.

Finished inks are packed in metal cans (0.5, 1, 2, or 5 kg), in metal or plastic pails (8, 11, and 19 L), or in 114- or 190-L metal or fiber drums and, occasionally, in tote bins. The more fluid inks (news, flexo, or gravure) usually are delivered in tank cars.

Ink vehicles are produced in separate resin-varnish plants. Here 1,900–19,000-L reactor kettles are equipped with powerful agitators, reflux condensers, liquid traps, gas and liquid pumps, and ducts for material charge. Heating is done by multistage Dowtherm or hot-oil jackets, or in some installations, electric (induction) heaters. Older units employ banks of gas-fired ceramic-cup burners. Temperatures and reaction rates are automatically monitored and controlled. Finished vehicles are filtered routinely via cone filters. In order to comply with EPA rules, reactor exhaust is scrubbed or incinerated. Operators should wear protective gear, such as respirators, safety glasses, etc, in order to avoid any health hazards or injury. The plant air is analyzed routinely for the presence of dust or volatiles from organic compounds.

Synthesized resins can be cast in solid form from the reactor kettles or more typically, converted directly into fluid varnishes in a single operation, often employing special blending kettles for this purpose. Recently, reactors used for vinyl-type polymers are of continuous (pipe) design which normally is more economical.

Control and Testing. Control of inks is done by examining their color, strength, hue, tack, rheology, drying rate, stability, and product proofness. Elaborate control equipment and laboratory testing procedures are employed to test the finished inks. Weather-Ometers, Fade-Ometers, glossmeters, colorimeters, spectrophotometers, viscometers, rub testers, and occasionally, gas chromatographs are employed to check production batches or to pretest new submissions or raw materials. Proofing presses and sometimes pilot presses are utilized by ink manufacturers to control the production and test new formulations. The trend toward higher printing speeds and quality, and toward greater economy and reduced air pollution necessitates vigorous ink research and development effort. New regulations, changing cost of raw materials, different substrates, and faster presses require constant updating of the formulations. Considerable research and development time and expenditures have been devoted to lower-temperature drying and nonpolluting inks. Ultraviolet cure for inks and waterborne inks for plastics represent the major programs and radical deviations from the traditional systems (see Uv System).

Lithographic Inks—Special Considerations. As with inks for all other printing processes, lithographic inks must be deposited on the substrate in selected areas only, eg, as required to produce an image. The method of achieving this selectivity, however, is considerably different in the lithographic process. The image on the plate is neither raised nor lowered but is on the same plane as the nonimage. Nevertheless, the ink must be kept from depositing on the nonimage area of the printing plate (see Printing processes) (6–8).

The ability to attain this image selectivity is governed by the physicochemical nature of the process-involving plate, fountain solution, and ink all acting together in a ternary dynamic system. It is this situation that imposes certain requirements upon lithographic inks not common to other printing inks.

Thus, the first requirement is that the vehicle be water-immiscible; indeed, mere water immiscibility is not enough but the interfacial relationship between ink and fountain solution must also prevent easy emulsification. Second, the vehicle must wet the pigment sufficiently well so as to preclude any possibility of the pigment's transferring to the aqueous fountain solution.

Obviously, these two primary characteristics are achieved by proper selection of vehicle and pigment. In general, heat-bodied drying oils, oil-extended alkyds, and solutions of various types of nonpolar resins in water-immiscible solvents serve as satisfactory vehicles. Pigments are selected for their dispersibility in the appropriate vehicle, their tinctorial strength, and their nonbleeding characteristics into the acidic fountain solution. Of course, consideration must be given to any particular use requirements involved, such as resistance to high temperature bake, product resistance and lightfastness.

The requirements of a particular lithographic ink are further governed by the nature of the press itself, such as whether it is single- or multicolor, sheet-fed or web-fed, or whether the ink is aimed at metal decorating. As sheet-fed presses increase in size, they also increase in linear printing speed. Web-offset presses also operate at higher linear printing speeds than the sheet machines. The linear printing speed, therefore, must be considered in adjusting the rheology of the ink; ie, the higher the speed, the lower the ink tack should be. This is necessary to prevent the substrate from sticking to the offset blanket, which can result in picking or tearing the sheet or pulling it from the grippers, or in web breaks in the case of web-fed presses.

Good performance of the ink on the plate is of paramount importance. Aside from the intrinsic characteristics of the ink by reason of the specific formulation, the most important extrinsic factor is the condition of the lithographic plate, particularly that of the nonimage area. The ink must transfer a sharp, clean image to the blanket and thence to the substrate. This means that no ink is permitted to appear in the nonimage area (if this occurs, it is known as scumming). Scumming may result from such causes as improper desensitization of the nonimage area, incorrect fountain solution, or poor dampening, as well as improper surface characteristics of the ink. Color can appear in the nonimage area for other reasons also, such as by running too little fountain solution (a condition known as catchup), by pigment transfer to the aqueous phase or by the ink itself having too low a viscosity.

The web-fed lithographic process (web offset) is one of the fastest growing printing methods. Heatset and paper-penetrating inks are being offered for this application. The presses range from full width (91 cm) to half web and narrow web (30 cm) types, operating from 120 to 490 m/min. In some cases, letterpresses are being partly converted to a hybrid lithographic process called direct litho (di-litho). Here, the printing is done directly from lithographic plate onto the paper, rather than indirectly via a blanket cylinder in classic lithography. Considerable research on the lithographic system led to the introduction of printing plates that are sufficiently selective to the ink in the image and nonimage areas to be able to eliminate the need for water-fountain solution. This variation, however, found only modest acceptance by the industry. Another recent development is the energy conserving low temperature drying (LTD) ink formulation based on the dispersed polymer principle or on co-solvent approaches.

Radiation-Cure Inks

In response to air-pollution regulations, the shortage or high cost of natural gas and because of a general desire to conserve energy, new ink formulations–drying systems have emerged which are based on radiant energy: ultraviolet, electron-beam, and infrared radiation. Lithographic and letterpress inks are now available for web-fed and sheet-fed presses that will cure–dry instantly when exposed to radiators of the required intensity. A brief description of each system follows.

Uv System. In the most simple form, uv inks consist of a reactive (monomeric or oligomeric acrylate) vehicle, photoinitiator (benzophenone), and colorants (conventional pigments). With the absorption of photons from a mercury lamp, the sensitizer becomes excited. It then undergoes electronic transitions and, thereby, becomes very reactive. In this state, it initiates free-radical reaction among the reactive species of the vehicle. This results in hardening (drying) of the ink film. General quality, stability, and safety difficulties must be considered when the manufacture and use of uv inks is attempted. They also tend to be more costly than the conventional types. In spite of these shortcomings, uv inks are now commercial for printing of paper, plastic, and metal because of the environmental and energy conservation benefits (13–17).

Electron-Beam System. Electron-beam-cured inks are similar to their uv counterparts. Electron irradiation, however, does not require photoinitiators in the formula as it readily cross-links the vinyl-rich vehicle, often requiring only 10–20 kGy ((1–2) $\times 10^6$ rad) of energy. The irradiators must be well shielded with a lead plate to be

harmless. The production units are still very costly as the electron-beam system is only in the early development stage for printing applications. At present only a few installations exist. The great energy conservation potential of electron-beam cure (10% of the heat energy) makes the system quite attractive to printers and convertors (15,18).

Ir System. Ir radiation imparts instant intense heat to the substrate and to the ink. It causes evaporation of solvent in heatset inks or quicksetting of sheet-fed inks. The latter application is relatively new and especially effective for inks that gel and penetrate readily into the stock. For many years, gas-fired ir-cup irradiators have been used on web-litho and letterpress machines with good success. The most recent innovation, however, is based on new, electrically (rather than gas) energized elements with sufficiently broad wavelength output to render the beam essentially nonselective to colored inks (see Infrared technology).

Flexographic and Rotogravure Inks

Flexographic and rotogravure inks have many elements in common with inks used for other printing processes. They constitute a distinct class, however, because of the specific characteristics of their printing processes, their application and ingredients, and methods of manufacture. The colorants, pigments, and dyes are the same as those used for letterpress, offset, and other methods. (A possible exception is the use of special surface treatment to provide better wetting and dispersion in flexographic and rotogravure-ink vehicles.) However, the flexographic and rotogravure inks differ from other inks in that they are of very low viscosity, they almost always dry by evaporation of highly volatile solvents, and generally they are produced by different manufacturing processes from those used for other inks (3,6,8).

Solvents. Flexographic and rotogravure printing processes require the use of very volatile solvents such as low boiling point alcohols, esters, aliphatic and aromatic hydrocarbons, ketones, and water. However, the flexographic process requires solvents that do not attack rubber rollers and printing plates, whereas there is no such limitation to gravure. Table 3 shows relevant properties of a number of solvents; those marked are limited to gravure.

High volatility is needed to provide fast enough drying to allow subsequent impressions on multicolor work and to prevent sticking or blocking in rewinds.

The high boiling solvents used for heat-set letterpress and offset inks would cause distortion and, therefore, cannot be used for printing plastic substrates usually printed by flexography and rotogravure.

Gravure inks usually are made to dry faster than flexographic inks because each impression must be completely dry before a subsequent impression. Flexographic inks do not have to be completely dry to receive a second impression but trapping (overprinting) is best when there is a great difference in dryness between the first-impression ink and the second-impression ink at the point of the second impression. This is usually controlled through variation in drying speed of the inks, with the first color printed being the most volatile.

Solvents for inks used for odor-sensitive packaging must be of low residual odor

Table 3. Typical Physical Constants of Commercially Used Flexo and Gravure Solvents[a]

Solvent	Comparative drying time[b]	Boiling range, °C	Flash point, °C	Quantity at 20°C, g/L
Alcohols				
methyl alcohol	10	64–65	16	791
ethyl alcohol, 99% anhydrous	18	75–80	18	791
ethyl alcohol, 95%	20	75–80	18	815
isopropyl alcohol, 99%	27	81–83	21	785
n-propyl alcohol	55	95–98	29	803
sec-butyl alcohol	63	99–100	29	801
isobutyl alcohol	77	106–109	39	801
n-butyl alcohol	125	116–119	46	809
Aliphatic naphthas[e]				
hexane	7	66–70	−18[c]	683
fast diluent naphtha	7	60–82	−18[c]	689
heptane (tolu-sol)	15	93–104	−18[c]	725
lacquer diluent	17	93–116	−1[c]	743
octane	31	102–110	−1	743
VM & P (varnish makers' and painters') naphtha	51	121–149	10	755
mineral spirits	600	154–204	38	779
Aromatic hydrocarbons[d]				
toluene	26	109–112	7	868
xylene	88	135–143	27	870
Esters[e]				
methyl acetate, 80%	5	53–59	−1[c]	899
ethyl acetate, 88%	10	72–80	6	887
isopropyl acetate	12	84–90	16	869
n-propyl acetate	22	95–103	18	881
sec-butyl acetate	33	104–117	32	860
isobutyl acetate	36	110–119	31	863
n-butyl acetate	63	115–130	39	875
amyl acetate	100	120–150	47	863
Cellosolve acetate	330	145–165	49	971
Glycol ethers				
Dowanol PM	88	118–126	38	917
methyl Cellosolve	130	123–126	46	962
Cellosolve	190	132–137	54	928
butyl Cellosolve	1000	166–173	74	804
Ketones[f]				
acetone	5	56–57	−9[c]	791
methyl ethyl ketone	11	78–81	−1[c]	804
methyl isobutyl ketone	37	114–117	24	801
methyl isoamyl ketone	150	143–146	43	813
cyclohexanone	270	130–173	54	944
Nitroparaffin				
2-nitropropane	50	119–120	39	987

[a] Acceptable for flexo if used with buna rubber plates and rollers.
[b] The drying-time comparisons are based on the use of ethyl acetate as standard at 10. Acetone is about twice as fast as ethyl acetate and is listed as 5.
[c] At very low temperatures, flash-point determinations are inconsistent; flash occurs below the temperature shown.
[d] Cannot be used in flexo.
[e] Should not exceed 25% of flexo solvent.
[f] Flexo usage restricted to butyl rubber plates and rollers.

to prevent product contamination. Hydrocarbons, in particular, should be selected to have narrow boiling ranges and negligible mercaptan content.

Solvent volatility, like rheology, is varied to attain the best printability with different types of work and printing speed. Slow drying particularly improves printability of fine detail flexography and gravure highlights. It is thus apparent that the high volatility required for high speed is often compromised with printability. Most flexographic and gravure inks operate best when formulated with a combination of solvents. However, the use of solvent blends causes a problem because the solvent evaporates from ink fountains and must be replaced to maintain viscosity. The constituent solvents in a blend seldom evaporate in the same proportion as they were initially in the ink. Therefore, makeup solvent should be proportioned to duplicate the evaporating proportion.

The evaporation of solvent mixtures can be quite complex, because of the interaction of the solvents. In some cases, such as ethyl acetate and toluene, the more volatile solvent, ethyl acetate, is more volatile from mixtures of all compositions; but ethanol (bp 78.3°C) is more volatile from mixtures containing mostly ethanol, whereas from mixtures containing a low percentage of toluene (bp 110.6°C), the toluene shows enhanced volatility.

Solvent combinations are selected for each type of ink on the basis of printability, drying speed, economy, and odor. Examples of specific flexographic and gravure ink systems are given in the sections dealing with specific inks.

Most volatile solvents constitute a fire hazard, requiring both printing plants and ink-manufacturing facilities that are constructed with fire- and explosionproof equipment.

Resins or Polymers and Other Vehicle Solids. The selection of resins or polymers for flexographic and rotogravure inks depends on the printing process, the solvent, and most important, the substrate to be printed and the ultimate use of the printed matter. Detailed examples are covered under the sections dealing specifically with flexographic inks and rotogravure inks. However, certain general requirements are common to both processes.

Printing Process. The printing process is a resin selection determinant because flexographic rubber rollers and plates preclude the use of aromatic hydrocarbons and limit the use of aliphatics, esters, and ketones. Therefore, resins soluble in aromatics only cannot be used in flexographic inks. Esters and ketones should be used in low concentrations. Chlorinated rubber is a typical example of a resin limited to gravure inks.

Solubility. Resins or polymers must be soluble readily and should provide low viscosity solutions at high solids (25–50%). Generally, the better the solubility, the better the print quality. Certain polymers, such as poly(vinyl acetate), tend to string or cobweb, causing poor printing.

Substrate. Paper and other stocks which partially absorb and mechanically hold inks do not present an adhesion problem. Certain paper or paperboard coatings and many plastic films, however, require that the ink have a chemical affinity for the substrate. This is achieved by proper resin selection. For instance, soluble vinyls are usually used in ink formulations for vinyl substrates.

Ultimate Use. The ink vehicle determines the resistance properties of a printed

substrate. This indicates that the ultimate use of printed matter is an important resin determinant. For instance, a packaging material used for greasy foodstuffs could not be printed with an ink based on aliphatic-soluble resins because grease acts as a solvent causing the print to smear. Similarly, cellophane which is to be heat-sealed should be printed with inks based on resins of high enough melting point to withstand the heat-seal operation. Inks for food packaging and other odor-sensitive applications should not be formulated with odoriferous resins such as phenolics.

Auxiliary Vehicle Components. Plasticizers are used in flexographic and rotogravure inks to provide ink film flexibility and aid adhesion. Excessive use causes a soft film and blocking.

Waxes and lubricants are often added in small quantities to provide scuff resistance.

Manufacture. Manufacturing processes can be related to two operations—vehicle preparation and color dispersion. Vehicle preparation can be as basic as polymerization of resins or as simple as cold dissolving of vehicle solids in appropriate solvents. Therefore, vehicle equipment includes autoclaves for polymerization reactions and high speed mixers for simple dissolving.

Pigment dispersion usually is done in ball mills which lend themselves to volatile fluid formulations. Pebble mills using porcelain balls and linings are used for white and light colors because steel ball mills, although more effective, cause discoloration. Darker colors such as reds, blues, and blacks are usually made in steel ball mills.

Color concentrates and pigment resin dispersions called chips are made in dough mixers and two-roll rubber mills. These high shear methods often result in better dispersion and consequently higher gloss than is achieved with ball mills. Rubber-mill chips are dissolved similarly to resins to provide color concentrates. Dough mixer and chip concentrates must be diluted with solvent and other vehicles to make finished inks. Sand milling is becoming more widely used in both flexo and gravure ink manufacture. Other high speed dispersing units, such as the Morehouse, Cowles, Kady, and others, are also used to advantage.

Flexographic Inks. Flexographic inks comprise an almost infinite variety of specific formulations for specific purposes. They can, however, be classified into five general composition categories: (*1*) alcohol-dilutable inks containing nitrocellulose as a main constituent of the vehicle; (*2*) polyamide inks; (*3*) dye inks; (*4*) acrylic inks; and (*5*) water-based inks. Inks can also be classified by intended use. Examples include paper or carton board, surface-printed foil and plastic films, and reverse-printed plastic films to be subsequently laminated.

Flexographic inks are supplied at a higher viscosity than they are used, and they must be diluted (reduced) just before use. A normal diluting solvent, or a fast-drying solvent may be used, according to conditions.

Alcohol-Dilutable Inks Containing Nitrocellulose as a Main Constituent of the Vehicle. Nitrocellulose (cellulose nitrate) frequently is combined with other resins and plasticizers to satisfy a variety of needs. These inks are used on paper, cartonboard, glassine, foil, cellophane, cellulose acetate, ethyl cellulose, polyester, polystyrene, and, occasionally, treated polyethylene. Dilutability with solvents primarily containing ethanol is a desirable characteristic because it permits the use of highly resilient, long wearing natural-rubber printing plates. The best solubility and consequent printability results from a mixture of 80–90% ethanol, the remainder comprising an ester such as

ethyl, isopropyl, or *n*-propyl acetate, and a glycol ether. The proportion of ester and glycol ether determines drying rate and is, therefore, selected on the basis of press speed and color sequence in multicolor work.

Nitrocellulose-based flexographic inks usually have a little less gloss than the best grades of polyamide type inks. Most nitrocellulose inks have fair to good heat resistance, generally 120–180°C. Nitrocellulose can be combined with acrylic ketone and polyester resins to provide compatibility with laminated adhesives and extruded polyethylene. Adhesive compatibility is required when ink is sandwiched between films to be used as packaging for snacks and other products requiring moisture and gas-barrier properties.

A typical surface-printing nitrocellulose ink formula is: titanium dioxide, 35 wt %; anhydrous ethanol, 30 wt %; esterified fumarated resin, 10 wt %; *n*-propyl acetate, 10 wt %; 0.25-s SS (viscosity measured by Zahn cup) nitrocellulose, 7 wt %; propylene glycol monomethyl ether (retarder), 5 wt %; dibutyl phthalate, 2 wt %; microcrystalline wax, 1 wt %. A typical laminating nitrocellulose ink formula is: titanium dioxide, 35 wt %; anhydrous ethanol, 32 wt %; ketone resin, 18 wt %; *n*-propyl acetate, 8 wt %; 0.25-s SS cellulose nitrate, 7 wt %. The diluents for both are: normal diluent, 90% anhydrous ethanol, 10% *n*-propyl alcohol; fast drying diluent, ethyl acetate; retarder, propylene glycol monomethyl ether (1-methoxy-2-propanol; not for laminating inks); slow drying diluent, 90% *n*-propanol, 10% *n*-propyl acetate. Dry nitrocellulose is explosive; extreme caution should be employed in use and storage. It should be stored in a well-ventilated, cool, isolated place, not in thick sections but in small units with space for ventilation and dissipation of any accumulated heat, not near steam pipes or other source of heat. In case of fire, combat by flooding with water. If fire gets out of control, move personnel out and let it burn. Do not close up space where nitrocellulose is burning; the accumulation of very hot flammable gases explodes violently on contact with air. Avoid inhaling brown fumes from decomposing nitrocellulose.

Polyamide Inks. The most widely used family of flexographic printing inks for printing plastic packaging films are formulated with polyamide resins. Co-solvent polyamide resins are most soluble in a mixture of equal parts of alcohol and aliphatic hydrocarbons. The most common blend is normal propyl alcohol and a low residual odor narrow-cut VM & P (varnish makers' and painters') naphtha. Buna rubber printing plates should be used to accommodate the hydrocarbon solvent.

Co-solvent polyamide resins largely have been replaced with alcohol-soluble varieties. Alcohol-soluble polyamides have the advantage of improved nitrocellulose compatibility and printability with natural-rubber plates. Alcohol-soluble polyamide inks have replaced co-solvent types to prevent odor caused by absorbed hydrocarbon solvents.

A typical co-solvent-type polyamide ink is: *n*-propyl alcohol, 30 wt %; narrow-cut VM & P naphtha, 30 wt %; polyamide resin, 24 wt %; phthalocyanine blue, 15 wt %; polyethylene wax, 1 wt %; normal diluent, 50% *n*-propyl alcohol, 50% VM & P naphtha; fast-drying diluent, 50% isopropyl alcohol, 50% heptane range hydrocarbon (bp 93–113°C).

A typical alcohol-reducible-type polyamide ink is: ethyl alcohol, 33 wt %; alcohol soluble polyamide resin, 28 wt %; phthalocyanine blue, 15 wt %; *n*-propyl alcohol, 15 wt %; *n*-propyl acetate, 8 wt %; polyethylene wax 1 wt %; normal diluent, 90 wt % ethyl alcohol, 10 wt % *n*-propyl acetate; and slow diluent, 90 wt % *n*-propyl alcohol, 10 wt % propyl acetate.

Where heat resistance is not a primary consideration, polyamide-based inks are used almost universally for printing treated polyethylene and treated polypropylene films, poly(vinylidene chloride)-coated films of all types, polyester films, cellulose acetate films, oriented and expanded polystyrene films, and polyamide films. Moderate heat resistance is achieved by replacing part of alcohol-soluble polyamide with nitrocellulose. Polyamide inks containing nitrocellulose have somewhat less gloss than inks containing only polyamide resin.

Slow solvent–low odor hydrocarbons, moderately less volatile than VM & P naphtha, are not generally available. Therefore, the best way to retard drying speed is by increased proportion of *n*-propyl alcohol or by modification with a resin that has slow solvent release (esterified fumarated rosin) (see Polyamides).

Dye Inks. The original flexographic inks were based on dyes dissolved in alcohol and mixed with shellac. The dyes, usually of triphenylmethane type, provide brilliant, intense colors for paper, glassine, and foil. Permanence and bleeding of these inks have been improved through laking with phenolic resin but dye inks are still not considered for packaging films.

A typical dye-ink formula is: methyl violet, 15 wt %; phenolic resin, 30 wt %; ethyl alcohol, 55 wt %; normal diluent, ethanol; slow-drying diluent, glycol ester; fast-drying diluent, ethyl acetate.

Acrylic Inks. Acrylic-type flexographic inks are most widely used where substantial heat resistance, together with their unique properties, are required for printing a wide range of poly(vinyl chloride) and poly(vinylidene chloride) films and coatings, oriented polystyrene, rubber hydrochloride, some grades of polyester films, some grades of cellulose acetate films, polyamide films, and some oriented polypropylene films.

Acrylic inks usually have less gloss than nitrocellulose-based inks. Dried ink films based on acrylic resins are usually very hard and tough with excellent abrasion resistance.

Most of the flexographic inks in this category require a mixture of a minimum of 20% ester solvent with anhydrous proprietary ethanol. In some cases, higher percentages of ester solvent are recommended to obtain good printability. Because of this, either natural-rubber printing plates and rollers or butyl-rubber printing plates and rollers often are recommended. In addition to excellent adhesion on many plastic film surfaces, acrylic-type flexographic inks are distinguished for good block resistance, excellent grease resistance, excellent water resistance, and many other difficult product requirements. With suitably formulated inks, these qualities are frequently combined with good heat-sealing characteristics. Partial replacement of acrylic resin with nitrocellulose provides even better heat-sealing characteristics, heat resistance and compatibility with laminating adhesives.

A typical acrylic ink formula is: ethanol; 32 wt %; titanium dioxide, 30 wt %; alcohol-soluble acrylic resin, 20 wt %; *n*-propyl acetate, 17 wt %; microcrystalline wax, 1 wt %; normal diluent, 65 wt % ethanol, 35 wt % *n*-propyl acetate; slow-drying diluent, glycol ether; and fast-drying diluent, ethyl acetate.

Water-Based Inks. Approximately 30% of all flexographic inks use water as their primary solvent and diluent. Until recently, they contained vehicles based on alkali-soluble proteins such as casein and alpha protein and partially esterified fumurated rosin and shellac. Carboxylated acrylic resins, usually containing styrene, have largely replaced natural resins because they provide better abrasion and water resistance. Ammonia or other volatile amines are used to solubilize carboxylated resins and form

resin salts. The volatile alkali evaporates from the ink film, rendering the printed matter water-resistant.

Water inks differ from acrylic water paints which contain latices. Latices historically have resulted in high yield value, thixotropic inks having poor printing properties. Newer latex concepts, however, have been useful. They benefit ink formulation by increasing vehicle solids. High molecular weight compositions can be varied to provide improved physical properties such as adhesion, gloss, and product resistance.

Water inks historically have been used for a variety of paper and paper board. The excellent heat resistance of proteins make that type of ink particularly useful for kraft liner board which must later withstand the heat of a corrugating process. Main advantages of water inks include excellent press stability printing quality, heat resistance, absence of fire hazard, and the convenience and economy of water for reduction and washup. The historical disadvantages include low gloss and slow drying which limited their use to absorbent stocks. The increasing cost of petroleum-derived organic solvents and air-pollution regulations have led to the development of water inks having excellent gloss, water resistance, and adhesion to foil and plastic film.

A typical low cost, water-based ink formula is: water, 62 wt %; barium lithol red, 15 wt %; isolated soya protein, 5 wt %; octyl alcohol (defoamer), 5 wt %; ammonium hydroxide (density, 0.90 g/cm^3) (29.1 wt % NH_3), 2 wt %; microcrystalline wax, 1 wt %. A typical better wet and dry rub resistance, water-based ink formula is: water, 63.5 wt %; carboxylated acrylic resin, 18 wt %; barium lithol red, 15 wt %; ammonium hydroxide (density, 0.90 g/cm^3) (29.1 wt % NH_3), 2 wt %; polyethylene wax, 1 wt %; fatty acid ester or silicone defoamer, 0.5 wt %. The diluents for both are: normal diluent, water; slow-drying diluent, glycol ether or glycol and fast-drying diluent, ethanol.

Rotogravure Inks. Since there is no rubber contact with solvents in gravure ink formulations, it is permissible to use solvents such as ketones and aromatic hydrocarbons which cannot be tolerated in flexo inks. This provides the gravure ink formulator with much greater latitude with regard to binder selection and constitutes the principal difference between gravure and flexo inks. In other respects the compositions used are on the whole similar (2,6,8).

Straight polyamide ink formulations have been reported to cause trouble on gravure equipment because of poor wiping characteristics. This objection has been compounded by the inability of straight polyamide inks to dry hard enough between color stations to work well at high press speeds. Additions of nitrocellulose to such an ink will improve both performance characteristics. Gravure printing of polyethylene film is limited to only a few converters which have mastered the stretchiness and poor registration problems with polyethylene by using carrier webs—sometimes referred to as slip sheeting. The use of polyamides in protective overlacquers applied by gravure appears to be more important than its use in gravure inks at this time.

Nitrocellulose-based inks are widely used for rotogravure printing of the same variety of plastic films mentioned in the section on flexographic inks. The main difference here again is that the rotogravure process does not involve any solvent restrictions so that solvents, such as isopropyl acetate, toluene, etc, can be used. Alcohol frequently is used as a part of the blend but in minor quantities.

Acrylic-type rotogravure inks are quite widely used for the same combination of properties, product resistance, and use requirements as those listed for flexographic inks. However, the thinner or solvent mixtures for the acrylic inks in rotogravure

printing normally consist of ester solvents such as isopropyl acetate. Little or no alcohol is used in the rotogravure version of the acrylic-type ink formulations.

Another important type of rotogravure ink system for flexible packaging application is that based on chlorinated rubber binder dissolved in aromatic hydrocarbon solvent such as toluene. Inks of this type cannot be used on flexographic printing equipment because of the undesirable solvent swelling of rubber plates and rollers that would result.

As with flexo inks, gravure ink formulations must take into account the following end-use characteristics: adhesion; blocking; alkali resistance; odor; grease and oil resistance; moisture-vapor transmission; paraffin bleed; acid resistance; scuff resistance; heat resistance; and product resistance.

To achieve the above-mentioned end-use characteristics, one must know which substrate is to be printed, ie, paper, film, foil, or board, and then one can select an ink containing the proper binder and solvent combination to satisfy the requirements. All of the various gravure ink systems are not necessarily compatible with one another. Because of this, the system shown in Table 4 has been devised to avoid intermingling incompatible types.

Rotogravure publication inks represent another large segment of the total production of gravure inks made and used in the United States. Inks of this type are used in printing paper substrates used in books, magazines, catalogues, Sunday supplements, preprints, comics, etc. Hydrocarbon solvent systems are generally used for the sake of economy. The binders used are aliphatic or aromatic hydrocarbon-soluble modified rosin types having good solvent release to ensure fast drying and low residual odor. Good gloss and printability are also prime requisites. Publication printing press speeds in the range of 550 m/min are not considered unusual now and progress is being made toward the 760 m/min mark.

A typical rotogravure publication ink (type A blue) formula is: lactol spirits (aliphatic hydrocarbon solvent), 37 wt %; metallated rosin, 35 wt %; clay, 17 wt %; phthalocyanine blue pigment, 11 wt %.

Miscellaneous Inks

Screen-Process Inks. These inks, often known in the past as silk-screen inks, are printed on the substrate by being forced through a screen stencil by means of a squeegee. For many years this was a hand-printing operation, but it has now become largely mechanized. Screen-process inks are dispersions of pigments in vehicles which are, for the most part, solutions of resins in solvents of the boiling range of VM & P naphtha. Drying is usually by evaporation, but in some cases it is a combination of oxidation and evaporation. Various types of binders are used such as rosin esters, phenolics, cellulose derivatives, vinyls and oleoresinous varnishes, depending on the film properties desired. After premixing, the ink is ground on a three-roll mill. The resulting ink should be short and soft so as not to drag on the squeegee and to release the substrate cleanly after the print is made.

The screen-process method of printing can apply a thicker film of ink to the substrate than other printing processes, and for this reason, is particularly adapted to applications where maximum opacity is desired, or where fluorescent pigments are used, or for printing etch-resists for printed circuits. Screen process also is used for printing of both board and paper posters, metal signs, glass, ceramics, and plastics.

Table 4. Gravure Ink Selection Systems

Type	Resin or binder used	Solvents used	Applications
A	metallated rosins, gilsonite, and other hydrocarbon solvent resins	low-cost aliphatic hydrocarbons such as hexane, textile spirits, lactol spirits, VM & P naphtha, mineral spirits	newspaper supplement, catalogue preprint, and similar publication printing
B	ethyl cellulose plus other modifying resins	50% aromatic hydrocarbon solvent 50% aliphatic hydrocarbon solvent	same as above except designed for better performance on coated stock
C	nitrocellulose modified with resins and plasticizers	esters, ketones usually extended with aromatic hydrocarbon solvent diluents such as toluene, xylene	for printing on all papers, films, foils, and paperboard including nitrocellulose-coated cellophane, glassine, acetate, metallized paper, etc
D	polyamides	usually a 50/50 blend of alcohol and aliphatic or aromatic hydrocarbon solvent	printing on foil, paper, boards, polymer-coated cellophane, polyethylene, polyester, and other specialty films; also for hard, tough, glossy, overlacquer application
E	nitrocellulose or ethyl cellulose plus alcohol-soluble resin modifiers and plasticizers	ethanol or other alcohols plus ester solvents such as ethyl acetate	dye inks and pigmented inks for stocks described under type C
T	chlorinated rubber plus other modifying resins and plasticizers	usually aromatic hydrocarbon solvent such as toluene or xylene	for nitrocellulose-coated cellophane, foil, paper and board for labels, wrappers, and cartons; also glossy overlacquers
W	natural or synthetic resins such as shellac, casein, maleated rosins, etc	water plus alcohols when required; ammonia or other	for absorbent stocks such as liner board, wallpaper, gift wrap, laminating inks, board to be waxed, etc
X	any other nonrecognized type required	alkali used also for solubilization of binder	all other miscellaneous applications

The substrate need not be flat as the process will also accommodate round, oval, or other irregularly shaped objects.

Mimeograph Inks. Mimeograph printing is a stencil-printing process used primarily for office duplicating work for reproducing typewritten copy. The film stencil is cut by typewriter or by means of a hand stylus and wrapped around the ink-filled drum of a mimeograph printing machine. Mimeograph inks are therefore rather fluid and nonoxidizing but must dry quickly by absorption into the stock. They are generally made by dispersing carbon black into a glycol vehicle containing one or more of a cellulose binder, castor oil, and lanolin.

Stamp-Pad Inks. These inks are impregnated into a cloth or foam rubber pad and transferred by pressure to rubber type which is then stamped or impressed against the substrate. The inks must be completely nondrying in the pad and yet dry by rapid penetration into the paper. Since it is desirable that the total ink soak into the stock, dyes, such as induline black, are used rather than pigments. The vehicles used are

usually glycols, although other solvents may be used when the ink is for stamping on metal. In the latter case, phenol or cresol is incorporated into the formula.

Collotype Inks. These inks are similar to lithographic inks simply because both printing methods are planographic processes. The collotype plate, also called a photogelatin plate, is coated with sensitized gelatin, which is then exposed through an unscreened negative. The gelatin is hardened in proportion to the light intensity through the various areas. When saturated with glycerol and water, the light-hardened portions take ink, whereas the unhardened portions do not. Dampening rollers are not used and the plate is kept damp by moisture from the atmosphere as well as by renewing the glycerol from time to time. The fact that no halftone screens are used results in continuous-tone printing. The inks are formulated similarly to air-drying lithographic inks using oleoresinous vehicles but have a higher concentration of pigment and are much heavier in body.

Ball-Point Inks. These inks are medium-viscosity semi-Newtonian fluids of high tinctorial strength which must be slow drying and free of particles so as to continue to feed to the paper without clogging. Drying on the paper is accomplished by rapid penetration and some evaporation. These properties are obtained by strong dye solutions and pigment dispersions in vehicles containing oleic acid and castor oil or a sulfonamide plasticizer. Rheology of these inks exhibits modest thixotropy which prevents their leakage through the openings around the ball.

Water-based writing inks consist of very fine pigment dispersions in aqueous media containing small amounts of glycol or glycerol and a dispersing aid. They dry mainly by evaporation and quick wetting of cellulosic fibers in paper substrates.

Steel-Die Inks. Steel-plate printing is an intaglio process inks where the image is etched in continuous nonscreened lines on a steel plate. The ink is applied in a heavy layer to fill the engraving and then wiped off the nonprinting surface with paper or cloth, leaving the ink only in the engraving which is pressed against the paper with rather strong pressure to deposit the ink on the paper. This process is used for high-quality stationery, stock certificates, and paper currency. Owing to the thick film that can be deposited, high strength formulations are not required, but the body of the ink is somewhat short so as to wipe cleanly. Drying is by oxidation or by evaporation of solvent. The pigment, including a large percentage of colorless extender pigment, is dispersed on a three-roll mill in a vehicle composed of heat-bodied drying oil or oleoresinous vehicle, sometimes in combination with a resin–solvent-type vehicle. Owing to the thick film of ink deposited, sufficient drying oil must be present to prevent brittleness on aging.

Electrostatic Inks. Electrostatic printing is accomplished by causing charged colored particles to move in an electrostatic field to a substrate in the form of an image. The image may be formed by a screen stencil or by a gravure cylinder. One of the primary advantages of this process is its ability to print through gaps and thus without pressure. The electrostatic ink, also called an electrostatic toner, is a powder composed of pigment dispersed in a resin. The particles must have the proper electrical properties, particle-size range, and be free-flowing. After the image is deposited on the substrate, it is heat- or solvent-fused to a continuous film. Pigments and resins must be chosen to meet the application requirements and at the same time to satisfy the physical and chemical resistance requirements of the process (see Electrophotography).

Decalcomania Inks. Decalcomania is a transfer method of printing. The design is first printed on a temporary base by lithography, letterpress, gravure, or screen process, depending upon the detail and thickness of image desired. Usually the temporary base is paper which has been coated with a water-soluble material. The inks must dry completely on the surface by oxidation or solvent evaporation because the treated paper has no ink absorbency. After the initial printing, the design is transferred to the permanent base by direct contact and soaking with water. Obviously, the formulation of decalcomania inks is governed by the particular printing process employed in printing the transfer paper. Decalcomanias for ceramics require pigments that may be heated to high temperatures. Further, most decalcomanias should use pigments that are fast to light because many are subsequently transferred to outdoor signs or to store windows. Vehicles consist of oleoresinous varnishes containing metallic driers or of resin–solvent types.

Hot-Transfer Inks. Hot-transfer printing is similar to the decalcomania process in that the printing is first done on a temporary substrate, but heat is used as the transfer mechanism rather than water solubility. One type of hot-transfer ink is made with heat-fusible resins and waxes to be transferred to cloth. These inks should penetrate into the cloth and not be affected by subsequent washing of the fabric. In a more recent development for the packaging industry, labels are printed on a web of special coated paper by conventional printing such as gravure. This web is then fed to automatic labeling equipment. The relationship between the paper web and the ink is such that the ink is immediately released by heat and transferred to the surface of the package, such as plastic bottles, to which it then adheres as a permanent label.

Ink-Jet Printing. This is a nonconventional form of printing that has the potential advantage of including all the necessary elements of a printed page in some digitized form in computer memory, thereby eliminating the step of platemaking. One principle of operation involves the issuance of liquid ink from an orifice at very high speed to form a jet which is then broken up by ultrasonic energy to produce uniform droplets that can be charged electrically. These droplets can be deflected electrostatically into a catcher, while the uncharged droplets continue in flight to form dots on the printing surface to construct images. Other principles of operation include pressurized, single-deflected jet; pressurized, multiple-deflected jet; nonpressurized, single-undeflected jet; and nonpressurized, multiple-deflected jet.

Ink-jet technology provides a means of fast, dependable, high quality, single-copy printing. Its nonimpact nature permits printing on uneven surfaces and delicate materials. Computer compatibility permits the encoding of repetitive and nonrepetitive information. Special coated papers are not necessary for ink-jet printing.

The inks formulated for jet printing must be quite fluid, stable, and free of any particles that could cause clogging of the jet nozzles, and be capable of depositing and adhering to a substrate with a minimum of character fogging. They are generally formulated with soluble dye colorant in a suitable resin–solvent vehicle (19–20).

Environmental Considerations

Government regulations are becoming increasingly stringent and have drastically altered the manufacture and use of printing inks and their ingredients (21). The effect of these controls has necessitated the investment of millions of dollars for research to change ink formulation techniques as well as methods of printing.

OSHA has enforced strict, and in some cases, prohibitive control of materials such as lead and chromium salts. The FDA, although not controlling inks that are not in direct contact with food, influences formulations used on meat and poultry packages. The USDA documents acceptability of all such products. Listing of all nonvehicle ingredients under *Title 21, Code of Federal Regulations* is a specific requirement. The Consumer Products Safety Commission limits the amount of lead in children's products (22).

The EPA most significantly affects ink formulation through TSCA, the *Clean Air Act of 1970* and amendments of 1977, the *Resources Conservation and Recovery Act* (RCRA) controlling disposal of waste material, and the *Clean Water Act*. TSCA established an inventory of chemical materials acceptable for manufacture. New chemical compounds require a complex and expensive procedure to gain a manufacturing permit. The *Clean Air Act* has imposed severe restrictions on fuming of common lithographic web-offset and letterpress publication inks. Exhaust of volatile organic compounds (VOC) used as solvent in rotogravure and flexographic ink printing is severely limited because they react in the atmosphere to form ozone and consequent smog. The most economical method to overcome air pollution is through the replacement of VOC with water. Solvent recovery via carbon adsorption and incineration equipment are currently used to satisfy state and Federal emission requirements.

Hazardous waste is defined as anything flammable, corrosive, toxic, or reactive. Many colorants in ink contain lead, chromium and organic compounds defined by RCRA as toxic. Volatile solvents in flexographic and gravure inks are flammable. The *Clean Water Act* controls sewage, severely limiting disposal of wash from corrugated board presses and chemical waste from manufacture of gravure cylinders.

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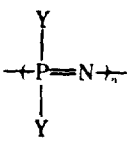
INORGANIC HIGH POLYMERS

The area of inorganic polymers is very extensive. Many inorganic compounds exist in the solid state as three-dimensional networks or two-dimensional layer structures. Inorganic polymers include solid metals, ionic crystals, ceramics, silica, silicates, etc. Such substances embrace a wide part of traditional inorganic chemistry and are adequately discussed elsewhere (see Ceramics; Silica; etc). In addition to these inorganic polymeric materials, there are inorganic polymers that exhibit elastomeric and plastic properties. The polymer backbones consist essentially of inorganic elements and occasionally have organic side groups to modify properties.

In general, inorganic high polymers offer unique property profiles not available with conventional organic polymers. Polysiloxanes are prime examples of inorganic high polymers. They possess a unique combination of high temperature stability and excellent low temperature elastomeric properties. Siloxanes are commercially important inorganic high polymers (see Silicon compounds, silicones).

Poly(phosphazenes)

Poly(phosphazenes) are polymers having alternating phosphorus and nitrogen atoms in the polymer backbone:



where Y can be halogen, pseudohalogen, or alkyl, aryl, alkoxy, aryloxy, arylamino, or alkylamino groups (see Phosphorus compounds; Fluorine compounds, organic, fluoroalkoxyphosphazenes) (1–3).

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Diuretics, 1
Driers and metallic soa
Drycleaning and laund
Drying, 75
Drying agents, 114
Drying oil 130
Dye carrie s, 151
Dyes and ye intermedia
Dyes, anthi iquinone, 212
Dyes, application and eva
Dyes, natural, 351
Dyes, reactive, 374
Dyes, sensitizing, 393
Economic evaluation, 409

DYES, REACTIVE

Reactive dyes are colored compounds that contain functional groups capable of forming covalent bonds with active sites in fibers such as hydroxyl groups in cellulose, amino, thiol, and hydroxyl groups in wool or amino groups in polyamides. This bond formation between the functional group and the substrate results in high wetfastness properties. These dyes differ fundamentally from other types of dyes that owe their wetfastness to physical adsorption or mechanical retention (see Dyes and dye intermediates). The principal commercial applications of reactive dyes are in the dyeing of cellulose, wool, and nylon, either individually or as components of fiber blends. They have also found use in dyeing silk, hair, and leather (see Dyes, application and evaluation).

Development of Reactive Dyes

The first recorded chemical combination of a dye with cellulose was achieved in 1895 by Cross and Bevan (1). They used a complicated process involving the benzoylation of soda–cellulose, followed by nitration, reduction, diazotization, and finally coupling with phenolic compounds to form the covalently fixed azo dye. Several other attempts were subsequently made to attach dyes to cellulose by means of a covalent bond (2–6). The dominating feature of almost all of this early work was the use of severe conditions such as concentrated caustic soda to prepare soda–cellulose or the use of inert solvents. The use of mild conditions necessary to render the coloration process technically feasible and reasonably efficient was given little or no consideration.

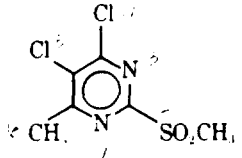
During the 1930s fast dyeings on wool were produced using dyes containing chloroacetylamino groups ($-NHCOCH_2Cl$) (7), and β-chloroethylsulfamoyl groups ($-SO_2NHCH_2CH_2Cl$) (8). It was not realized at that time that the high wetfastness of these dyes was due to the reaction between the labile chlorine atom and the amino groups in the wool.

Dyes prepared from diazo components containing β-sulfatoethyl sulfone groups ($-SO_2CH_2CH_2OSO_3H$) (9), were also patented for application to cellulose acetate and nylon, since they contained no nuclear sulfonic acid groups. Hoechst (10) commenced research work on dyes containing vinyl sulfone and β-sulfatoethyl sulfone substituents, which led to the introduction of the Remalan group of reactive dyes (11). Although it was known that the high fastness of the Remalan dyes was associated with chemical bond formation between the dye and the fiber; the suitability of vinyl sulfone dyes as reactive dyes for cellulose was not realized until after the appearance of the Procion (ICI) reactive dyes.

Previous work on the reaction of soda cellulose with cyanuric chloride (5,12) led to a useful industrial method for the production of dyeings in which a covalent bond was formed between the dye and the fiber (13). This development resulted in the introduction of the first range of reactive dyes for cellulose marketed by ICI in 1956 as the Procion M Dyes. The initial members of this range were all highly reactive dichlorotriazinyl derivatives capable of reaction with cellulose under cold-dyeing conditions. They were quickly followed by the less reactive monochlorotriazinyl dyes requiring hot-dyeing conditions, which were marketed as the Procion H range (14). Direct dyes containing triazine residues patented previously by Ciba were used in the

manufacture of a complete range of monochlorotriazinyl reactive dyes under the name Cibacron (15).

The success of the Procion dyes was followed by extensive research programs by all the major dyestuff manufacturers. As a result, a large number of reactive systems are mentioned in the patent literature (16–17). Consequently, reactive dyes containing 2,4,5-trichloropyrimidinyl groups were introduced under the trade names of Reactone (Ciba-Geigy) (18) and Drimarene (Sandoz) (19). In the early 1960s Bayer developed the Levafix P and E groups based upon 4,5-dichloro-6-methyl-2-methylsulfonylpyrimidine (1) (20) and 2,3-dichloroquinoxaline (2) (21) reactive groups, respectively; and BASF produced the Primazin P range with 4,5-dichloro-6-pyridazinone (3) (22) as the reactive species. Hoechst marketed their vinyl sulfone derivatives as the Remazol group (10). In addition, Bayer introduced similar dyes containing β-sulfatoethylsulfamoyl groups ($—SO_2NHCH_2CH_2OSO_3H$) (21), and BASF extended the Primazin range (23) to include dyes containing β-sulfatopropionamide groups ($—NHCOCH_2CH_2OSO_3H$), which combine with cellulose through nucleophilic addition reactions to form cellulose ether derivatives.



(1)
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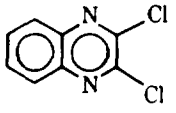
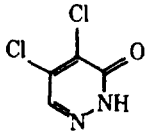


(2)
[2213-63-0]



(3)
[932-22-9]

During the mid 1950s the major emphasis was on reactive dyes for cellulosic fibers, but 1959 heralded the introduction of the Procinyl (ICI) group of reactive disperse dyes designed specifically for application to nylon (24). Although reactive dyeing began with wool (7–8,11), it was not until 1963 that the first range of reactive dyes, specifically for application by exhaustion procedures, was marketed by ICI under the trade name Procilan (ICI). These dyes are generally 2:1 premetallized dyes containing reactive acrylamide groups which are not subject to hydrolysis in the dyebath (25–26). Reactive dyes for wool, however, gained importance with the introduction of the Lanasol (Ciba-Geigy) dyes containing the α-bromoacrylamide group ($—NHCOC(Br)=CH_2$) (27–28) which are noted for their bright shades, high reactivity and good wet-fastness properties. Similar properties are exhibited by the Drimalan F (Sandoz), Reactolan (Ciba-Geigy), and Verofix (Bayer) dyestuff groups containing a difluorochloropyrimidinyl group (29–31). The Hostalan dyes (Hoechst) that were developed to overcome the problems of unlevel dyeing (32–34) are the reaction products of Remazol (vinyl sulfone type) dyestuffs and *N*-methyltaurine (4).

$CH_3NHCH_2CH_2SO_3H$
(4)
[107-68-6]

Dichlorotriazinyl and monochlorotriazinyl dyes, although primarily designed for cellulose, have also been applied to wool. The Cibacrolan (Ciba-Geigy) group of monochlorotriazinyl dyes were introduced specifically for wool (35–36).

Tables 1 and 2 illustrate the various commercial types of reactive dyes developed

Table 1. Reactive Dyes for Cellulosic Fiber

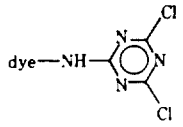
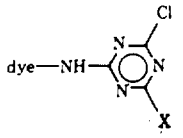
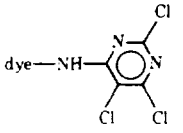
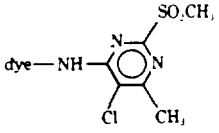
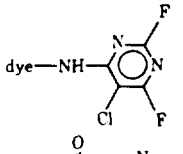
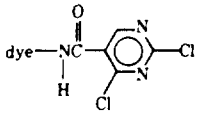
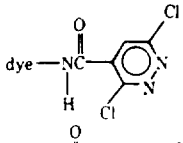
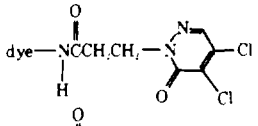
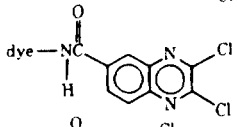
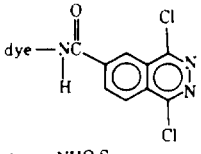
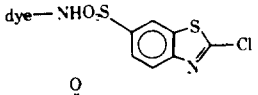
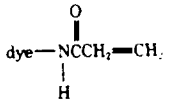
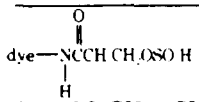
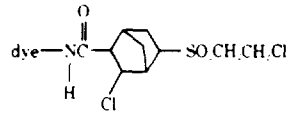
Reactive group: Structure	Name	Trade name	Manufacturer	Refs.
	dichlorotriazine	Procion M	ICI	13,37–40
 X = NH_2, NHR, NHC_6H_5, OR; or SO_3H	monochlorotriazine	Procion H Procion H-E Cibacron Cibacron Pront Procion SP	ICI Ciba-Geigy Ciba-Geigy ICI	13,33,40–41
	trichloropyrimidine	Reactone Drimarene X Drimarene Z	Ciba-Geigy Sandoz	18,33,42
		Levafix P	Bayer	20,42–43
	monochlorodifluoropyrimidine	Drimarene R Drimarene K Levafix EA Levafix PA	Sandoz Bayer	33,37,41
	dichloropyrimidine	Reactofil	Ciba-Geigy	37
	dichloropyridazine	Solidazol	Cassella	33,42
	dichloropyridazinone	Primazin P	BASF	22,33,42
	dichloroquinoxaline	Levafix E Cavalite	Bayer DuPont	14,21
	dichlorophthalazine	Solidazol Reatex Elisiane	Cassella Francolor	33,42
	chlorobenzothiazole	Reatex Elisiane	Francolor	39,42
	acrylamide	Primazin	BASF	23,33

Table 1. (*continued*)

Reactive group				
Structure	Name	Trade name	Manufacturer	Refs.
				
dye—SO_2CH_2=CH_2	vinyl sulfone	Remazol	Hoechst	10
dye—$SO_2CH_2CH_2OSO_3H$		Cavalite	DuPont	
dye—SO_2NH—$CH_2CH_2OSO_3H$	β-sulfatoethyl-sulfonamide	Levafix	Bayer	21
	β-chloro-ethyl-sulfone	Solidazol N	Cassella	37
dye—$NHCH_2OH$	methylol	Calcobond	Cyanamid	42

for cellulosic fibers, and for wool and polyamide fibers respectively. The tables show the major reactive groups, the corresponding chemical structures, and the common trade names. Other trade names not included in the tables can be found in a summary by Siegel (20) and the *Colour Index* (55) (see Dyes and dye intermediates). Extensive patent literature and publications relating to reactive dyes have been reviewed by Davies (16) and Rosenthal (17) during the period 1967–1975.

Excellent monographs on reactive dyes have been provided (14,37). Comprehensive reviews on this subject have also been published (38–42,53,56–60) and a pertinent bibliography can be found in the *Colour Index* (55).

A reactive dye molecule may, for convenience, be regarded as a combination of the following units:

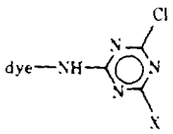
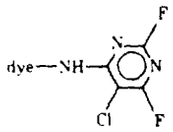
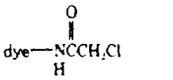
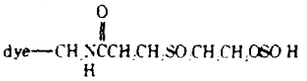
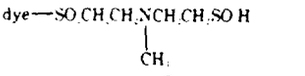
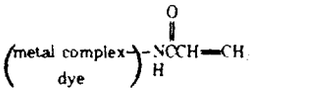
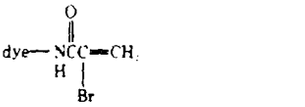
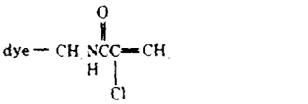
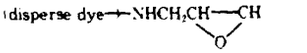
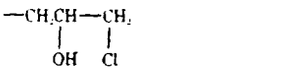
dye—B—Y—X

where dye is the chromophore (usually an azo, anthraquinone, or phthalocyanine residue); B is a bridging atom or group although this, in many cases, is part of the chromophoric system; Y is the unit carrying the reactive group (the activity of the reactive group depends to a large extent upon the nature of Y); and X is the group that reacts with the fiber. An additional water solubilizing group, which is not part of the chromophoric unit, may be found as part of the reactive group such as the sulfuric acid ester group of β-hydroxyethyl sulfone reactive dyes.

Chromophoric System. In principle, practically any desired chromophoric system can be combined with reactive groups to produce reactive dyes. The properties of the resulting dye, however, are affected by both of these groups. Proper combination is, therefore, needed to obtain dyes with good qualities such as high tinctorial strength, good solubility, good fastness properties, and economy.

Commonly used chromogens include azo, metallized-azo, anthraquinone, phthalocyanine, and metal-complex formazan derivatives. Azo compounds comprise the widest range of shade from greenish-yellow to black. For yellow dyes, coupling products of pyrazolones and aminopyrazoles are commonly used (61). Pyridone derivatives have gained much importance in the recent years as coupling components for yellow dyes (62). Brilliant red colors are usually based on aminohydroxynaphth-

Table 2. Reactive Dyes for Wool and Polyamide Fibers

Reactive group Structure		Name	Trade name	Manufacturer	Refs.
	X = Cl	dichlorotriazine	Procion M	ICI	14–15,35,44
	X = NH_2, NHR, NHC_2H_5	monochlorotriazine	Procion H	ICI	
			Cibacron	Ciba-Geigy	
			Cibacrolan	Ciba-Geigy	
	X = OR		Cibacron Pront	Ciba-Geigy	
		monochlorodifluoropyrimidine	Drimalan F	Sandoz	29–30,45–46
			Reactolan	Ciba-Geigy	
			Verofix	Bayer	
		ω-chloracetylamino	Cibalan Brilliant	Ciba-Geigy	44,47
			Drimalan	Sandoz	
dye—$SO_2CH{=}CH_2$		vinyl sulfone	Remalan		10–11,43,48
dye—$SO_2CH_2CH_2OSO_3H$		β-sulfatoethylsulfone	Remalan	Hoechst	
			Remazolan		
(metal complex dye)—$SO_2CH_2CH_2OSO_3H$		β-sulfatoethylsulfone	Remalan Fast		
		sulfatoethyl acrylamide sulfone	Lanafix	Sumitomo	33,38
		methyltaurine-ethylsulfone	Hostalan	Hoechst	32–34
		acrylamide	Procilan	ICI	25–26,49–50
		α-bromoacrylamide	Lanasol	Ciba-Geigy	27,51–52
		α-chloroacrylamide	Lanasyn Pure Blue FBL	Sandoz	33,42,53
		epoxide	Procinyl[a]	ICI	24,26,54
 (and others)		3-chloro-2-hydroxypropyl			

[a] Procinyl dyes used specifically for polyamide fibers.

alenedisulfonic acids (63). **Chromium, copper and cobalt metal-complex** azo dyes comprise the majority of metallized azo dyes. These dyes generally possess excellent lightfastness (64). Brilliant blue and green reactive dyes with high fastness to light are the main contribution of anthraquinone derivatives (65). **Copper and nickel** phthalocyanine reactive dyes give bright turquoise shades with good washfastness and satisfactory crocking fastness (66). Bright blue to green metal-complex dyes from

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properties. C
systems for
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and the reac
but can signi
the use of ox
hydrolyzed, a
dye. In additi
degree of dye
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stability to hy
chloroquinoxa
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an amide brid
can result in th
Sulfonamide a
sulfone group i
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erable as in the
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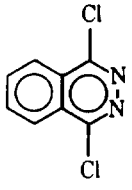
ucture and arra
omophore to wh

Synthesis

Reactive dyes h
on molecular compl
and more rapid diff
The methods of
reactive component.

formazan derivatives have been patented (67) and claimed to possess good fastness properties. Other groups mentioned in patent literature are also used as chromophoric systems for reactive dyes, but they have achieved little commercial importance up to the present.

The Bridging Group. The nature of the bridging group between the chromophore and the reactive group not only affects the shade, strength, and affinity of the dye, but can significantly affect its reactivity and the stability of the dye–fiber bond. Thus the use of oxygen or sulfur bridging groups is unsatisfactory, since they are readily hydrolyzed, and aliphatic or aromatic chains tend to lower the water solubility of the dye. In addition the length and flexibility of the bridging group has an affect on the degree of dye–fiber fixation. Therefore, amino and alkylamino groups are generally used as bridging groups in heterocyclic reactive dyes in view of the ease of synthesis, stability to hydrolysis, and minimum interference with solubility. In the case of dichloroquinoxaline (2) and dichlorophthalazine (5) reactive dyes that contain only one reactive chlorine group, the chromophore is attached to the reactive system through an amide bridging group. This bridging group is susceptible to acid hydrolysis, which can result in the rupture of the bond between the chromophore and the reactive system. Sulfonamide and amide bridging groups have been suggested as replacements for the sulfone group in the Remazol dyes. Although the stability of the dye–fiber bond is increased using these groups, a reduction in the reactivity of the dye is observed.



(**5**)

[*4752-10-7*]

The Reactive System. The combined unit Y–X in the above formula can be regarded as the reactive system. Generally, the reactive systems used in commercially available reactive dyes can be classified into two groups: (*1*) reactive systems based on nucleophilic substitution reactions, in which the mobile reactive group X is replaced by an attacking base, and (2) reactive systems based on nucleophilic addition reactions, in which a 1,2 trans addition of a nucleophile occurs across a polarized double bond. Examples of reactive systems (*1*) and (2) are halogeno-heterocyclic and vinyl sulfone systems, respectively. In some cases, both addition and substitution reactions are operable as in the α-bromoacrylamide types.

The reactivity of a reactive dye, therefore, is governed primarily by the chemical structure and arrangement of the reactive system (Y–X) and the variation of the chromophore to which the reactive system is attached.

Synthesis

Reactive dyes have a great advantage over direct dyes in that they do not depend on molecular complexity for adsorption. This allows a brighter spectrum of shades and more rapid diffusion characteristics compared with direct dyes.

The methods of synthesis of reactive dyes depend largely on the nature of the reactive component. Very thorough reviews have been presented of the methods of

production of various types of reactive dyes (14,37). In general, the following methods are used: (*1*) prepare an azo dye containing a nucleophilic group, eg, —NH_2, —OH, and then condense the azo dye with a heterocyclic aromatic reactive system, eg, cyanuric chloride, tetrachloropyrimidine etc; (2) combine a diazotized aromatic amine with a coupling component containing a reactive system, or a diazonium compound containing a reactive system with a coupling component; (*3*) condense an aromatic compound containing a reactive system to an anthraquinone derivative, in particular, 1-amino-4-bromoanthraquinone-2-sulfonic acid (bromaminic acid); and (*4*) for phthalocyanine dyes which do not carry a suitable nucleophilic group for the condensation with the reactive system, it is necessary to introduce a bridging group, eg, a sulfonamide, to act as the nucleophile.

Reactive Dyes for Cellulosic Materials, Wool, and Nylon

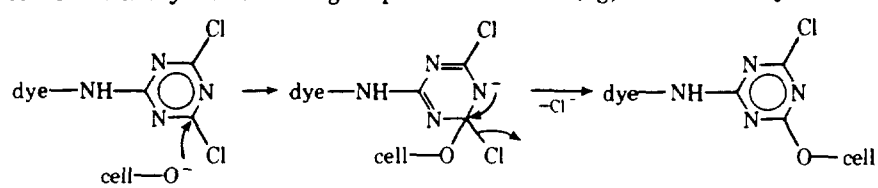
Cellulosic Materials. Cellulose (qv) is a carbohydrate. It consists of (1 → 4)-β-D-glucan and is considered as a polyalcohol with three hydroxyl groups per unit of glucopyranose. As a consequence, any group that is capable of forming a covalent bond with alcoholic hydroxyl groups is a potential reactive system to be used in a dye molecule for cellulosic fiber. However, certain criteria must be met in order for this reactive system to be of practical use.

The most important criterion is that the dye can be applied in an aqueous medium. In this instance, there are two competing reactions. One is the reaction of the dye and the fiber, and the other is the reaction (hydrolysis) between the dye and water. In principle, it is possible to dye cellulosic fibers in an aqueous alkaline medium with water soluble reactive dyes (68–69). Under alkaline conditions, the hydroxyl groups in the cellulose molecules are partially ionized and can act as nucleophilic reagents. The reactive system of the dye molecule can then react either with cell-O^- or OH^-. It has been shown (70–71) that the dissociation constant for cellulose is higher than that of water, thus cell-O^- reacts faster than OH^- with the reactive group of the dyestuff. This preference of dye–fiber interaction has been attributed to the higher nucleophilicity of the aliphatic hydroxyl groups of cellulose (72). In order for the hydroxyl anion of cellulose to attack the reactive system of the dye, they must be in proximity, ie, the dye molecules must be adsorbed onto the fiber. This property, known as substantivity, is the second fundamental condition that must be fulfilled before a dye–fiber interaction can take place.

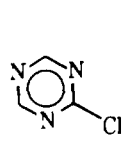
Another important criterion is that the covalent bond formed between the dye and the fiber must be sufficiently stable to resist subsequent aftertreatments. In other words, the dye–fiber interaction must be relatively irreversible. In addition, the dye must have a suitable shelf-life, and be nontoxic and economical to produce.

Reactive systems can be classified into several groups depending upon the reaction mechanism (58):

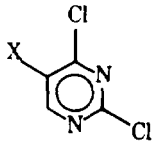
Reactive Systems Based on Nucleophilic Substitution. This generally involves a base-catalyzed addition of a nucleophilic functional group of the cellulose to the electrophilic center of the reactive groups followed by the subsequent displacement of a suitable leaving group. This mechanism applies particularly to heterocyclic aromatic compounds containing labile leaving groups. Shown below is the reaction scheme of a dichlorotriazinyl functional group with cellulose (eg, Procion M dyes).



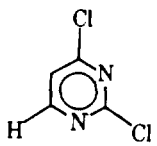
An excellent discussion has been presented of the mechanisms of the reaction of reactive dyes with cellulosic fiber (54). This nucleophilic substitution reaction mechanism also applies to other similar heterocyclic aromatic compounds such as monochloro-*s*-triazine (**6**) derivatives (Procion H and H-E type and Cibacron); 2,4,5-trihalopyrimidine (eg, (**7**)) (Drimarene K, R, X, and Z type, Reactone, Levafix EA and PA); 2,4-dichloropyrimidine (**8**) (Reactofil); 3,6-dichloropyridazine (**9**) (Solidazol); 1-*H*-4,5-dichloro-6-pyridazinone (**3**) (Primazin P); 2,3-dichloroquinoxaline (**2**) (Levafix E, Cavalite); 1,4-dichlorophthalazine (**5**) (Solidazol, Elisiane); and 2-chlorobenzothiazole (**10**) (Elisiane).



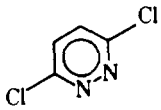
(**6**)
[6153-86-2]



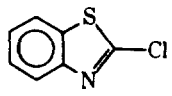
(**7**)
X = Cl
[5750-76-5]



(**8**)
[3934-20-1]



(**9**)
[141-30-0]



(**10**)
[615-20-3]

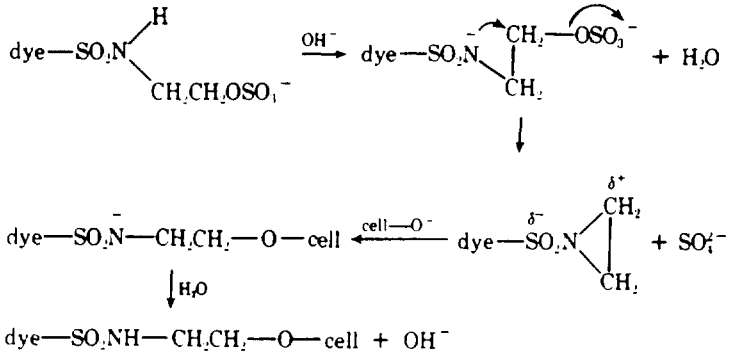
The reactivity of the heterocyclic aromatic systems can be altered by making suitable substitutions in the ring: (*1*) the hetero-atoms in the aromatic ring are important in that they affect the electronegativity of the system; an increase in the number of hetero-atoms favors nucleophilic exchange, and consequently, the reactivity of a triazine derivative is higher than that of a pyrimidine derivative; and (2) replacing the halogen with an electron-attracting group will increase the reactivity, whereas an electron-donating group will decrease the reactivity; eg, replacement with an amine, such as in the case for Procion H and Cibacron dyes, reduces the reactivity.

An important substitution in the pyrimidine system is the replacement of the chlorine atom at the 5-position with an electronegative group such as $—NO_2$, —CN, —COOH, etc. ICI claimed that substituting a nitro group in the 5-position of the pyrimidine ring enhanced the reactivity to such an extent that the dye could be applied to cellulose under much milder conditions than trichloropyrimidyl derivatives (73). However, this was not suitable for practical application because the dye–fiber bond was weakened by the over-activation of the nitro group making the resulting dyeing deficient in washfastness. Dyes containing a cyano group in the 5-position possess high reactivity and afford satisfactory dyeings (13).

When a carboxyl group is substituted into the 5-position of the pyrimidine ring, the reactive system can be attached to the chromophore through an amide bridge. This results in another group of dyes, called Reactofil (74–75), which possess reactivity towards cellulose of the same order as that of a dichlorotriazinyl dye.

In general, the reactivity of *N*-heterocyclic reactive groups increases in the order of: chloropyrimidine < monochloro-*s*-triazine < dichloroquinoxaline < dichloro-*s*-triazine.

Nucleophilic substitution at a saturated carbon is demonstrated in β-substituted ethylamine derivatives. The reaction proceeds via an ethyleneimine intermediate that exhibits high reactivity towards nucleophilic substitution reactions. For cellulosic fiber, the leaving group at the β-position is generally a sulfato group. The neighboring group participation of the nitrogen is essential for the easy formation of the three-member ethyleneimine ring (21).



Reactive Systems Based on Nucleophilic Addition. The mechanism of this reaction generally consists of two steps. The first step is a base-catalyzed elimination of a labile group (eg, $—OSO_3H$ and Cl) generating a reactive double bond, followed by a 1,2 trans addition of the functional group of the cellulosic fiber to the double bond. Two commercially important groups of dyes react according to this mechanism: (*1*) Remazol, a vinyl sulfone derivative (dye—$SO_2CH=CH_2$) produced by Farbwerke Hoechst (10); and (2) Primazin, an acrylamide derivative (dye—NH—CO—$CH=CH_2$) produced by BASF (54) (see Acrylamide). Venkataraman and co-workers (76) have illustrated the reaction mechanism of cellulose with β-sulfatoethyl sulfone groups, the precursor of vinyl sulfone (Remazol), according to the following scheme:

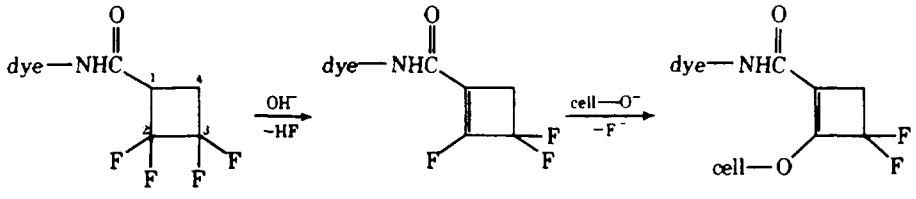
$$\text{dye—SO}_2\text{CH}_2\text{CH}_2\text{OSO}_3\text{Na} + \text{NaOH} \rightarrow \text{dye—SO}_2\text{CH=CH}_2 + \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$$

$$\text{dye—SO}_2\text{CH=CH}_2 + \text{cell—OH} \xrightarrow{\text{OH}^-} \text{dye—SO}_2\text{CH}_2\text{CH}_2\text{—O—cell}$$

The electron-withdrawing nature of the bridge sulfonyl group activates the α-methylene hydrogen, thus facilitating the 1,2 elimination by a base. This property has the intrinsic disadvantage that the dye–fiber bond formed in dyeings can also be easily cleaved on subsequent aftertreatments. In fact, dyeings of vinyl sulfone dyes are less fast to boiling dilute sodium carbonate solution than are dyeings of chlorotriazinyl dyes. By substituting a vinyl sulfonamide group (—NH—$SO_2CH=CH_2$) at the bridge, the activating effect is reduced and the dyeings exhibit better alkali fastness (54).

By analogy, β-chloropropionylamides are the precursors of acrylamide. A base elimination of hydrogen chloride provides the reactive acrylamide form. However, this type of dyes (Primazin) has only limited use in dyeing cellulosic fibers and is mainly used for wool dyeing.

Reactive Systems Based on Both Nucleophilic Addition and Substitution. Several patents have been issued to Farbwerke Hoechst covering dyes with 2,2,3,3-tetrafluorocyclobutane-1-carboxamide [*383-76-6*] groups. The fluorine atoms on *C*-2 are activated by the carbonyl group on *C*-1 resulting in high reactivity of such dyes. The probable course of the reaction is shown below (14):



The first step is the base-catalyzed elimination of HF followed by nucleophilic substitution of the fluorine atom remaining on the double-bonded carbon by cellulose anions.

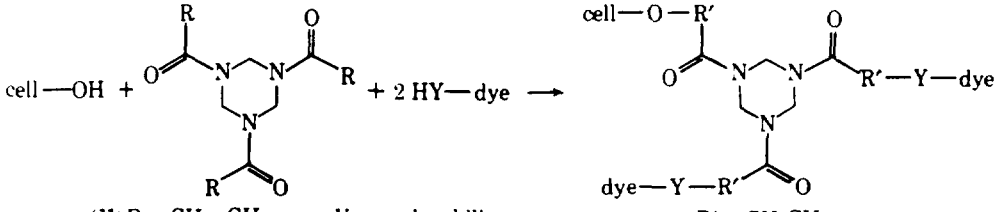
Dyes that React with Fibers Under Acid Conditions. All the reactive dyes mentioned above are applied to cellulosic fiber under alkaline conditions. The Calcobond dyes introduced by American Cyanamid Company are applied under acidic conditions. The reaction system is a methylolated nitrogen. The dye–fiber reaction is promoted by acid and heat and is believed to proceed according to the following mechanism (37):

$$\text{dye—NHCH}_2\text{OH} + \text{H}_3\text{O}^+ \rightleftharpoons \text{dye—NHCH}_2^+ + 2\,\text{H}_2\text{O}$$

$$\text{dye—NHCH}_2^+ + \text{cell—OH} + \text{H}_2\text{O} \rightleftharpoons \text{dye—NHCH}_2\text{—O—cell} + \text{H}_3\text{O}^+$$

Many dyes containing methylol groups attached to the chromophore in different ways are described in the relevant patent literature (77). The advantages mentioned for this type of dyes are: (*1*) they can be used together with disperse dyes, which are generally unstable in alkaline medium, to dye cotton and polyester blends; (2) the reactive system is similar to many textile-finishing agents and, therefore, can be applied together in a single operation. However, these dyes have failed to achieve much practical significance in dyeing of cellulosic fibers because they are incompatible with conventional reactive dyes and the cotton will lose up to 50% in tensile strength under the high temperature acidic fixation step (see also Amino resins).

Polyfunctional Fixing Agents That Form Covalent Bonds with Both the Dyestuff and the Substrate. Another approach to reactive dyeing is the linking of dyestuff molecules containing nucleophilic groups (eg, NH_2 and OH) with the nucleophilic hydroxyl anion of cellulose by means of a colorless polyfunctional component capable of reacting with both dye and fiber. Many different compounds have been disclosed in the patent literature as bridging compounds. Most of these suffer the disadvantage of having too low an affinity for cellulosic fiber and are only suitable for pad-dyeing and printing purposes. The most important polyfunctional reactive system is 1,3,5-triacryloylhexahydro-*s*-triazine (11) (triacryloformal). This forms the basis of the Basazol range of dyes (BASF). Hensel and Lützel (22) have postulated the following reaction scheme for structures (11) and (12):



(11) R = $CH{=}CH_2$ [*959-52-4*]
(12) R = CH_2CH_2OH [*4002-62-4*]
Y = nucleophilic group
R′ = CH_2CH_2

The color yields of ordinary reactive dyes are usually not higher than 60–85% because of some hydrolysis in the dyebath. Color yields of about 90%, however, have been obtained with 1,3,5-triacryloformal (11) as the bridging compound. The reasons for this high yield are: (*1*) the carbonyl group has strong activating effect; and (2) contrary to the aromatic triazines, the activity of the substituents is not significantly altered

after one or more of them has reacted. A good review of the general principle of dyestuff fixation by cross-linking agents has been presented (52).

Dyes Containing Several Reactive Groups. Conventional reactive dyes for cellulosic fibers suffer an obvious drawback in that only ca 70% of the dye is fixed onto the fiber, the remainder of the dye undergoes hydrolysis in the dyebath. There has been a continuous search for dyes that will exhibit high fixation efficiency. There are two possible methods to accomplish this goal: (*1*) use a reactive group that is not easily hydrolyzed; and (2) incorporate two or more reactive groups in a dye molecule to increase the chance of fixation. The latter method appears to have been the one mainly used in developing high fixation dyes. The high fixation dyes with multireactive groups are based upon statistical probability. That is, with two or more reactive groups there is better chance of fixation to the fiber. Furthermore, if one of the groups is hydrolyzed, the remaining groups may still react with the fiber. It must be stressed, however, that the presence of two or more reactive groups in a dye molecule does not necessarily provide high fixation. Other properties such as solubility, substantivity, and diffusibility are also determining factors.

The reactive groups of the dye can be linked as a reactive packet (17) with another group that does not carry a second chromophore (dye—NH—R_1—B—R_2; R_1 and R_2 = reactive groups; B = bridge). Another type of reactive group is a bridge that contains two chromophores (dye—NH—R_1—B—R_2—HN—dye).

Many patents have appeared covering dyes with two or more reactive groups. The favored group in such dyes is chlorotriazines (78). Two important groups of high fixation reactive dyes, Procion HE and Procion Supra, have achieved commercial importance. Procion Supra dyes (ICI) are intended primarily for use in textile printing applications but may also be employed in continuous dyeing processes.

Wool. The wool (qv) fiber contains many potential sites capable of forming covalent bonds with reactive dyes. Nevertheless, the incentive to invent reactive dyes for wool was not great because a wide variety of shades with high washfastness could be achieved with existing chrome dyes and milling acid dyes.

The reactive dyes first used on wool were designed primarily for application to cellulose. Difficulties were encountered with unlevel dyeing properties and hydrolysis of the dye during dyeing. These problems have now been largely overcome through development of reactive groups with little or no tendency to hydrolyze during the dyeing process, the use of special auxiliary products that minimize unlevel dyeing properties (53), and modification of the dyeing process.

In a review of the mechanism of reaction of proteins with reactive dyes, Shore (79) noted that the reaction with wool was more difficult to interpret than the reactive dye–cellulose systems (54,80) because of: (*1*) a greater variety of reactive groups in wool, the chemical reactions of which are complicated; (2) stronger and more localized interactions between the dye and fiber molecules; (*3*) an effect on dyeing behavior by the morphological structure of wool; and (*4*) susceptibility of the wool fiber degradation during dyeing. Many investigations during the last decade have also been directed towards the characterization of the main groups in the wool fiber that react with the dye (81–90). The reactive dye–wool systems can, however, be classified in the same general manner as the reactive dye–cellulose systems.

Reactive Systems Based on Nucleophilic Substitution. In an investigation of the rate of reaction of a dichlorotriazinyl dye with a series of simple model compounds containing the same functional groups as identifiable amino acids, the principal groups

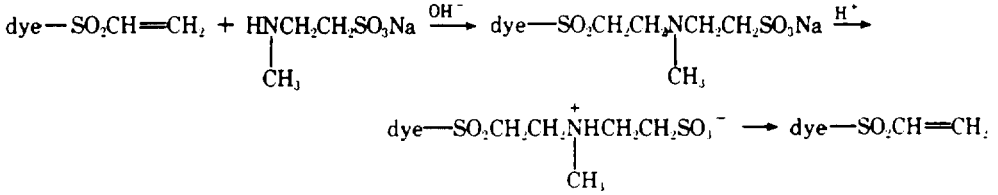
in proteins reacting with this particular dye were cysteine thiol groups, the primary amino groups of lysine and *N*-terminal amino acid residues, and the imidazole group of histidine (91). Several other studies (36,85,92) have also shown that one or more of these principal groups are capable of reaction with halogeno-heterocyclic dyes.

Several manufacturers have recently introduced reactive dyes based on 2,4-difluoro-5-chloropyrimidine, eg, Drimalan F (Sandoz), Reactolan (Ciba-Geigy), Verofix (Bayer), which exhibit a high degree of reactivity and resistance to hydrolysis. This property has been attributed to the capability of both fluorine atoms to react with nucleophiles (30).

Dyes containing chloroacetyl groups react with both the cysteine and histidine residues in wool (26). The reaction of a chloroacetyl dye with cysteine, histidine, and lysine depends upon the pH conditions employed (93–94). Several polymethine dyes (qv) containing *N*-chloroacetyl groups have been examined as fiber-reactive dyes for wool. The washfastness properties were improved significantly compared to the corresponding nonreactive dyes (95).

Reactive Systems Based on Nucleophilic Addition. Remalan dyes containing vinyl sulfone groups undergo considerable hydrolysis under neutral dyeing conditions (48). The Remazolan dyes were introduced to overcome this problem. They are applied to wool by a special method, which ensures complete reaction of the vinyl sulfone group with the fiber producing dyeings with excellent washfastness properties (47).

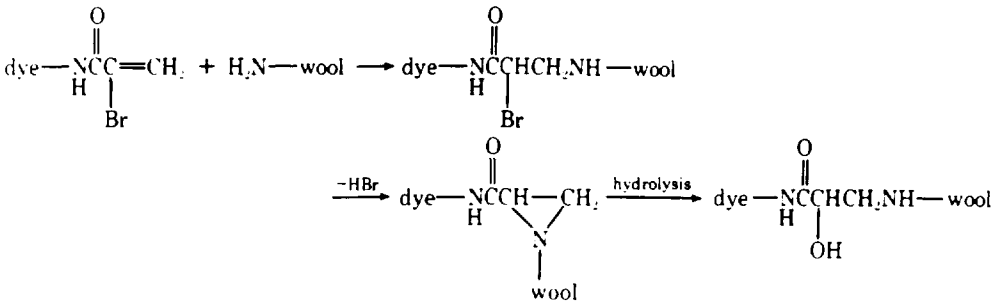
The Remazol dyes originally designed for cellulose can also be applied to wool (96–97). The unlevel dyeing properties of these conventional vinyl sulfone dyes led to the introduction of the Hostalan dyes (32–34). These dyes are prepared by reaction of vinyl sulfone dyes of the Remazol class with *N*-methyltaurine (4) under alkaline conditions. The reactive vinyl sulfone group is then gradually regenerated during the exhaustion dyeing process and level dyeing is attained by raising the dyebath temperature quickly to the boil. The reactions involved can be represented by the following scheme (98–99):



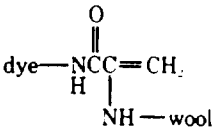
Reactive dyes containing the acrylamide (—NHCOCH=CH_2) or β-chloropropionamide (—NHCOCH_2CH_2Cl) group exhibit lower reactivity for cellulose than the corresponding vinyl sulfone dyes. These dyes, therefore, can be applied advantageously to wool where a less reactive group is required to obtain adequate level dyeings. They also show practically no tendency to hydrolyze under normal wool dyeing conditions (26), unlike the triazine and vinyl sulfone types. This property is very desirable for satisfactory washfastness. The acrylamide reactive system forms the basis of the Procilan dyes (50) which exhibit good light- and washfastness properties, resembling those of the chrome dyes.

Reactive Systems Based on Both Nucleophilic Addition and Substitution. The Lanasol reactive dyes (Ciba-Geigy) containing α-bromoacrylamide groups were designed for application to wool. The chemistry of their reaction with wool has been detailed (51,100). Reaction of these dyes with the amino groups in wool proceeds through

nucleophilic addition at the double bond, followed by elimination of HBr and formation of an aziridine compound through nucleophilic substitution. Subsequent hydrolysis and internal rearrangement, with ring opening, forms the stable compound as shown below:



The leaving group is the bromine atom (51) and the formation of the aziridine compound can also proceed by nucleophilic substitution of the bromine through the intermediate:



Reactions Involving Disulfide Bonds. In recent years, dyes have been produced that, during or after application to the fiber, react covalently with themselves to form high molecular weight molecules.

Self-condensation dyes containing *S*-alkylthiosulfate ($R—SSO_3H$) and *S*-arylthiosulfate groups ($Ar—S—SO_3H$), known as Bunte salts (101), have been marketed as the Inthion (Hoechst) (102) and Dykolite (Southern Dyestuff Co.) (103–104) dyes, respectively, for application to cellulosic fibers.

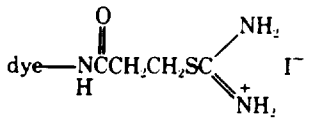
An important member of the Inthion group, namely Wool Fast Turquoise Blue SW ($—SO_2NHCH_2SSO_3H$) (Hoechst) was shown to exhibit excellent wetfastness properties on wool (102). It has been suggested (105–106) that the Bunte salt dyes react with the cysteine thiol groups to form an asymmetrical disulfide, which then disproportionates to the insoluble disulfide dye as shown:

$$\text{dye—SSO}_3\text{Na} + \text{wool—SH} \rightarrow \text{dye—S—S—wool} + \text{NaHSO}_3$$

$$2\,(\text{dye—S—S—wool}) \rightarrow \text{dye—S—S—dye} + \text{wool—S—S—wool}$$

Thus the improved wetfastness exhibited by these dyes could be due to the increased molecular size of the disulfide dye rather than covalent bond formation. It has also been suggested that dyes containing thiol groups form covalent bonds with wool (89,107–109).

Recently dyes containing β-isothioureidopropionamide (13) groups have been found suitable as reactive dyes for wool (110). A study of the mechanism of fixation on wool of several isothiouronium dyes, referred to as the Thiolan dyes, concluded



(13)

[56919-62-1]

that the high washfastness was due to insolubilization within the fiber rather than to mixed disulfide formation with cysteine (111). These dyes, therefore, can be regarded as condense dyes (112) rather than classical reactive dyes.

Reactions Involving Modified Wool. The introduction of shrink-resistant machine-washable wool necessitated the use of dyes that exhibit very high washfastness. This property could not be achieved satisfactorily using milling acid dyes, premetallized dyes or even chrome dyes. Fortunately, the newer reactive dyes for wool (eg, Lanasol, Drimalan, Verofix, Hostalan, etc) satisfied the stringent washfastness standards and, in addition, provided popular bright shades.

This modified wool is produced by a chlorine pretreatment followed by application of a resin to the fibers, for example the Chlorine-Hercosett process (113) (International Wool Secretariat), and the Dylan GRB and GRC processes (Precision Processes Textiles Ltd.).

The application of reactive dyes to Chlorine-Hercosett 57- (Hercules Powder Co.) treated wool has been studied in detail (99,114–116). Lewis and Seltzer (114) found that this resin-treated wool has a higher affinity for anionic dyes, owing to the high basicity of the resin, than either chlorinated or untreated wool.

Auxiliary leveling agents, such as Albegal B (Ciba-Geigy), Drimagen F (Sandoz) or Avolan RE (Bayer), which react with both the dye and the fiber, are recommended for use with the newer reactive dyes. These dyeing assistants reduce penetration of the dye into the fiber at low temperatures, but as the temperature is elevated, the auxiliary product–dye complex breaks down allowing the dye to react covalently with the fiber (31). The role of concentrated urea solutions in promoting the rate of reaction of reactive dyes with wool at low temperatures has been studied (117–120). Results of this work ultimately led to the development of a cold pad-batch process (121) which produces level, fast, bright dyeings on wool.

Reactive Dyes for Nylon. The level dyeing of nylon with high washfastness properties was initially unobtainable with conventional acid and disperse dyes, owing to variations in the physical and chemical characteristics of the fiber. The Procinyl reactive dyes were, therefore, developed. They are disperse dyes (devoid of solubilizing groups) containing a group capable of reaction with nylon. The patent literature indicates that the reactive group is not limited to one particular system and can include chlorotriazinyl, epoxy, 2-chloro-1-hydroxyethyl, β-chloroethylsulfamoyl, and aziridine groups. These dyes are stable in water and can be applied as conventional disperse dyes from weakly acid dyebaths. At the conclusion of dyeing, the dyebath is made alkaline in order to promote reaction of the dye and the fiber, resulting in a level dyeing with high fastness properties. Chemical combination of the Procinyl dyes with nylon has been demonstrated (24,122). It is suggested that reactivity is associated not only with the primary amino end groups of the fiber, but also with amide groups in the polymer chain. The possibility that dimerization or polymerization of the dye itself within the fiber has not been ruled out.

Recently the mechanism of fixation of disperse dyes containing a sulfonylazide ($—SO_2N_3$) or an arylazide (ArN_3) group on nylon has been examined (123). It was found that, under aqueous dyeing conditions, reaction occurs with the amino end groups of the polymer through a sulfonamide linkage. During heat-transfer printing, however, the azide group decomposes rapidly to a reactive nitrene species which undergoes insertion into carbon–hydrogen bonds of the polymer forming a nitrogen bridge (see Printing processes).

Analysis

The analysis of reactive dyes requires identification of the chromophore and the reactive system. The chromophore can be identified by the general methods adopted for any class of dyes (124). The identification of the reactive group after reaction with the fiber is a more difficult problem. The identification of reactive dyes on cellulosic fibers is described in refs. 125–126. These methods depend on the relative stability of the dye–fiber bond to acidic and alkaline hydrolysis. The extent of fixation of reactive dyes on wool fibers has been determined by solvent extraction techniques (127–130) (see Dyes, application and evaluation).

Dyestuffs, though not necessarily toxic, add organic carbon and color to waste water, which is objectionable to the public for esthetic reasons. The effective and economical removal of the various classes of dyes, including reactive dyes, from waste waters has been studied using techniques such as chemical coagulation or oxidation (131–132), activated carbon adsorption (133), polymeric adsorption/ion-exchange processes (134–135), high energy radiation (136), and electrolysis (137) (see Dyes and dye intermediates).

Economic Aspects

The annual production and sales figures for reactive dyes in the United States, compared to total dye production, over the period 1960 to 1976 are shown in Table 3.

A rapid growth of reactive dyes clearly occurred during the period 1960–1965 with production increasing by 545%. During the following six years growth continued, but at a slower rate of 234%. Reactive dye production has remained relatively constant since 1971 at approximately 1.2–1.4% of total dye production. A 29% decrease in production occurred in 1975, owing no doubt to the worldwide recession at that time. Sales of reactive dyes, however, increased by 27% during that year indicating that reduced production in the United States was counteracted by imports and overall reduction of inventories.

Table 3. Annual United States Production and Sales of Reactive Dyes[a]

	Production, t			Sales, t		
Year	Total dyes	Fiber-reactive	% of total	Total dyes	Fiber-reactive	% of total
1960	70,700	130	0.2	67,000	100	0.1
1965	94,000	720	0.8	86,200	710	0.8
1970	106,000	1,010	1.0	101,000	1,220	1.2
1971	111,000	1,680	1.5	105,000	1,590	1.5
1972	119,000	1,680	1.4	116,000	1,620	1.4
1973	129,000	1,680	1.3	121,000	1,560	1.3
1974	125,000	1,550	1.2	119,000	1,420	1.2
1975	93,500	1,100	1.2	94,700	1,400	1.5
1976	116,000	1,590	1.4	113,000	1,810	1.6

[a] Ref. 138.

In 1976 a total of 646 metric tons of reactive dyes was imported into the United States, representing 6.2% of the total dye imports. Approximately 97% of these imported reactive dyes were noncompetitive with reactive dyes manufactured in the United States.

In addition, reactive dyes have increased continuously in number since their inception in 1956. Currently, there are a total of 697 reactive dyes listed in the *Colour Index* (55). A breakdown by color is given in Table 4.

Reactive dyes have provided dyers with a full spectrum of shades. They possess high solubility, and good leveling power and are easy to apply. Reactive dyes are particularly compatible with environmental and effluent regulations because objectionable chemicals are not necessary for application. The low temperature method allows economical use of energy. However, the ideals of complete fixation and easy application represent the ultimate targets of dye makers.

Table 4. Reactive Dyes Listed in the *Colour Index*[a]

Color	Year		
	1966	1971	1978
yellow	33	79	134
orange	25	60	86
red	54	115	176
violet	11	22	34
blue	41	101	175
green	0	18	23
brown	15	22	28
black	16	31	41
Total	*195*	*448*	*697*

[a] Ref. 55.

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Medium Priority
01/12/89
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UPDATED PRELIMINARY ASSESSMENT
Old Startex Spartanburg County Landfill
SCD 980 558 191
Spartanburg County

Prepared by: Gerald Stewart
Date Completed: December 16, 1988

I. INTRODUCTION/EXECUTIVE SUMMARY

Between the late 1960's to 1981, the Old Startex Spartanburg County Landfill was utilized by Lyman Dyeing and Finishing Company and Spartanburg County to dispose of domestic and industrial wastes (Ref. 1, pg. 3). The identity and quantity of wastes disposed in the approximately thirty-five acre landfill are unknown. According to Nick Odom, Environmental Manager-Springs Industries, Inc., the site probably received mostly inert materials and a minimum amount of liquids, such as organics and inorganics (Ref. 1, pg. 4). However, as suggested in the company's Section 103(c) notification, it is impossible to know all types of wastes that were dumped at the site during the active years. Because of the nature of the wastes generated by textile printing and finishing operations in the 1960's and 70's, some of the materials disposed in the landfill probably contained hazardous substances (Ref. 1, pg. 3).

An estimated 775 people are dependent on groundwater wells located within three mile of the Old Startex Spartanburg County Landfill (Ref. 3, pg. 2). No public water supply intakes are located within fifteen miles downstream of the site (Ref. 4, pg. 176). Therefore, the migration of contaminants into the groundwater supply is the major area of concern. No groundwater monitoring has been done to assess the impact of contaminants on groundwater quality. Therefore, the Old Startex Spartanburg County Landfill is given a medium priority for a Site Screening Investigation (SSI).

II. SITE BACKGROUND AND HISTORY

A. Ownership History

Present Owner: Spring Industries, Inc.
P.O. Box 70
Fort Mills, S.C. 29715

Present Operator: Spring Industries, Inc.
P.O. Box 2000
Lyman, S.C. 29365

Previous Owner: Lyman Dyeing and Finishing Company
(presently, Spring Industries)
P.O. Box 2000
Lyman, South Carolina 29365

Previous Operators: Same as previous owner
and
(2) Spartanburg County

B. Site Location/Description

Spring Industries, Incorporated Lyman Plant is located in the Town of Lyman, South Carolina. Old Startex Spartanburg County Landfill is located approximately 3,750 feet to the east-southeast of the Springs Industries, Inc.'s plant (Ref. 2). Geographically, the site is positioned at 34^0 56' 24.3" North latitude and 082^0 06' 39.5" West longitude (Ref. 2).

Old Startex Spartanburg County Landfill is estimated to cover thirty to forty acres of land (Ref. 1, pg. 2). No additional specifications of the landfill are known.

C. Regulatory History/RCRA Status

Lyman Dyeing and Finishing Company (presently, Springs Industries) submitted Section 103(c) CERCLA notification for the Old Startex Spartanburg County Landfill to the US EPA on June 22, 1981 (Ref. 1, pg. 1-3). According to the 103(c) notification, no potentially hazardous materials were placed into the landfill after the early 1970's (Ref. 1, pg. 3). Lyman Dyeing and Finishing Company closed the landfill in 1981.

Lyman Dyeing and Finishing Company submitted a hazardous waste activity notification to SCDHEC of temporary storage of oil base and/or water base paint waste (Ref. 1, pg. 5-12). According to the state notification, the company generated approximately seventy-five pounds of paint waste per year (Ref. 1, pg. 5). Lyman Dyeing and Finishing Company is not classified as a RCRA facility of any type according to SCDHEC files. SCDHEC files indicate that the company is newly listed with the US EPA under the RCRA program.

D. Process and Waste Disposal History

According to Lyman Dyeing and Finishing Company's 103(c) notification, the Old Startex Spartanburg County Landfill received domestic and industrial wastes or refuse from Lyman Dyeing and Finishing Company, Spartanburg County and other industries from the late 1960's until the early 1970's (Ref. 1, pg. 3). The dump handled industrial waste and refuse generated by the textile printing and finishing operations at the Lyman D&F

plant and industrial waste from other companies (Ref. 1, pg. 3). Therefore, the dump site is suspected to contain hazardous waste.

Spartanburg County operated the site until the early 1970's. Afterward, Lyman D&F Company closed access to the site to the public and other industries (Ref. 1, pg. 3). From the early 1970's until 1981, Lyman D&F Company utilized the site for disposal of broken wooden pallets and cinders from their boiler house (Ref. 1, pg. 3). According to Nick Odom, Environmental Manager - Springs Industries, Inc., the landfill probably received a large amount of textile rags, cardboard, bricks, blocks and fly ash and a minimum amount of liquids, such as organics and inorganics (Ref. 1, pg. 4).

However, the composition and amount of hazardous waste disposed of in the Old Startex Spartanburg County Landfill is unknown. According to the 103(c) notification, the landfill contains between 13 and 26 million cubic feet of potentially hazardous wastes (Ref. 1, pg. 2).

E. Removal/Remedial Actions

No remedial or removal actions are known to have taken place at the site.

F. Demography/Regional Setting

Old Startex Spartanburg County Landfill is located approximately .75 mile east-southeast of Lyman, South Carolina and .75 mile northwest of Startex, South Carolina (Ref. 2). Within three miles of the site, the region is heavily populated and contains numerous villages and townships (Ref. 2).

The region is fairly hilly with numerous woodlands, creeks and rivers (Ref. 2).

III. GROUNDWATER PATHWAY

A. Regional Hydrogeology

Old Startex Spartanburg County Landfill is underlain by weathering products of bedrock containing a heterogeneous mixture of sands, silts and clays, and a mixture of igneous and metamorphic crystalline rock (Ref. 3, pg. 1). The on-site soil is composed of Davidson sandy clay loam containing an average of sixty percent clay (Ref. 3, pg. 2). Soils of this composition has a saturated hydraulic conductivity of approximately 10^{-4} to 10^{-7} cm/sec. (Ref. 3, pg. 2). The depth to groundwater is estimated to be between ten and twenty feet (Ref. 3, pg. 2).

The aquifer of concern consists of the saprolite aquifer and bedrock aquifer (Ref. 3, pg. 2). The direction of groundwater flow in the superficial unconfined aquifer (saprolite aquifer) appears to be toward the west (Ref. 3, pg. 2). No sole source aquifer or Karst topography is known to occur within four miles of the site (Ref. 3, pg. 2).

B. Groundwater Use

Ground water is used as a source of drinking water by an estimated 775 people living within three miles of the Old Startex Spartanburg County Landfill (Ref. 3, pg. 2). Approximately 204 domestic wells are sparsely distributed throughout the three-mile radius (Ref. 2 and Ref. 3, pg. 2). The nearest groundwater well is located approximately 1,584 feet east of the site (Ref. 3, pg. 2). If the area of concern is increased to four miles, the number of people depending on ground water would increase to 1,756 (Ref. 3, pg. 2).

No additional uses of the aquifer of concern are known.

C. Groundwater Impact

No groundwater monitoring is known to have taken place at the Old Startex Spartanburg County Landfill. Therefore, the impact on groundwater caused by the burial of industrial and unknown wastes at the site is unknown. However, potentially hazardous wastes buried at the site are suspected to have adversely impacted the aquifer of concern.

IV. SURFACE WATER PATHWAY

A. Regional Characteristics

Old Startex Spartanburg County Landfill is located approximately 1,000 feet northeast of a small tributary that flows to the south and empties into the Middle Tyger River (Ref. 2). The Middle Tyger River flows toward the southeast at approximately 103 cubic feet/sec. (Ref. 4, pg. 166). The site slope and intervening slope are estimated to be 2.0 percent and 7.9 percent respectively (Ref. 2).

B. Surface Water Use

No public supply or agricultural surface water intakes are located within fifteen miles downstream of the Old Startex Spartanburg County Landfill (Ref. 4, pg. 176). According to the South Carolina Heritage Trust County Program, October 12, 1987, for Spartanburg County, no federally endangered species occur within four miles of the site.

Within three miles downstream of the site, the Middle Tyger River is predominantly used for recreational boating and fishing.

C. Surface Water Impact

No surface water sampling has been conducted to determine the impact of contaminated runoff from the site on the small tributary located 1,000 feet from the site.

V. CONCLUSIONS AND RECOMMENDATIONS

Because the types and amount of hazardous waste disposed in the Old Startex Spartanburg County Landfill are unknown and 775 people may be adversely affected via the migration of contaminated leachates into the groundwater supply, the Old Startex Spartanburg County Landfill is given a medium priority for a Site Screening Investigation (SSI). The SSI is needed to more thoroughly evaluate hazardous conditions associated with the old landfill by collecting and analyzing appropriate groundwater and surface water samples for potential contaminants. Additionally, the SSI should evaluate the potential for on-site soil and air contamination (These areas were not addressed in this report). The results from the SSI should be used to determine the need for further action.

VI. REFERENCES

1. South Carolina Department of Health and Environmental Control; Files and Records of Communications.

2. U.S. Geological Survey; Wellford and Greer, South Carolina, Quadrangles. 1983 Editions.

3. SCDHEC - Division of Hydrogeology; Hydrogeologic Review of the Old Startex Spartanburg County Landfill, completed by Judy L. Canova, November 22, 1988.

4. South Carolina Water Resource Commission, S.C. State Water Assessment: Report No. 140, 1983.

REFERENCE NO. 13

RECORD OF COMMUNICATION	X PHONE CALL	___DISCUSSION	___FIELD TRIP	___CONFERENCE

TO: Jerry Ryland NUS FROM: C Amoroso DATE: 3/13/91 TIME: 11:00

SUBJECT: Old Startex, Spartanburg Co landfill SCD 980558 191

SUMMARY OF COMMUNICATION:

I called Jerry Ryland to find out why gw was not sampled during the SSI (it was planned according to the study plan). Ryland said that they hit bedrock 2-3 feet below surface, therefore could not take gw samples. The nearby private well referred to in the state-PA could not be located. Thus, no gw. Ryland thinks that it is unlikely that gw is effected, recommends NFRAP, but monitoring of local wells by local authorities. Public water lines are available in nearby area and probably could be extended the the few people who use gw.

CONCLUSIONS, ACTION TAKEN OR REQUIRED

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SOUTH CAROLINA

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Water Resources of Spartanburg County, South Carolina

By

W. M. Bloxham, George E. Siple, and T. Ray Cummings

Prepared by
U.S. Geological Survey, Water Resources Division
in cooperation with
Spartanburg County Planning And Development Commission
Spartanburg, South Carolina

1970

ERRATA

WATER RESOURCES OF SPARTANBURG COUNTY should be amended by the following:

1. "Rainbow Lake" (pages 7, 9, and figure 2) should be subsequently identified as "R. B. Simms Filtration Plant."

2. "South Pacolet River Reservoir" (pages 7, 21, 23, and figures 5, 6, 9, 20, 23, 27, and plate 1) is known locally as "Reservoir No. 1."

3. The determination of oxygen sag in Fairforest Creek between miles 8 and 9 (page 51) was made prior to the treatment plant expansion and the resulting improvement in effluent quality.

Water Resources of Spartanburg County

South Carolina

by

W. M. Bloxham, George E. Siple, and T. Ray Cummings

Prepared by

U.S. Geological Survey, Water Resources Division

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Spartanburg County Planning and Development Commission

Columbia, South Carolina

1970

CONTENTS

	Page
Abstract	1
Introduction	2
Purpose and scope of the investigation	2
Method of investigation	3
Previous investigations	3
Stream- and well-numbering system	3
Acknowledgments	5
Geography	5
Location and extent of the area	5
Topography	7
Climate	7
Drainage	9
Geology	13
Population	13
Industrialization	15
Current utilization of water	15
Source of supply	15
Quantity used	17
Stream development	19
Effect on streamflow	21
Diversion	23
Farm ponds	23
Surface water characteristics	25
Variation in streamflow	25
Prediction of supply	27
Frequency of low flow	31
Storage of streamflow	35
Short-term records	39
Tributary flow	41
Quality of water	43
Water-quality criteria	44
Collection of data	45
Field measurements of water quality	47
Specific conductance	47
Hardness	48
pH	48
Dissolved oxygen	49
Laboratory analyses	51
Relation of water quality to discharge	53
Temperature of surface water	53

ILLUSTRATIONS

			Page
Plate			In pocket
Figure	1.	Map showing distribution of average annual precipitation	6
	2.	Curves showing magnitude and frequency of mean annual precipitation at Rainbow Lake	8
	3.	Map of major drainage basins	10
	4.	Curve relating drainage area and stream length	11
	5.	Geologic map	12
	6.	Map locating major industries	14
	7.	Map showing areas presently served by Spartanburg Water Works	16
	8.	Graph of volume of treated water pumped by Spartanburg Water Works	18
	9.	Map of major stream development with tabular data showing effect on streamflow	20
	10.	Curves of change in magnitude and frequency of the annual minimum 7-day flow by regulation on Middle Tyger River	22
	11.	Hydrograph of daily discharge for North Tyger River near Fairmont	24
	12.	Map of gage sites with tabulated basic streamflow data	26
	13.	Graph of average flow and drainage area relationship for streams in Spartanburg County	28
	14.	Duration curves of daily flow for three Spartanburg County streams	29
	15.	Curves showing magnitude and frequency of annual minimum flows at North Tyger River near Fairmont	32
	16.	Curves showing magnitude and frequency of annual minimum 7-day flow for three Spartanburg County streams	33
	17.	Curve relating mean annual flow to runoff of Spartanburg County streams	34
	18.	Curves of draft-storage-frequency relations for Spartanburg County streams	36
	19.	Duration curves of daily flow for four short-term gaging stations	38
	20.	Map of variability of annual minimum 7-day flows at 10-year recurrence interval of tributary streams	42

Page

Figure 21. Graph showing relation of dissolved-solids content (calculated) to specific conductance---------- 46
22. Effect of waste discharges on Fairforest Creek, and North, Middle, and South Tyger Rivers, October and November 1967---- 50
23. Map showing chemical characteristics of surface water in Spartanburg County-------- 52
24. Graph showing relation of dissolved-solids content to discharge of three Spartanburg County streams---------- 54
25. Frequency curves for daily mean temperature at Enoree River near Enoree, October 1966 to September 1968---------- 56
26. Graph showing distribution of well yields---- 60
27. Map showing location of wells with respect to low, medium, and high yields---------- 64
28. Graph showing geophysical logs of well SP-291---------- 66
29. Graph showing distribution of wells according to depth---------- 68
30. Graph showing relation of well yield to thickness of saprolite in wells 100-200 feet deep---------- 72
31. Graph showing weekly low water-levels in well GR-172 and rainfall at Greenville-Spartanburg airport---------- 74
32. Graph showing distribution of selected chemical characteristics by rock type------ 76
33. Map showing chemical characteristics of ground waters, supplemented by selected surface waters---------- 78

TABLES

			Page
Table	1.	Summary of climatological data at Spartanburg, S.C., 1931-60	4
	2.	Low-flow yield of tributary streams in Spartanburg County	40
	3.	Well yields in relation to geologic unit	63
	4.	Well yields in relation to depth of well	70

In Appendix

	5.	Inventory of principal water use in Spartanburg County	89
	6.	Magnitude and frequency of annual low flows at gaging stations in Spartanburg County	90
	7.	Discharge measurements made at project sites in Spartanburg County	91
	8.	Miscellaneous field measurements of the chemical and physical properties of streams in Spartanburg County	93
	9.	Chemical analyses of surface water in Spartanburg County	97
	10.	Dissolved oxygen at Fairforest Creek and North, Middle, and South Tyger Rivers, October and November 1967	101
	11.	Monthly maximum and minimum water temperatures at North Tyger River near Fairmont and Enoree River near Enoree, October 1966 to September 1968	103
	12.	Average monthly water temperatures at gaging stations in Spartanburg County, 1949-67	104
	13.	Description of rock units	105
	14.	Data on wells and springs in Spartanburg County	106
	15.	Chemical analyses of selected well and spring waters, Spartanburg County	111
	16.	Summary of statistical values for chemical analyses of well waters, Spartanburg County	112

Topography

Spartanburg County lies just southeast of the Blue Ridge Mountain in the Piedmont province, which is characterized by subdued topographic features and moderate relief. The land surface is inclined so that elevations exceed 1,000 feet in the northwest section of the county but decrease to less than 600 feet in the southeast. The hills have a well-rounded appearance with no conspicuously prominent ridges or peaks. Valley floors are generally about 100 feet deep with well-developed water courses. There are few swamplike areas.

Climate

A humid, temperate climate characterizes the area. Spartanburg County is located on the lee side of the mountains, which provide protection from the cold air masses that move southeastward during the winter. At Spartanburg, temperatures usually are between 32°F and 90°F for 8 months of the year; the average daily temperature for the county is about 60°F. Table 1 shows temperature and precipitation extremes at the U. S. Weather Bureau station at Spartanburg.

Figure 1 shows the rainfall-distribution pattern in Spartanburg County. Average annual rainfall is about 50 inches--an amount that exceeds the national average by 20 inches. Rainfall is usually well distributed throughout the year. Depending upon location, accumulations may vary from 30 inches in a dry year to over 80 inches in a wet year. Figure 2 illustrates variability of annual rainfall at Rainbow Lake adjacent to South Pacolet River Reservoir. For example, it is probable that an average yearly precipitation of 35 inches at Rainbow Lake will occur once in 20 years, and equally probable that an average precipitation of 67 inches will occur once in 20 years. Snowfall adds little to the annual precipitation. Average annual snow, most of which falls in two or three minor storms, is 3.7 inches per year at Spartanburg.

Evaporation and transpiration of plants reduce the amount of water available for man's use. In Spartanburg County more than half the average annual precipitation is returned to the atmosphere each year by evaporation and the transpiration of plants. The combined effect, evapotranspiration, is greatest during the warm growing season.

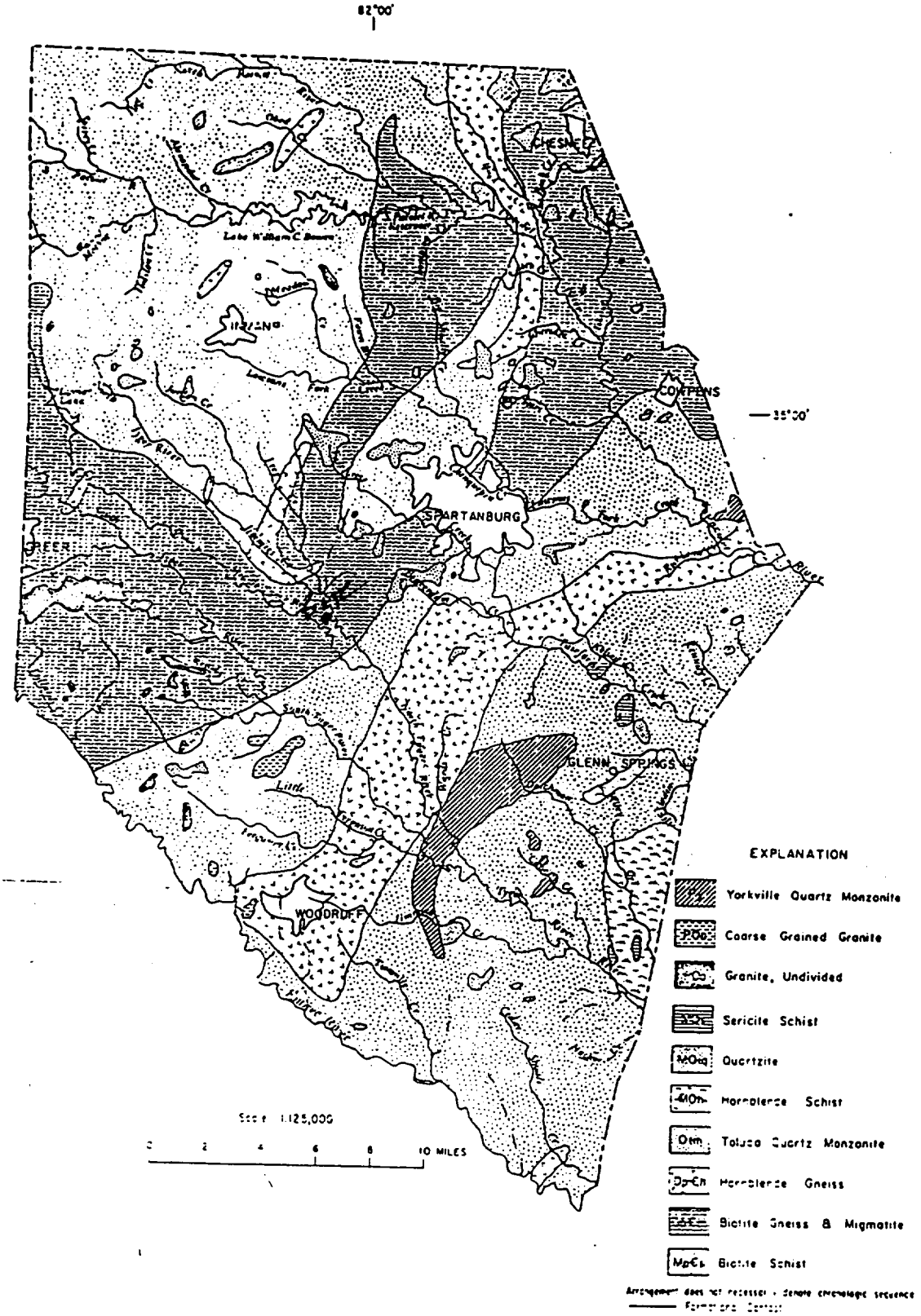

Figure 5.--Geologic map of Spartanburg County (adapted from Overstreet and Bell, 1965a)

Geology

Nearly all of Spartanburg County, except for some small areas in the southeastern part bordering Union County, lies within the Inner Piedmont belt, a major sub-division of crystalline rocks in the Piedmont province (King, 1955). The small area in the southeastern part of the county contains rocks typical of the Kings Mountain belt. The Inner Piedmont belt includes metamorphic rock types such as biotite gneiss, biotite schist, quartzite, hornblende gneiss, and other rocks of gabbroic nature. The Kings Mountain belt is characterized by the presence of sericite schist, hornblende schist, quartz monzonite, and minor amounts of quartzite and marble (King, 1955).

The geologic belts east of the Brevard belt (a narrow strike-slip fault zone separating the rocks of the Inner Piedmont belt from those of the Blue Ridge belt) are distinguished principally by modifications of the original sedimentary rocks by folding, regional metamorphism, and igneous intrusion (Overstreet and Bell, 1965b, p. 16). As such, they represent metamorphic zones superimposed on a regional stratigraphic sequence.

Intrusive rocks, in addition to the monzonite, include unnamed granites, mafic dikes, muscovite-pegmatite dikes, and fine-grained diabase dikes.

Over much of the county, the hard crystalline rock has weathered to a soft clayey or sandy material (saprolite), which maintains many of the original rock structures and extends from ground surface to depths of as much as 140 feet.

A geologic map of Spartanburg County, figure 5, has been adapted from Overstreet and Bell (1965a). Some recent modifications not shown include a fairly significant plutonic body southwest of Pacolet and a manganese-rich zone delineated along the east boundary of Croft State Park (Henry Bell, III, oral commun., 1969).

Population

About 75 percent of the county's total population of about 165,000 is concentrated in the central part, which includes the city of Spartanburg and other urban and manufacturing centers. In recent years, economic factors have caused a movement to urban localities, but much of the county remains rural. The northern section, with thriving peach farms, supports about 15 percent of the total population, whereas the southern section is generally thinly populated and of diminished agricultural activity.

During October 1966 to September 1968, continuous temperature recorders were operated on North Tyger River near Fairmont and Enoree River near Enoree. Appendix table 11 shows the maximum and minimum monthly temperatures[1/] recorded at these stations. The highest temperature recorded at either station was 28°C in August 1968 on the Enoree River; the lowest temperature recorded was 2°C in February 1968, also at Enoree River.

Figure 25 is a frequency curve of daily mean water temperatures of Enoree River near Enoree. Ten percent of the time the mean temperature equaled or exceeded 24°C; 50 percent of the time, 16°C; and 90 percent of the time, 6°C.

Appendix table 12 lists average monthly water temperatures at gaging stations in Spartanburg County during 1949-67, when the gaging stations were visited to make discharge measurements. Average monthly temperatures do not differ appreciably from station to station. The temperature of Middle Tyger River at Lyman, however, seems to be higher than the other streams. This may be the result of heated waste waters raising the temperature of the stream.

GROUND WATER CHARACTERISTICS

Ground water is one of the most important natural resources of Spartanburg County. It is the principal source of water for rural homes and farms, small to medium-sized industries, and some supplemental irrigation. The quantity of water available from wells drilled in consolidated rock is usually less than that which may be obtained from surface-water sources. However, the importance of ground water lies in the fact that in moderate amounts, it is available in a large part of the area and thus can satisfy the requirements for most domestic, stock, and small industrial use. The consistency of ground-water quality and temperature are additional factors that enhance its utility and economic value.

1/ In October 1967 the Geological Survey began reporting temperature data in degrees Celsius (°C). Degrees Celsius are equivalent to the more familiar degrees centigrade.

Description of Water-Bearing Rocks

The distribution of specific rock types throughout Spartanburg County is shown on figure 5, which was adapted from Overstreet and Bell (1965a). Although 10 rock units are shown as cropping out within the county, all but a small percentage of the rocks exposed are contained within five major units. These are the biotite schist, biotite gneiss and migmatite, quartz monzonite, hornblende gneiss, and hornblende schist. Descriptions of these units are given in appendix table 13 and are adapted principally from those of Overstreet and Bell (1965b).

Occurrence of Ground Water

General Hydrologic Conditions

In areas underlain by crystalline rocks, such as those found in Spartanburg County, ground water occurs in both the mantle of weathered rock, or saprolite, overlying the hard rock and in the secondary fractures, such as joints, faults, bedding planes, or foliation planes within the hard rock. Where the rock is composed of water-soluble minerals, the fractures may become enlarged by solution from circulating ground water. Owing to the increasing load of overburden with increasing depth, both the number and size of the fracture openings decrease with depth. Because of this, most of the higher yields from wells in the Piedmont occurs in those wells drilled to depths less than 250 feet. At depths greater than about 300 feet the number and size of fractures tend to diminish to a degree where only small quantities of water circulate through them. Some fractures formed at depths greater than 1,000 feet by deep-seated orogenic or seismic activity may contain significant amounts of water, but generally the water is highly mineralized. Only minor amounts of water may collect and move through the intergranular spaces in the rock itself, because of the extremely low porosity and permeability of unfractured crystalline rock.

Water movement in the saprolite is controlled to a large extent by the permeability of the unit. Where the saprolite is comparatively less permeable than the underlying fractured rock, it can act as a confining bed. The saprolite layer usually functions as a reservoir to receive and store percolating rain water and subsequently supply ground water over protracted periods of below-normal rainfall.

Early development of ground water in Spartanburg County consisted predominantly of dug wells or springs. In fact, several springs were utilized in the development of spas or health resorts. Some spring waters are still bottled and marketed today, for example, the water of Glenn Springs (pl. 1). The dug wells were generally 2 to 3 feet in diameter and lined with wood, stone, or brick curbing. They were dug by hand and usually obtained water from the saprolite or from the top few feet of the underlying hard rock. The bottom of such a well was usually only a few feet below the normal water table. Thus, in sustained drought, the water table would recede below this depth and the well became dry.

Both water-table and artesian conditions are characteristic of the area, although the former is more typical. Under water-table conditions, the surface of the zone of saturation (or water table) is under atmospheric pressure and is free to move upward or downward, without being confined by impermeable, or nearly impermeable, material. Under artesian conditions the potentiometric surface (an imaginary surface that coincides everywhere with the head of water in the aquifer) usually occurs above the saprolite-hard rock contact. The water table may fluctuate across this contact. Where percolating waters enter an inclined fracture zone, the water level in a well intercepting these fractures at depth will rise above the top of the fracture zone, and might rise above the top of the casing and flow if the well is at a lower elevation than the area of recharge.

Recharge and Discharge

The source of all ground water in Spartanburg County is the precipitation (mostly in the form of rainfall) within the county plus the underflow across county boundaries. Approximately one-quarter to one-third of the precipitation filters down into the zone of saturation, whereas the remainder is lost to surface runoff or evapotranspiration. The proportion of rainfall that finally reaches the water table is affected by several factors. The intensive summer storms of short duration contribute a much smaller amount of recharge than the steady light rains characteristic of the fall and winter seasons. A high rate of evapotranspiration during the growing season likewise diminishes the amount of rainfall that might otherwise reach the water table.

Rocks or soils of high permeability, such as sand or highly fractured rocks, can readily absorb and transmit water and are therefore more receptive to higher rates of recharge via the high-rate, short-duration type of rainfall. However, the less permeable soils or rocks containing relatively few or small-sized fractures require the slow-rate, long-duration type of rainfall for significant recharge.

Subsequent to the recharge process, whereby rainfall percolates down through the soil to the saturated zone or water table and forms a reservoir of ground water, the water moves by gravity toward points of lower elevation to discharge in springs, swamps, streams, or lakes, where the water table intersects the ground surface. Where the water table lies close to the ground surface, additional discharge takes place by evapotranspiration from the ground or leaves of plants and trees. Artificial discharge takes place through the pumping of wells.

Well Yield

Wells drilled in either the comparatively soft weathered rock or the hard fractured crystalline rocks of the Piedmont, generally have low to moderate yields. The data available on Spartanburg County (appendix table 14) indicate a range in well yield of 1 to 250 gpm. The average yield of all wells was about 20 gpm, and the median yield about 7 gpm. Most domestic wells are not drilled to develop maximum yield, and, thus, statistical parameters applied to the total number of wells do not reflect accurate values of average yield. The average yield of those wells drilled to obtain maximum yield was 53 gpm.

A study of well yields in the Appalachian area (Wyrick, 1966, p. 35), which includes Spartanburg County, estimates the maximum potential yield of wells in these types of rocks as equivalent to the average yield of the highest 3 percent of the most productive wells inventoried. For Spartanburg County this average yield was reported as ranging from 100 to 300 gpm. In the present study, this average maximum yield was calculated to be 139 gpm.

REFERENCE NO. 15

National Water Summary 1984

Hydrologic Events, Selected Water-Quality Trends, and Ground-Water Resources

By United States Geological Survey

United States Geological Survey
Water-Supply Paper 2275

DEPARTMENT OF THE INTERIOR
DONALD PAUL HODEL, Secretary

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SOUTH CAROLINA
Ground-Water Resources

Fresh ground water is available in most of South Carolina. Although it provides only about 4 percent of total water used in the State, it serves 42 percent of the population, or about 1.33 million people. Most large withdrawals of ground water are obtained from Coastal Plain aquifers in the southeastern two-thirds of the State. Ground-water withdrawals in 1980 for various uses and related statistics are given in table 1.

Table 1. Ground-water facts for South Carolina

[Withdrawal data rounded to two significant figures and may not add to totals because of independent rounding. Mgal/d = million gallons per day; gal/d = gallons per day. Source: Lonon and others, 1983]

Population served by ground water, 1980	
Number (thousands)	1,330
Percentage of total population	42
From public water-supply systems:	
Number (thousands)	530
Percentage of total population	17
From rural self-supplied systems:	
Number (thousands)	800
Percentage of total population	25
Freshwater withdrawals, 1980	
Surface water and ground water, total (Mgal/d)	5,800
Ground water only (Mgal/d)	210
Percentage of total	4
Percentage of total excluding withdrawals for thermoelectric power	21
Category of use	
Public-supply withdrawals:	
Ground water (Mgal/d)	82
Percentage of total ground water	40
Percentage of total public supply	22
Per capita (gal/d)	155
Rural-supply withdrawals:	
Domestic:	
Ground water (Mgal/d)	57
Percentage of total ground water	28
Percentage of total rural domestic	100
Per capita (gal/d)	71
Livestock:	
Ground water (Mgal/d)	6
Percentage of total ground water	3
Percentage of total livestock	55
Industrial self-supplied withdrawals:	
Ground water (Mgal/d)	46
Percentage of total ground water	22
Percentage of total industrial self-supplied:	
Including withdrawals for thermoelectric power	1
Excluding withdrawals for thermoelectric power	5
Irrigation withdrawals:	
Ground water (Mgal/d)	15
Percentage of total ground water	7
Percentage of total irrigation	27

GENERAL SETTING

South Carolina is located in three physiographic provinces (fig. 1)—the Coastal Plain province, which occupies approximately the southeastern 63 percent of the State; the Piedmont province, which occupies roughly 35 percent of the State; and the Blue Ridge province, which occupies about 2 percent of the State (Fenneman, 1938). Coastal Plain deposits consist of consolidated and unconsolidated sediments of continental and marine origin that thicken from a few feet at the Fall Line to more than 4,000 feet (ft) at the southern tip of the State. The Piedmont and Blue Ridge provinces are underlain by metamorphosed sedimentary, volcanic, and igneous rocks. Most of the area is mantled by a layer of chemically weathered bedrock called saprolite, which ranges in thickness from a few feet to about 100 ft, but generally is less than 50 ft thick.

Recharge to the ground-water system in South Carolina is from precipitation. Statewide average annual precipitation is slightly more than 48 inches (in.) (Snyder and others, 1983) and ranges from an average of 46 in. in part of the central area of the State to 80 in. in the Blue Ridge province. Ground-water recharge ranges from less than 1 in. in parts of the Piedmont–Blue Ridge to about 15 in. in parts of the Coastal Plain.

PRINCIPAL AQUIFERS

Principal aquifers in South Carolina consist of unconsolidated to partly consolidated sediments of the Coastal Plain province and igneous and metamorphic rocks of the Blue Ridge and Piedmont provinces. The aquifer names commonly used in South Carolina are, for the most part, synonymous with the names of geologic formations that contain the principal water-bearing materials. The aquifers are described below and in table 2; their areal distribution is shown in figure 1.

COASTAL PLAIN AQUIFERS

The formations of the Coastal Plain consist of unconsolidated or partly consolidated sediments, including sand, gravel, clay, limestone, marl, coquina, and shale. Many of the formations of the Coastal Plain are excellent aquifers that are able to store and transmit large quantities of water.

Shallow Aquifer

A shallow aquifer occurs throughout the Coastal Plain but is not mapped in figure 1. In general, the aquifer consists of deposits that range in age from Cretaceous to Holocene, is less than 100 ft thick, and contains water under unconfined conditions, although semiconfined conditions may be present locally. The aquifer is used mostly for domestic and other small supplies, but, in some areas, such as North Myrtle Beach where very permeable beds of coquina are present, yields can exceed 500 gallons per minute (gal/min). Water quality is extremely variable, as are yields, but the aquifer is a valuable resource in many areas, particularly for rural domestic use. Recharge is from local rainfall; therefore, water levels tend to fluctuate seasonally.

Table 2. Aquifer and well characteristics in South Carolina

[Ft = feet; gal/min = gallons per minute; mg/L = milligrams per liter. Sources: Reports of the U.S. Geological Survey and several St agencies]

Aquifer name and description	Well characteristics			Remarks
	Depth (ft)	Yield (gal/min)		
	Common range	Common range	May exceed	
Coastal Plain aquifers: Shallow aquifer: Sand, gravel, and coquina. Unconfined. (Not shown in fig. 1).	20 - 100	5 - 10	500	Tapped mostly for domestic use. Variable wate quality with local problems. Concentrations of iron greater than 1 mg/L, and pH less tha 5.5 in many areas.
Floridan aquifer system: Fossiliferous limestone. Confined.	80 - 250	100 - 300	2,000	Principal aquifer in southern South Carolina. Saltwater encroachment a potential problem. Water predominantly calcium bicarbonate type except in coastal areas where it is salty.
Tertiary sand aquifer: Fine to course quartzose sand. Confined to unconfined.	100 - 300	50 - 200	700	Interfingers with limestone in southern Barnwell County. Concentrations of dissolv solids less than 50 mg/L near recharge areas; water predominantly a sodium bicarbonate type downdip except near the coast where it is salty.
Black Creek aquifer: Thinly laminated sand and clay lenses. Confined.	200 - 700	50 - 400	900	Principal source of ground water in Horry and Georgetown Counties (Myrtle Beach are Water predominantly calcium carbonate type with concentrations of iron greater than 3 mg/L near recharge areas, a sodium bicarbonate type downdip, and salty in northeast Horry County and along southern coast. Equivalent to Cretaceous aquifer in North Carolina.
Middendorf aquifer: White and gray sand and gravel. Confined.	200 - 2,000	200 - 700	2,000	Most intensively used in the upper Coastal Plain. Concentrations of dissolved solids are less than 50 mg/L; concentrations of iron greater than 1 mg/L in the upper Coastal Plain. Water predominantly sodium bicarbonate type downdip, and salty in northeast Horry County. Equivalent to Cretaceous aquifer in North Carolina.
Piedmont and Blue Ridge aquifers: Fractured igneous and metamorphic rocks and saprolite. Confined to unconfined.	50 - 300	10 - 30	300	Small yields and areal variability limit large-scale use. Water quality variable in dissolved solids and major constituents.

Floridan Aquifer System

The Floridan aquifer system in South Carolina includes parts of some Miocene formations, but the principal water-bearing units are the Santee and Ocala Limestones of Eocene age. These formations consist of creamy-white to yellow fossiliferous limestone. Typically, the upper part of each unit, particularly the Ocala Limestone, contains extensive loosely cemented shell deposits. These limestones are the facies equivalents of the Eocene sands of the Tertiary sand aquifer. The Floridan aquifer system extends over a wide triangle in the southern part of South Carolina (fig. 1). It is capable of yielding as much as 2,000 gal/min of water suitable for public supply, but common yields range from 100 to 300 gal/min.

Tertiary Sand Aquifer

The Tertiary sand aquifer includes permeable parts of the Congaree, the Warley Hill, the McBean, and the Barnwell Formations, listed in ascending order. The water-bearing sands have limited extent and are present mostly in the upper part of the Coastal Plain between the Savannah and Congaree Rivers. Well yields range from 50 to 200 gal/min but m exceed 700 gal/min.

Black Creek Aquifer

The Black Creek aquifer, of Cretaceous age, ranges thickness from a few feet in updip areas to about 400 ft coastal areas. The Black Creek aquifer is the most import source of ground water in Horry and Georgetown Counti Wells in the two-county area yield 50 to 400 gal/min but m exceed 900 gal/min. The quality of the water in the Bla Creek aquifer in Horry and Georgetown Counties generally acceptable for drinking water except for fluoride concentr tions of as much as 7 milligrams per liter (mg/L), chlor concentrations that exceed the 250 mg/L national drinki water regulation (U.S. Environmental Protection Age 1982a, b) in some areas, and dissolved-solids concentrati of as much as 1,800 mg/L in some areas. The large chlor concentrations in the water are believed to be caused by teeth in the Black Creek Formation (Zack, 1980). Salt present in parts of the Black Creek aquifer but is not

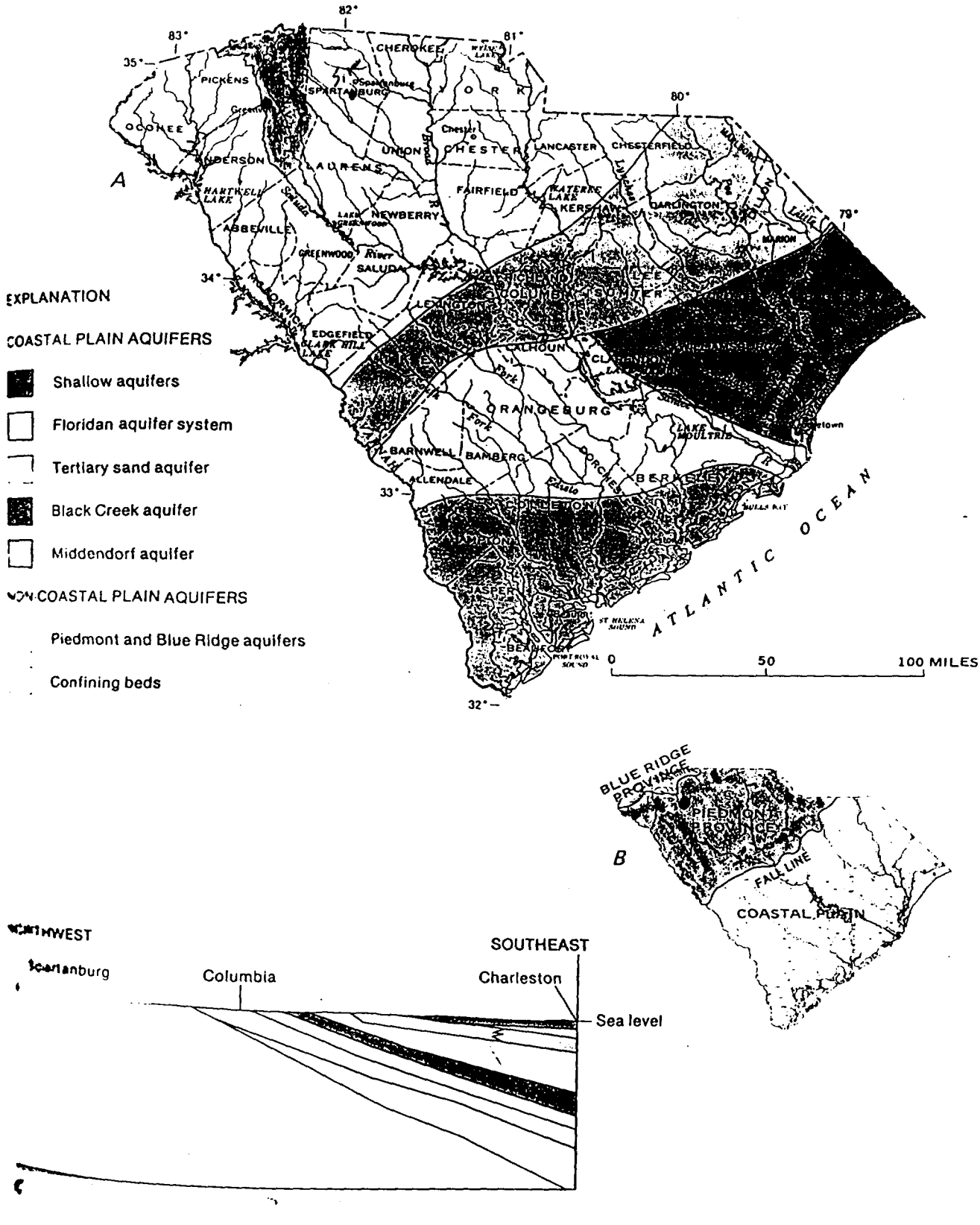


Figure 1. Principal aquifers in South Carolina. *A*, Delineations indicating the most widely used aquifers. *B*, Physiographic diagram and divisions. *C*, Generalized cross section. (See table 2 for a more detailed description of the aquifers. Sources: *A*, *C*, Compiled by W. R. Aucott from U.S. Geological Survey files. *B*, Fenneman, 1938; Raisz, 1954.)

located at this time. In general, the water becomes more mineralized toward the south and southwest and along the coast near the North Carolina–South Carolina boundary.

Middendorf Aquifer

The Middendorf aquifer is the most areally extensive aquifer in the Coastal Plain. The aquifer consists of one or more white and gray sand and gravel beds separated in some areas by clay beds. This aquifer yields large quantities of water, which meets national drinking-water regulations, to numerous wells in the upper and middle regions of the Coastal Plain (fig. 1). In Sumter and Florence Counties, where it is most widely used, the aquifer is about 200 ft thick; yields to individual wells generally range from 200 to 700 gal/min but may exceed 2,000 gal/min.

Piedmont and Blue Ridge Aquifers

The massive crystalline igneous and metamorphic rocks in the Piedmont and Blue Ridge provinces have little permeability, and individual aquifers are not areally extensive. The largest yields are from wells constructed in fracture zones in the rocks. Many large-diameter dug wells have been constructed in the saprolite overlying the unweathered bedrock. Water levels usually rise in winter and spring when rainfall is greatest and decline during summer and early fall when evapotranspiration is greatest. The water generally is suitable for most domestic uses.

GROUND-WATER WITHDRAWALS AND WATER-LEVEL TRENDS

Most major ground-water withdrawal areas are in the Coastal Plain where aquifers are most productive (fig. 2). Water levels generally decline in response to increases in pumping and recover as pumping is reduced. The hydrographs in figure 2 represent conditions in the Coastal Plain of South Carolina near the major withdrawal areas.

Ground-water withdrawal has caused water-level declines of about 120 ft in the Black Creek aquifer in the Myrtle Beach area (location 12, fig. 2). The annual rate of decline in the Myrtle Beach area had increased to about 5 ft by 1977 (Spigner and others, 1977, p. 16) and had further increased to 9.5 ft by 1984 at the center of the cone of depression (CH2MHill, Inc., 1984, p. 3-1). The decline at Conway (location 5, fig. 2), 15 miles from the Myrtle Beach center of pumping, was about 60 ft from 1950 to 1982.

Most wells in the Florence area (location 7, fig. 2) are screened in the Middendorf aquifer. Water levels at the center of pumpage in that area have declined about 150 ft since 1940 when major pumping began (W. R. Aucott and G. K. Speiran, U.S. Geological Survey, written commun., 1984). [The hydrograph for location 7 (fig. 2) shows water-level changes on the perimeter of the cone of depression and, therefore, declines are less.] Although withdrawal in the Sumter area (locations 16 and 17, fig. 2) is greater than that for either Myrtle Beach or Florence, drawdown near the center of pumping is only about 25 ft, probably because the aquifer at Sumter has greater transmissivity than the aquifers at the other two locations and is closer to recharge areas. Pumping at the Savannah River Plant (location 15, fig. 2) has lowered water levels in the Black Creek and Middendorf aquifers in that area about 15 ft at the center of the cone of depression but has not significantly affected water levels because of the large transmissivity of the aquifer.

Public supply and industrial withdrawals from the Floridan aquifer system have lowered water levels at least 160 ft in the Savannah, Ga., area. The cone of depression resulting from these withdrawals extends into southern South Carolina, and water levels in the Floridan aquifer system on Hilton Head Island (location 10, fig. 2) are now below sea level which has created the possibility of saltwater intrusion from outcrop areas at or north of Port Royal Sound. In addition, pumping may cause upward migration of saltwater from the deep part of the aquifer system. Pumping on Hilton Head Island probably has contributed to water-level declines and also has increased the danger of saltwater contamination.

Ground-water withdrawals for irrigation are seasonal, usually are spaced widely, and are located mostly in the upper part of the Coastal Plain where aquifer yields are large. Because of these conditions and the small withdrawals, water levels in the Coastal Plain have shown only a seasonal response to pumping, and no deep permanent cones of depression have developed.

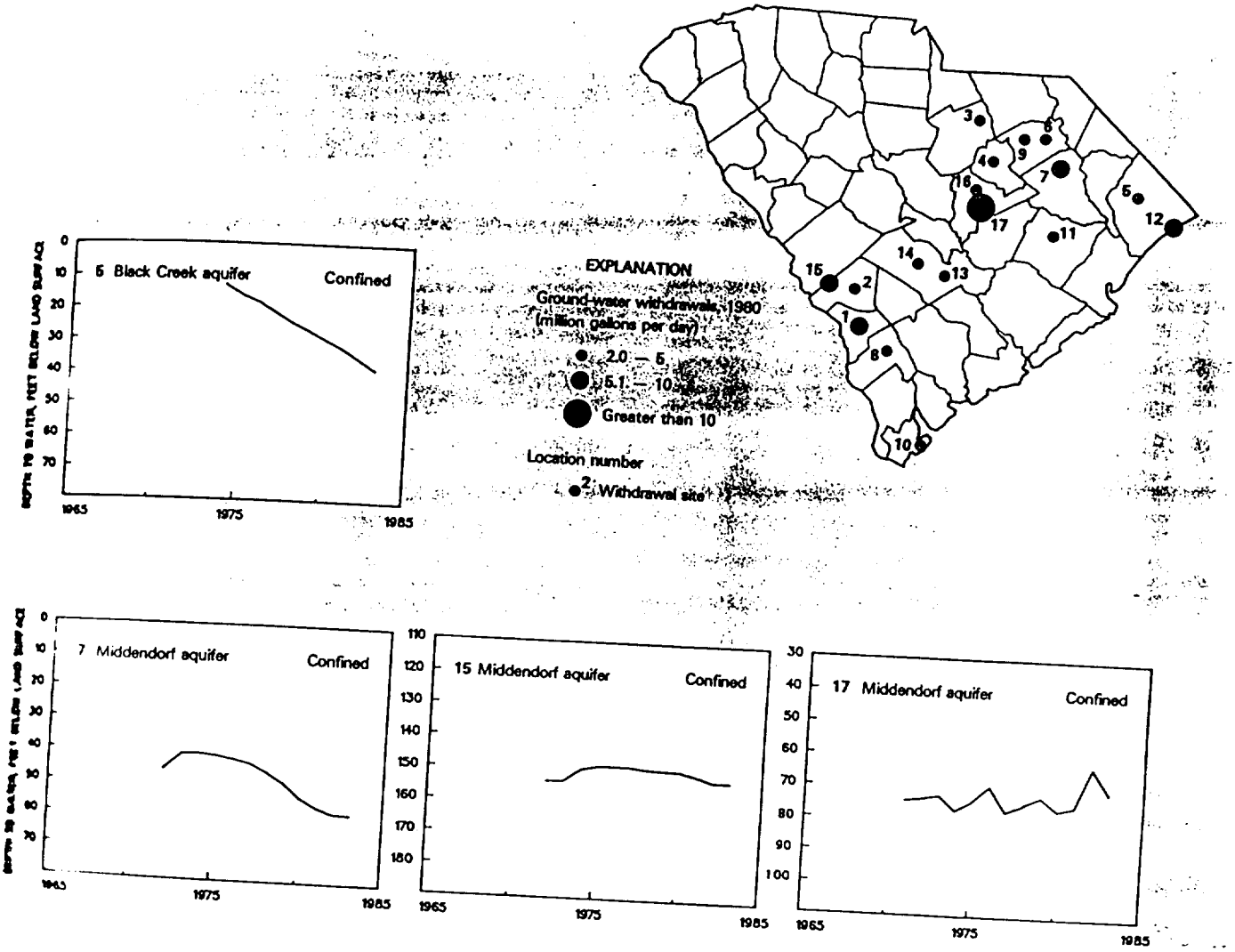
GROUND-WATER MANAGEMENT

The South Carolina Department of Health and Environmental Control (DHEC) and the South Carolina Water Resources Commission (WRC) are responsible for protecting the quality of ground-water resources of the State. The DHEC programs include

1. Review and permitting of all public supply wells for proper design and construction.
2. Regulation of the water-well drilling industry to ensure compliance with minimum well-construction standards.
3. Regulation of all sites of potential ground-water contamination, such as pits, ponds, lagoons, feedlots, and injection wells, in compliance with proper monitoring and clean-up activities.

The WRC water-management program is authorized by the Ground Water Use Act of 1969. This program is designed to protect aquifers in designated areas (Capacity Use Areas) by regulating the design, construction, spacing, and abandonment of wells to protect the aquifers from saltwater intrusion and over-pumping. All ground-water users that withdraw more than 100,000 gallons per day (gal/d) must obtain a permit from the Commission and must report monthly water use on a quarterly basis. Under the Act, the Commission is authorized to regulate ground-water withdrawals within the Capacity Use Areas. The program is designed primarily to minimize the effect of intensive localized pumping.

Ground-water data and technical assistance are provided to ground-water users by the U.S. Geological Survey in cooperation with the DHEC, the WRC, and other agencies. The DHEC primarily is responsible for protecting aquifers from the introduction of foreign materials, and the USGS and the WRC are responsible for describing the geologic framework and evaluating aquifer yields, water quality problems.

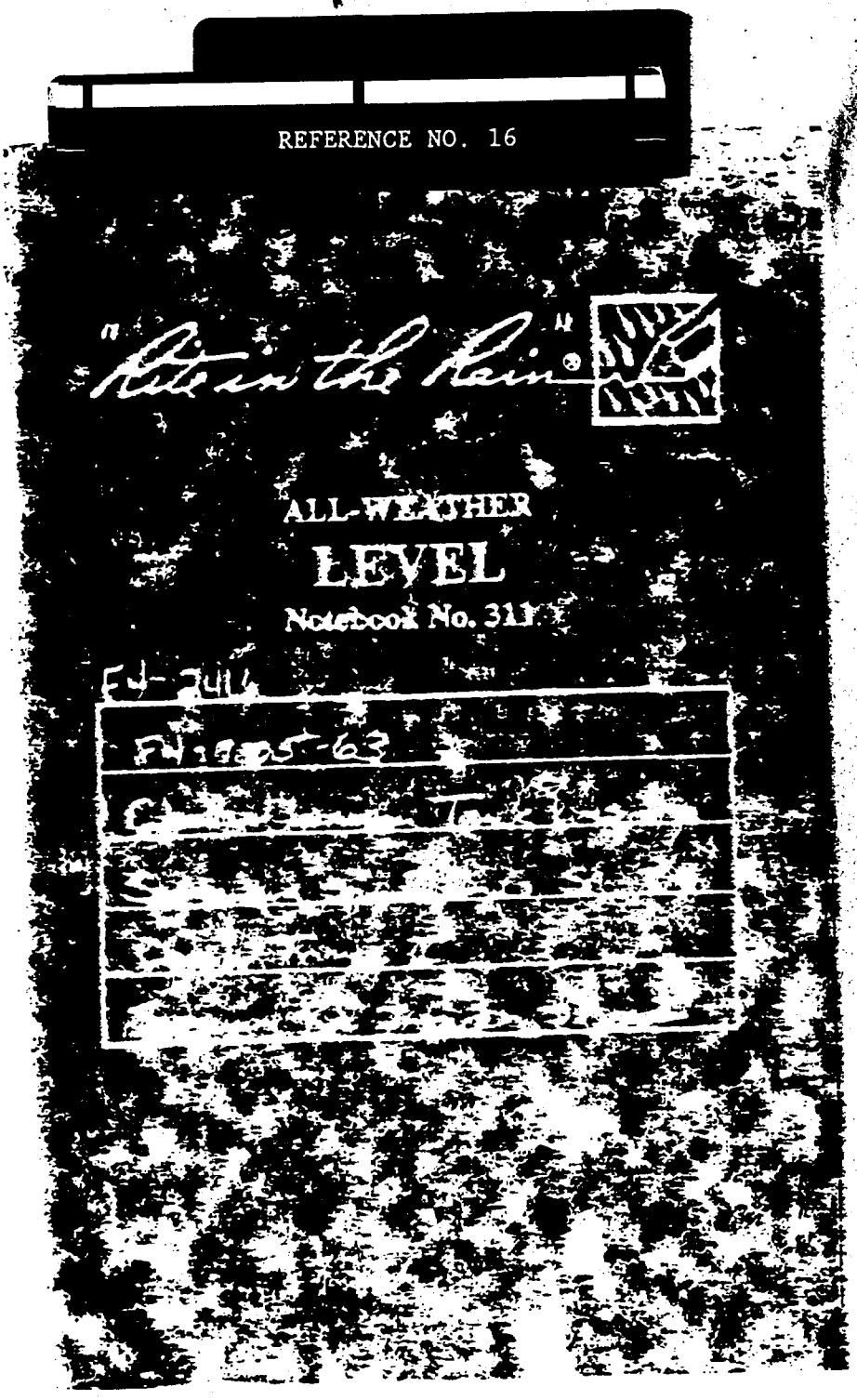


WITHDRAWAL SITES

No. on map	Geographic area	Aquifer	Principal uses
1	Allendale County	Black Creek, Tertiary sand	Irrigation.
2	Barnwell	Tertiary sand	Public supply, industrial.
3	Bethune	Middendorf	Industrial.
4	Bishopville	....do	Public supply, industrial.
5	Conway	Black Creek, Middendorf	Do.
6	Darlington	Middendorf, Black Creek	Do.
7	Florence	....do	Public supply.
8	Hampton	Floridan	Industrial.
9	Hartsville	Middendorf	Public supply.
10	Hilton Head	Floridan	Do.
11	Kingstree	Black Creek, Middendorf	Do.
12	Myrtle Beach-North Myrtle Beach	....do	Do.
13	Orangeburg County	Tertiary sand, Middendorf	Irrigation.
14	Orangeburg	Middendorf	Industrial.
15	Savannah River Plant	Middendorf, Black Creek	Do.
16	Sumter County	Middendorf	Irrigation.
17	Sumter-Shaw AFB	Middendorf, Black Creek	Public supply.

2. Areal distribution of major ground-water withdrawals and graphs of annual greatest depth to water in selected wells in Carolina. (Sources: Withdrawal data from U.S. Geological Survey files and Lonon and others, 1983; water-level data from Geological Survey files.)

REFERENCE NO. 16



7/17/90

10:00 Arrived at Greenville County Offices to look for ownership of 3M and Slater Plant Property.

10:40 Land # or Map Ref # for 3M is
400.01-01-19.01

Found out: Minnesota Mining and MFG Co.
3M Center Box 33441
St Paul, MN 55133
owns the land.

Bought land from County on 10/22/81.
The county owns the buildings. This might be an error where really the County owns land + 3M owns building but it is probably documented correctly.

Deed No for transaction of land to 3M on 10/22/81 is 1157-177

Byron Stone of Real Property Services said transaction will take place shortly where 3M will own the building.

DT 7/17/90

Obtained ownship + aerial maps of the area.

3M is located along
Pleasantdale Road
Donaldson Center
PO Box 6506
Greenville, SC

11:00 Started to find ownership of Slater Plant Property along Batesville Road.

The plant is located along or at Batesville Crossing Road and Mill Road.

Map Ref #
521.1-1-31

Ownship history
J P Stevens & Co, Inc 10/31/49 & 5/4/60
Deed # 375-85

DT 7/17/90

6

3 owners of sold off tract of Chemical Lawn.

John W Beeson
P.O. Box 1407 (6 acres)
Spartanburg, SC 29301
578-8038
Map Ref # 6-12-00 025-00

In boot slightly outside the owners at one time was

Douglas Pest Control, Inc.
1307 Asheville Hwy
Spartanburg, SC 29303

Left County building

Dale W Tyler
7/17/90

DT 7/17/90

7/18/90
9.15

Arrived at Spartanburg Water System to talk with John Barron, Drafter Technician of SWS.

Only two areas do not buy water from SWS :: Meansville Riley Road and Jameson (green ✓ area).

Slatex - Jackson system covers yellow areas on Spartanburg County water map.

Record systems are a little messed up because maps not drawn to DT 7/18/90 scale and are now converting them.

Intake for SWS is Pacolet River.

40 mgd
34,000 connections

DT 7/18/90

7

a filter plant from Middle Jygen River which serves a few [illegible] J-W-D district [illegible] of water from them

[illegible] has a small filter station which services a few customers.

[illegible] will send us a book of all the water lines in the system.

11:50 Arrived at Lyman filter plant. No one is around.

Lyman filter plant belongs to a company called:

Springs, Walsutta Dye Plant
Specialty Fabrics Plant

DT 7/18/90

1:15 Arrived at City Hall in Greensville. Talked w/ Frank Eskridge of Engineering Dept of GWS

1 North Saluda River
2. Table Rock Lake
3 Lake Kiwi

} intakes

50 mgd
89,000 connections

Frank said they will get us maps of areas: (56.1) (56)

(52.1) (51) (49) (49.1)

(50) (59) (24) (27) (16) (28)

(25) (32) (22) (23) (29.2)

They are a little sensitive about giving out this much information but I told him EPA needs.

7/18/90

the territory now. He will send maps of planned expansion and current maps of water lines.

Buys water from SWS
5,500 connections
350 future connections

DT 7/16/20

NUS CORPORATION AND SUBSI[redacted] [redacted] [redacted] ELECON NOTE

REFERENCE NO. 17

CONTROL NO. F4-9007-23	DATE: February 25, 1991	TIME: 5:00 PM

DISTRIBUTION:

Old Lyman Dump

BETWEEN: Bill Blackwood	OF: Blackwood and Associates	PHONE: 803-583-5432

AND: John Schendel, NUS Corporation

DISCUSSION:

He provided some information on the Startex Water System:

- The system gets its water from the Springs Industries water intake on the Middle Tyger River in Lyman.
- At one time, Startex had a fire protection surface water intake on the Middle Tyger River. But, this intake no longer exists. There are no surface water intakes on the Middle Tyger River at Startex, domestic or otherwise, anymore. The sewage treatment plant upstream at Lyman would preclude such an intake, Mr. Blackwood said.
- To get water distribution maps for Startex, I must call the Startex Water Systems at 803-574-0211 to talk to Lester Ellidge, VP Engineering of Spartan Mills, or at 803-439-5235 to talk to the operator of the water system, Ronnie Turner.
- Startex Mills operates the water system. Spartan Mills owns Startex Mills.

NUS CORPORATION AND SUBSIDIARIES		TELECON NOTE
CONTROL NO. F4-9007-23	**DATE:** July 31, 1990	**TIME:** 9:00 AM
DISTRIBUTION: Old Lyman Dump	[redacted] REFERENCE NO. 18	
BETWEEN: Larry Plemmons, Engineer	**OF:** SJWD Water District at Lyman	**PHONE:** 803-439-4423
AND: John Schendel, NUS Corporation		

DISCUSSION:

We discussed water distribution in and around Lyman, S. C. A few years ago, SJWD Water District took over the responsibility of water distribution within the town of Lyman. Before that time, the town got its water solely from the Spring Industries Filter Plant, which draws its water from the Middle Tyger River; and the SJWD Water District served the rural area outside Lyman's city limits with water purchased from Spartanburg's Water Works, which takes its water from Lake Bowen. Actually, now, even though Lyman's water distribution has been combined with SJWD Water Districts', the distribution is still as before the consolidation. Plans are underway, but incomplete, to tie in Lyman's and SJWD's water networks. Presently, Lyman accounts for 20% of the water used by the SJWD Water District; the remainder, 80%, is used by consumers outside of the city limits. As indicated before, each of these percentages draw from different sources and they are not mixed before distribution. The total number of hookups (commercial and residential) that SJWD serves is 10,000 plus. There are still a lot of private domestic wells being used in the rural areas surrounding Lyman. A few more notes:

- The Startex Mill area has its own water system, with a tie-in with Spring Industries Filter Plant.
- The SJWD Water district at Lyman has a tie-in with Inman/Campobello, but the water source for Inman/Campobello is the same as for SJWD at Lyman, namely, Spartanburg Water Works (Lake Bowen).
- Directions to SJWD Water District at Lyman:

  Go north from Atlanta on I-85
  Take Lyman-Spartanburg exit, Highway 29
  Go left under interstate, 3 or 4 miles
  After reaching Wellford city limits,
  look for SJWD on right, next to BI-LO store
  SJWD hours are from 8 to 5.

SJWD

Need water lines

distribution areas

NUS CORPORATION AND SUBSIDIARIES | **TELECON NOTE**

CONTROL NO. F4-9007-23	**DATE:** February 26, 1991	**TIME:** 10:45 AM

DISTRIBUTION:

Old Lyman Dump

[redacted]

REFERENCE NO. 19

BETWEEN: Larry Plemmons, Engineer	**OF:** SJWD Water District	**PHONE:** 803-439-4423

AND: John Schendel, NUS Corporation

DISCUSSION:

A few more notes from Mr. Plemmons:

- Piedmont Rural water system, which serves the area north-northwest of Lyman, is operated now by the SJWD Water District.
- In only a few months, the town of Lyman will change over from getting water from Springs Industries to getting water from the SJWD Water District. At that time, the Springs Industries water intake will be used only as an industrial intake for the Springs Industries mill in Lyman.

REFERENCE NO. 20

LEVEL

NOTEBOOK NO. 311

F4-1439

Safety Kleen

Greer, Spartanburg County, SC

F4-8904-15

If found return to
NUS Corporation
1927 Lakeside Pkwy, Suite 610
Tucker, GA 30084

000002

5/31/89

5-31-89 Humid + Hot temperatures expected to be in the mid 90's

9:15 Left NUS to drive to Greenville, SC.

11:45 Arrived in Greenville and checked into motel.

11:55 Drove to Court House to try + obtain a county map prior to visiting Water Departments. We were referred to City Hall

12:20 Arrived at City Hall + was referred to the Chamber of Commerce

000003

5/31/89 JJ

they also sell approximately 1 000000 gallons per day (via master meter) to the community of [illegible] ridge.

They knew of no water intakes along the Enoree River (migratory pathway) within 15-miles of the facility area, but they did suggest we talk with people with the Startex - Jackson - Wellford - Duncan (SJWD) water system and ask them where the community of Woodruff obtains water.

5/31/89 JJ

2:35 Left the Greer Water Dept. to go to the SJWD water dept. in Lyman.

2:55 Arrived at SJWD and met with Mr Danny Blackwell, Manager.

Mr Blackwell stated that they buy water from Spartanburg and also have two auxiliary wells aquired when SJWD took over the old Piedmont system.

000010

5/31/89

Mr Blackwell gave us a map showing the territories of each of the water systems in Spartanburg County. He also showed us where the Spartanburg intake is. The Spartanburg intake is located on William C. Bowen lake approximately 16 miles north of the facility.

UNKNOWN

5/31/89

He suggested that we visit mr. Charles Notess at the Spartanburg County Planning and development Dept to get an accurate population per house estimate for our study area.

000011

000040

Airbill No.

Lab

Media
Soil
Water

Case No.

Low Concentration yes/no

Organics

No.

Airbill No.

Lab

Media
Soil
Water

Organics

No.

05 00006

Date 5-31-89 By Whom. John Jenkins

Time: # keyed to map N/A

Location: SJWD Water Dept.

Picture of: Water Issue distribution Map

Date 6-1-89 By Whom. Ken Mallory (KM)

Time: # keyed to map: 1

Location: North side of fill recovery station

Picture of: fill recovery station + sump

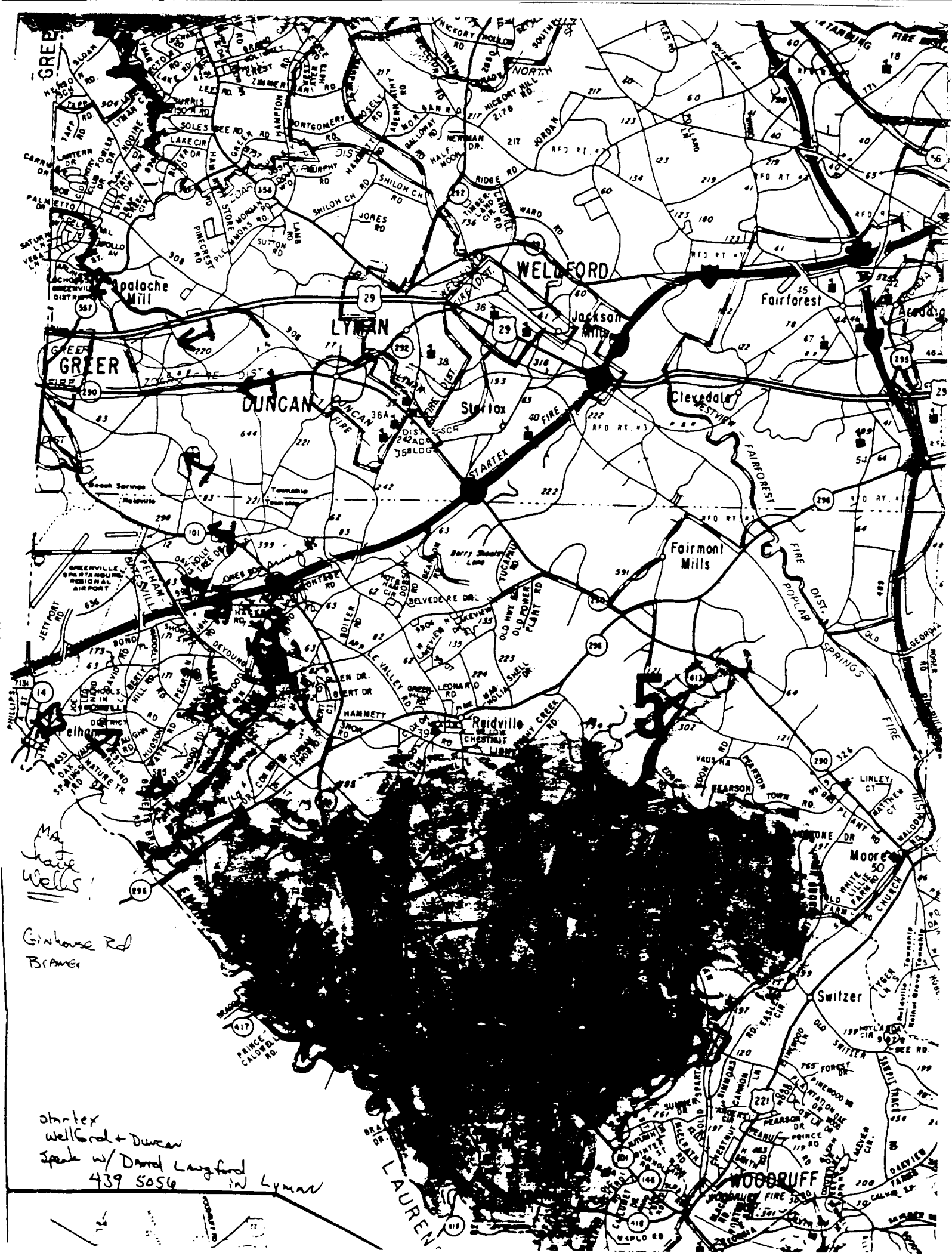
Date 6-1-89 By Whom. KM

Time: # keyed to map:

Location: North side of fill & recovery station

Picture of: fill & recovery station

000041



May have Wells!

Ginhouse Rd
Bramer

Startex
Wellford + Duncan
Speak w/ David Langford
439 5056 in Lyman

NUS CORPORATION AND SUBSIDIARIES		TELECON NOTE
CONTROL NO. F4-9007-23	**DATE:** February 25, 1991	**TIME:** 3:30 PM
DISTRIBUTION: Old Lyman Dump [redacted] — REFERENCE NO. 21 —		
BETWEEN: Buddy Cudd	**OF:** Greer Commission of Public Works, Operations Center	**PHONE:** 803-848-5300
AND: John Schendel, NUS Corporation		

DISCUSSION:

Mr. Cudd indicated that he would mail me the water distribution line maps for the area east of Greer and west of Lyman. Other information:

- The Greer CPW gets its water from two lakes, Lake Robinson and Lake Cunningham. Both lakes are in Greenville County and are both on the South-Tyger River.
- Another number for the Greer CPW is 803-877-3381.

[redacted]

REFERENCE NO. 22

TELEPHONE CONVERSATION SUMMARY

DYNAMAC CORPORATION

Call made by: Coby C. Dolan
Date of call: July 20, 1992
Time of call: 1000

Signature/Date: Coby Dolan 7/20/92
Facility : Old Lyman Dump
EPA ID No. : SCD980558183

Person(s) contacted : Danny Blackwell
Title/Position : General Manager
Organization : Startex-Jackson-Wellford-Duncan (SJWD) Water District
Telephone number : (803) 439-4423
Address (city/state): Lyman, South Carolina

General Subject : Surface water uses in Spartanburg County, South Carolina.

Summary of Conversation: Mr. Blackwell said that the SJWD water district buys all of its water from the Spartanburg Water System (SWS) and from Spring Industries.

The water from Spring Industries comes from a surface water intake located on the Middle Tyger River. The intake is located upstream from Springs Industries' wastewater treatment plant. Water from this intake services the town of Lyman which has approximately 500 connections.

The rest of the SJWD system obtains water from SWS. Spartanburg obtains their water from Lake Bowen which is located along the Pacolet River. SJWD services approximately 10,500 connections with this water. The two water supplies do not intermix water.

Mr. Blackwell will send me a copy of their water lines for our use.

REFERENCE NO. 23

TELEPHONE CONVERSATION SUMMARY

DYNAMAC CORPORATION

Call made by: Coby C. Dolan
Date of call: July 20, 1992
Time of call: 1115

Signature/Date: Coby C Dolan 7/20/92
Facility : Old Lyman Dump
EPA ID No. : SCD980558183

Person(s) contacted : Mr. A. John Baron
Title/Position : Drafter Technician
Organization : Spartanburg Water System
Telephone number : (803) 585-9142
Address (city/state): Spartanburg, South Carolina

General Subject : Surface water uses in Spartanburg County, South Carolina.

Summary of Conversation: Mr. Baron said that all of the water for the Spartanburg Water System (SWS) is obtained from a surface water intake on Lake Bowen which is located on the Pacolet River, northeast of the city of Spartanburg.

SWS also sells water to the following systems:

- Inman-Campobello
- Liberty-Chesanee-Fingerville
- Woodruff-Robuck
- Startex-Jackson-Wellford-Duncan

Mr. Baron requested that I send him copies of the topographical maps for the county. He will mark SWS's water lines on the maps and return them to me. In addition he will include information on the number of residential connections that are directly served by the SWS.

Linda P. Bilanchone, Commissioner
Myles W. Whitlock, Jr., Commissioner
J. R. Wright, Commissioner

SPARTANBURG WATER SYSTEM
Where Water Goes --- Spartanburg Grows

Wayne E. Iseman, General Manager
J. Daniel Bennett, Director
G. Newton Pressley, Secy. & Treas.

REFERENCE NO. 24

August 3, 1992

Mr. Coby C. Dolan
Dynamac Corporation
Peachtree Center Tower
230 Peachtree St., N. W.
Suite 500
Atlanta, Ga. 30303

Dear Mr. Dolan:

I am returning your maps as you requested showing our water lines. Most of the geographic area covered is in other water districts; therefore, please find enclosed a blueprint of these districts along with their phone numbers.

The Spartanburg Water System serves 40,000 residential customers in our service area. This figure does not include any residential customers in adjoining districts.

If you have any questions or if I can be of further assistance, please feel free to call me.

Sincerely,

SPARTANBURG WATER SYSTEM

A. John Baron

A. John Baron
Drafting Technician

AJB:lwb
Enclosures

OVERSIZED

DOCUMENT

[redacted]

REFERENCE NO. 25

TELEPHONE CONVERSATION SUMMARY

DYNAMAC CORPORATION

Call made by: Nilgun Akpinar
Date of call: July 22, 1992
Time of call: 1100

Signature/Date: 7-22-92 Nilgun Akpinar
Facility: Old Startex,
Spartanburg County
Landfill
EPA ID No.: SCD980558191

Person(s) contacted : Ron Turner
Title/Position : Operator of Water System
Organization : Startex Water System
Telephone : (803) 439-5235
Address(city/state) : Startex, South Carolina

General Subject : Startex Water System

Summary of conversation: Mr. Turner confirmed that the Startex Water System buys water from Spring Industries. The water comes from the Spring Industries filter plant's surface water intake, which is located on the Middle Tyger River in Lyman. The Startex Water System in turn, sells that water to the village of Startex. He said that there are only 324 connections to the system.

When I inquired about groundwater use, Mr. Turner replied that there were no groundwater users in the area that Startex Water System services.

Mr. Turner will provide me with a water distribution line map for the water system if I send him a copy of a topographical map of the area. His address is:

Startex Water System
Post Office Box 623
Startex, South Carolina 29377

Note: I received the attached water distribution line map on August 12, 1992 from Ron Turner, Operator of the Water System, Startex Water System.

OVERSIZED

DOCUMENT

REFERENCE NO. 26

TELEPHONE CONVERSATION SUMMARY

DYNAMAC CORPORATION

Call made by: Nilgun Akpinar
Date of call: July 20, 1992
Time of call: 1600

Signature/Date: 7-20-92 Nilgun Akpinar
Facility: Old Startex,
Spartanburg County
Landfill
EPA ID No.: SCD980558191

Person(s) contacted : Brentley Thomas
Title/Position : Technician
Organization : Greer Commission of Public Works
Telephone : (803) 877-3381
Address(city/state) : Greer, S.C.

General Subject : Information of Greer CPW

Summary of conversation: Mr. Thomas said that the sources for Greer CPW are two lakes: Lake Robinson and Lake Cunningham. Both lakes are in Greenville County and are both on the South-Tyger River.

He said that there are over ten thousand connections to their system, and that they sell water to Blue Ridge Rural Water Company.
He said that I need to speak with Buddy Cudd, the water superintendant to request the water distribution line map of the area.

REFERENCE NO. 27

TELEPHONE CONVERSATION SUMMARY

DYNAMAC CORPORATION

Call made by: Nilgun Akpinar
Date of call: July 21, 1992
Time of call: 1130

Signature/Date: 7-21-92 Nilgun Akpinar
Facility: Old Startex,
Spartanburg County
Landfill
EPA ID No.: SCD980558191

Person(s) contacted : Buddy Cudd
Title/Position : Water Superintendant
Organization : Greer Commission of Public Works
Telephone : (803) 848-5517
Address(city/state) : Greer, South Carolina

General Subject : Greer Commission of Public Works

Summary of conversation: Mr. Cudd recapped what Mr. Brentley Thomas had said earlier. The sources for the water system are: Lakes Robinson and Cunningham (both of which are located on the South Tyger River). There are over ten thousand connections to their system, and they sell water to Blue Ridge Rural Water Company. He stated that I would have to call Jerry Balding, the general manager, to request the water distribution line informationn. Jerry Balding's telephone number is: (803)-5500.

Note: I received the attached water distribution line map on August 20, 1992 from Dennis E. Arringon, Engineer, Greer Commission of Public Works.

OVERSIZED

DOCUMENT

REFERENCE NO. 28

PROJECT NOTE

DATE : 12 August 1992

TO : Old Lyman Dump file
EPA ID No. SCD980558183

FROM : Coby C. Dolan, Environmental Specialist, Dynamac Corporation Coby Dolan 8/12/92

Subject: Drinking water service areas and sources for the Startex-Jackson-Wellford-Duncan (SJWD) Water District.

Summary: At 1100 hours on 8-12-92 Mr. Dolan met with Cathy Amaroso of the EPA Waste Management Division to discuss information gathering for the Old Lyman Dump. Missing information included drinking water service area for the SJWD Water District. Ms. Amaroso offered information gathered from Victor Blix of Black & Veatch. This information later provided by Mr. Blix outlined the service area for SJWD. Ms. Amaroso stated that all persons within the outlined area indicated on the attached map are assumed to be receiving water from the SJWD Water District.

OVERSIZED

DOCUMENT

REFERENCE NO. 29

TELEPHONE CONVERSATION SUMMARY

DYNAMAC CORPORATION

Call made by:	Coby C. Dolan	Signature/Date :	Coby C Dolan 7/14/92
Date of call:	July 14, 1992	Facility :	Old Lyman Dump
Time of call:	1302	EPA ID No. :	SCD980558183

Person(s) contacted :	Leonard J. Dangerfield
Title/Position :	Coordinator
Organization :	EPA Region IV- Water Management Division
Telephone number :	(404) 347-445
Address (city/state):	Atlanta, Georgia
General Subject :	Surface and ground water use in Spartanburg County, SC. FERD Report.

Summary of conversation: Mr. Dangerfield agreed to send any information that his department had on water use in Spartanburg County, South Carolina. This information would include locations of municipal and private wells, surface water intakes and distribution systems for the county and populations served.

Mr. Dangerfield suggested that I fax him a written request of the information need so that he could expediate this data to me. His fax number is (404) 347-5204.

U.S. Department of Commerce, Proof Copy of table generated for 1990 CPH-1: Summary Population and Housing Characteristics, issued by Bureau of the Census (April 1991). [redacted]

REFERENCE NO. 30

Table 6. Household, Family, and Group Quarters Characteristics: 1990

[For definitions of terms and meanings of symbols, see text]

State County Place and [In Selected States] County Subdivision	Persons in households	All households	Family households: Total	Family households: Married-couple family	Family households: Female householder, no husband present	Nonfamily households: Total	Householder living alone: Total	Householder living alone, 65 years and over: Total	Householder living alone, 65 years and over: Female	Persons per— Household	Persons per— Family	Persons in group quarters: Total	Persons in group quarters: Institutionalized persons	Persons in group quarters: Other persons in group quarters
The State	3 370 160	1 258 044	928 206	710 089	175 204	329 838	281 347	109 012	84 812	2.68	3.16	116 543	44 134	72 409
COUNTY														
Abbeville County	23 216	8 780	6 560	5 003	1 248	2 220	2 070	1 093	871	2.64	3.14	646	209	437
Aiken County	119 250	44 883	33 450	26 436	5 614	11 433	10 113	3 814	2 964	2.66	3.13	1 690	1 272	418
Allendale County	10 646	3 791	2 720	1 581	978	1 071	988	472	343	2.81	3.43	1 076	1 044	32
Anderson County	143 558	55 481	41 495	33 272	6 474	13 986	12 579	5 865	4 721	2.59	3.04	1 638	931	707
Bamberg County	15 891	5 587	4 118	2 733	1 160	1 469	1 350	663	498	2.84	3.41	1 011	112	899
Barnwell County	19 996	7 100	5 369	3 836	1 274	1 731	1 586	713	536	2.82	3.31	297	236	61
Beaufort County	79 634	30 712	22 854	18 433	3 802	7 858	6 286	2 215	1 710	2.59	3.01	6 791	261	6 530
Berkeley County	127 656	42 386	34 083	28 025	4 619	8 303	6 657	1 785	1 364	3.01	3.38	1 120	937	183
Calhoun County	12 645	4 487	3 396	2 507	705	1 091	1 004	511	387	2.82	3.34	108	88	20
Charleston County	278 920	107 069	73 392	53 579	16 142	33 677	28 434	7 982	6 232	2.61	3.16	16 119	1 923	14 196
herokee County	44 009	16 456	12 353	9 386	2 343	4 103	3 757	1 706	1 388	2.67	3.15	497	241	256
hester County	32 052	11 448	8 658	6 231	2 006	2 790	2 574	1 306	1 035	2.80	3.31	118	118	-
hesterfield County	38 197	14 047	10 571	7 807	2 233	3 476	3 193	1 516	1 190	2.72	3.21	380	370	10
larendon County	28 212	9 544	7 414	5 121	1 895	2 130	1 964	1 008	740	2.96	3.45	238	217	21
olleton County	34 095	12 040	9 220	6 803	1 934	2 820	2 583	1 248	956	2.83	3.31	282	220	62
arlington County	60 797	21 999	16 684	11 939	3 908	5 315	4 855	2 158	1 758	2.76	3.24	1 054	829	225
illon County	28 819	9 887	7 423	4 936	2 090	2 464	2 264	1 062	848	2.91	3.47	295	224	71
orchester County	80 968	28 213	22 317	18 165	3 247	5 896	4 805	1 537	1 241	2.87	3.25	2 092	1 717	375
dgefield County	18 107	6 424	4 904	3 702	922	1 520	1 406	644	510	2.82	3.31	268	165	103
airfield County	21 860	7 467	5 694	3 877	1 395	1 769	1 634	798	558	2.93	3.45	435	407	28
lorence County	111 645	40 217	30 175	21 839	6 947	10 042	8 773	3 495	2 850	2.78	3.27	2 699	1 662	1 037
eorgetown County	46 097	16 275	12 536	9 557	2 436	3 739	3 354	1 502	1 156	2.83	3.31	205	165	40
reenville County	311 951	122 878	87 897	69 531	14 856	34 981	30 345	11 110	9 075	2.54	3.05	8 216	3 104	5 112
reenwood County	57 937	22 730	16 300	12 398	3 188	6 430	5 745	2 357	2 094	2.55	3.08	1 630	686	944
ampton County	18 125	6 322	4 766	3 420	1 117	1 556	1 438	721	568	2.87	3.41	66	64	2
orry County	140 490	55 764	40 450	32 537	6 273	15 314	12 434	4 152	3 258	2.52	2.97	3 563	752	2 811
asper County	15 221	5 298	4 033	2 749	1 027	1 265	1 152	541	396	2.87	3.38	266	126	140
ershaw County	43 190	15 810	12 214	9 660	2 029	3 596	3 221	1 393	1 101	2.73	3.17	409	384	25
ancaster County	54 117	19 778	15 313	11 877	2 750	4 465	3 983	1 874	1 516	2.74	3.16	399	265	134
aurens County	55 423	20 660	15 584	11 889	2 929	5 076	4 611	2 187	1 745	2.68	3.18	2 669	1 648	1 021
ee County	18 284	6 054	4 683	3 073	1 361	1 371	1 277	610	470	3.02	3.53	153	132	21
exington County	166 222	61 633	47 274	38 822	6 807	14 359	11 622	3 509	2 920	2.70	3.10	1 389	1 198	191
cCormick County	7 501	2 731	2 054	1 481	471	677	620	315	230	2.75	3.25	1 367	1 361	6
arion County	33 634	11 766	8 899	5 852	2 635	2 867	2 662	1 284	1 025	2.86	3.39	265	242	23
arlboro County	28 677	10 163	7 513	4 910	2 145	2 650	2 441	1 156	898	2.82	3.38	684	590	94
ewberry County	32 406	12 314	9 005	6 708	1 848	3 309	3 066	1 604	1 291	2.63	3.15	766	288	478
conee County	57 050	22 358	16 875	13 891	2 235	5 483	4 922	2 093	1 664	2.55	2.98	444	406	38
rangeburg County	81 133	28 909	21 565	14 879	5 576	7 344	6 565	2 920	2 266	2.81	3.33	3 670	816	2 854
ickens County	86 388	33 422	24 159	20 278	2 932	9 263	7 198	2 882	2 371	2.58	3.02	7 506	672	6 834
ichland County	259 629	101 590	67 604	48 859	15 453	33 986	26 888	7 361	5 972	2.56	3.15	26 091	11 144	14 947
aluda County	16 046	5 824	4 485	3 511	748	1 339	1 231	658	524	2.76	3.20	311	201	110
partanburg County	220 739	84 503	62 663	48 679	11 099	21 840	19 014	8 058	6 539	2.61	3.07	6 061	3 806	2 255
umter County	95 063	32 723	25 673	19 121	5 480	7 050	6 221	2 539	2 017	2.91	3.34	7 574	1 345	6 229
nion County	30 109	11 407	8 519	6 277	1 829	2 888	2 696	1 402	1 163	2.64	3.13	228	221	7
illiamsburg County	36 660	12 108	9 380	6 442	2 484	2 728	2 555	1 309	1 034	3.03	3.56	155	155	-
ork County	127 895	47 006	35 908	28 381	5 982	11 098	9 204	3 602	2 921	2.72	3.14	3 602	1 180	2 422
ACE AND COUNTY SUBDIVISION														
bbeville city, Abbeville County	5 674	2 282	1 546	973	501	736	685	359	303	2.49	3.11	104	104	-
iken city, Aiken County	19 245	7 749	5 341	4 139	1 025	2 408	2 132	872	712	2.48	3.05	627	582	45
llendale town, Allendale County	4 356	1 568	1 110	562	479	458	417	201	152	2.78	3.40	54	22	32
nderson city, Anderson County	24 819	10 509	6 645	4 428	1 895	3 864	3 497	1 759	1 479	2.36	3.03	1 365	680	685
ndrews town	3 050	1 024	767	526	211	257	238	130	108	2.98	3.58	-	-	-
Georgetown County	3 038	1 019	764	523	211	255	236	129	108	2.98	3.58	-	-	-
Williamsburg County	12	5	3	3	-	2	2	1	-	2.40	3.33	-	-	-
rcadia Lakes town, Richland County	899	360	275	251	22	85	70	27	19	2.50	2.87	-	-	-
l CDP, Pickens County	2 604	998	765	637	94	233	208	96	79	2.61	3.02	-	-	-
tlantic Beach town, Horry County	446	189	119	50	62	70	60	15	9	2.36	2.98	-	-	-
ynor town, Horry County	470	182	136	106	28	46	40	23	22	2.58	2.96	-	-	-
amberg town, Bamberg County	3 564	1 332	952	603	306	380	349	180	136	2.68	3.26	279	76	203
arnwell city, Barnwell County	5 157	1 916	1 371	909	399	545	487	206	161	2.69	3.25	98	98	-
atesburg town	4 058	1 470	1 103	699	349	367	331	183	152	2.76	3.21	24	-	24
Lexington County	3 673	1 354	999	648	303	355	320	176	147	2.71	3.18	24	-	24
Saluda County	385	116	104	51	46	12	11	7	5	3.32	3.44	-	-	-
eaufort city, Beaufort County	9 367	3 807	2 624	1 885	622	1 183	1 032	423	353	2.46	3.00	209	207	2
elton city, Anderson County	4 646	1 932	1 358	1 027	274	574	536	298	251	2.40	2.92	-	-	-
elvedere CDP, Aiken County	6 123	2 245	1 754	1 438	258	491	428	144	112	2.73	3.14	10	-	10
ennettsville city, Marlboro County	9 329	3 451	2 451	1 530	790	1 000	934	462	389	2.70	3.32	16	15	1
erea CDP, Greenville County	13 283	5 382	3 892	3 098	641	1 490	1 242	384	329	2.47	2.91	252	252	-
ethune town, Kershaw County	405	165	115	96	13	50	46	35	32	2.45	3.06	-	-	-
ishopville town, Lee County	3 430	1 307	915	515	354	392	376	203	178	2.62	3.24	130	113	17
lacksburg town, Cherokee County	1 907	770	526	347	145	244	233	122	110	2.48	3.07	-	-	-
lackville town, Barnwell County	2 688	915	675	376	258	240	228	115	82	2.94	3.52	-	-	-
lenheim town, Marlboro County	191	79	51	36	14	28	26	16	13	2.42	3.08	-	-	-
luffton town, Beaufort County	738	284	208	162	42	76	67	34	28	2.60	3.09	-	-	-
lythewood town, Richland County	164	65	52	42	9	13	12	3	2	2.52	2.88	-	-	-
oiling Springs CDP, Spartanburg County	3 522	1 301	1 068	923	116	233	205	76	58	2.71	3.02	-	-	-
onneau town, Berkeley County	374	132	102	85	14	30	28	10	8	2.83	3.24	-	-	-
owman town, Orangeburg County	1 060	346	262	163	84	84	78	42	37	3.06	3.58	3	3	-
ranchville town, Orangeburg County	1 107	427	291	195	86	136	128	68	57	2.59	3.30	-	-	-
riarcliffe Acres town, Horry County	552	220	171	160	7	49	44	29	22	2.51	2.91	-	-	-
rookdale CDP, Orangeburg County	5 378	1 868	1 386	694	612	482	421	160	120	2.85	3.39	21	21	-
runson town, Hampton County	587	220	153	113	27	67	60	35	26	2.67	3.30	-	-	-
ucksport CDP, Horry County	1 022	297	239	143	86	58	53	21	18	3.44	3.97	-	-	-
uffalo CDP, Union County	1 569	610	442	347	75	168	157	87	74	2.57	3.09	-	-	-

SII [POSTSCRIPT] CPH145 CENSUS90 72582000 05/17/91 9:20 AM MACHINE: C DATA:CENSUS90'PHITIPSDAT-5. 05/17/91 09:13:40 OUTPUT:ONSITE-P27U4 PAGE: 45
CENSUS90'92. 05/17/91 09:13:54 UTF:CENSUS90'92. 05/17/91 09:13:54 META:CENSUS90'PHITABLES45. 05/17/91 09:19:24

NOTE: The population counts set forth herein are subject to possible correction for undercount or overcount. The United States Department of Commerce is considering whether to correct these counts and will publish corrected counts, if any, not later than July 15, 1991.

Table 6

REFERENCE NO. 31

TELEPHONE CONVERSATION SUMMARY

DYNAMAC CORPORATION

Call made by:	Coby C. Dolan	Signature/Date	: Coby C. Dolan 7/14/92
Date of call:	July 13, 1992	Facility	: Old Lyman Dump
Time of call:	1355	EPA ID No.	: SCD980558183

Person(s) contacted	: Mr. Buddy Atkins
Title/Position	: Water Resources Engineer
Organization	: S. Carolina Water Resources Commission, Surface Water Division
Telephone number	: (803) 737-0800
Address (city/state)	: Columbia, South Carolina
General Subject	: Water flow of the Middle Tyger and North Tyger Rivers.

Summary of conversation: Mr. Atkins confirmed that the water gaging station (#1575) located on the Middle Tyger River at Lyman stopped providing yearly average water flows in January of 1968. At this time the U.S. Geological Survey 30 year average was 103 cubic feet per second. Mr. Atkins believes this average to be still relatively accurate at present. He said that the water flows in the area have not changed very drastically. The 1970's experienced a wet period and the 1980's experienced a dry period. The overall average should still be around 103 cfs.

Concerning the North Tyger River gaging station (#1570) near Fairmont, Mr. Atkins provided me with the average flow from October 1950 through September of 1988. The flow for this period was 63.8 cfs according to the U.S.G.S.

REFERENCE NO. 32

TELEPHONE CONVERSATION SUMMARY

DYNAMAC CORPORATION

Call made by:	Coby C. Dolan	Signature/Date:	Coby C. Dolan 7/21/92
Date of call:	July 21, 1992	Facility :	Old Lyman Dump
Time of call:	0905	EPA ID No. :	SCD980558183

Person(s) contacted :	Mr. Butch Lynn
Title/Position :	Property Owner
Organization :	N/A
Telephone number :	(803) 439-6851
Address (city/state):	Lyman, South Carolina

General Subject : Unnamed creek running through the property in between Mr. Lynn's farm and the Lyman Wastewater Treatment Plant.

(Mr. Lynn occupies the property directly to the east of the Old Lyman Dump. During the SSI, he allowed the EPA Region IV FIT to use his pasture as an access to the Lyman Dump property.)

Summary of Conversation: I explained to Mr. Lynn that I was gathering follow-up information for the work that had been done by the field team (FIT EPA Region IV) two years ago. He was very cooperative.

On the question of whether any persons had ever fished in the unnamed creek, Mr. Lynn was confident that no one ever has. He said that he often walks through the property and has never seen any persons fishing along there. For that matter he said that he has never seen anything of appreciable size in the creek saying that it was just too small to support larger fish. Mr. Lynn has lived on the property next to the old landfill since 1969. He said that the creek is fed by two springs, one spring is located to the north of the railroad tracks and the other is on the property in question to the south of the railroad tracks.

Mr. Lynn said that he does occasionally fish in the Middle Tyger River but only upstream of the wastewater treatment plant. He says the water is very nasty looking downstream of the plant. He has seen fish in the river downstream of the plant, but would never fish from there.

REFERENCE NO. 33

TELEPHONE CONVERSATION SUMMARY

DYNAMAC CORPORATION

Call made by:	Coby C. Dolan	Signature/Date :	Coby C. Dolan 7/14/92
Date of call:	July 14, 1992	Facility :	Old Lyman Dump
Time of call:	1127	EPA ID No. :	SCD980558183

Person(s) contacted	:	Randy Geddings
Title/Position	:	Wildlife Biologist
Organization	:	S.C. Wildlife & Marine Resources Dept.
Telephone number	:	(803) 654-6346
Address (city/state)	:	Clemson, South Carolina
General Subject	:	Surface water uses in Spartanburg County, South Carolina.

Summary of conversation: Mr. Geddings confirmed that recreational fishing occurs all up and down the Middle Tyger and North Tyger Rivers. He said that some of the common species of fish found in the rivers are; bullhead, carps, largemouth bass, bluegill, and redbreast.

I described to Mr. Geddings the unnamed creek that travels through Old Lyman Dump (just east of the Springs Industries Wastewater Treatment Plant) and feeds into the Middle Tyger River. Its length is approximately 1.4 miles. Mr. Geddings could not give me any information on this creek, and said that he had never heard of it. He suggested that I speak with Clayburn Stone of the S.C. Department of Health and Environmental Control. Mr. Stone is the regional director and may know something concerning this creek. Mr. Stone's phone number is (803) 583-5993. Mr. Geddings did not have any other suggestions on how to get information on the unnamed creek.

REFERENCE NO. 34

TELEPHONE CONVERSATION SUMMARY

DYNAMAC CORPORATION

Call made by:	Coby C. Dolan	Signature/Date :	Coby C. Dolan 7/16/92
Date of call:	July 16, 1992	Facility :	Old Lyman Dump
Time of call:	0930	EPA ID No. :	SCD980558183

Person(s) contacted	:	Clayburn Stone
Title/Position	:	Conservation Officer
Organization	:	S.C. Department of Health and Environmental Control
Telephone number	:	(803) 583-5993
Address (city/state)	:	Spartanburg, South Carolina
General Subject	:	Surface water uses in Spartanburg County, South Carolina.

Summary of Conversation: Mr. Stone said that recreational fishing occurs throughout the North and Middle Tyger Rivers. Recreational boating also occurs but is limited to very small crafts such as canoes given the limited size of the rivers.

Mr. Stone did not believe that there were any intakes in the rivers that were being used for irrigation or drinking water, but he could not say this with certainty.

Mr. Stone did not have any information concerning fishing in the small unnamed creek that runs in a north-south direction directly to the east of the Lyman wastewater treatment plant. He suggested that I call Springs Industries, who runs the plant, to ask about the creek.

South Carolina
Wildlife & Marine
Resources Department

Equal Opportunity Agency

James A. Timmerman, Jr., Ph.D.
Executive Director
W. Brock Conrad, Jr.
Director of
Wildlife and Freshwater Fisheries

July 17, 1992

Mr. Nilgun Akainar
Dynamac Corp.
Peach Tree Center Tower
230 Peach Tree Street NW, Suite 500
Atlanta, GA 30303

Dear Mr. Akainar:

Here is a list of species and communities that are tracked in Spartanburg County by S.C. Heritage Trust. Occurrences of these elements are marked on topographic maps that are on file in our Columbia office.

The enclosed list includes the following fields of data:

ELEMENT - scientific and common names.

ELCODE - element code, indicating taxonomic class in bytes 1-2:

AA - Animals, Amphibians
AB - Animals, Birds
AF - Animals, Fish
AM - Animals, Mammals
AR - Animals, Reptiles
PD - Plants, Dicots
PG - Plants, Gymnosperms
PM - Plants, Monocots
PP - Plants, Pteridophytes

GRANK/SRANK - the Nature Conservancy rating of degree of endangerment:

G1 - Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction
G2 - Imperiled globally because of rarity or factor(s) making it vulnerable
G3 - Either very rare throughout its range or found locally in a restricted range, or having factors making it vulnerable
G4 - Apparently secure globally, though it may be rare in parts of its range
G5 - Demonstrably secure globally, though it may be rare in parts of its range
GH - Of historical occurrence throughout its range, with possi-

bility of rediscovery
GX - Extinct throughout its range
G? - Status unknown

S1 - Critically imperiled state-wide because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation
S2 - Imperiled state-wide because of rarity or factor(s) making it vulnerable
S3 - Rare or uncommon in state
S4 - Apparently secure in state
S5 - Demonstrably secure in state
SA - Accidental in state (usually birds or butterflies that are far outside normal range)
SE - Exotic established in state
SH - Of historical occurrence in state, with possibility of rediscovery
SN - Regularly occurring in state, but in a migratory, non-breeding form
SR - Reported in state, but without good documentation
SX - Extirpated from state
S? - Status unknown

STATUS - legal status:

FE - Federal Endangered
FT - Federal Threatened
NC - Of Concern, National (unofficial - plants only)
RC - Of Concern, Regional (unofficial - plants only)
SE - State Endangerd (official state list - animals only)
ST - State Threatened (official state list - animals only)
SC - Of Concern, State (unofficial - animals)
SL - Of Concern, State (unofficial - plants)
SX - State Extirpated
PE/PT/C1/C2 - Proposed or candidate for federal listing
UN - Undetermined

All information is based on the existing S.C. Heritage Trust database, and we do not assume that it is complete. Areas not yet inventoried by our biologists may contain important species. Also, our data are always in need of updating because as natural populations change over time, species must be added, dropped, or reclassified.

Thank you for your inquiry. If I can be of further assistance, please call me at 803-734-4032.

Sincerely,

Katherine Boyle

Katherine Boyle
Data Manager

SPARTANBURG COUNTY

ELEMENT: ISOETES PIEDMONTANA / PIEDMONT QUILLWORT
ELCODE: PPISO010H0 — **STATUS:** SL
GRANK: G4Q — **SRANK:** S2

ELEMENT: LYGODIUM PALMATUM / CLIMBING FERN
ELCODE: PPSCH02030 — **STATUS:** SL
GRANK: G4 — **SRANK:** S1S2

ELEMENT: JUNIPERUS COMMUNIS
ELCODE: PGCUP05030 — **STATUS:** SL
GRANK: G5 — **SRANK:** S?

ELEMENT: JUNCUS GEORGIANUS / GEORGIA RUSH
ELCODE: PMJUN01170 — **STATUS:** UN
GRANK: G4G5 — **SRANK:** S?

ELEMENT: MELANTHIUM VIRGINICUM / VIRGINIA BUNCHFLOWER
ELCODE: PMLIL1F020 — **STATUS:** UN
GRANK: G5 — **SRANK:** S?

ELEMENT: HEXASTYLIS NANIFLORA / DWARF-FLOWERED HEARTLEAF
ELCODE: PDARI03060 — **STATUS:** FT
GRANK: G2 — **SRANK:** S2

ELEMENT: SOLIDAGO BICOLOR / WHITE GOLDENROD
ELCODE: PDAST8P060 — **STATUS:** SL
GRANK: G5 — **SRANK:** S1

ELEMENT: VIGUIERA PORTERI / PORTER'S GOLDENEYE
ELCODE: PDAST9T080 — **STATUS:** SL
GRANK: G4 — **SRANK:** S1

ELEMENT: HACKELIA VIRGINIANA / VIRGINIA STICKSEED
ELCODE: PDBOR0G0U0 — **STATUS:** UN
GRANK: G5 — **SRANK:** S?

ELEMENT: ARENARIA UNIFLORA / ONE-FLOWER STITCHWORT
ELCODE: PDCAR0G0W0 — **STATUS:** UN
GRANK: G3G4 — **SRANK:** S?

ELEMENT: LONICERA FLAVA / YELLOW HONEYSUCKLE
ELCODE: PDCPR030A0 — **STATUS:** SL
GRANK: G5? — **SRANK:** S2

ELEMENT: GAULTHERIA PROCUMBENS / TEABERRY
ELCODE: PDERI0F050 — **STATUS:** SL
GRANK: G5 — **SRANK:** S1

ELEMENT: MONOTROPSIS ODORATA / SWEET PINESAP
ELCODE: PDERI0V010 — **STATUS:** RC
GRANK: G3 — **SRANK:** S1

ELEMENT: FOTHERGILLA MAJOR / MOUNTAIN WITCH-ALDER
ELCODE: PDHAM01020 — **STATUS:** RC
GRANK: G3 — **SRANK:** S1

ELEMENT: JUGLANS CINEREA / WHITE WALNUT
ELCODE: PDJUG02030 — **STATUS:** C2
GRANK: G5 — **SRANK:** S?

ELEMENT: CIRCAEA LUTETIANA SSP CANADENSIS / INTMED ENCHANTERS NIGHTSHADE
ELCODE: PDONA04021 — **STATUS:** SL
GRANK: G5T5 — **SRANK:** S1

ELEMENT: ACONITUM UNCINATUM / BLUE MONKSHOOD
ELCODE: PDRAN010A0 — **STATUS:** SL
GRANK: G4 — **SRANK:** S2

ELEMENT: NESTRONIA UMBELLULA / NESTRONIA
ELCODE: PDSAN05010 **STATUS:** C2
GRANK: G3G4 **SRANK:** S2

ELEMENT: MICROTUS PENNSYLVANICUS / MEADOW VOLE
ELCODE: AMAFF11010 **STATUS:** SC
GRANK: G5 **SRANK:** S4

ELEMENT: MESIC MIXED HARDWOOD FOREST
ELCODE: CTPCX00010 **STATUS:** UN
GRANK: G5 **SRANK:** S4

ELEMENT: OAK-HICKORY FOREST
ELCODE: CTTXX00010 **STATUS:** UN
GRANK: G5 **SRANK:** S5

ELEMENT: OUTCROP
ELCODE: OOXXX01103 **STATUS:** UN
GRANK: **SRANK:**

REFERENCE NO. 36

South Carolina
Wildlife & Marine
Resources Department

Equal Opportunity Agency

James A. Timmerman, Jr., Ph.D.
Executive Director
W. Brock Conrad, Jr.
Director of
Wildlife and Freshwater Fisheries

July 28, 1992

Mr. Coby Dolan
DYNAMAC Corp.
Peachtree Center Tower
230 Peachtree Street NW, Suite 500
Atlanta, GA 30303

Dear Mr. Dolan:

Here is a printout of occurrences in Spartanburg County of species that are officially or unofficially listed as threatened or endangered, or are considered by Heritage Trust to be "elements of concern". These occurrences are marked on maps that are on file in our Columbia office.

Thank you for your inquiry. If I can be of further assistance, please call me at 803-734-4032.

Sincerely,

Katherine Boyle

Katherine Boyle
Data Manager
S.C. Heritage Trust

S.C. Heritage Trust

ELEMENT OCCURRENCES OF SPARTANBURG COUNTY

JUNE 1992

The enclosed list includes the following fields of data:

ELEMENT - scientific and common names.

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GH - Of historical occurrence throughout its range, with possibility of rediscovery
GX - Extinct throughout its range
G? - Status unknown

S1 - Critically imperiled state-wide because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation
S2 - Imperiled state-wide because of rarity or factor(s) making it vulnerable
S3 - Rare or uncommon in state
S4 - Apparently secure in state
S5 - Demonstrably secure in state
SA - Accidental in state (usually birds or butterflies that are far outside normal range)
SE - Exotic established in state
SH - Of historical occurrence in state, with possibility of rediscovery
SN - Regularly occurring in state, but in a migratory, non-breeding form
SR - Reported in state, but without good documentation
SX - Extirpated from state
S? - Status unknown

STATUS - legal status:

FE - Federal Endangered
FT - Federal Threatened
NC - Of Concern, National (unofficial - plants only)
RC - Of Concern, Regional (unofficial - plants only)
SE - State Endangerd (official state list - animals only)
ST - State Threatened (official state list - animals only)
SC - Of Concern, State (unofficial - animals)
SL - Of Concern, State (unofficial - plants)
SX - State Extirpated
PE/PT/C1/C2 - Proposed or candidate for federal listing
UN - Undetermined

All information is based on the existing S.C. Heritage Trust database, and we do not assume that it is complete. Areas not yet inventoried by our biologists may contain important species. Also, our data are always in need of updating because as natural populations change over time, species must be added, dropped, or reclassified.

ELEMENT: ISOETES PIEDMONTANA / PIEDMONT QUILLWORT
EOCODE: PPISO010H0*001*SC
GRANK: G4Q
TOPOMAP: 45 - PACOLET
LAT: 345505
SOURCE: T. PRESTON AND L. SULLIVAN (CON)
STATUS: SL
SRANK: S2
DOTNUM: 6
LONG: 814613
DATE: 76-03-01
DESC: PIEDMONT QUILLWORT. REPORTED FROM GRANITE OUTCROP, 1.5 MILES WEST OF JCT OF PACOLET RD AND SC 150. PLOTTED AT KEYSTONE QUARRY.

ELEMENT: ISOETES PIEDMONTANA / PIEDMONT QUILLWORT
EOCODE: PPISO010H0*010*SC
GRANK: G4Q
TOPOMAP: 42 - GREER
LAT: 345413
SOURCE: D. RAYNER
STATUS: SL
SRANK: S2
DOTNUM: 1
LONG: 821223
DATE: 80-05-01
DESC: LOCATED ON OUTCROP AT GREENVILLE- SPARTANBURG AIRPORT.

ELEMENT: LYGODIUM PALMATUM / CLIMBING FERN
EOCODE: PPSCH02030*005*SC
GRANK: G4
TOPOMAP: 24 - VALLEY FALLS
LAT: 350521
SOURCE: MULLINS (CONV)
STATUS: SL
SRANK: S1S2
DOTNUM: 2
LONG: 815328
DATE: 78-05-01
DESC: REPORTED FROM NORTH-FACING BLUFF; JCT OF PACOLET RIVER AND RD 189. SITE NAME: TAYLOR BLALOCK RESERVOIR.

ELEMENT: JUNIPERUS COMMUNIS
EOCODE: PGCUP05030*001*SC
GRANK: G5
TOPOMAP: 65 - MOORE
LAT: 345217
SOURCE: R. CLARK AND CHILDRESS (CON)
STATUS: SL
SRANK: S?
DOTNUM: 1
LONG: 815305
DATE: 72-08-08
DESC: GROUND JUNIPER VAR. DEPRESSA. REPORTED FROM TOP OF ROAD CUT ON SC 56, CA 3.0 MILES NE OF STONE STATION. AREA IS ABOUT 0.5 MI SOUTH OF FAIRFORES CREEK. ALSO REPORTED BY HENDRIX. SITE NAME: GOLIGHTLY CHURCH.

ELEMENT: JUNCUS GEORGIANUS / GEORGIA RUSH
EOCODE: PMJUN01170*003*SC
GRANK: G4G5
TOPOMAP: 42 - GREER
LAT: 345413
SOURCE: RAYNER, POWELL, AND GREETER
STATUS: UN
SRANK: S?
DOTNUM: 1
LONG: 821223
DATE: 79-09-01
DESC: ON MOIST MARGINS, EDGE OF ISLANDS AND POOLS OF ROCK OUTCROPS; 0.25 ACRES, OUT- CROP 100 YDS SSW *OF EASTERN TIP OF E-W ORIENTED GRASSY RUNWAY ON SOUTHERN AND EASTERN SIDES.*

ELEMENT: MELANTHIUM VIRGINICUM / VIRGINIA BUNCHFLOWER
EOCODE: PMLIL1F020*006*SC
GRANK: G5
TOPOMAP: 44 - SPARTANBURG
LAT: 345735
SOURCE: R. CLARK, C.G. CHILDREN, JR. (CON)
STATUS: UN
SRANK: S?
DOTNUM: 6
LONG: 815527
DATE: 72-06-24
DESC: SPARTANBURG. BASE OF RAILROAD OVERPASS, JUST NORTH OF JUNCTION OF PINE STREET WITH DANIEL MORGAN AVENUE.

ELEMENT: HEXASTYLIS NANIFLORA / DWARF-FLOWERED HEARTLEAF
EOCODE: PDARI03060*004*SC
GRANK: G2
TOPOMAP: 5 - LANDRUM
LAT: 351102
SOURCE: PIERCE AND WYCKOFF (CON)
STATUS: FT
SRANK: S2
DOTNUM: 1
LONG: 820814
DATE: 70-04-01
DESC: REPORTED FROM MESIC HARDWOODS, FAIRVIEW FARMS 0.5 MI SSE OF JCT OF NORTH PACOLET RIVER AND SC 14.

ELEMENT: HEXASTYLIS NANIFLORA / DWARF-FLOWERED HEARTLEAF
EOCODE: PDARI03060*007*SC
GRANK: G2
TOPOMAP: 24 - VALLEY FALLS
LAT: 350521
SOURCE: S.E. WILDLIFE SERVICE
STATUS: FT
SRANK: S2
DOTNUM: 2
LONG: 815328
DATE: 81-05-01
DESC: 16 COLONIES OCCUR SCATTERED ALONG THE MARGINS OF THE NEW TAYLOR BLALOCK RESERVOIR ABOVE S-189 BRIDGE; PLANTS ARE ON STEEP NORTH-FACING SLOPES WITH MOUNTAIN LAUREL; 2577 PLANTS WERE DESTROYED BY THE RESERVOIR, ~1454 PLANTS LOCATED ABOVE THOSE. SITE NAME: TAYLOR BLALOCK RESERVOIR.

ELEMENT: HEXASTYLIS NANIFLORA / DWARF-FLOWERED HEARTLEAF
EOCODE: PDARI03060*009*SC
GRANK: G2
TOPOMAP: 44 - SPARTANBURG
LAT: 345839
SOURCE: D.A. RAYNER (NO VOUCHER MADE)
STATUS: FT
SRANK: S2
DOTNUM: 1
LONG: 815658
DATE: 81-01-01
DESC: TWO SMALL COLONIES(4X3' & 2X2'); STREAMBANK ALONG CHINQUAPIN CREEK, WITHIN PRO- POSED RIGHT-OF-WAY OF RELOCATION OF I-85 ~4400' N70*W (SHOULD BE 30*) OF THE JCT OF SC 9 AND US 176. ORIGINALLY LOCATED BY MELISSA JOHNSTON. SITE NAME: CHINQUAPIN CREEK.

ELEMENT: HEXASTYLIS NANIFLORA / DWARF-FLOWERED HEARTLEAF
EOCODE: PDARI03060*011*SC
GRANK: G2
TOPOMAP: 45 - PACOLET
LAT: 345926
SOURCE: L.L. GADDY
STATUS: FT
SRANK: S2
DOTNUM: 7
LONG: 815136
DATE: 80-04-01
DESC: FOLLOW US-29 EAST FROM SPARTANBURG. TURN LEFT ON FIRST UNNUMBERED PAVED ROAD ON LEFT AFTER PASSING S-138. PROCEED ABOUT 0.5 MI TO SIGN ON RIGHT; "SARANAC LAKE." TURN RIGHT AND FOLLOW PAVED ROAD 0.8 MI TO "HULLWOOD" (PRIVATE).

ELEMENT: SOLIDAGO BICOLOR / WHITE GOLDENROD
EOCODE: PDAST8P060*002*SC
GRANK: G5
TOPOMAP: 5 - LANDRUM
LAT: 351057
SOURCE: R.C. CLARK ET AL. #19933 (CONV)
STATUS: SL
SRANK: S1
DOTNUM: 2
LONG: 820830
DATE: 70-10-07
DESC: RICH WOODS AND ROADCUT BELOW FAIRVIEW FARMS, ~2.9 MILES ENE OF LANDRUM. D.A. RAYNER NOTES (5/79): "PROBABLY NOT S. BICOLOR--STEMS ESSENTIALLY GLABROUS EXCEPT FOR RACHIS. LEAVES ALSO."

ELEMENT: VIGUIERA PORTERI / PORTER'S GOLDENEYE
EOCODE: PDAST9T0B0*001*SC
GRANK: G4
TOPOMAP: 42 - GREER
LAT: 345346
SOURCE: CHILDRESS AND CLARK
STATUS: SL
SRANK: S1
DOTNUM: 2
LONG: 821241
DATE: 72-09-22
DESC: CONFEDERATE DAISY. ENDEMIC TO GRANITE OUTCROPS PRIMARILY IN GEORGIA. HERE IT OCCURS ON OUTCROP NEXT TO GRNVLLE-SPTNBG AIRPORT. AREA HAS BEEN PARTIALLY COVERED BY ROADFILL. MAP LOCATION INDICATED BY D. RAYNER.

ELEMENT: HACKELIA VIRGINIANA / VIRGINIA STICKSEED
EOCODE: PDBOR0G0U0*002*SC
GRANK: G5
TOPOMAP: 64 - REIDVILLE
LAT: 344723
SOURCE: O. M. FREEMAN (NCU 250139)
DESC: LOCATED ONE MILE SOUTH OF SWITZER ON U.S. HWY. 221.

STATUS: UN
SRANK: S?
DOTNUM: 2
LONG: 820117
DATE: 82-02-05

ELEMENT: ARENARIA UNIFLORA / ONE-FLOWER STITCHWORT
EOCODE: PDCAR0G0W0*008*SC
GRANK: G3G4
TOPOMAP: 42 - GREER
LAT: 345413
SOURCE: CLARK, POWELL, AND CHILDRESS (CONV)
DESC: REPORTED FROM A GRANITE OUTCROP AT THE GREENVILLE-SPARTANBURG AIRPORT. QUARRY DOES NOT SHOW UP ON THE TOPO OR SOIL SURVEY MAP.

STATUS: UN
SRANK: S?
DOTNUM: 1
LONG: 821223
DATE: 70-05-01

ELEMENT: ARENARIA UNIFLORA / ONE-FLOWER STITCHWORT
EOCODE: PDCAR0G0W0*038*SC
GRANK: G3G4
TOPOMAP: 64 - REIDVILLE
LAT: 345155
SOURCE: D. RAYNER
DESC: OUTCROP LOCATED 0.5 MI EAST OF REIDVILLE ON 296 FROM JCT WITH 62. NORTH OF 296. STREAMSIDE AND STREAMBED OUTCROP. HIGHLY DISTURBED.

STATUS: UN
SRANK: S?
DOTNUM: 1
LONG: 820615
DATE: 80-05-01

ELEMENT: ARENARIA UNIFLORA / ONE-FLOWER STITCHWORT
EOCODE: PDCAR0G0W0*039*SC
GRANK: G3G4
TOPOMAP: 45 - PACOLET
LAT: 345854
SOURCE: D. RAYNER
DESC: SEVERAL OUTCROPS IN THIS AREA CONTAIN A. UNIFLORA. LOCATED IN CLIFTON JUST EAST OF THE PACOLET RIVER. NORTH OF RD 59.

STATUS: UN
SRANK: S?
DOTNUM: 5
LONG: 814848
DATE: 80-05-01

ELEMENT: ARENARIA UNIFLORA / ONE-FLOWER STITCHWORT
EOCODE: PDCAR0G0W0*054*SC
GRANK: G3G4
TOPOMAP: 63 - PELHAM
LAT: 345220
SOURCE: D. RAYNER
DESC: GRANITIC FLATROCK; 0.3 MILES DUE WEST OF THE INTERSECTION OF SEC HWYS 173 & 63; ABOUT 0.3 MILES SOUTH OF I-85.

STATUS: UN
SRANK: S?
DOTNUM: 2
LONG: 821235
DATE: 80-05-13

ELEMENT: ARENARIA UNIFLORA / ONE-FLOWER STITCHWORT
EOCODE: PDCAR0G0W0*057*SC
GRANK: G3G4
TOPOMAP: 63 - PELHAM
LAT: 345123
SOURCE: D. RAYNER
DESC: ABUNDANT ON AND AROUND 2 ACRE GRANITIC FLATROCK; WITHIN A SMALL TRIANGLE OF UNNUMBERED ROADS; 2.1 MILES DUE SOUTH OF THE JUNCTION OF SEC. RD 12 AND I-85.

STATUS: UN
SRANK: S?
DOTNUM: 1
LONG: 821142
DATE: 80-05-13

ELEMENT: ARENARIA UNIFLORA / ONE-FLOWER STITCHWORT
EOCODE: PDCAR0G0W0*058*SC
GRANK: G3G4
TOPOMAP: 63 - PELHAM
LAT: 345144
SOURCE: D. RAYNER
STATUS: UN
SRANK: S?
DOTNUM: 3
LONG: 821314
DATE: 80-05-13
DESC: ON SMALL(2 AC.) GRANITIC FLATROCK; 0.5MI ENE OF THE JUNCTION OF SEC. RD. 63 AND SC 14, NEAR PELHAM.

ELEMENT: LONICERA FLAVA / YELLOW HONEYSUCKLE
EOCODE: PDCPR030A0*002*SC
GRANK: G5?
TOPOMAP: 44 - SPARTANBURG
LAT: 345915
SOURCE: CLARK
STATUS: SL
SRANK: S2
DOTNUM: 4
LONG: 815759
DATE: 79-09-01
DESC: FOUND IN A PATCH OF RELIC HARDWOODS LEFT BEHIND AFTER DEVELOPMENT OF THE AREA. LOCATED 0.2 MI SSW OF THE JUNCTION OF I-85 AND I-585. VERIFIED BY B. POWELL OF CONVERSE COLLEGE.

ELEMENT: LONICERA FLAVA / YELLOW HONEYSUCKLE
EOCODE: PDCPR030A0*004*SC
GRANK: G5?
TOPOMAP: 5 - LANDRUM
LAT: 351102
SOURCE: R. CLARK, POWELL AND CHILDRESS (CONV)
STATUS: SL
SRANK: S2
DOTNUM: 1
LONG: 820814
DATE: 70-05-01
DESC: REPORTED FROM NORTH-FACING SLOPE, RICH WOODS 0.5 MILES SSE OF JUNCTION OF SC 14 AND THE NORTH PACOLET RIVER. IDENTIFICATION BASED ON A NON-FLOWERING SPECIMEN (DAR).

ELEMENT: LONICERA FLAVA / YELLOW HONEYSUCKLE
EOCODE: PDCPR030A0*005*SC
GRANK: G5?
TOPOMAP: 6 - FINGERVILLE WEST
LAT: 350930
SOURCE: R. CLARK, CHILDRESS AND POWELL (CONV)
STATUS: SL
SRANK: S2
DOTNUM: 1
LONG: 820700
DATE: 70-05-01
DESC: REPORTED FROM RAVINE AND MESIC WOODS EAST OF I-26 FRONTAGE RD, CA. 1.5 MILES SE OF GRACE CHURCH, CA. 4.0 MILES ESE OF LANDRUM. IDENTIFICATION BASED ON NON-FLOWERING SPECIMEN (DAR).

ELEMENT: LONICERA FLAVA / YELLOW HONEYSUCKLE
EOCODE: PDCPR030A0*006*SC
GRANK: G5?
TOPOMAP: 45 - PACOLET
LAT: 345505
SOURCE: W. BURROUGHS (FUR)
STATUS: SL
SRANK: S2
DOTNUM: 6
LONG: 814613
DATE: 72-08-01
DESC: REPORTED NEAR GRANITE OUTCROP, KEYSTONE QUARRY, 1.5 MI NNW OF PACOLET.

ELEMENT: GAULTHERIA PROCUMBENS / TEABERRY
EOCODE: PDERI0F050*001*SC
GRANK: G5
TOPOMAP: 24 - VALLEY FALLS
LAT: 350548
SOURCE: CLARK, POWELL AND CHILDRESS (CON)
STATUS: SL
SRANK: S1
DOTNUM: 1
LONG: 815315
DATE: 70-05-01
DESC: REPORTED FROM AN OAK-HEATH COMMUNITY ON NORTH-FACING BLUFF ABOVE BUCK CREEK, 1.9 MILES NW OF MAYO, SC. SITE NAME: BUCK CREEK.

ELEMENT: MONOTROPSIS ODORATA / SWEET PINESAP
EOCODE: PDERI0V010*002*SC
GRANK: G3
TOPOMAP: 5 - LANDRUM
LAT: 350934
SOURCE: A. HARPER (MOBG)
DESC: LANDRUM, SC. UPLAND WOODS. EXACT LOCATION UNKNOWN.

STATUS: RC
SRANK: S1
DOTNUM: 3
LONG: 821130
DATE: 10-12-01

ELEMENT: FOTHERGILLA MAJOR / MOUNTAIN WITCH-ALDER
EOCODE: PDHAM01020*004*SC
GRANK: G3
TOPOMAP: 6 - FINGERVILLE WEST
LAT: 350930
SOURCE: CLARK, CHILDRESS AND POWELL (CON)
DESC: REPORTED FROM RAVINE AND MESIC WOODS EAST OF I-26 FRONTAGE ROAD, CA. .5 MILES SE OF GRACE CHURCH, CA. 4 MILES ESE OF LANDRUM.

STATUS: RC
SRANK: S1
DOTNUM: 1
LONG: 820700
DATE: 70-06-01

ELEMENT: JUGLANS CINEREA / WHITE WALNUT
EOCODE: PDJUG02030*003*SC
GRANK: G5
TOPOMAP: 44 - SPARTANBURG
LAT: 345700
SOURCE: J. LYLES 846 (FGR)
DESC: LAWSON FORK FLOODPLAIN BELOW JUNCTION OFF SNYDER ROAD AND LAWSON FORK.

STATUS: C2
SRANK: S?
DOTNUM: 5
LONG: 815359
DATE: 72-08-02

ELEMENT: CIRCAEA LUTETIANA SSP CANADENSIS / INTMED ENCHANTERS NIGHTSHADE
EOCODE: PDONA04021*008*SC
GRANK: G5T5
TOPOMAP: 43 - WELLFORD
LAT: 345639
SOURCE: L. L. GADDY--SJWD WATER DISTRICT REPORT
DESC: ABUNDANT ON ALKALINE PORTIONS OF FLOODPLAIN OF NORTH TYGER RIVER, WITH PODOPHYLLUM PELTATUM, VIOLA CANADENSIS, BELOW CANOPY INCLUDING LIRIODENDRON AND JUGLANS NIGRA.

STATUS: SL
SRANK: S1
DOTNUM: 1
LONG: 820340
DATE: 88-05-01

ELEMENT: ACONITUM UNCINATUM / BLUE MONKSHOOD
EOCODE: PDRAN010A0*005*SC
GRANK: G4
TOPOMAP: 44 - SPARTANBURG
LAT: 345708
SOURCE: R. C. CLARK 19453 (CONV)
DESC: FOUND IN RAVINE ALONG LAWSON'S FORK TRIBUTARY DOWNSTREAM FROM JCT OF SNYDER ROAD AND LAWSON'S FORK CREEK. NEAR SPARTANBURG HIGH SCHOOL. ADDITIONAL COLLECTION BY CLARK (#19984) FROM RAVINE BETWEEN EASTWOOD CR AND WESTMINSTER DR IN THIS AREA, 21 SEPT 1970.

STATUS: SL
SRANK: S2
DOTNUM: 2
LONG: 815404
DATE: 70-08-22

ELEMENT: ACONITUM UNCINATUM / BLUE MONKSHOOD
EOCODE: PDRAN010A0*006*SC
GRANK: G4
TOPOMAP: 5 - LANDRUM
LAT: 351102
SOURCE: CLARK (CONV)
DESC: FAIRVIEW FARMS, 0.5 MILE SE OF JCT OF NORTH PACOLET RIVER AND RD 14. RICH WOODS AND ROADCUT.

STATUS: SL
SRANK: S2
DOTNUM: 1
LONG: 820814
DATE: 70-10-01

ELEMENT: NESTRONIA UMBELLULA / NESTRONIA
EOCODE: PDSAN05010*006*SC
GRANK: G3G4
TOPOMAP: 44 - SPARTANBURG
LAT: 345803
SOURCE: (CONV)
STATUS: C2
SRANK: S2
DOTNUM: 3
LONG: 815623
DATE: 79-09-01
DESC: REPORTED IN UPLAND OAK-HICKORY WOODS BEHIND COUNTY HEALTH BUILDING. SITE IS NOW A PARKING LOT. SITE WAS ADJACENT TO SPARTANBURG HOSPITAL.

ELEMENT: MICROTUS PENNSYLVANICUS / MEADOW VOLE
EOCODE: AMAFF11010*005*SC
GRANK: G5
TOPOMAP: 23 - INMAN
LAT: 350213
SOURCE: R.H. COLEMAN (CHM)
STATUS: SC
SRANK: S4
DOTNUM: 1
LONG: 820348
DATE: 50-08-09
DESC: ONE MALE CAPTURED, 0.5 MILE NORTH OF CAMPTON.

ELEMENT: MESIC MIXED HARDWOOD FOREST
EOCODE: CTPCX00010*019*SC
GRANK: G5
TOPOMAP: 45 - PACOLET
LAT: 345322
SOURCE: PIGG
STATUS: UN
SRANK: S4
DOTNUM: 1
LONG: 815048
DATE: 75-11-16
DESC: ONE OF SEVERAL MATURE STANDS UNCUT DUE TO SHELL FRAGMENTS EMBEDDED IN TREES DURING WW2 FIRING RANGE PRACTICE. DBH: BEECH(2'), WHITE OAK(18"), BLACK OAK (15") AND RED OAK(15") ARE CO-DOMINANTS. TOPOGRAPHY IS GENTLY SLOPING OR FLAT. SEE MAP BY D. RAYNER IN CROFT S. P. FILE, AREA #4.

ELEMENT: MESIC MIXED HARDWOOD FOREST
EOCODE: CTPCX00010*023*SC
GRANK: G5
TOPOMAP: 45 - PACOLET
LAT: 345354
SOURCE: D. RAYNER
STATUS: UN
SRANK: S4
DOTNUM: 2
LONG: 815150
DATE: 78-02-17
DESC: AREA DESCRIBED AS WITHIN CROFT S. P. JUST NE OF THE JUNCTION OF KELSEY CREEK AND DAIRY RIDGE ROAD. AREA CONTAINS LARGE CONCENTRATION OF MATURE BEECHES (AVG. DBH 18-20"). SEE MAP BY D. RAYNER OF AREA #2 IN CROFT S. P. FILE.

ELEMENT: MESIC MIXED HARDWOOD FOREST
EOCODE: CTPCX00010*024*SC
GRANK: G5
TOPOMAP: 45 - PACOLET
LAT: 345354
SOURCE: D. RAYNER
STATUS: UN
SRANK: S4
DOTNUM: 2
LONG: 815150
DATE: 78-02-17
DESC: AREA DESCRIBED AS WITHIN CROFT S. P. JUST NE OF THE JUNCTION OF KELSEY CREEK AND DAIRY RIDGE ROAD. AREA CONTAINS LARGE CONCENTRATION OF MATURE BEECHES (AVG. DBH 18-20"). SEE MAP BY D. RAYNER OF AREA #2 IN CROFT S. P. FILE.

ELEMENT: OAK-HICKORY FOREST
EOCODE: CTTXX00010*039*SC
GRANK: G5
TOPOMAP: 66 - GLENN SPRINGS
LAT: 345224
SOURCE: PIGG
STATUS: UN
SRANK: S5
DOTNUM: 1
LONG: 815215
DATE: 75-11-16
DESC: FOREST CREEK. RIVERBOTTOM AREA, JUST NORTHWEST OF JUNCTION WITH FLEMING BRANCH. SWEET GUM DBH 16"-20", AVG 18"; POPLAR 10"-18", AVG 15". ASH AND RIVER BIRCH ARE CODOMINANT. OUTLYING EDGE GRADES INTO A MIDSLOPE OAK-HICKORY FOREST. SEE MAP BY D.A. RAYNER IN CROFT STATE PARK FILE, AREA #1.

ELEMENT: OAK-HICKORY FOREST
EOCODE: CTTXX00010*042*SC — **STATUS:** UN
GRANK: G5 — **SRANK:** S5
TOPOMAP: 45 - PACOLET — **DOTNUM:** 3
LAT: 345247 — **LONG:** 814953
SOURCE: PIGG — **DATE:** 75-11-16
DESC: WHITE OAKS (18"DBH) DOMINATE THIS STAND OF MATURE HARDWOODS CONTAINING SHELL FRAGMENTS FROM WW2 FIRING RANGES. A DESIGNATED DIRTBIKE TRAIL CUTS THROUGH THE AREA. AREA IS JUST EAST OF WHAT IS NOW LAKE JOHNSON. SEE AREA #3 ON D. RAYNER MAP IN CROFT SP FILE.

ELEMENT: OUTCROP
EOCODE: OOXXX01103*008*SC — **STATUS:** UN
GRANK: — **SRANK:**
TOPOMAP: 45 - PACOLET — **DOTNUM:** 4
LAT: 345610 — **LONG:** 814649
SOURCE: J. HARRINGTON — **DATE:** 74-11-01
DESC: SOAPSTONE IN THIS AREA WAS USED BY INDIANS OF THE ARCHAIC PERIOD (3000 YRS.AGO) TO MAKE BOWLS. AREA IS JUST WEST OF THE PACOLET RIVER CA. 4000' DOWNSTREAM FROM LAWSONS FORK CREEK. OTHER SITES RUN IN LINE SW AND NE OF THE AREA FROM CROFT SP TO THE S'BURG-CHEROKEE COUNTY LINE.

ELEMENT: OUTCROP
EOCODE: OOXXX01103*011*SC — **STATUS:** UN
GRANK: — **SRANK:**
TOPOMAP: 42 - GREER — **DOTNUM:** 1
LAT: 345413 — **LONG:** 821223
SOURCE: RAYNER — **DATE:** 80-05-01
DESC: LOCATED AT GREENVILLE-SPARTANBURG AIRPORT, OWNED BY GREENVILLE-SPARTANBURG AIRPORT COMMISSION.

ELEMENT: SITE RECORD NNAPP
EOCODE: SXXXXNNAPP*196*SC — **STATUS:** UN
GRANK: — **SRANK:**
TOPOMAP: 45 - PACOLET — **DOTNUM:** .
LAT: 345230 — **LONG:** 815100
SOURCE: PIGG — **DATE:** 75-12-01
DESC: SEVERAL AREAS IN THIS PARK HAVE MATURE, UNCUT TREES CONTAINING SHELL FRAGMENTS FROM WW2 FIRING RANGES. FEW HARDWOOD STANDS OF THIS SIZE REMAIN.

Enter the next ring distance
GEMS>

Enter program execution mode: B (batch) or I (interactive)
GEMS> I

OLD STARTEX
LATITUDE 34:56:30 LONGITUDE 82: 6:35 1980 POPULATION

KM	0.00-.400	.400-.810	.810-1.60	1.60-3.20	3.20-4.80	4.80-6.40	SECTOR TOTALS
S 1	0	0	0	1221	718	635	2574
S 2	0	0	940	347	0	8	1295
S 3	0	0	0	627	0	0	627
S 4	0	0	731	1505	0	311	2547
S 5	0	0	1406	0	1511	0	2917
S 6	0	0	0	0	1005	0	1005
RING TOTALS	0	0	3077	3700	3234	954	10965

press RETURN to continue
Alt-Z FOR HELP| IBM PC | FDX | 2400 E71 | LOG CLOSED | PRINT OFF | ON-LINE

REFERENCE NO. 38

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

July 27, 1992

Mr. David L. Rusher
Regional Manager
Dynamac Corporation
230 Peachtree Street, N.W., Suite 500
Atlanta GA 30303

RE: 4-RIN-02308-92

Dear Mr. Rusher:

This is in response to your Freedom of Information Act (FOIA) request regarding Federal Reporting Data Systems Report for Spartanburg county, SC.

Please find enclosed the requested material.

Fees are waived as de minimis.

Should you have questions, please contact the FOIA office at (404) 347-4332 or [FAX 404 347-0021].

Sincerely yours,

Len Dangerfield

Len Dangerfield, FOIA Coordinator
Water Management Division

Enclosure

cc: FOIA Office
Action Office FOIA Coordinator

Printed on Recycled Paper

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4210001

SYSTEM NAME : SPARTANBURG WATER SYSTEM PHONE:
SYSTEM ADDRESS:
SPARTANBURG SC 29304

GRANT ELIGIBLE : Y
STATUS : CAC
PLANT TYPE : C
OWNER TYPE :

ADDRESSES: NONE

PLANT SERVICE AREA: (* INDICATES PRIMARY SERVICE AREA)

ID	MAJOR CATEGORY	SUBCATETORIES
01	OTHER	*WHOLESALER

VISITS:

ID	DATE	REASON
05	03/30/90	1 - SANITARY SURVEY
01	07/21/83	1 - SANITARY SURVEY
02	06/25/84	1 - SANITARY SURVEY
03	04/29/85	1 - SANITARY SURVEY
04	08/19/80	1 - SANITARY SURVEY

ACTIVE INDICATOR : A
POPULATION SERVED: 96,919
REGULATE BY : B
SURFACE % :
INV UPDATE DATE : 05/20/92
NUMBER OF SERVICES: 38,300
INV INSERT DATE : 02/10/79
GROUND % :
BEGIN DATE :
SEASON START :
LAST UPDATE DATE: 05/20/92
PUR SURFACE % :
DEACTIVATION DATE:
SEASON END :
PRIMARY SOURCE : S
PUR GROUND % :

GEOGRAPHIC AREAS SERVED :

ID	ADMIN REGION	ADMIN DIST	CONG DIST	STATE COUNTY	FIPS COUNTY	MSA	INDIAN RESV CD	CITY
01			05		083	3160		

SOURCE (SRC) /ENTRY POINT (EPT) /PLANT (PLT) INFORMATION:

TYPE	ID	NAME	CODE	AVAIL	DATA ORG	LAT	LONG	SELLER ID	TREATMENTS ID	OBJECTIVE	PROCESS
SRC	201		S	P	S				01	NO TREATMENT AT SO	TREATMENT APPLIED AT PLANT
PLT	400		T		S				01	CORROSION CONTROL	INHIBITOR, BIMETALLIC PHOSPHATE
									01	CORROSION CONTROL	PH ADJUSTMENT, POST

LOCATE STATEMENT:
LOCATE (0) C100 WH C3 EQ SC AND NK C509 EQ 083:

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4220002

SYSTEM NAME : INMAN-CAMPOBELLO W/D PHONE:
SYSTEM ADDRESS:
INMAN SC 29349

GRANT ELIGIBLE : Y
STATUS : CAC
PLANT TYPE : C
OWNER TYPE :

ADDRESSES: NONE

PLANT SERVICE AREA: (* INDICATES PRIMARY SERVICE AREA)

ID	MAJOR CATEGORY	SUBCATETORIES
01	*RESIDENTIAL	

VISITS:

ID	DATE	REASON
07	03/19/91	1 - SANITARY SURVEY
06	03/2 /90	1 - SANITARY SURVEY
01	09/28/87	1 - SANITARY SURVEY
02	05/08/84	1 - SANITARY SURVEY
03	03/21/83	1 - SANITARY SURVEY
04	09/22/81	1 - SANITARY SURVEY
05	08/01/80	1 - SANITARY SURVEY

ACTIVE INDICATOR : A
POPULATION SERVED: 15,641
REGULATE BY : B
SURFACE % :

INV UPDATE DATE : 05/20/92
NUMBER OF SERVICES: 6,123
INV INSERT DATE : 02/10/79
GROUND % :

BEGIN DATE :
SEASON START :
LAST UPDATE DATE: 05/20/92
PUR SURFACE % :

DEACTIVATION DATE:
SEASON END :
PRIMARY SOURCE : P
PUR GROUND % :

GEOGRAPHIC AREAS SERVED :

ID	ADMIN REGION	ADMIN DIST	CONG DIST	STATE COUNTY	FIPS COUNTY	MSA	INDIAN RESV CD	CITY
01			04		083	3160		

SOURCE (SRC) /ENTRY POINT (EPT) /PLANT (PLT) INFORMATION:

TYPE	ID	NAME	CODE	AVAIL	DATA ORG	LAT	LONG	SELLER ID	TREATMENTS ID	OBJECTIVE	PROCESS
SRC	301	SPARTANBURG W/S	P	P	S			SC4210001	01	NO TREATMENT AT SO	NO TREATMENT / NOT APPLICABLE
PLT	950	INMAN CAMPOBELL	0		H	0350248	0820525				

LOCATE STATEMENT:
LOCATE (0) C100 WH C3 EQ SC AND NK C509 EQ 083:

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4220003

SYSTEM NAME : METRO SUBDISTRICT B PHONE:
SYSTEM ADDRESS:
SPARTANBURG SC 29303

GRANT ELIGIBLE : Y
STATUS : CAC
PLANT TYPE : C
OWNER TYPE :

ADDRESSES: NONE

PLANT SERVICE AREA: (* INDICATES PRIMARY SERVICE AREA)

ID	MAJOR CATEGORY	SUBCATETORIES
01	*RESIDENTIAL	

VISITS:

ID	DATE	REASON
08	01/31/91	1 - SANITARY SURVEY
07	01/[illegible]/90	1 - SANITARY SURVEY
01	01/30/89	1 - SANITARY SURVEY
02	03/12/85	1 - SANITARY SURVEY
03	04/29/85	1 - SANITARY SURVEY
04	06/23/82	1 - SANITARY SURVEY
05	02/10/81	1 - SANITARY SURVEY
06	09/07/79	1 - SANITARY SURVEY

ACTIVE INDICATOR :	A	INV UPDATE DATE :	05/20/92	BEGIN DATE :		DEACTIVATION DATE:	
POPULATION SERVED:	2,305	NUMBER OF SERVICES:	802	SEASON START :		SEASON END :	
REGULATE BY :	B	INV INSERT DATE :	02/10/79	LAST UPDATE DATE:	05/20/92	PRIMARY SOURCE :	P
SURFACE % :		GROUND % :		PUR SURFACE % :		PUR GROUND % :	

GEOGRAPHIC AREAS SERVED :

ID	ADMIN REGION	ADMIN DIST	CONG DIST	STATE COUNTY	FIPS COUNTY	MSA	INDIAN RESV CD	CITY
01			04		083	3160		

SOURCE (SRC) /ENTRY POINT (EPT) /PLANT (PLT) INFORMATION:

TYPE	ID	NAME	CODE	AVAIL	DATA ORG	LAT	LONG	SELLER ID	TREATMENTS ID	OBJECTIVE	PROCESS
SRC	101		G	O	S				01	TREATMENT UNKNOWN	TREATMENT NOT REPORTED
SRC	102		G	O	S				01	TREATMENT UNKNOWN	TREATMENT NOT REPORTED
SRC	103		G	O	S				01	TREATMENT UNKNOWN	TREATMENT NOT REPORTED
SRC	104		G	O	S				01	NO TREATMENT AT SO	NO TREATMENT / NOT APPLICABLE
SRC	301	SPARTANBURG	P	P	S			SC4210001	02	NO TREATMENT AT SO	NO TREATMENT / NOT APPLICABLE
PLT	950	METRO SUBDIST B	O		H	0345657	0815555				

LOCATE STATEMENT:

LOCATE (0) C100 WH C3 EQ SC AND NK C509 EQ 083:

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4220006

SYSTEM NAME : SJWD WATER DISTRICT PHONE:
SYSTEM ADDRESS:
LYMAN SC 29365

GRANT ELIGIBLE : Y
STATUS : CAC
PLANT TYPE : C
OWNER TYPE :

ADDRESSES: NONE

PLANT SERVICE AREA: (* INDICATES PRIMARY SERVICE AREA)

ID	MAJOR CATEGORY	SUBCATETORIES
01	*RESIDENTIAL	

VISITS:

ID	DATE	REASON
07	01/30/91	1 - SANITARY SURVEY
01	01/09/80	1 - SANITARY SURVEY
02	08/13/87	1 - SANITARY SURVEY
03	04/02/85	1 - SANITARY SURVEY
04	04/24/84	1 - SANITARY SURVEY
05	11/10/81	1 - SANITARY SURVEY
06	08/01/80	1 - SANITARY SURVEY

ACTIVE INDICATOR :	A	INV UPDATE DATE :	05/20/92	BEGIN DATE :		DEACTIVATION DATE:	
POPULATION SERVED:	27,905	NUMBER OF SERVICES:	10,122	SEASON START :		SEASON END :	
REGULATE BY :	B	INV INSERT DATE :	02/10/79	LAST UPDATE DATE:	05/20/92	PRIMARY SOURCE :	P
SURFACE % :		GROUND % :		PUR SURFACE % :		PUR GROUND % :	

GEOGRAPHIC AREAS SERVED :

ID	ADMIN REGION	ADMIN DIST	CONG DIST	STATE COUNTY	FIPS COUNTY	MSA	INDIAN RESV CD	CITY
01			04		083	3160		

SOURCE (SRC) /ENTRY POINT (EPT) /PLANT (PLT) INFORMATION:

TYPE	ID	NAME	CODE	AVAIL	DATA ORG	LAT	LONG	SELLER ID	TREATMENTS ID	OBJECTIVE	PROCESS
SRC	101		G	O	S	0350303	0821007		01	NO TREATMENT AT SO	NO TREATMENT / NOT APPLICABLE
SRC	102		G	O	S	0350148	0821040		01	NO TREATMENT AT SO	NO TREATMENT / NOT APPLICABLE
SRC	103		G	O	S	0350223	0820923		01	NO TREATMENT AT SO	NO TREATMENT / NOT APPLICABLE
SRC	104		G	O	S				01	NO TREATMENT AT SO	NO TREATMENT / NOT APPLICABLE
SRC	301	SPARTANBURG WAT	P	P	S			SC4210001	01	NO TREATMENT AT SO	NO TREATMENT / NOT APPLICABLE
SRC	302	INMAN CAMPOBELL	P	P	S			SC4220002	01	NO TREATMENT AT SO	NO TREATMENT / NOT APPLICABLE
SRC	303	LYMAN PRINTING&	P	P	S			SC4240004	01	NO TREATMENT AT SO	NO TREATMENT / NOT APPLICABLE

LOCATE STATEMENT:

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LOCATE (0) C100 WH C3 EQ SC AND NK C509 EQ 083:
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EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4240004

SYSTEM NAME : SPRINGS INDUSTIES PHONE:
SYSTEM ADDRESS:
LYMAN SC 29365

GRANT ELIGIBLE : Y
STATUS : CAC
PLANT TYPE : C
OWNER TYPE :

ADDRESSES: NONE

PLANT SERVICE AREA: (* INDICATES PRIMARY SERVICE AREA)

ID	MAJOR CATEGORY	SUBCATETORIES
01	OTHER	*WHOLESALER

VISITS:

ID	DATE	REASON
01	01/19/87	1 - SANITARY SURVEY
02	01/27/87	1 - SANITARY SURVEY
03	11/29/83	1 - SANITARY SURVEY
04	10/15/81	1 - SANITARY SURVEY
05	08/07/80	1 - SANITARY SURVEY

ACTIVE INDICATOR : A INV UPDATE DATE : 05/20/92 BEGIN DATE : DEACTIVATION DATE:
POPULATION SERVED: 1,680 NUMBER OF SERVICES: 4 SEASON START : SEASON END :
REGULATE BY : B INV INSERT DATE : 02/10/79 LAST UPDATE DATE: 05/20/92 PRIMARY SOURCE : S
SURFACE % : GROUND % : PUR SURFACE % : PUR GROUND % :

GEOGRAPHIC AREAS SERVED :

ID	ADMIN REGION	ADMIN DIST	CONG DIST	STATE COUNTY	FIPS COUNTY	MSA	INDIAN RESV CD	CITY
01					083	3160		

SOURCE (SRC) /ENTRY POINT (EPT) /PLANT (PLT) INFORMATION:

TYPE	ID	NAME	CODE	AVAIL	DATA ORG	LAT	LONG	SELLER ID	TREATMENTS ID	OBJECTIVE	PROCESS
SRC	201		S	P	S				01	NO TREATMENT AT SO	TREATMENT APPLIED AT PLANT
PLT	400		T		S				01	CORROSION CONTROL	INHIBITOR, HEXAMETAPHOSPHATE
									01	CORROSION CONTROL	PH ADJUSTMENT, POST

LOCATE STATEMENT:
LOCATE (0) C100 WH C3 EQ SC AND NK C509 EQ 083:

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4240004

SOURCE (SRC) /ENTRY POINT (EPT) /PLANT (PLT) INFORMATION:

TYPE	ID	NAME	CODE	AVAIL	DATA ORG	LAT	LONG	SELLER ID
PLT	950	SPRINGS INDUSTI	0		H	0345653	0820739	

TREATMENTS

ID	OBJECTIVE	PROCESS
02	DISINFECTION	GASEOUS CHLORINATION, POST
03	DISINFECTION	GASEOUS CHLORINATION, PRE
04	PARTICULATE REMOVA	COAGULATION
05	PARTICULATE REMOVA	FILTRATION, RAPID SAND
06	PARTICULATE REMOVA	FLOCCULATION
07	PARTICULATE REMOVA	RAPID MIX
08	PARTICULATE REMOVA	SEDIMENTATION
09	PARTICULATE REMOVA	PH ADJUSTMENT, PRE
10	TASTE / ODOR CONTR	PERMANGANATE

LOCATE STATEMENT:
LOCATE (0) C100 WH C3 EQ SC AND NK C509 EQ 083:

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4240007

SYSTEM NAME : STARTEX UTILITY SYS. INC PHONE:
SYSTEM ADDRESS:
STARTEX SC 29377

GRANT ELIGIBLE : Y
STATUS : CAC
PLANT TYPE : C
OWNER TYPE :

ADDRESSES: NONE

PLANT SERVICE AREA: (* INDICATES PRIMARY SERVICE AREA)

ID	MAJOR CATEGORY	SUBCATETORIES
01	*RESIDENTIAL	

VISITS:

ID	DATE	REASON
05	08/30/89	1 - SANITARY SURVEY
01	08/30/[illegible]	1 - SANITARY SURVEY
02	04/15/87	1 - SANITARY SURVEY
03	01/03/84	1 - SANITARY SURVEY
04	02/12/82	1 - SANITARY SURVEY

ACTIVE INDICATOR : A
POPULATION SERVED: 948
REGULATE BY : B
SURFACE % :

INV UPDATE DATE : 05/20/92
NUMBER OF SERVICES: 330
INV INSERT DATE : 03/11/80
GROUND % :

BEGIN DATE :
SEASON START :
LAST UPDATE DATE: 05/20/92
PUR SURFACE % :

DEACTIVATION DATE:
SEASON END :
PRIMARY SOURCE : P
PUR GROUND % :

GEOGRAPHIC AREAS SERVED :

ID	ADMIN REGION	ADMIN DIST	CONG DIST	STATE COUNTY	FIPS COUNTY	MSA	INDIAN RESV CD	CITY
01			04		083	3160		

SOURCE (SRC) /ENTRY POINT (EPT) /PLANT (PLT) INFORMATION:

TYPE	ID	NAME	CODE	AVAIL	DATA ORG	LAT	LONG	SELLER ID	TREATMENTS ID	OBJECTIVE	PROCESS
SRC	301	SPRINGS INDUSTR	P	P	S			SC4240004	01	NO TREATMENT AT SO	NO TREATMENT / NOT APPLICABLE
PLT	950	STARTEX MILL	O		H	0345657	0815555				

LOCATE STATEMENT:
LOCATE (0) C100 WH C3 EQ SC AND NK C509 EQ 083:

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4240007

VARIANCE OR EXEMPTION				ENFORCEMENTS			
CONTAMINANT ID	MODIFIED MCL	VAR/EXMP CODE	VAR/EXMP ID	LEGAL STATUS	DATE	ID	RELATED VIOLS
				SIA	02/03/92	9205369	9218241

LOCATE STATEMENT:
LOCATE (0) C100 WH C3 EQ SC AND NK C509 EQ 083:

FEDERAL REPORTING DATA SYSTEM - FRDS-II
ANNUAL DATA EVALUATION REPORT
FOIA #2308 - DYNAMAC
NO SORT REQUESTED

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4240007

VIOLATIONS								VIOLATIONS							
CONT ID	TY	BEGIN DATE	DUR	AWARE DATE	SMP TKN	ANALYTICAL RESULT	VIO ID	CONT ID	TY	BEGIN DATE	DUR	AWARE DATE	SMP TKN	ANALYTICAL RESULT	VIO ID
3100	23	12/01/91	001				9218241								

LOCATE STATEMENT:
LOCATE (0) C100 WH C3 EQ SC AND NK C509 EQ 083:

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4260004

SYSTEM NAME : M G PROFFITT III PHONE: (803) 244-9790
SYSTEM ADDRESS:

GRANT ELIGIBLE : N
STATUS : CIH
PLANT TYPE : C
OWNER TYPE : 2

ADDRESSES: NONE

PLANT SERVICE AREA: (* INDICATES PRIMARY SERVICE AREA)

ID	MAJOR CATEGORY	SUBCATETORIES
01	RESIDENTIAL	MOBILE HOME PARK

VISITS:

ID	DATE	REASON
01	04/29/85	1 - SANITARY SURVEY
[illegible]	[illegible]	[illegible]
03	02/01/83	1 - SANITARY SURVEY
04	01/12/82	1 - SANITARY SURVEY
05	06/17/81	1 - SANITARY SURVEY
06	08/08/77	1 - SANITARY SURVEY

ACTIVE INDICATOR : I INV UPDATE DATE : 03/21/86 BEGIN DATE : 06/01/77 DEACTIVATION DATE: 8511
POPULATION SERVED: 72 NUMBER OF SERVICES: 26 SEASON START : SEASON END :
REGULATE BY : B INV INSERT DATE : 02/10/79 LAST UPDATE DATE: 01/14/86 PRIMARY SOURCE : G
SURFACE % : GROUND % : PUR SURFACE % : PUR GROUND % :

GEOGRAPHIC AREAS SERVED :

ID	ADMIN REGION	ADMIN DIST	CONG DIST	STATE COUNTY	FIPS COUNTY	MSA	INDIAN RESV CD	CITY
90			04		083	3160		
01	42	03	04	83		3160		

SOURCE (SRC) /ENTRY POINT (EPT) /PLANT (PLT) INFORMATION:

TYPE	ID	NAME	CODE	AVAIL	DATA ORG	LAT	LONG	SELLER ID	TREATMENTS ID	OBJECTIVE	PROCESS
SRC	001	ONE WELL	G	P	S	0345704	0821102		01	TREATED	FLUORIDE ADJUSTMENT (CONVERTED FR

LOCATE STATEMENT:
LOCATE (9) C100 WH C3 EQ SC AND NK C509 EQ 083:

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4260004

VARIANCE OR EXEMPTION				ENFORCEMENTS			
CONTAMINANT ID	MODIFIED MCL	VAR/EXMP CODE	VAR/EXMP ID	LEGAL STATUS	DATE	ID	RELATED VIOLS
				SIE	05/03/83	8301794	8301794
				SIE	07/23/82	8201733	8201733

LOCATE STATEMENT:
LOCATE (0) C100 WH C3 EQ SC AND NK C509 EQ 083:

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4260004

VIOLATIONS

CONT ID	TY	BEGIN DATE	DUR	AWARE DATE	SMP TKN	ANALYTICAL RESULT	VIO ID
3000	03	03/01/83	001		000		8301794
3000	03	02/01/80	001				8011507

VIOLATIONS

CONT ID	TY	BEGIN DATE	DUR	AWARE DATE	SMP TKN	ANALYTICAL RESULT	VIO ID
3000	02	06/01/92	001			11.00000000	8201733

LOCATE STATEMENT:
LOCATE (0) C100 WH C3 EQ SC AND NK C509 EQ 083:

FEDERAL REPORTING DATA SYSTEM - FRDS-II
ANNUAL DATA EVALUATION REPORT
FOIA #2308 - DYNAMAC
NO SORT REQUESTED

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4250001

SYSTEM NAME : L LEWIS PHONE: (803) 877-1938
SYSTEM ADDRESS:

GRANT ELIGIBLE : N
STATUS : CIH
PLANT TYPE : C
OWNER TYPE : 2

ADDRESSES: NONE

PLANT SERVICE AREA: (* INDICATES PRIMARY SERVICE AREA)

ID	MAJOR CATEGORY	SUBCATETORIES
01	RESIDENTIAL	

VISITS:

ID	DATE	REASON
01	01/21/82	1 - SANITARY SURVEY
02	06/17/81	1 - SANITARY SURVEY
03	08/11/80	1 - SANITARY SURVEY

ACTIVE INDICATOR :	I	INV UPDATE DATE :	02/10/79	BEGIN DATE :	06/01/77	DEACTIVATION DATE:	8303
POPULATION SERVED:	66	NUMBER OF SERVICES:	16	SEASON START :		SEASON END :	
REGULATE BY :	B	INV INSERT DATE :	02/10/79	LAST UPDATE DATE:	03/14/83	PRIMARY SOURCE :	G
SURFACE % :		GROUND % :		PUR SURFACE % :		PUR GROUND % :	

GEOGRAPHIC AREAS SERVED :

ID	ADMIN REGION	ADMIN DIST	CONG DIST	STATE COUNTY	FIPS COUNTY	MSA	INDIAN RESV CD	CITY
90			04		083	3160		
01	42	03	04	83		3160		

SOURCE (SRC) /ENTRY POINT (EPT) /PLANT (PLT) INFORMATION:

TYPE	ID	NAME	CODE	AVAIL	DATA ORG	LAT	LONG	SELLER ID	TREATMENTS ID	OBJECTIVE	PROCESS
SRC	001	TWO WELLS	G	P	S	0345914	0820416		01	TREATMENT UNKNOWN	TREATMENT NOT REPORTED

LOCATE STATEMENT:
LOCATE (0) C100 WH C3 EQ SC AND NK C509 EQ 083:

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4250001

CONTAMINANT ID	VARIANCE OR EXEMPTION: MODIFIED MCL	VAR/EXMP CODE	VAR/EXMP ID	ENFORCEMENTS: LEGAL STATUS	DATE	ID	RELATED VIOLS
				EFJ	09/30/83	8301267	8301267
				EFJ	09/30/83	8301411	8301411
				EFJ	09/30/83	8301420	8301420
				EFJ	09/30/83	8301500	8301500
				EFJ	09/30/82	8200924	8200924
							8201152
							8201384
							8201731
							8201791
							8201841
							8212468
							8212573
							8212648
							8212[illegible]
							8212918
							8213087

LOCATE STATEMENT:
LOCATE (0) C100 WH C3 EQ SC AND NK C509 EQ 083:

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4250001

VIOLATIONS							
CONT ID	TY	BEGIN DATE	DUR	AWARE DATE	SMP TKN	ANALYTICAL RESULT	VIO ID
3000	03	11/01/82	001		000		8301267
3000	03	10/01/82	001		000		8301420
3000	03	04/01/82	001		000		8200924
3000	03	09/01/82	001		000		8201334
3000	03	07/01/82	001		000		8201791
3000	03	12/01/81	001		000		8212468
3000	03	02/01/82	001		000		8212648
3000	03	11/01/81	001		000		8212918
3000	03	11/01/80	001		000		8112008
3000	03	12/01/80	001		000		8112296
3000	03	02/01/81	001		000		8112378
3000	03	04/01/81	001		000		8112446
3000	03	06/01/81	001		000		8112891
3000	03	08/01/81	001		000		8112975
3000	03	11/01/79	001				8011239
3000	03	12/01/79	001				8011239
3000	03	03/01/80	001				8011496
3000	03	04/01/80	001				8011641
3000	03	05/01/80	001				8011985
3000	03	09/01/80	001				8012058

VIOLATIONS							
CONT ID	TY	BEGIN DATE	DUR	AWARE DATE	SMP TKN	ANALYTICAL RESULT	VIO ID
3000	03	12/01/82	001		000		8301411
3000	03	01/01/83	001		000		8301500
3000	03	05/01/82	001		000		8201152
3000	03	06/01/82	001		000		8201731
3000	03	08/01/82	001		000		8201841
3000	03	01/01/82	001		000		8212573
3000	03	03/01/82	001		000		8212831
3000	03	10/01/81	001		000		8213087
3000	03	10/01/80	001		000		8112095
3000	03	01/01/81	001		000		8112322
3000	03	03/01/81	001		000		8112392
3000	03	05/01/81	001		000		8112696
3000	03	07/01/81	001		000		8112923
3000	03	09/01/81	001		000		8113046
3000	03	10/01/79	001				8011126
3000	03	01/01/80	001				8011374
3000	03	02/01/80	001				8011502
3000	03	08/01/80	001				8011976
3000	03	06/01/80	001				8012030
3000	03	07/01/80	001				8012143

LOCATE STATEMENT:
LOCATE (0) C100 WH C3 EQ SC AND NK C509 EQ 083:

FEDERAL REPORTING DATA SYSTEM - FRDS-II
ANNUAL DATA EVALUATION REPORT
FOIA #2308 - DYNAMAC
NO SORT REQUESTED

EPA REGION: 04 PRIMACY STATE: SC PRIMACY: Y PWS ID: SC4260013

SYSTEM NAME : LAMB TRAILER PK PHONE: (803) 439-6669
SYSTEM ADDRESS: RT 1
LYMAN SC 29365

GRANT ELIGIBLE : N
STATUS : NAH
PLANT TYPE : N
OWNER TYPE : 2

ADDRESSES: NONE

PLANT SERVICE AREA: (* INDICATES PRIMARY SERVICE AREA)

ID	MAJOR CATEGORY	SUBCATETORIES
01	RESIDENTIAL	MOBILE HOME PARK
02	TRANSIENT	OTHER

VISITS:

ID	DATE	REASON
01	07/08/75	[illegible] SANITARY SURVE

ACTIVE INDICATOR : A INV UPDATE DATE : 02/10/79 BEGIN DATE : 06/01/77 DEACTIVATION DATE:
POPULATION SERVED: 14 NUMBER OF SERVICES: 4 SEASON START : 01/01 SEASON END : 12/31
REGULATE BY : B INV INSERT DATE : 02/10/79 LAST UPDATE DATE: 04/20/78 PRIMARY SOURCE : G
SURFACE % : GROUND % : PUR SURFACE % : PUR GROUND % :

GEOGRAPHIC AREAS SERVED :

ID	ADMIN REGION	ADMIN DIST	CONG DIST	STATE COUNTY	FIPS COUNTY	MSA	INDIAN RESV CD	CITY
90			04		083	3160		
01		03	04	83		3160		

SOURCE (SRC) /ENTRY POINT (EPT) /PLANT (PLT) INFORMATION:

TYPE	ID	NAME	CODE	AVAIL	DATA ORG	LAT	LONG	SELLER ID	TREATMENTS ID	OBJECTIVE	PROCESS
SRC	001	ONE WELL	G	P	S	0345822	0820935		01	TREATMENT UNKNOWN	TREATMENT NOT REPORTED

LOCATE STATEMENT:
LOCATE (C) C100 WH C3 EQ SC AND NK C509 EQ 083:

South Carolina Department of Health
and Environmental Control
Solid Waste Management Division
2600 Bull Street
Columbia, SC 29201
Phone: (803) 758-5631

REFERENCE NO. 39

Instructions for completing
this Form on reverse side.

NOTIFICATION OF HAZARDOUS WASTE ACTIVITY

A. General.
(1) Identification.
(a) Name of person or organization conducting hazardous waste activities: Lyman Printing & Finishing

Lyman, S. C. 29365

(b) Mailing Address: _____

(c) Phone Number: 803/433-4000

(2) Principal technical contacts (Name(s), mailing address(es) and phone number(s)):

H. B. Bridgeman, Lyman Prt. & Finish, Lyman, S. C. 29365 433/4433 (80

D. E. Sands, Lyman Prt. & Finishing, Lyman, S. C. 29365 433/4322 (803

(3) Types of hazardous waste activities person or organization conducts within the State: (Check all applicable boxes.)
(a) Generation of hazardous waste [X]
(b) Transportation of hazardous waste (other than on-site of generation or on-site of treatment, storage or disposal facility) [ ]
(c) Treatment, storage, or disposal of hazardous waste at a facility owned or operated by the person or organization [XX]
(4) Certification: I hereby certify (or declare) that the information provided herein is complete and correct to the best of my knowledge. I understand that all information on this form may be made available to the public unless otherwise noted as provided under (5) below. I am authorized to sign official documents for the organization or person identified in (1) (a) above.

[signature] Dir., Engineering Serv. 12/19/79
Signature Name and Title Date

(5) Confidentiality.
Information reported to the Department in this Notification may be claimed as confidential, and therefore exempt from public disclosure under Section 6B of the South Carolina Hazardous Waste Management Act, which reads:

> Information obtained by the department under this chapter shall be available to the public, unless the department certifies such information as being proprietary. The Department may make such certification where any person shows, to the satisfaction of the department, that the information, or parts thereof, if made public, would divulge methods, production rates, processes, or other confidential information entitled to protection. Nothing in this subsection shall be construed as limiting the disclosure of information by the department to any officer, employee or authorized representative of the State concerned with effecting this chapter, providing such person respects the proprietary nature of the information.

In order for information to be considered for confidentiality, the Department must be supplied with a detailed list of exactly what information is claimed as confidential and on what basis the claim of confidentiality is made, including facts and information to support such claim. Upon receiving such claim, the Department will make a determination as to whether or not the information is entitled to confidentiality. A determination by the Department that a portion of the Notification will be considered confidential does not serve as a determination that the entire Notification will be considered confidential.
(6) Warning: Section 44-56-[illegible] of the Hazardous Waste Management Act provided for significant penalties for violations of the Act, the rules and regulations promulgated pursuant to the Act, or orders issued by the Board, Commissioner, or the Department. No hazardous waste as defined under Section [illegible], shall be generated, stored, transported, or disposed within the State unless

DHEC 1987 (9/[illegible])

General Instructions

(1) This Notification Form is to be used by all persons required to file a Notification Form with the Department by Section D of the Emergency Hazardous Waste Regulation.

(2) All definitions contained in the Hazardous Waste Management Act (Section 44-56-10 et seq. of the 1976 S.C. Code of Laws) and Section A of the Emergency Hazardous Waste Regulation shall apply to this Form.

(3) Generators of hazardous waste shall complete Parts A and B of this Form. A separate Notification Form shall be completed for each place of generation if the generator produces hazardous waste at more than one location within the State.

(4) Transporters of hazardous waste shall complete Parts A and C of this Form. A person who transports hazardous waste solely on the site of generation or solely on the site of a hazardous waste facility is not considered a transporter for this Notification.

(5) Owner(s)/Operator(s) of hazardous waste treatment, storage, or disposal facilities shall complete Parts A and D of this Form. A separate Notification Form shall be completed for each separate facility (if the owner/operator has more than one location within the State at which hazardous waste is treated, stored, or disposed.)

(6) If a question arises as to how to complete a particular item of this Form or additional copies of this Form are needed, please contact the Solid Waste Management Division at the telephone number or address given on the front of this Form.

(7) If additional space is needed to complete any item, attach a separate sheet to complete the item. Clearly identify on the separate sheet which item is being continued on that sheet.

(8) Type or print in ink all items of this Form except the signature in item A(4), which must be signed in ink.

Specific Instructions

A. General.
(1) Self-explanatory.
(2) Principal Technical Contacts. Enter the name, address, and telephone number of an individual or individuals whom the Department may contact for clarification of information submitted on this Form.
(3) Self-explanatory.
(4) Certification. An individual authorized to sign official documents for the organization or person identified in A(1)(a) shall enter his signature, name, title, and date. The signature shall be in ink.
(5) Self-explanatory.
(6) Self-explanatory.

B. Generator
(1) Self-explanatory.
(2) Self-explanatory.
(3) Self-explanatory.
(4) Give the county in which place of generation is located. If place of generation is located in more than one county, give the county in which the place of generation is primarily located.
(5) Self-explanatory.
(6) Types of hazardous waste(s) generated at location:
(a) Ignitable waste - the waste meets the ignitable characteristics of Section C of the Emergency Hazardous Waste Regulation.
(b) Corrosive waste - the waste meets the corrosive characteristics of Section C of the Emergency Hazardous Waste Regulation.
(c) Reactive waste - the waste meets the reactive characteristics of Section C of the Emergency Hazardous Waste Regulation.
(d) Toxic waste - the waste meets the toxic characteristics of Section C of the Emergency Hazardous Waste Regulation.

notification of hazardous waste activity has been submitted to the Department according to the regulations promulgated under the Act.

B. Generator.

(1) Mailing address of place of generation: Lyman Printing & Finishing, Lyman, S. C. 29365

(2) Location of place of generation: Lyman, S. C.

(3) Phone number at place of generation: 803/433-4000

(4) County in which place of generation is located: Spartanburg

(5) General Description of generator's operations at the location of generation: Textile Printing/Finishing Operation

(6) Types of hazardous waste(s) generated at location: (Check all applicable boxes.)

(a) Ignitable ☐
(b) Corrosive ☐
(c) Reactive ☐
(d) Toxic ☐
(e) Listed ☒

(7) Estimated amount of hazardous waste generated at location annually in pounds (pounds/year): 75 Lbs.

(8) For each hazardous waste produced at the location submit a completed Hazardous Waste Information Form (DHEC Form No. 1986).

C. Transporter.

(1) General description of kind of transportation transporter is engaged in:

(2) State and county in which the transporter has his principal place of business: _____ State _____ County

(3) Location, mailing address, and phone number of all terminals or other transportation facilities the transporter maintains within the State:

(4) Identification code(s) if transporter has previously been assigned a hazardous waste identification code by the Federal Environmental Protection Agency or any other state. Also include source of I.D. Code and by whom such codes were assigned:

(5) Interstate Commerce Commission Number or South Carolina Public Service Commission Number (state whether number is ICC or PSC):

(6) Types of hazardous wastes handled by the transporter: (Check all applicable boxes.)

(a) Ignitable ☐
(b) Corrosive ☐
(c) Reactive ☐
(d) Toxic ☐
(e) Listed ☒

(e) Listed waste - the waste is listed as a hazardous waste under Section C of the Emergency Hazardous Waste Regulation.
(7) Give estimated amount of hazardous waste producted per year at the location based upon the best available information. The generator may be required by the Department to produce information as to the basis of this estimation.
(8) Self-explanatory.

C. Transporter.
(1) Self-explanatory.
(2) Self-explanatory.
(3) Self-explanatory.
(4) Self-explanatory.
(5) If transporter has not been assigned either a ICC or PSC number, state "None".
(6) Types of hazardous wastes handled by the transporter:
(a) Ignitable waste - the waste meets the ignitable characteristics of Section C of the Emergency Hazardous Waste Regulation.
(b) Corrosive waste - the waste meets the corrosive characteristics of Section C of the Emergency Hazardous Waste Regulation.
(c) Reactive waste - the waste meets the reactive characteristics of Section C of the Emergency Hazardous Waste Regulation.
(d) Toxic waste - the waste meets the toxic characteristics of Section C of the Emergency Hazardous Waste Regulation.
(e) Listed waste - the waste is listed as a hazardous waste under Section C of the Emergency Hazardous Waste Regulation.
(7) Give estimated amount of hazardous waste transported by the transporter annually based upon the best available information. The transporter may be required by the Department to produce information as to the basis of this estimation.

D. Hazardous Waste Facilities.
(1) Self-explanatory.
(2) Self-explanatory.
(3) Self-explanatory.
(4) Self-explanatory.
(5) Give the county in which the facility is located. If the facility is located in more than one county give the county in which the facility is primarily located.
(6) Before answering this question, be sure to read the definitions of "treatment", "storage", and "disposal" contained in the Emergency Hazardous Waste Regulation.
(7) Self-explanatory.
(8) Types of hazardous wastes handled by facility:
(a) Ignitable waste - the waste meets the ignitable characteristics of Section C of the Emergency Hazardous Waste Regulation.
(b) Corrosive waste - the waste meets the corrosive characteristics of Section C of the Emergency Hazardous Waste Regulation.
(c) Reactive waste - the waste meets the reactive characteristics of Section C of the Emergency Hazardous Waste Regulation.
(d) Toxic waste - the waste meets the toxic characteristics of Section C of the Emergency Hazardous Waste Regulation.
(e) Listed waste - the waste is listed as a hazardous waste under Section C of the Emergency Hazardous Waste Regulation.
(9) Give estimated amount of hazardous waste handled by the facility annually based upon the best available information. The generator may be required by the Department to produce information as to the basis of this estimation.

(7) Estimat amount of hazardous wastes handled annually by transporter in pounds (pounds/year): 75 Lbs.

D. Hazardous Waste Facilities.

(1) Name of facility: Lyman Printing & Finishing

(2) Mailing address of facility: Lyman, S. C. 29365

(3) Location of facility: Lyman, S. C.

(4) Phone number of facility: 803/433-4000

(5) County in which facility is located: Spartanburg

(6) Type of operations conducted at the facility: (Check all applicable boxes).

(a) Treatment of hazardous waste ☐
(b) Storage of hazardous waste ☒ Temporary storage until treated
(c) Disposal of hazardous waste ☐ disposed.

(7) Submit on a separate sheet of paper a description of the hazardous waste activities conducted at the facility. See Item 8 DHEC Form 1986

(8) Types of hazardous wastes handled at the facility: (Check all applicable boxes.)

(a) Ignitable ☐
(b) Corrosive ☐
(c) Reactive ☐
(d) Toxic ☐
(e) Listed ☒

(9) Estimated amount of hazardous waste treated, stored, or disposed annually at the facility in pounds (pounds/year): 75 Lbs.

and Facilities Control
2600 Bull Street
Columbia, SC 29201
Phone: (803) 758-5681

REFERENCE NO. 40

this Form on reverse side.

HAZARDOUS WASTE INFORMATION

(1) Name of generator: Lyman Printing & Finishing

(2) Place of generation: Lyman, South Carolina 29365

(3) General description of hazardous waste, including process producing waste:

Paint waste - maintenance and/or repair

(4) Description of the hazardous waste:

Oil base and/or water base paint waste

(5) Check the hazardous waste characteristics the waste exhibits as identified in Section C of the Emergency Hazardous Waste Regulation; or if the waste is listed as a hazardous waste, check "Listed"; or if the waste has been declared hazardous by the generator, check the hazardous waste characteristic(s), as identified in Section C of the Emergency Hazardous Waste Regulation the generator suspects the waste to exhibit.

(a)	Ignitable	☐
(b)	Corrosive	☐
(c)	Reactive	☐
(d)	Toxic	☐
(e)	Listed	☒

(6) Attach any information obtained from the testing of the waste performed to determine their hazard. If the generator declares the waste to be hazardous attach information on what basis the decision to declare the waste hazardous was made.

(7) Estimated amount of the waste produced per year in pounds (pounds/waste):

75 Lbs.

(8) Describe the method(s) by which this waste is currently being treated, stored, or disposed, including the name and address of any facility to which the waste is being sent.

Fred Bridwell - Painting Contractor - Spartanburg, S. C.

S. C. Waste Management - Commercial Waste Hauler, Spartanburg, S. C.

(9) Certification: I hereby certify (or declare) that the information provided herein is complete and correct to the best of my knowledge. I understand that all information on this Form may be made available to the public except those portions entitled to confidentiality as provided by Section 44-56-[illegible] of the South Carolina Hazardous Waste Management Act. I am authorized to sign official documents for the generator named in (1) above.

[signature] Dir., Engineering Serv. 12/19/79

Signature Name and Title Date

NOTE: Additional copies of this Form may be reproduced locally as needed.

DHEC 1980(9/[illegible])

General Instructions

1. This Hazardous Waste Information Form is to be used when designated by the Department. A separate Form shall be completed for each hazardous waste.

2. All definitions contained in the Hazardous Waste Management Act (Section 44-56-10 et seq. of the 1976 S.C. Code of Laws) and the Emergency Hazardous Waste Regulation shall apply to this Form.

3. If a question arises as to how to complete a particular item of this Form or additional copies of this Form are needed, please contact the Solid Waste Management Division at the telephone number or address given on the front of this Form.

4. If additional space is needed to complete any item, attach a separate sheet to complete the item. Clearly identify on the separate sheet which item is being continued on that sheet.

5. Type or print in ink all items of this Form except the signature required in item (9), which must be signed in ink.

Specific Instructions

(1) Self-explanatory.
(2) Self-explanatory.
(3) Self-explanatory.
(4) A description of the hazardous waste handled by general type and specific contents using the best available information.
(5) Self-explanatory.
(6) Self-explanatory.
(7) Give estimated amount of the waste produced per year based upon the best available information. The generator may be required by the Department to produce information as to the basis of this estimation.
(8) Self-explanatory.
(9) Certification. An individual authorized to sign official documents for the organization or person identified in (1) shall enter his signature, name, title, and date. The signature shall be in ink.

NUS CORPORATION AND SUBSIDIARIES *TELECON NOTE*

CONTROL NO.	DATE: 2-20-91	TIME: 9:14

DISTRIBUTION: [redacted]

File

REFERENCE NO. 41

BETWEEN: Gerald Stewart	OF: SCDHEC	PHONE: (803) 734-5449

AND: Terry Ryland, NUS Corporation

DISCUSSION:

I asked Mr. Stewart about any RCRA history or permitting of the Old Startex Landfill. He told me the landfill was never permitted and that Springs Industries has recently agreed to stop using the landfill in an effort to avoid having to permit the landfill.

NUS CORPORATION
1927 LAKESIDE PARKWAY
SUITE 614
TUCKER, GEORGIA 30084
404-938-7710

SISB/SAS
RECEIVED
MAR 3 1991
EPA - REGION IV

C-586-3-1-14

March 20, 1991

Mr. A.R. Hanke
Waste Programs Branch
Waste Management Division
Environmental Protection Agency
345 Courtland Street, N. E.
Atlanta, Georgia 30365

Subject: Field Screening Site Inspection Report, Phase II
Revision 0
Old Startex, Spartanburg County Landfill
Startex, Spartanburg County, South Carolina
TDD No. F4-9007-22
EPA ID No. SCD980558191

Dear Mr. Hanke:

Enclosed please find one (2) copies of the Final Screening Site Inspection Report, Phase II, Revision 0, for Old Startex, Spartanburg County Landfill, located in Startex, Spartanburg County, South Carolina.

If you have any questions or comments about this submittal, please contact me.

Very truly yours,

Terry Ryland
Project Manager

Approved:

TR/jec

Enclosure (1)

R-586-3-1-38

4/17/91

DATE REPORT ACCEPTED

DISPOSITION Recommended SIP-Low

SAM SIGNATURE

FINAL REPORT

SCREENING SITE INSPECTION, PHASE II
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA
EPA ID #: SCD980558191

Prepared Under
TDD No. F4-9007-22
CONTRACT NO. 68-01-7346

Revision 0

FOR THE

WASTE MANAGEMENT DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY

MARCH 20, 1991

NUS CORPORATION
SUPERFUND DIVISION

Prepared By	Reviewed By	Approved By
Terry Ryland Project Manager	Bob Donaghue Assistant Regional Project Manager	Phil Blackwell Regional Project Manager

NOTICE

The information in this document has been funded wholly by the United States Environmental Protection Agency (EPA) under Contract Number 68-01-7346 and is considered proprietary to the EPA.

This information is not be released to third parties without the expressed or written consent of the EPA.

TABLE OF CONTENTS

Section No.		Page
EXECUTIVE SUMMARY		**ES-1**
1.0	**INTRODUCTION**	**1**
1.1	Objectives	1
1.2	Scope of Work	1
2.0	**SITE CHARACTERIZATION**	**3**
2.1	Site Background and History	3
2.2	Site Description	3
	2.2.1 Site Features	3
	2.2.2 Waste Characteristics	6
3.0	**REGIONAL POPULATIONS AND ENVIRONMENTS**	**7**
3.1	Population and Land Use	7
	3.1.1 Demography	7
	3.1.2 Land Use	7
3.2	Surface Water	7
	3.2.1 Climatology	7
	3.2.2 Overland Drainage	8
	3.2.3 Potentially Affected Water Bodies	8
3.3	Groundwater	9
	3.3.1 Hydrogeology	9
	3.3.2 Aquifer Use	9
3.4	Summary of Potentially Affected Populations and Environments	10
4.0	**FIELD INVESTIGATION**	**11**
4.1	Sample Collection	11
	4.1.1 Sample Collection Methodology	11
	4.1.2 Duplicate Samples	11
	4.1.3 Sample Codes, Descriptions, Locations, and Rationale	11
	4.1.4 Field Measurements	11
4.2	Sample Analysis	16
	4.2.1 Analytical Support and Methodology	16
	4.2.2 Analytical Data Quality	16
	4.2.3 Presentation of Analytical Results	16
5.0	**SUMMARY**	**28**
REFERENCES		**29**
APPENDIX A	Topographic Map	
APPENDIX B	Analytical Results	
APPENDIX C	Site Inspection Report	

TABLES

Number		Page
Table 1	Sample Codes, Descriptions, Locations, and Rationale	12
Table 2	Surface Water Samples, Field Measurements	15
Table 3	Summary of Organic Analytical Results, Surface Soil Samples	18
Table 4	Summary of Organic Analytical Results, Subsurface Soil Samples	20
Table 5	Summary of Organic Analytical Results, Sediment Samples	21
Table 6	Summary of Organic Analytical Results, Surface Water Samples	22
Table 7	Summary of Inorganic Analytical Results, Surface Soil Samples	24
Table 8	Summary of Inorganic Analytical Results, Subsurface Soil Samples	25
Table 9	Summary of Inorganic Analytical Results, Sediment Samples	26
Table 10	Summary of Inorganic Analytical Results, Surface Water Samples	27

FIGURES

Figure 1	Site Location Map	4
Figure 2	Site Layout Map	5
Figure 3	Sample Location Map	14

EXECUTIVE SUMMARY

The Old Startex, Spartanburg County Landfill was operated by Spartanburg County, South Carolina, from the mid to late 1960s through the early 1970s. During this time, the landfill accepted wastes from Lyman Printing and Finishing Company, Spartanburg County, and other industries for disposal of household and industrial waste. Waste types thought to be disposed of at the site are minimal amounts of organics and inorganics commonly associated with printing and dyeing facilities.

The site is located in the Piedmont physiographic province. The source of groundwater in the area is the unconfined crystalline rock aquifer system. Water is stored in this aquifer system within the fractures of the crystalline bedrock and within the pore spaces of the overlying mantle of weathered rock and residual soil, or regolith. Depth to groundwater is approximately 20 feet below land surface and flows west toward the Middle Tyger River. Recharge to the aquifer system occurs from rainfall on the land surface.

Targets potentially affected by possible contamination from the site would be private well users. There are an estimated 204 private wells within a 3-mile radius of the site. All other residents within the area obtain water from alternate, unthreatened sources.

Eighteen environmental samples were collected during the investigation. Six surface soil, four subsurface soil, four sediment, and four surface water samples. Low levels of organics were found in some of the surface and subsurface soil samples. Various levels of inorganics such as aluminum, barium, chromium, cobalt, copper, lead, magnesium, manganese, and vanadium were found in surface, subsurface, and sediment soil samples. Some of these elements such as chromium, cobalt, copper, lead, and manganese are used in the production of inks and dyes. The presence of these metals could possibly be associated with waste disposal activities at the landfill by the Lyman Printing and Finishing Company. Surface water samples from a nearby stream showed no elevated levels of organics or inorganics.

Based upon the limited targets in the area and low concentrations of isolated contaminants detected during this investigation, FIT 4 recommends no further remedial action be planned for the Old Startex, Spartanburg County Landfill. However, FIT 4 does recommend that applicable state and/or county agencies monitor several of the closest private wells to the landfill due to groundwater depth and the presence of several polynuclear aromatic hydrocarbons detected in surface soil samples.

1.0 INTRODUCTION

The NUS Corporation Region 4 Field Investigation Team (FIT) was tasked by the U.S. Environmental Protection Agency (EPA), Waste Management Division to conduct a Screening Site Inspection (SSI) at the Old Startex, Spartanburg County Landfill site in Startex, Spartanburg County, South Carolina. The investigation was performed under the authority of the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). The task was performed to satisfy the requirements stated in Technical Directive Document (TDD) number F4-9007-22. The field investigation was conducted on September 24, 1990.

1.1 OBJECTIVES

The objectives of this inspection were to determine the nature of contaminants present at the site and to determine if a release of these substances has occurred or may occur. Further, this inspection sought to determine the possible pathways by which contamination could migrate from the site and the populations and environments it would potentially affect. Through these objectives, a recommendation was made regarding future activities at the site.

1.2 SCOPE OF WORK

The objectives were achieved through the completion of a number of specific tasks. These activities were to:

- Obtain and review background material relevant to HRS scoring of site.
- Obtain topographic maps of site.
- Evaluate target populations associated with the groundwater, surface water, air, and onsite exposure pathways.
- Conduct a survey of private wells.
- Determine location and distance to nearest potable well.

- Develop a site sketch.

- Collect 18 environmental samples.

2.0 SITE CHARACTERIZATION

2.1 SITE BACKGROUND AND HISTORY

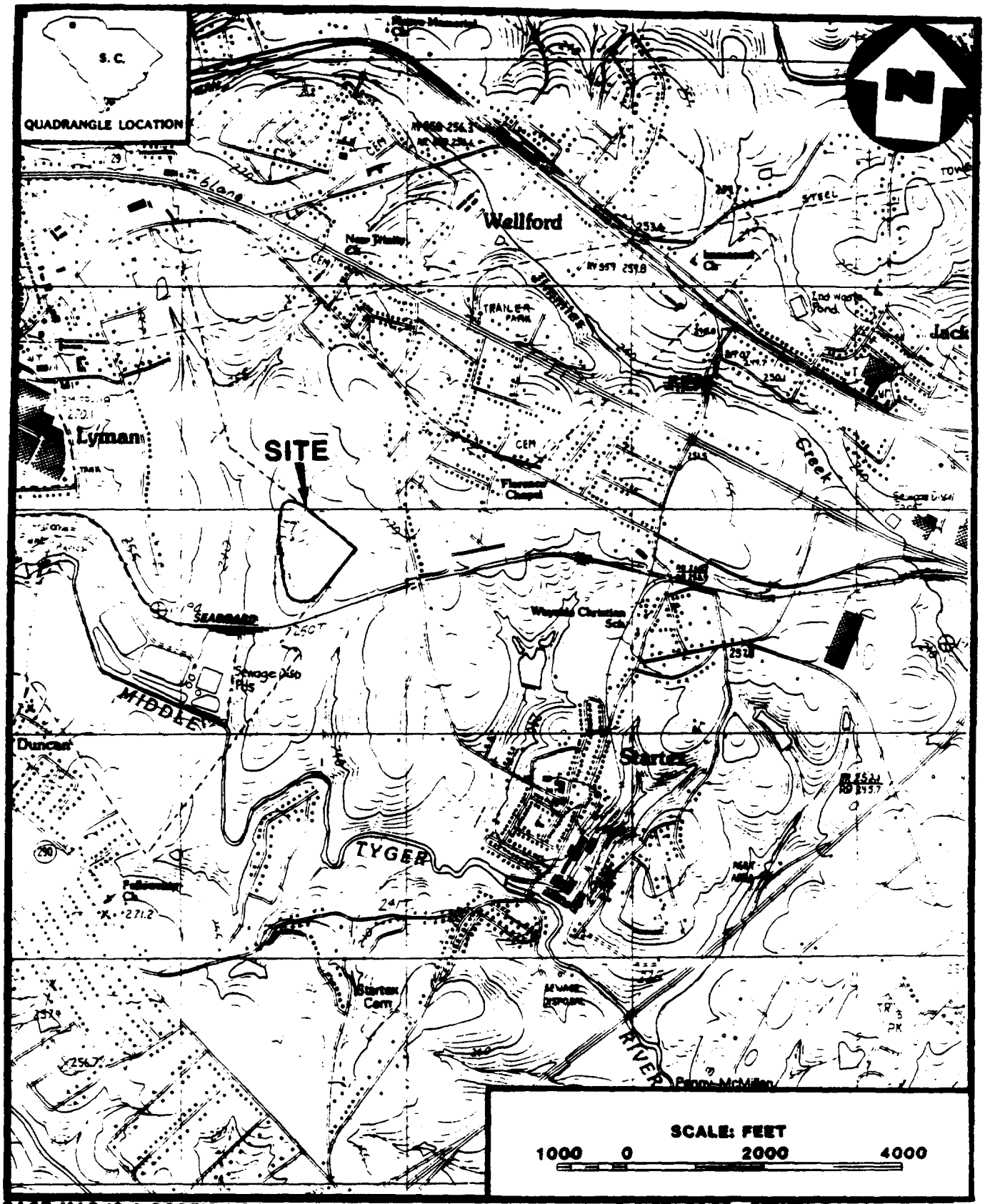
The Old Startex, Spartanburg County Landfill is located off Finch Road in Startex, Spartanburg County, South Carolina (Figure 1). The landfill, although owned by Lyman Printing and Finishing Company, was operated by Spartanburg County from the mid to late 1960s through the early 1970s. During this time, the landfill accepted wastes from Lyman Printing and Finishing Company, Spartanburg County, and other industries for disposal of household and industrial waste or refuse (Ref. 1). When Spartanburg County ceased operations at the site, Lyman Printing and Finishing Company closed access of the site to the public and other industries. Since that time, Lyman Printing and Finishing Company (now Springs Industries) has used the site for disposal of coal cinders from their furnace (Refs. 1, 2).

Neither Spartanburg County nor Lyman Printing and Finishing Company ever applied for a permit to operate a waste disposal landfill. Springs Industries has recently agreed with the South Carolina Department of Health and Environmental Control to stop using the landfill for waste disposal in an effort to avoid having to get the landfill permitted (Ref. 3).

2.2 SITE DESCRIPTION

2.2.1 Site Features

The site is approximately 30 to 40 acres in size (Ref. 1). Its entire surface area is covered with coarse to fine coal cinders. No other waste type was observed at the site. The landfill is thought to be an area fill type of landfill due to the shallow depth to bedrock and surrounding rolling hill topography. A thick border of dense vegetation and some heavily wooded areas surround the site. There was no evidence of any stressed vegetation or odor within the area. Leachate was observed in the northwest corner of the property in an area downgradient of the landfill. The leachate was orange to red in color and seemed to be stagnant in small pools. A dirt road, with a gate at the entrance, leads to the site. The site itself is not fenced, but accessibility by the public is limited due to its location (Ref. 2, Figure 2).

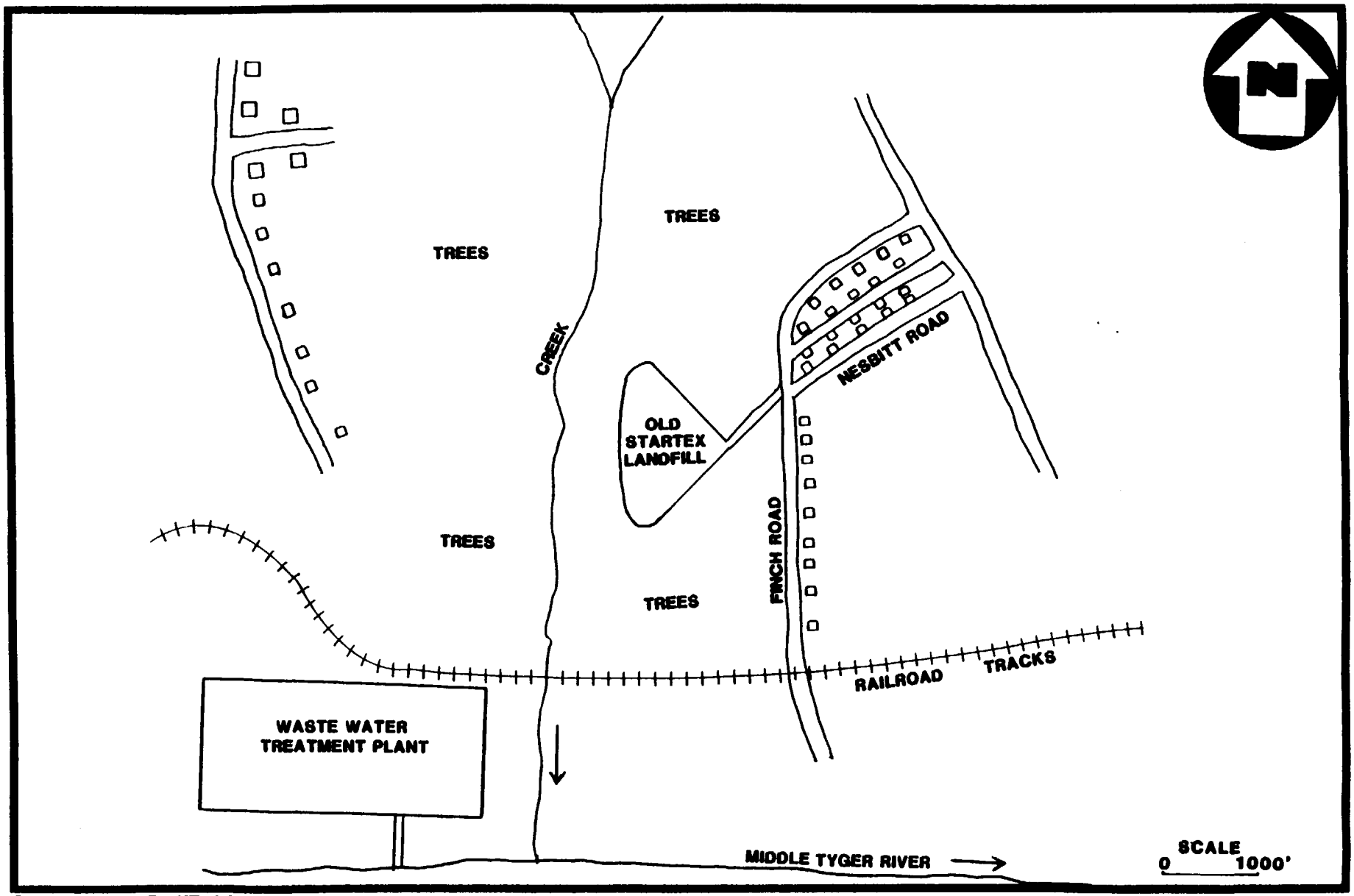


BASE MAP IS A PORTION OF THE U.S.G.S. 7.5 MINUTE QUADRANGLE WELLFORD, SOUTH CAROLINA 1983.

SITE LOCATION MAP
OLD STARTEX, SPARTANBURG COUNTY LANDFIILL
STARTEX, SOUTH CAROLINA

FIGURE 1

NUS CORPORATION



SITE LAYOUT MAP
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SOUTH CAROLINA

FIGURE 2

NUS CORPORATION

2.2.2 Waste Characteristics

It is unknown as to the exact amount and type of waste buried in the landfill, since it received waste from various sources (Ref. 1). The landfill is thought to have received a minimum amount of liquid organic and inorganic waste from Lyman Printing and Finishing Company, as stated in the 103(c) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) notification submitted by Lyman Dyeing and Finishing Company in June 1981 (Ref. 1). Most chemical wastes generated by local industry were typically drained into the wastewater treatment system. Other waste types possibly associated with this type of landfill are textile rags, cardboard, brick, blocks, and fly ash (Ref. 4).

Some of the waste types commonly associated with printing and dyeing facilities are soaps of cobalt, manganese, and lead formed with organic acids such as linolenic, naphthenic, and octanoic acids (Ref. 5, p. 379). Other waste types include metal-complex dyes made with chromium, copper, cobalt, and nickel (Ref. 6, p. 378). Solvents associated with inks include alcohols, aliphatic naphthas, aromatic hydrocarbons, esters, glycol ethers, ketones, and nitroparaffin (Ref. 5, p. 387).

3.0 REGIONAL POPULATIONS AND ENVIRONMENTS

3.1 POPULATION AND LAND USE

3.1.1 Demography

The site is located in a small, rural area between the cities of Startex, Wellford, Lyman, and Duncan, South Carolina. These cities are all within a 0.5- to 1-mile radius of the site. The nearest residence to the site is 800 feet east along Finch Road (Appendix A). Population within a 1-mile radius is 3,077, within a 4-mile radius is 10,965 (Ref. 7).

3.1.2 Land Use

Land use within a 4-mile radius of the site is a mixture of rural and residential with commercial property scattered throughout the communities (Appendix A). Much of the rural land is used for raising cattle and growing fescue for winter feed (Ref. 2). Numerous schools and churches are located within a 2-mile radius of the site (Appendix A). There are no land-related sensitive environments or endangered species associated specifically with Spartanburg County. Some species of mammals and birds are endangered throughout the state (Ref. 8).

3.2 SURFACE WATER

3.2.1 Climatology

The climate of Spartanburg County is described as mild. Summers range from May to September with average temperatures of 90°F or higher. Fall lasts from September to November and contains some of the most pleasant weather of the year with light rainfall, plenty of sunshine, and moderate temperatures. Winters are mild and relatively short with approximately 60 days of the season consisting of temperatures at freezing or below. Spring begins during the month of March and continues through to May. It frequently consists of cold and windy days followed by warmer, more pleasant days (Ref. 9, pp. 76, 77). Spartanburg County receives a net annual precipitation of 12 inches and a 1-year, 24-hour rainfall of 3.5 inches (Refs. 10, pp. 29, 39; 11, p. 93).

3.2.2 Overland Drainage

There are no distinct overland drainage pathways at the site. All precipitation is absorbed by the highly permeable, surficial coal cinders. The western outer edge of the landfill dips gently to the west for approximately 1,000 feet to an unnamed stream. The stream flows south for 2,000 feet then flows into the Middle Tyger River. This river continues flowing in a southeasterly direction for 12 miles before converging with the North Tyger River. The North Tyger River continues in a southeasterly direction for the remainder of the surface water pathway (Appendix A).

3.2.3 Potentially Affected Water Bodies

The Middle Tyger and North Tyger rivers are the primary water bodies encountered along a 15-mile, surface water pathway from the site. At the city of Lyman, upgradient of any influence from the site, the Middle Tyger River is an effluent receiving source for the city's waste treatment plant which treats domestic and industrial waste. The discharge of 8,000,000 gallons has resulted in a serious degradation of the scenic and aesthetic values of the river as well as a reduction in the fisheries population (Refs. 2, 12). This river is not used for any type of fishing or recreation from the discharge pipe of the Lyman Waste Plant to the city of Startex. From there, the river becomes cleaner as the heavy silt from the waste treatment plant settles out. Fishing and recreation along the Middle Tyger River restores and continues into the North Tyger River (Ref. 13).

The only surface water intake on the Middle Tyger River is located upstream of the waste treatment plant and the perennial stream which passes near the site. This intake serves the city of Lyman (Ref. 2). There are no other known surface water intakes along the Middle Tyger or North Tyger rivers (Ref. 14).

All other surrounding communities within a 4-mile radius of the site obtain potable water from various sources. The Greer Water Department has one intake located at the eastern end of Lake Cunningham, which is outside of any influence from the site. The cities of Startex, Jackson, Wellford, and Duncan formed the SJWD Water Corporation which has two wells located in Inman and buys water from Spartanburg. SJWD supplies water to most of the area surrounding the site. Spartanburg obtains its water from a surface water intake on William C. Bowen Lake which is located outside of any influence from the site (Ref. 15, Appendix A).

There are no known federally listed endangered species or sensitive environments located along the Middle Tyger or North Tyger rivers for 15 stream miles from the site (Ref. 8).

3.3 GROUNDWATER

3.3.1 Hydrogeology

The Old Startex Spartanburg County Landfill is located within the Piedmont physiographic province of northwestern South Carolina, which is characterized by a series of complexly fractured and folded metamorphic rocks containing numerous igneous intrusions. The facility lies within the Inner Piedmont Belt, which is composed of highly metamorphosed gneisses and schists of Pre-Cambrian age, intruded in many areas by younger granites (Ref. 16, p. 13). The topography of the area is regionally mature, consisting of a broad plateau dissected by streams that generally trend southeast (Ref. 16, pp. 9, 10). The land surface has moderate relief, with generally subdued topographic features such as well-rounded hills with no prominent peaks or ridges (Ref. 16, p. 7).

Locally, the soils around the facility consist of moderately permeable sandy clay and clay loams of the Davidson series (Ref. 9, pp. 14, 64-65, sheet 28). Soils of this series are formed from the weathering of gabbro, diorite, and hornblende schists or gneisses. These soils are typically deep and well-drained (Ref. 9, pp. 14). Davidson series soils are generally greater than 15 feet thick and have an estimated hydraulic conductivity of 1.0×10^{-4} to 1.0×10^{-7} cm/sec (Refs. 9, pp. 14; 17, p. 2).

Depth to groundwater at the facility is estimated to be 20 feet below land surface, and the predominant direction of groundwater flow is to the west toward the Middle Tyger River (Refs. 17, p. 2). Both water-table and artesian conditions can be found in the general area, since the regolith may locally have low permeability and act as a confining layer, but water-table conditions are most likely (Ref. 16, p. 58).

3.3.2 Aquifer Use

The only known users of groundwater within a 4-mile radius of the site are those houses which are not located near water supply lines. There are 204 houses (775 people based on 3.8 per house), all within a 3-mile radius and an additional 257 houses (976 people) between a 3- to 4-mile radius of the site which are thought to use private wells for drinking water. The nearest well is located 0.3 mile east of the site (Ref. 17, p. 2).

3.4 SUMMARY OF POTENTIALLY AFFECTED POPULATIONS AND ENVIRONMENTS

The primary pathways of concern at the site are groundwater and surface water. Contaminants from the landfill could leach into the shallow water table. There are approximately 204 homes (976 people) with private wells within a 3-mile radius of the site that use groundwater as their source of potable water. The surface water pathway is also of concern, since the Middle Tyger and the North Tyger rivers are used for fishing and recreation. The air and onsite exposure pathways are also of concern because of the potential for contaminated airborne particles to come in contact with anyone present at the site.

4.0 FIELD INVESTIGATION

4.1 SAMPLE COLLECTION

4.1.1 Sample Collection Methodology

All sample collection, sample preservation, and chain-of-custody procedures used during this investigation were in accordance with the standard operating procedures as specified in Sections 3 and 4 of the Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual; United States Environmental Protection Agency, Region IV, Environmental Services, Division, April 1, 1986.

4.1.2 Duplicate Samples

Vince Blount, a geologist with Universal Engineering Sciences, Orlando, Florida, accepted split samples on behalf of Alan McManus, Environmental Manager, Springs Industries (Ref. 2).

4.1.3 Description of Samples and Sample Locations

Eighteen environmental samples were collected during the investigation. Sample locations and rationale are shown in Table 1. Sample locations are mapped on Figure 3. Six surface soil samples were collected: one background and five from various locations along the perimeter of the landfill. Four subsurface samples were collected from the same sampling locations as the surface soils. Samples OS-SB-04 and OS-SB-05 were not collected due to contact with bedrock at shallow depths. Four sediment samples were collected in all: two from an unnamed perennial stream near the site and two from the Middle Tyger River. One sample was collected on the unnamed stream upgradient of the site for background. Another sample was collected on the same stream downgradient of the site. One sample was collected upgradient of the confluence of the unnamed stream and the Middle Tyger River. The other sample was collected downgradient of that confluence. Four surface water samples were collected from the same sample locations as the sediments.

4.1.4 Field Measurements

Field measurements were taken on all surface water samples. Samples were measured for pH, conductivity, and temperature. Measurements are shown in Table 2.

TABLE 1

SAMPLE CODES, DESCRIPTIONS, LOCATIONS, AND RATIONALE
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Sample Type	Location	Rationale
OS-SS-01	Surface Soil	Entrance to landfill, along Finch Road	Control sample
OS-SS-02	Surface Soil	Northeast edge of landfill	Detection around landfill perimeter
OS-SS-03	Surface Soil	Northwest edge of landfill	Detection around landfill perimeter
OS-SS-04	Surface Soil	West edge of landfill	Detection around landfill perimeter
OS-SS-05	Surface Soil	Southwest corner of landfill	Detection around landfill perimeter
OS-SS-06	Surface Soil	Southeast edge of landfill	Detection around landfill perimeter
OS-SB-01	Subsurface Soil	Same as SS-01, collected at 6-7' below land surface (bls)	Control sample
OS-SB-02	Subsurface Soil	Same as SS-02, collected at landfill perimeter 4' bls	To determine presence or absence of contamination
OS-SB-03	Subsurface Soil	Same as SS-03, collected at landfill perimeter 3-6' bls	To determine presence or absence of contamination
OS-SB-04	Subsurface Soil	Not Collected	Hit bedrock at 1' bls
OS-SB-05	Subsurface Soil	Not Collected	Hit bedrock at 2' bls
OS-SB-06	Subsurface Soil	Same as SS-06, collected at landfill perimeter 4-5' bls	To determine presence or absence of contamination
OS-SD-01	Sediment	Background	Control sample for perennial stream
OS-SD-02	Sediment	On site, downgradient sediment along perennial stream	To determine presence or absence of contamination
OS-SD-03	Sediment	Background	Control sample for Tyger River
OS-SD-04	Sediment	On site	Downgradient on Tyger River

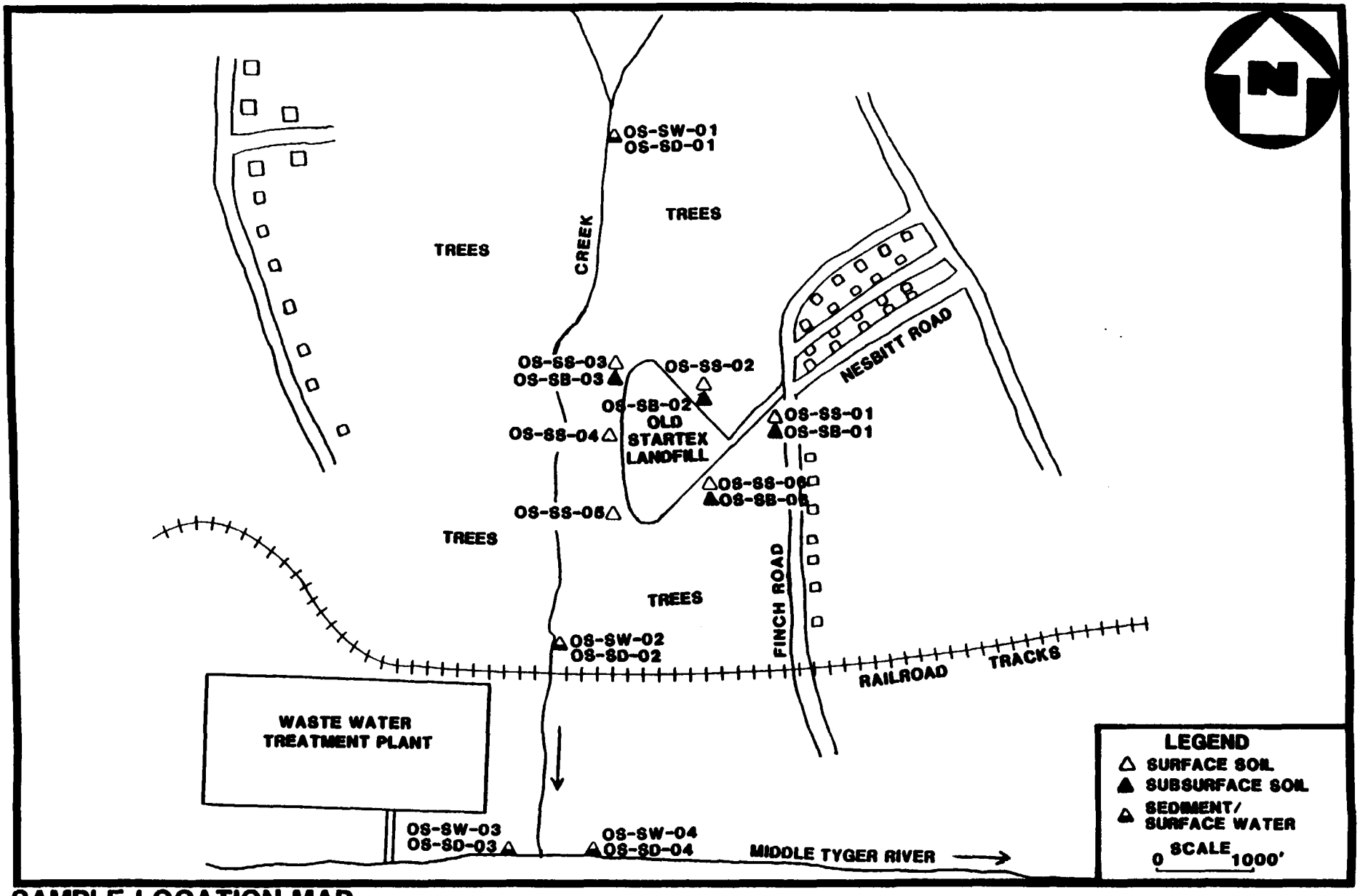
OS - Old Startex
SS - Surface Soil
SB - Subsurface Soil
SD - Sediment
SW - Surface Water

TABLE 1

SAMPLE CODES, DESCRIPTIONS, LOCATIONS, AND RATIONALE
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Sample Type	Location	Rationale
OS-SW-01	Surface Water	Background	Control sample for perennial stream
OS-SW-02	Surface Water	Downgradient along perennial stream	To determine presence or absence of contamination
OS-SW-03	Surface Water	Background	Control sample for Middle Tyger River
OS-SW-04	Surface Water	Downgradient of perennial stream confluence with Middle Tyger River	To determine presence or absence of contamination

OS - Old Startex
SS - Surface Soil
SB - Subsurface Soil
SD - Sediment
SW - Surface Water



SAMPLE LOCATION MAP
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SOUTH CAROLINA

FIGURE 3

NUS CORPORATION

TABLE 2

FIELD MEASUREMENTS
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Date (1990)	Time	pH	Temp. (°C)	Conductivity (umhos/cm)
OS-SW-01	9/25	855	6.14	15	70.0
OS-SW-02	9/25	1050	6.84	17	46.1
OS-SW-03	9/25	1250	7.7	25	506
OS-SW-04	9/25	1245	7.61	24	383

OS - Old Startex
SW - Surface Water

4.2 SAMPLE ANALYSIS

4.2.1 Analytical Support and Methodology

All samples collected were analyzed under the Contract Laboratory Program (CLP) and analyzed for all parameters listed in the Target Compound List (TCL). Organic analysis of soil and water samples was performed by Gulf South Research Institute (GULF), New Orleans, Louisiana. Inorganic analysis of soil and water was performed by Silver Valley (SILVER), Kellogg, Indiana.

All laboratory analyses and laboratory quality assurance procedures used during this investigation were in accordance with standard procedures and protocols as specified in the Analytical Support Branch Operations and Quality Assurance Manual, United States Environmental Protection Agency, Region IV, Environmental Services Division, revised June 1, 1985; or as specified by the existing United States Environmental Protection Agency standard procedures and protocols for the contract analytical laboratory program.

4.2.2 Analytical Data Quality

All analytical data were subjected to a quality assurance review as described in the EPA Environmental Services Division laboratory data guidelines. In the tables, some of the concentrations of the organic and inorganic parameters have been flagged with a "J". This indicates that the qualitative analysis was acceptable, but the quantitative value has been estimated. A few other compounds are flagged with an "N", indicating that they were detected based on the presumptive evidence of their presence. This means that the compound was tentatively identified, and its detection cannot be used as a positive identification as to its presence. The complete analytical data sheets are provided in Appendix B.

4.2.3 Presentation of Analytical Results

Throughout the following discussion of analytical results, the concentrations of some of the contaminants have been described as "elevated". This means that the concentration was either three times that found in the background sample, or it was three times the minimum quantitation limit (MQL) of that contaminant in the background sample.

Table 3 presents a summary of organic results for the soil trip blank (analyzed for purgeable organics only) and six surface soil samples. Concentrations are compared to the background surface soil

sample, OS-SS-01. Elevated organic contamination was found in sample OS-SS-02 (from the northeast edge of the landfill) and OS-SS-03 (from the northwest edge of the landfill). Acetone was found in surface soil OS-SS-03, at over 50 times the MQL. (Acetone is commonly used in laboratories.) Several tentatively identified compounds (TICs) were reported in this sample: levels of benzothiazolone, hexadecanoic acid, and butoxyethanol phosphate were estimated to range from 2,000 to 4,000 ug/kg. Phosphate esters, particularly butoxyethanol phosphate (also known as tris(butoxyethyl) phosphate), are used as plasticizers and leveling agents (Ref. 18, p. 323). Fifteen unidentified compounds, estimated total of 90,000 ug/kg, were also reported. Petroleum product was tentatively identified in this sample and in OS-SS-06, which also contained 10 unidentified compounds totaling 10,000 ug/kg.

Diethyl phthalate was found in sample OS-SS-03 (less than twice background), and bis(2-ethylhexyl)phthalate was found in OS-SS-04 (five times background). Both are commonly used as plasticizers. The only other surface soil sample showing elevated organic contamination was OS-SS-02, which contained 12 different polynuclear aromatic hydrocarbon (PAH) compounds. Most levels were near or below MQLs except for fluoranthene and pyrene, which exceeded background MQLs by almost three times.

The results of the organic analysis of the four subsurface soil samples are summarized in Table 4. The only sample showing significant contamination was OS-SB-03. The volatile compounds chlorobenzene, ethyl benzene, xylenes, and ethylmethyl benzene (TIC) were reported at low levels ranging from near background MQLs to almost four times background MQLs. Typical occurrences of this type of compound are as solvents or components of gasoline.

The analysis of sample OS-SB-03 for extractable compounds revealed several compounds that were tentatively identified or unidentified. Banzothiozalone and butoxyethanolphosphate were tentatively identified, both at an estimated concentration of 2,000 ug/kg. (Both of these compounds were also reported in surface soil OS-SS-03). Also, fourteen unidentified compounds were reported at an estimated total of 10,000 ug/kg.

Organic results from sediment and surface water samples are summarized in Tables 5 and 6. The only organic compounds reported in any of the four sediment samples were estimated low levels of unidentified compounds and tetramethylbutane (TIC). Fluoranthene and pyrene were found in surface water sample OS-SW-04, at 2 to 3 ug/l, well under the background MQLs of 10 ug/l.

Tetramethylbutane was reported in the soil trip blank, in all six surface soil samples, in two (of four) subsurface soil samples, and in three (or four) sediment samples (a total of 11 out of 14 soil/sediment

TABLE 3

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SURFACE SOIL SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/kg)	Soil Trip Blank	Background	Landfill Perimeter				
			Northeast	Northwest	West	Southwest	Southeast
	OS-TB-01S	OS-SS-01	OS-SS-02	OS-SS-03	OS-SS-04	OS-SS-05	OS-SS-06
PURGEABLE COMPOUNDS							
ACETONE	-	11U	-	630	-	-	-
TETRAMETHYLBUTANE(1)	20JN	40JN	50JN	80JN	20JN	30JN	60JN
PROPADIENE(1)						4JN	
EXTRACTABLE COMPOUNDS							
DIETHYL PHTHALATE	-	380U	-	600J	-	-	-
PHENANTHRENE	-	380U	520	-	-	-	-
ANTHRACENE	-	380U	100J	-	-	-	-
FLUORANTHENE	-	380U	1100	210J	76J	-	-
PYRENE	-	380U	1100	380J	110J	-	-
BENZO(A)ANTHRACENE	-	380U	430	-	-	-	-
CHRYSENE	-	380U	570	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	-	380U	-	-	1900	-	-
BENZO(B AND/OR K)FLUORANTHENE	-	380U	770J	-	-	-	-
BENZO-A-PYRENE	-	380U	370J	-	-	-	-
INDENO (1,2,3-CD) PYRENE		380U	230J	-			-

- Material analyzed for but not detected above minimum quantitation limit (MQL)
J Estimated value.
N Presumptive evidence of presence of material
U Material was analyzed for but not detected. The number given is the MQL.
- Tentatively identified compound. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined

TABLE 3

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SURFACE SOIL SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/kg)	Soil Trip Blank	Background	Landfill Perimeter				
			Northeast	Northwest	West	Southwest	Southeast
	OS-TB-01S	OS-SS-01	OS-SS-02	OS-SS-03	OS-SS-04	OS-SS-05	OS-SS-06
DIBENZO(A,H)ANTHRACENE	-	380U	130J	-	-	-	-
BENZO(GHI)PERYLENE	-	380U	260J	-	-	-	-
BENZOFLUORANTHENE(NOT B OR K)(1)			200JN				
PINENE(1)			500JN				
UNIDENTIFIED COMPOUNDS/NO			400J/1	90,000J/15	3000J/6	800J/1	10,000J/10
PETROLEUM PRODUCT(1)				N			N
BENZOTHIAZOLONE(1)				2000JN			
HEXADECANOIC ACID(1)				4000JN			1000JN
BUTOXYETHANOLPHOSPHATE(1)				3000JN			

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value.
N Presumptive evidence of presence of material.
U Material was analyzed for but not detected. The number given is the MQL.
(1) Tentatively identified compound. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.

TABLE 4

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SUBSURFACE SOIL SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/kg)	Soil Trip Blank	Background	Landfill Perimeter		Landfill Perimeter
			Northeast	Northwest	Southeast
	OS-TB-01S	OS-SB-01	OS-SB-02	OS-SB-03*	OS-SB-06
PURGEABLE COMPOUNDS					
CHLOROBENZENE	-	6U	-	19	-
ETHYL BENZENE	-	6U	-	9	-
TOTAL XYLENES	-	6U	-	22	-
TETRAMETHYLBUTANE(1)	20JN	90JN		10JN	
ETHYLMETHYLBENZENE(1)				100JN	
UNIDENTIFIED COMPOUNDS/NO					20J/1
EXTRACTABLE COMPOUNDS					
BIS(2-ETHYLHEXYL) PHTHALATE	-	900	-	-	-
UNIDENTIFIED COMPOUNDS/NO				10,000J/14	
BENZOTHIAZOLONE(1)				2000JN	
BUTOXYETHANOLPHOSPHATE(1)				2000JN	

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J *Estimated value.*
N Presumptive evidence of presence of material.
U Material was analyzed for but not detected. The number given is the MQL.
(1) Tentatively identified compound. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.
* Samples OS-SB-04 and OS-SB-05 were not collected.

TABLE 5

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SEDIMENT SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/kg)	Background Upgradient OS-SD-01	Downgradient of Landfill OS-SD-02	Background Upgradient OS-SD-03	Downgradient of Landfill OS-SD-04
PURGEABLE COMPOUNDS				
TETRAMETHYLBUTANE[1]		10JN	20JN	20JN
UNIDENTIFIED COMPOUND NO	50J3			

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value.
N Presumptive evidence of presence of material.
(1) Tentatively identified compound. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.

TABLE 6

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SURFACE WATER SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/l)	Trip Blank OS-TB-01	Background Upgradient OS-SW-01	Downgradient of Landfill OS-SW-02	Background Upgradient OS-SW-03	Downgradient of Landfill OS-SW-04
EXTRACTABLE COMPOUNDS					
FLUORANTHENE	-	-	-	10U	2J
PYRENE	-	-	-	10U	3J
HEXANEDIOIC ACID ETHYLHEXYLESTER(1)		4JN			

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value.
N Presumptive evidence of presence of material.
U Material was analyzed for but not detected. The number given is the MQL.
(1) Tentatively identified compound. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.

samples). Concentrations ranged from 10 to 90 ug/kg. Because of its appearance in the trip blank and background samples, it is probably not attributable to the site. Tetramethylbutane is very similar to iso-octane, a common lab solvent (both are 8-carbon alkanes).

Table 7 presents inorganic results for the six surface soil samples. Cobalt was present in OS-SS-03 at 100 times the background MQL. In samples OS-SS-04, OS-SS-05, and OS-SS-06, cobalt levels exceeded background MQLs by factors of three to four. In OS-SS-03, levels of eight additional metals exceeded background levels by factors of three to 10.

Table 8 presents inorganic results for the four subsurface soil samples. Calcium levels exceeded the background MQL for all three onsite subsurface samples (OS-SB-02, OS-SB-03, and OS-SB-06), by factors of 10 to 17. Estimated values for chromium were also detected in samples OS-SB-02 and OS-SB-06 at elevated levels.

Results of inorganic analysis of the four sediment samples are summarized in Table 9. Several results are marginally elevated. Sediment OS-SD-02 contains almost four times as much iron and vanadium as the upstream background at OS-SD-01. For OS-SD-04, levels of aluminum, barium, chromium, copper, lead, magnesium, and vanadium exceeded background levels (based on OS-SD-03, upstream), by three to five times.

The results of inorganic analysis of the four surface water samples are summarized in Table 10. OS-SW-02 is compared to the upstream background at OS-SW-01, and OS-SW-04 is compared to the upstream background at OS-SW-03. For all inorganic parameters measured for these surface water samples, differences were negligible.

TABLE 7

SUMMARY OF INORGANIC ANALYTICAL RERSULTS
SURFACE SOIL SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (mg/kg)	Background	Landfill Perimeter				
		Northeast	Northwest	West	Southwest	Southeast
	OS-SS-01	OS-SS-02	OS-SS-03	OS-SS-04	OS-SS-05	OS-SS-06
ALUMINUM	89,000	21,000	33,000	61,000	11,000	26,000
ARSENIC	13J	2.6J	-	-	11J	-
BARIUM	52	54	230	110	200	140
CALCIUM	430	480	2000	790	4400	3100
CHROMIUM	65J	54J	44J	88J	13J	44J
COBALT	2.3U	5.2	240	9	8	7.4
COPPER	32	17	38	40	35	23
IRON	73,000	24,000	100,000	63,000	10,000	28,000
LEAD	58J	18J	51J	34J	11J	33J
MAGNESIUM	490	410	1600	2000	760	1000
MANGANESE	130	390	1400	170	65	450
NICKEL	9.1U	7.8	30	19	16	-
POTASSIUM	290U	-	1400	2100	-	-
SELENIUM	0.98UJ	1.9	-	-	-	-
SILVER	1.3U	-	-	-	-	2.9N
SODIUM	30U	-	150	-	190	
VANADIUM	220	64	80	180	44	73
ZINC	29	73	120	33	-	38

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value.
N Presumptive evidence of presence of material.
U Material was analyzed for but not detected. The number given is the MQL.

TABLE 8

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SUBSURFACE SOIL SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

	Background	Landfill Perimeter		Landfill Perimeter
		Northeast	Northwest	Southeast
PARAMETERS (mg/kg)	OS-SB-01	OS-SB-02	OS-SB-03*	OS-SB-06
ALUMINUM	61,000	80,000	6500	39,000
BARIUM	180	60	52	75
CALCIUM	20U	200	350	330
CHROMIUM	40J	130J	18J	140J
COBALT	18	8.5	48	6
COPPER	92	71	2 8	29
IRON	68,000	94 000	4300	37,000
LEAD	39J	24J	9 8J	16J
MAGNESIUM	7700	800	290	880
MANGANESE	410	400	900	290
NICKEL	17	28	-	7 5
POTASSIUM	6800	-	-	-
SELENIUM	0.70U	3.7J	-	-
SILVER	0.93U	-	-	3 7JN
VANADIUM	170	250	16	100
ZINC	87	45	-	27

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value.
N Presumptive evidence of presence of material.
U Material was analyzed for but not detected. The number given is the MQL.
* OS-SB-04 and OS-SB-05 were not collected.

TABLE 9

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SEDIMENT SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (mg/kg)	Background Upgradient OS-SD-01	Downgradient of Landfill OS-SD-02	Background Upgradient OS-SD-03	Downgradient of Landfill OS-SD-04
ALUMINUM	6500	6100	1900	6600
BARIUM	34	18	9.6	29
CALCIUM	98	56	50U	99
CHROMIUM	46J	100J	4.6J	19J
COBALT	-	-	1.8U	2.4
COPPER	9.6	-	2U	8.5
IRON	7900	29,000	3200	7800
LEAD	8J	5.8J	2.5J	7.4J
MAGNESIUM	1000	380	130	650
MANGANESE	76	75	160	130
SODIUM	30U	-	27	23
VANADIUM	22	84	7.1	18

- Material analyzed for but not detected above minimum quantitation limit (MQL).
J Estimated value
U Material was analyzed for but not detected. The number given is the MQL.

TABLE 10

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SURFACE WATER SAMPLES
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

PARAMETERS (ug/l)	Trip Blank OS-TB-01	Background Upgradient OS-SW-01	Downgradient of Landfill OS-SW-02	Background Upgradient OS-SW-03	Downgradient of Landfill OS-SW-04
BARIUM	-	22	19	16	18
CALCIUM	-	2800	2900	2600	2600
COPPER	-	-	-	40	39
IRON	-	-	-	650	750
MAGNESIUM	-	1300	1400	1900	1900
MANGANESE	-	13	30	83	83
NICKEL	-	-	-	28U	38
POTASSIUM	-	-	-	5600	5100
SODIUM	-	2800	2900	86,000	85,000
VANADIUM	-	-	-	11	14
ZINC	-	-	-	110	110

- Material analyzed for but not detected above minimum quantitation limit (MQL).

U Material was analyzed for but not detected. The number given is the MQL.

5.0 SUMMARY

There are approximately 775 people located within the 3-mile radius of the facility who are presumed to use private wells for drinking water. All other residents in the area obtain their water from surface water, an alternate, unthreatened source.

Eighteen environmental samples were collected during the investigation. Six surface soil, four subsurface soil, four sediment, and four surface water samples. Low levels of organics were found in some of the surface and subsurface soil samples. Surface water samples showed no elevated levels of organics.

Various levels of inorganics such as aluminum, barium, chromium, cobalt, copper, lead, magnesium, manganese, and vanadium, were found in surface, subsurface, and sediment soil samples. Some of these elements such as chromium, cobalt, copper, lead, and manganese are used in the production of inks and dyes. The presence of these metals could possibly be associated with waste disposal activities at the landfill by the Lyman Printing and Finishing Company. No elevated levels of inorganics were found in surface water samples.

Based upon the limited targets in the area and low concentrations of isolated contaminants detected during this investigation, FIT 4 recommends no further remedial action be planned for the Old Startex, Spartanburg County Landfill. However, FIT 4 does recommend that applicable state and/or county agencies monitor several of the closest private wells to the landfill due to groundwater depth and the presence of several polynuclear aromatic hydrocarbons detected in surface soil samples.

REFERENCES

1. EPA Notification of Hazardous Waste Site (EPA Form 8900-1) for Lyman Dyeing and Finishing Company, Lyman, South Carolina. Filed by Lamac T. Oxford, Vice President, June 22, 1981.

2. NUS Corporation Field Logbook No. F4-2550 for Old Startex, Spartanburg County Landfill, TDD No. F4-9007-22. Documentation of sample collection activity, September 24, 1990.

3. Gerald Stewart, South Carolina Department of Health and Environmental Control, telephone conversation with Terry Ryland, NUS Corporation, February 20, 1991. Subject: RCRA compliance of Old Startex Landfill.

4. Record of Communication between Gerald Stewart and Nick Odom, Environmental Manager, Springs Industries, Inc., November 28, 1988. Subject: Ownership history and waste disposal practices at the Old Startex, Spartanburg County Landfill, and Old Lyman Dump.

5. Bohdan V. Burachinsky, Hugh Dunn, and James K. Ely, "Inks," Kirk-Othmer Encyclopedia of Chemical Technology, 3rd ed., Vol. 13 (New York: John Wiley & Sons, 1981).

6. John Elliott and Patrick P. Yeung, "Dyes, Reactive," Kirk-Othmer Encyclopedia of Chemical Technology, 3rd ed., Vol. 8 (New York: John Wiley & Sons, 1979).

7. U.S. Environmental Protection Agency, Graphical Exposure Modeling System (GEMS) Data Base, compiled from U.S. Bureau of the Census data (1980).

8. U.S. Fish and Wildlife Service, Endangered and Threatened Species of the Southeastern United States (Atlanta, Georgia, 1988).

9. U.S. Department of Agriculture, Soil Survey, Spartanburg County, South Carolina (April 1968).

10. U.S. Department of Commerce, Climatic Atlas of the United States (Washington, D.C.: GPO, June 1968) Reprint: 1983, National Oceanic and Atmospheric Administration.

11. U.S. Department of Commerce, Rainfall Frequency Atlas of the United States, Technical Paper No. 40 (Washington, D.C.: GPO, June 1961).

12. Information on the Middle Tyger River obtained from Randy Geddings, South Carolina Wildlife and Marine Resources Department, Clemson, South Carolina, August 1990.

13. Randy Geddings, South Carolina Wildlife and Marine Resources Department, telephone conversation with Terry Ryland, NUS Corporation, January 31, 1991. Subject: The Middle Tyger River.

14. NUS Corporation Field Logbook No. F4-2429 for Old Lyman Dump, TDD No. F4-9007-23. Documentation of facility reconnaissance, August 14, 1990.

15. NUS Corporation Field Logbook No. F4-1439 for Safety Kleen, TDD No. F4-8904-15. Documentation of local water information, May 31, 1989.

16. W.M. Bloxham, George E. Siple, and T. Ray Cummings, Water Resources of Spartanburg County, South Carolina, South Carolina Water Resources Commission Report No. 3 (Spartanburg, South Carolina: U.S. Geological Survey, 1970).

17. Judy Canova, South Carolina Department of Health and Environmental Control, Division of Hydrogeology, memo to John Cresswell, Bureau of solid and Hazardous Waste Management, November 22, 1988. Subject: Hydrogeologic review of the Old Startex Spartanburg County Landfill

18. Francis J. Randall and Sean G. Dwyer, "Polishes," Kirk-Othmer Encyclopedia of Chemical Technology, 3rd ed., Vol. 18 (New York: John Wiley & Sons, 1982), p. 323.

EPA Notification of Hazardous Waste Site

R

Reference No. 1

United States Environmental Protection Agency Washington

This initial notification information is required by Section 103(c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and must be mailed by June 9, 1981.

Please type or print in ink. If you need additional space, use separate sheets of paper. Indicate the letter of the item which applies.

810609

SCS000000110 3

A Person Required to Notify:

Enter the name and address of the person or organization required to notify.

Name: Lyman Dyeing and Finishing Co.

Street: Pacific Street

City: Lyman State: S.C. Zip Code: 29365

B Site Location:

Enter the common name (if known) and actual location of the site.

SC D 980558191

Name of Site: Old Startex Spartanburg County Landfill

Street: End of road going south off old US 29 at Walt Moore's Stor

City: Startex County: Spartanburg State: S. C. Zip Code: 29377

C Person to Contact:

Enter the name, title (if applicable), and business telephone number of the person to contact regarding information submitted on this form.

Name (Last, First and Title): Holsten, John - Director of Regulatory Affairs

Phone: 803/433-4113

D Dates of Waste Handling:

Enter the years that you estimate waste treatment, storage, or disposal began and ended at the site.

From (Year): 1966-68 To (Year): 1981 ~~present~~

E Waste Type: Choose the option you prefer to complete

Option 1: Select general waste types and source categories. If you do not know the general waste types or sources, you are encouraged to describe the site in Item I—Description of Site.

General Type of Waste:
Place an X in the appropriate boxes. The categories listed overlap. Check each applicable category.

1. ☒ Organics
2. ☒ Inorganics
3. ☐ Solvents
4. ☐ Pesticides
5. ☐ Heavy metals
6. ☐ Acids
7. ☐ Bases
8. ☐ PCBs
9. ☒ Mixed Municipal Waste
10. ☒ Unknown
11. ☐ Other (Specify)

_____

_____

_____

Source of Waste:
Place an X in the appropriate boxes.

1. ☐ Mining
2. ☐ Construction
3. ☒ Textiles
4. ☐ Fertilizer
5. ☐ Paper/Printing
6. ☐ Leather Tanning
7. ☐ Iron/Steel Foundry
8. ☐ Chemical, General
9. ☐ Plating/Polishing
10. ☐ Military/Ammunition
11. ☐ Electrical Conductors
12. ☐ Transformers
13. ☐ Utility Companies
14. ☒ Sanitary/Refuse
15. ☐ Photofinish
16. ☐ Lab/Hospital
17. ☒ Unknown
18. ☐ Other (Specify)

_____

_____

_____

Option 2: This option is available to persons familiar with the Resource Conservation and Recovery Act (RCRA) Section 3001 regulations (40 CFR Part 261).

Specific Type of Waste:
EPA has assigned a four-digit number to each hazardous waste listed in the regulations under Section 3001 of RCRA. Enter the appropriate four-digit number in the boxes provided. A copy of the list of hazardous wastes and codes can be obtained by contacting the EPA Region serving the State in which the site is located.

0 9 0 1 7 6 0 0 3 1 1

RECEIVED EPA/REGION IV

JUN 4 11 12 AM '81 ENFORCEMENT DIVISION

RECEIVED EPA/REGION IV

12 32 PM '81 ENFORCEMENT DIVISION

Form Approved
OMB No. 2000-0138

EPA Form 8900-1

Notification of Hazardous Waste [illegible] Side Two

F Waste Quantity:

Place an X in the appropriate boxes to indicate the facility types found at the site.

In the "total facility waste amount" space give the estimated combined quantity (volume) of hazardous wastes at the site using cubic feet or gallons.

In the "total facility area" space, give the estimated area size which the facilities occupy using square feet or acres.

Facility Type

1. ☐ Piles
2. ☐ Land Treatment
3. ☒ Landfill
4. ☐ Tanks
5. ☐ Impoundment
6. ☐ Underground Injection
7. ☐ Drums, Above Ground
8. ☐ Drums, Below Ground
9. ☐ Other (Specify) _____

Total Facility Waste Amount C

cubic feet ~~13~~ 26 million

gallons _____

Total Facility Area

square feet _____

acres ~~30~~ 40 A

G Known, Suspected or Likely Releases to the Environment:

Place an X in the appropriate boxes to indicate any known, suspected, or likely releases of wastes to the environment.

☐ Known ☒ Suspected ☐ Likely ☐ None

Note: Items H and I are optional. Completing these items will assist EPA and State and local governments in locating and assessing hazardous waste sites. Although completing the items is not required, you are encouraged to do so.

H Sketch Map of Site Location: (Optional)

Sketch a map showing streets, highways, routes or other prominent landmarks near the site. Place an X on the map to indicate the site location. Draw an arrow showing the direction north. You may substitute a publishing map showing the site location.

I Description of Site: (Optional)

Describe the history and present conditions of the site. Give directions to the site and describe any nearby wells, springs, lakes, or housing. Include such information as how waste was disposed and where the waste came from. Provide any other information or comments which may help describe the site conditions.

(see attachment)

J Signature and Title:

The person or authorized representative (such as plant managers, superintendents, trustees or attorneys) of persons required to notify must sign the form and provide a mailing address (if different than address in item A). For other persons providing notification, the signature is optional. Check the boxes which best describe the relationship to the site of the person required to notify. If you are not required to notify check "Other".

Lamar T. Oxford

Name Lamar T. Oxford, Vice President

Street _____

City _____ State _____ Zip Code _____

Signature _____ Date 6/22/81

- ☒ Owner, Present
- ☐ Owner, Past
- ☐ Transporter
- ☐ Operator, Preser
- ☐ Operator, Past
- ☐ Other

I. The Old Startex Spartanburg County Landfill was opened in the middle-to-late 1960's, probably some time between 1966-1968. This land was and is owned by Lyman Printing & Finishing Company but was operated for several years by Spartanburg County with the understanding that Lyman P&F Co. could use the dump at no charge. Spartanburg County operated the dump site from its opening until some time in the early 1970's. During county operation the site was used for landfill disposal of domestic and industrial wastes or refuse. Industrial wastes were not limited to those originating from Lyman P&F Co. The identity and quantity of industrial wastes disposed of at this dump by Lyman P&F Co. during county operation are not known, but it is possible, because of the nature of the wastes generated by textile printing and finishing operations of that time, that some of those wastes would be classified as "hazardous" under current definitions. When Spartanburg County ceased operations at the site, Lyman P&F Co. closed access to the site to the public and other industries. Since that time, Lyman P&F Co. (now Lyman D&F Co.) has used the site as a disposal site for only broken wooden pallets and cinders from their boiler house.

We are reporting this site strictly because we do not know what all was dumped at the site during its active years. We know of no adverse environmental effects or of any health hazards posed by this dump.

EPA Notification of Hazardous Waste Site

United States
Environmental Protection
Agency
Washington DC 20460

This initial notification information is required by Section 103(c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and must be mailed by June 9, 1981.

Please type or print in ink. If you need additional space, use separate sheets of paper. Indicate the letter of the item which applies.

Person Required to Notify:

Enter the name and address of the person or organization required to notify.

Name: Lyman Dyeing and Finishing Co.

Street: Pacific Street

City: Lyman State: S.C. Zip Code: 29365

Site Location:

Enter the common name (if known) and actual location of the site.

Name of Site: Old Startex Spartanburg County Landfill

Street: End of road going south off old US 29 at Walt Moore's Stor

City: Startex County: Spartanburg State: S. C. Zip Code: 29377

Person to Contact:

Enter the name, title (if applicable), and business telephone number of the person to contact regarding information submitted on this form.

Name (Last, First and Title): Holsten, John - Director of Regulatory Affairs

Phone: 803/433-4113

Dates of Waste Handling:

Enter the years that you estimate waste treatment, storage, or disposal began and ended at the site.

From (Year): 1966-68 To (Year): present

Waste Type: Choose the option you prefer to complete

Option 1: Select general waste types and source categories. If you do not know the general waste types or sources, you are encouraged to describe the site in Item I—Description of Site.

General Type of Waste:
Place an X in the appropriate boxes. The categories listed overlap. Check each applicable category.

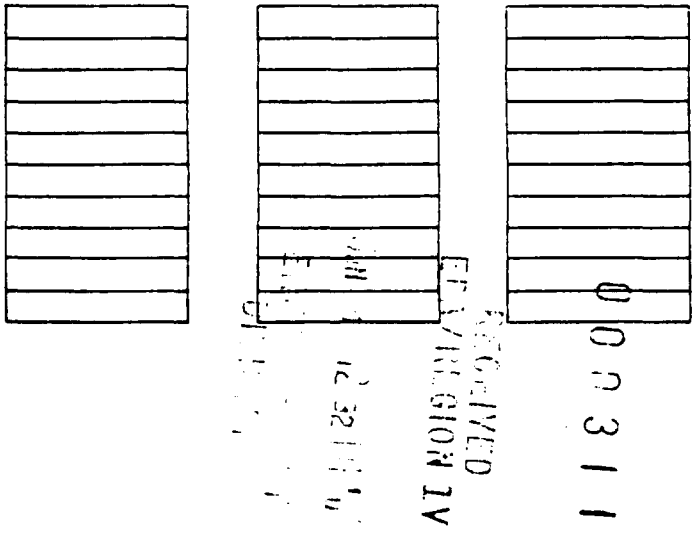
1. [X] Organics
2. [X] Inorganics
3. [ ] Solvents
4. [ ] Pesticides
5. [ ] Heavy metals
6. [ ] Acids
7. [ ] Bases
8. [ ] PCBs
9. [X] Mixed Municipal Waste
10. [X] Unknown
11. [ ] Other (Specify)

Source of Waste:
Place an X in the appropriate boxes.

1. [ ] Mining
2. [ ] Construction
3. [X] Textiles
4. [ ] Fertilizer
5. [ ] Paper/Printing
6. [ ] Leather Tanning
7. [ ] Iron/Steel Foundry
8. [ ] Chemical, General
9. [ ] Plating/Polishing
10. [ ] Military/Ammunition
11. [ ] Electrical Conductors
12. [ ] Transformers
13. [ ] Utility Companies
14. [X] Sanitary/Refuse
15. [ ] Photofinish
16. [ ] Lab/Hospital
17. [X] Unknown
18. [ ] Other (Specify)

Option 2: This option is available to persons familiar with the Resource Conservation and Recovery Act (RCRA) Section 3001 regulations (40 CFR Part 261).

Specific Type of Waste:
EPA has assigned a four-digit number to each hazardous waste listed in the regulations under Section 3001 of RCRA. Enter the appropriate four-digit number in the boxes provided. A copy of the list of hazardous wastes and codes can be obtained by contacting the EPA Region serving the State in which the site is located.



Form Approved
OMB No. 2000-0138

EPA Form 8900-1

F **Waste Quantity:**

Place an X in the appropriate boxes to indicate the facility types found at the site.

In the "total facility waste amount" space give the estimated combined quantity (volume) of hazardous wastes at the site using *cubic feet or gallons.*

In the "total facility area" space, give the estimated *area size* which the facilities occupy using square feet or acres.

Facility Type

1. ☐ Piles
2. ☐ Land Treatment
3. ☒ Landfill
4. ☐ Tanks
5. ☐ Impoundment
6. ☐ Underground Injection
7. ☐ Drums, Above Ground
8. ☐ Drums, Below Ground
9. ☐ Other (Specify) _____

Total Facility Waste Amount

cubic feet: 13 - 26 million

gallons: _____

Total Facility Area

square feet: _____

acres: 30 - 40

G **Known, Suspected or Likely Releases to the Environment:**

Place an X in the appropriate boxes to indicate any known, suspected, or likely releases of wastes to the environment.

☐ Known ☒ Suspected ☐ Likely ☐ Non

Note: Items H and I are optional. Completing these items will assist EPA and State and local governments in locating and assessir hazardous waste sites. Although completing the items is not required, you are encouraged to do so.

H **Sketch Map of Site Location:** (Optional)

Sketch a map showing streets, highways, routes or other prominent landmarks near the site. Place an X on the map to indicate the site location. Draw an arrow showing the direction north. You may substitute a publishing map showing the site location.

I **Description of Site:** (Optional)

Describe the history and present conditions of the site. Give directions to the site and describe any nearby wells, springs, lakes, or housing. Include such information as how waste was disposed and where the waste came from. Provide any other information or comments which may help describe the site conditions.

(see attachment)

J **Signature and Title:**

The person or authorized representative (such as plant managers, superintendents, trustees or attorneys) of persons required to notify must sign the form and provide a mailing address (if different than address in item A). For other persons providing notification, the signature is optional. Check the boxes which best describe the relationship to the site of the person required to notify. If you are not required to notify check "Other".

Lamar T. Oxford

Name: Lamar T. Oxford, Vice President

Street: _____

City: _____ State: _____ Zip Code: _____

Signature: _____ Date: _____

- ☒ Owner, Present
- ☐ Owner, Past
- ☐ Transporter
- ☐ Operator, Prese
- ☐ Operator, Past
- ☐ Other

Reference No. 2

"Rite in the Rain®"

ALL-WEATHER

LEVEL

Notebook No. 311

FY-2550

Old Stactex Landfill
Spartanburg County, S.C.
TDD FY-9007-22-
Terry Ryland

LOGBOOK REQUIREMENTS
REVISED - NOVEMBER 29, 1988

NOTE: ALL LANGUAGE SHOULD BE FACTUAL AND OBJECTIVE

1. Record on front cover of the Logbook TDD No., Site Name, Site Location, Project Manager.
2. All entries are made using ink. Draw a single line through errors. Initial and date corrections.
3. Statement of Work Plan, Study Plan, and Safety Plan discussion and distribution to field team with team members' signatures.
4. Record weather conditions and general site information.
5. Sign and date each page. Project Manager is to review and sign off on each logbook daily.
6. Document all calibration and pre-operational checks of equipment. Provide serial numbers of equipment used onsite.
7. Provide reference to Sampling Field Sheets for detailed sampling information.
8. Describe sampling locations in detail and document all changes from project planning documents.
9. Provide a site sketch with sample locations and photo locations.
10. Maintain photo log by completing the stamped information at the end of the logbook.
11. If no site representative is on hand to accept the receipt for samples, an entry to that effect must be placed in the logbook.
12. Record I.D. numbers of COC and receipt for sample forms used. Also record numbers of destroyed documents.
13. Complete SMO information in the space provided.

The following people have read and understand the work plan and study plan.

Terry Ryland 9-24-90
Terry Bland
Willie Smitherman
W Dantes
Maurice Rowan
Maurice Rowan Jr.
Alvin Williams
Alvin Williams
Sam McIver
Ron McIver
John [illegible] 9/27/90

Terry Bland 9-24-90

2

Monday 9-24-90

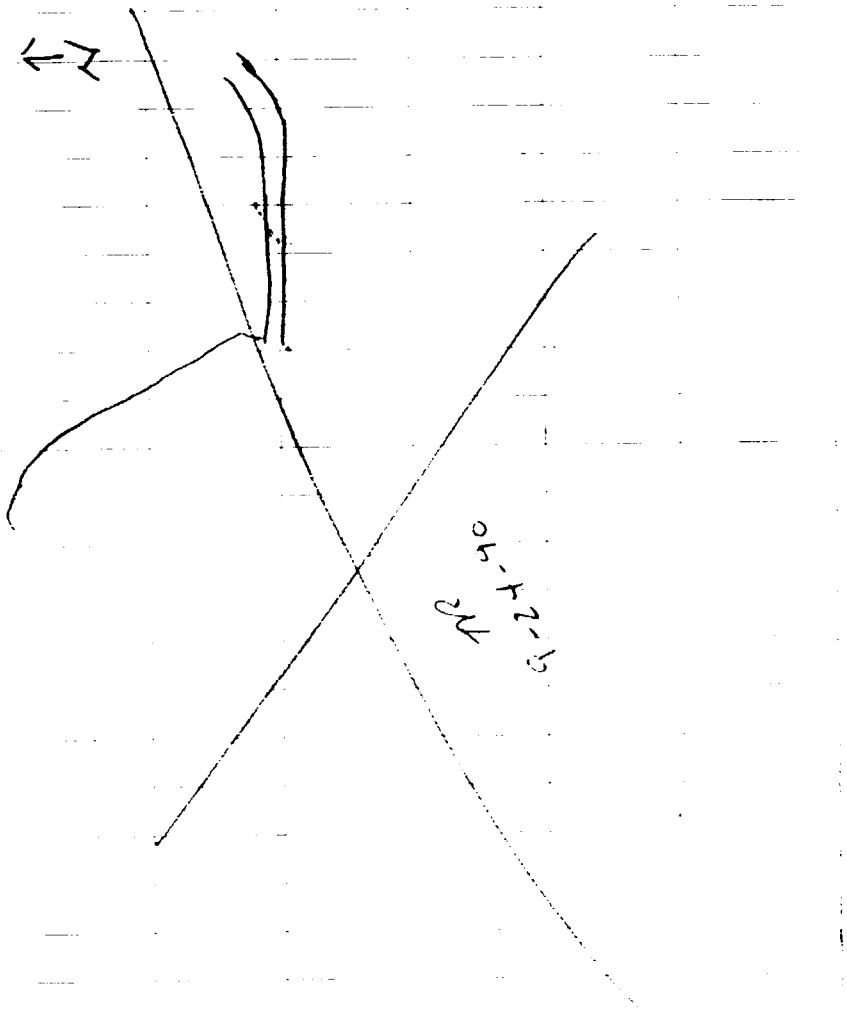
8:00 Arrived on site
Weather: clear sky with light cool breeze.

Site covered with a black to gray colored gravely material. Light weight and looks similar to lava rocks. Was informed that it is coal cinders.

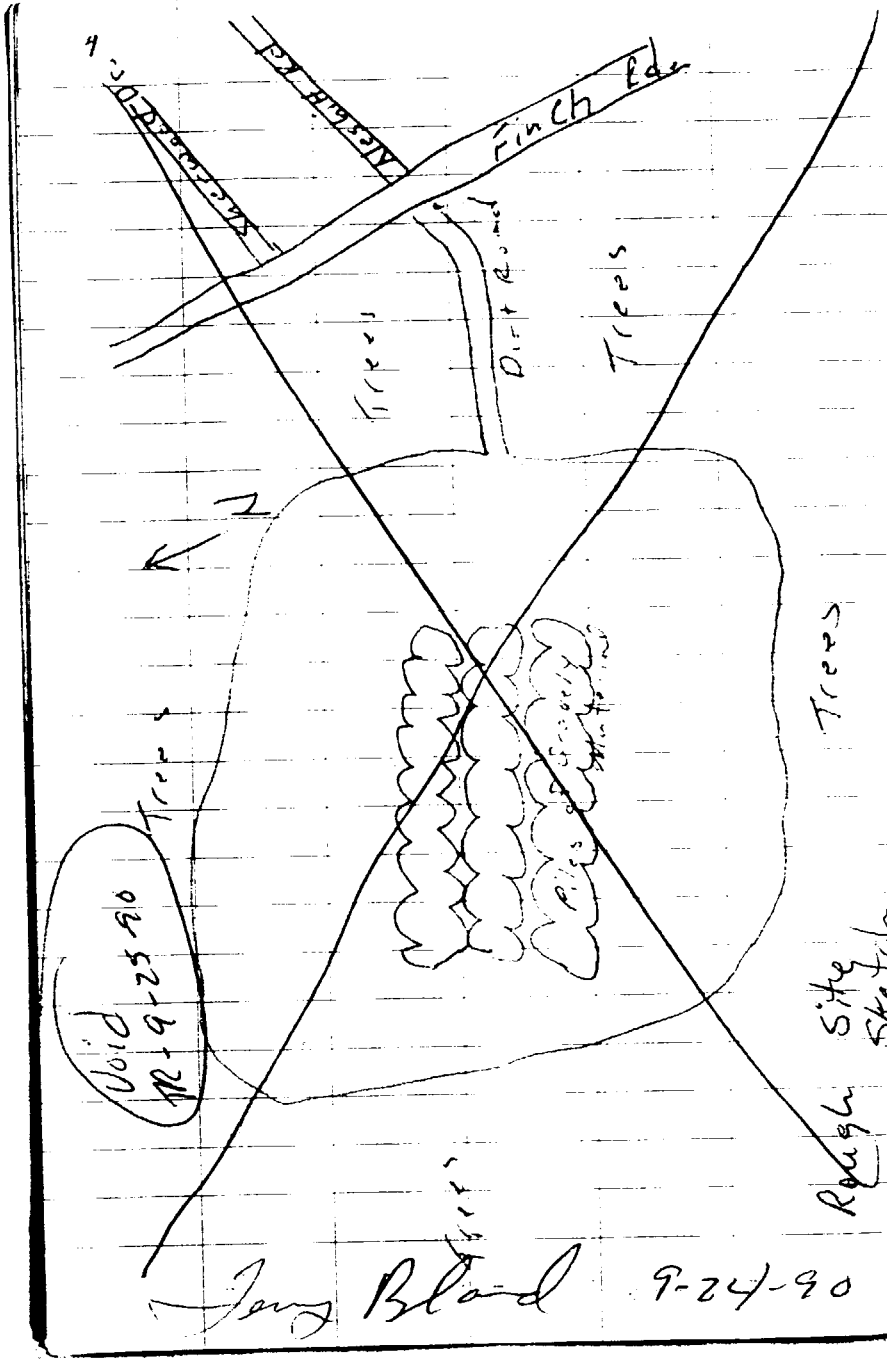
9:00 Set up near Finch Road to collect background sample.

9:15 Collected OS-SS-01
9:30 Collected OS-SB-01 at 6' bls.
9:45 Augered to 15' bls and hit a rock. Could not go deeper. No water in well. Soil, dry. Abandoned attempt for a temporary well.

Jerry Bland 9-24-90



Jerry Bland 9-24-90



11:00 Springs Ind. consultant arrived on site.

His name is Vince Blount - Geologists w/ Universal Engineering Sciences

3532 Maggie Blvd.
Orlando, Florida 32811
(407) 423-0504
Fax (407) 423-3106

I did not know Springs Ind. was using a consultant. Previous attempts to contact the company resulted in talking to no one associated with the landfill.

Vince wants to split samples and oversee the geophysical and FASP operations.

Jerry Bland 9-24-90

We had to disregard the previously collected background sample and recollect it tomorrow when Vince is here to watch and get his split sample.

The rest of today will be used to determine sampling locations.

John's crew went to his site to conduct the geophysical and FASP.

There are two landfills located close together, both owned by Springs Ind. or associated with Springs Incl. John Schendel is investigating one site and I the other. Geo + FASP are conducted on John's site only.

Jay Bland 9-24-90

We must wait for it to be completed of FASP and Geo before the consultant can come to my site to view the sampling of soils and sed. from old Startex landfill.

12:00 leave site for lunch.

13:00
1:00pm Back from lunch

Going search out sampling locations for sed. + SW to be collected tomorrow.

15:00
3:00 PM Sampling locations have been found. Now going to check on the other crew's progress.

18:00 leave for the day,

Jay Bland 9-24-90

8 Tuesday 9-25-90

8:00 Arrived on site
Weather is the same as yesterday.

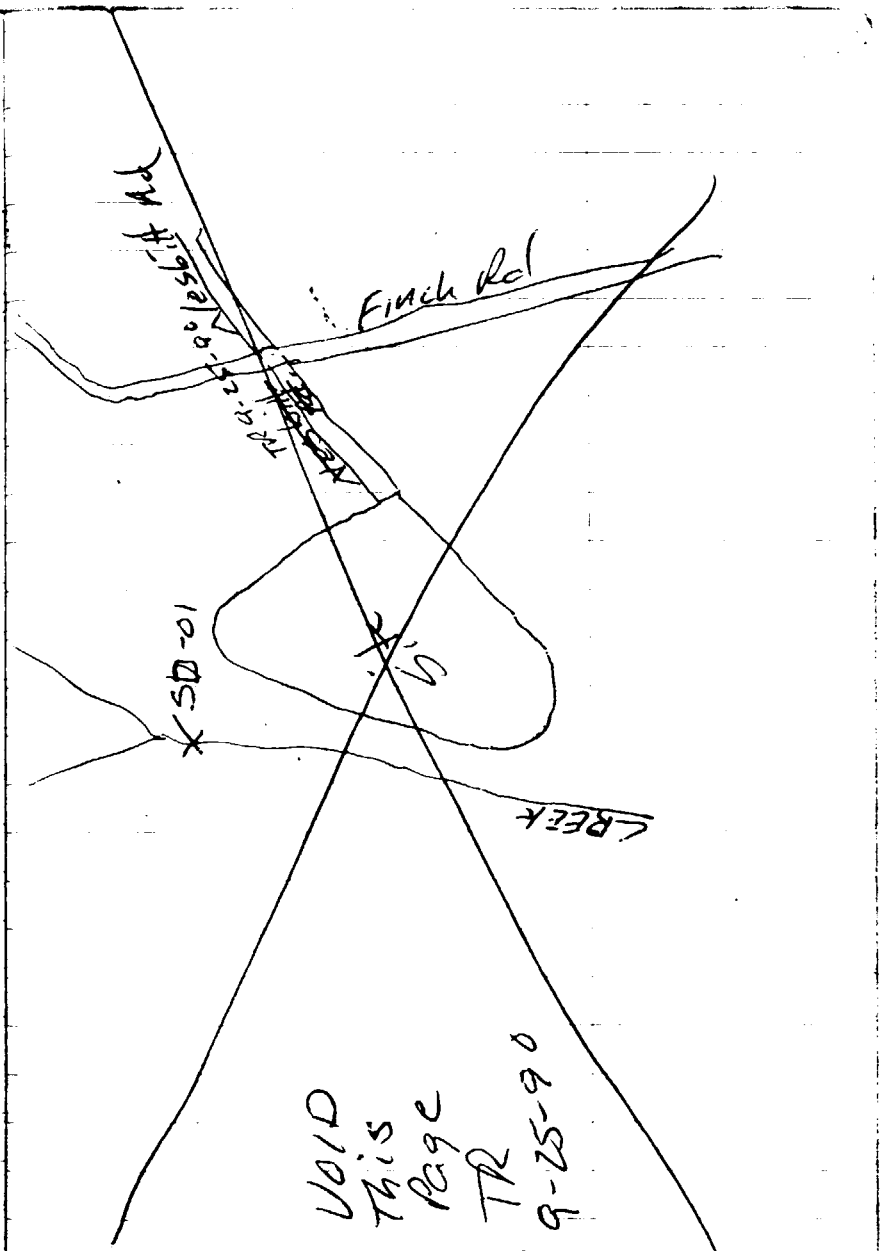
Getting things ready to collect the background sed. + surface waters.

Vince will be coming with us to collect his splits.

8:55 (SD-01) collected upgradient of site along perennial stream.
(SW-01) collected at same location

9:15 Decal # 683235 pH meter calibrated by W. Smitherman

Jerry Bland 9-25-90



VOID
This
Page
TR
9-25-90

Jerry Bland 9-25-90

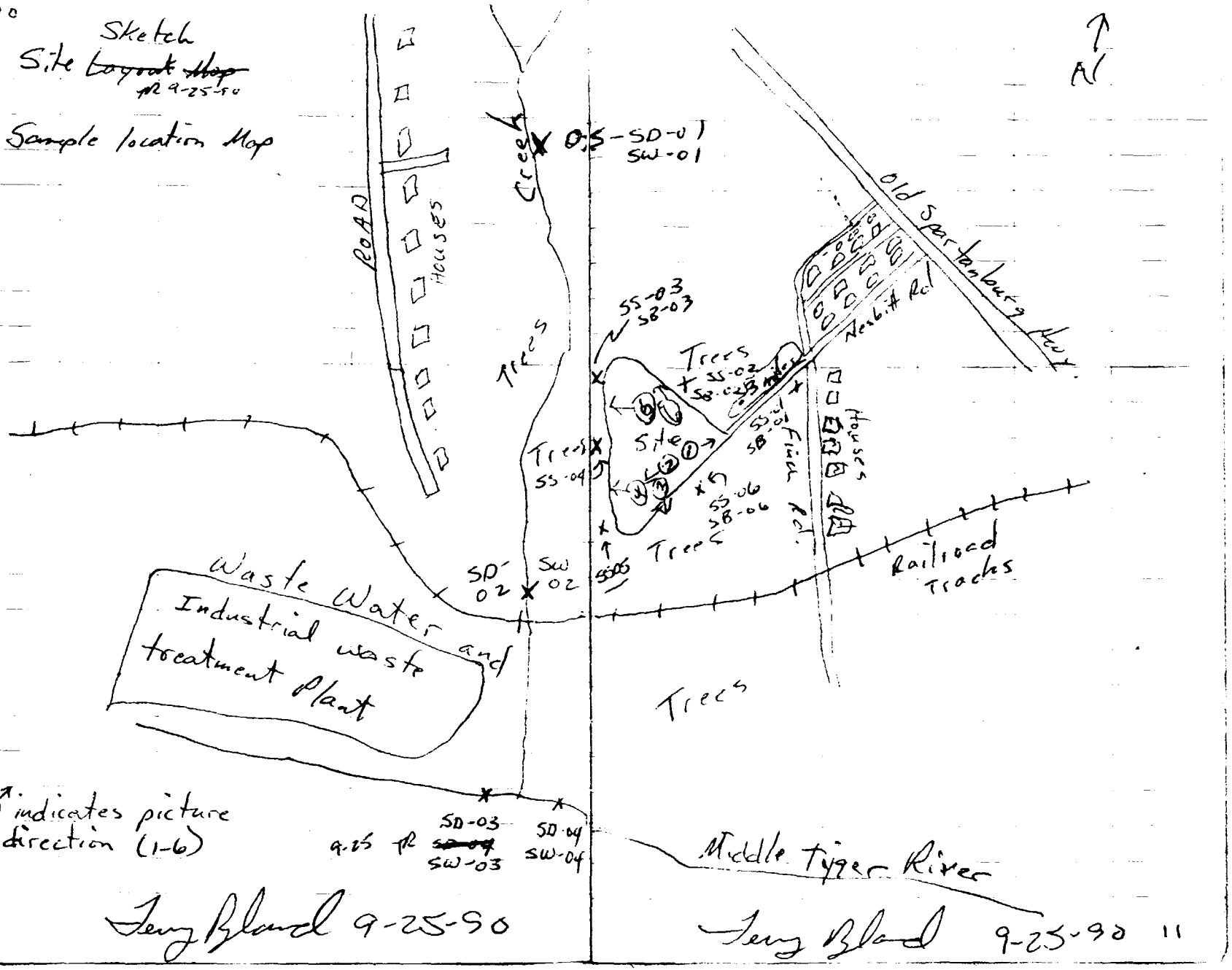
10

Sketch

Site ~~Layout Map~~

R 9-25-90

Sample location Map



* indicates picture direction (1-6)

9-25 R

Terry Bland 9-25-90

Terry Bland 9-25-90

10:40 (SD-02) collected near railroad tracks, and creek. The creek flows beneath the tracks. ~~by~~ TR 4-25 Collected sample upgradient of tracks in creek bed.

10:50 (SW-02) collected from same location as SD-02.

12:40 (SD-04) collected on Middle TYGER River where the creek empties into the River. Collected downgradient of intersection ± 30 feet.

12:45 (SW-04) collected at same location as SD-04.

The creek I'm referring to is a perennial stream, indicated on Topo map, which flows south to Middle Tygers

Jerry Bland 9-05-90

River. It also flows near the west edge of the landfill.

Middle Tyger River is black in water color. We are located down-gradient ~~from~~ TR 4-25 of a waste treatment plant where black water and sludge is visible. A plant worker said the plant ~~also~~ TR 4-25 discharges into the river.

12:50 (SD-03) collected on Middle TYGER RIVER upgradient or upstream of intersection with creek. Collected ± 30 feet upstream.

13:00 (SW-03) collected from same location as SD-03.

Field Measurements on Surface Water Samples

	pH	Cond. (µmhos/cm)	Temp.
SW-01	6.14	70.0	15°C
SW-02	6.84	46.1	17°C
SW-03	7.7	5.06 x 10³	25°C
SW-04	7.61	383	24°C

14:00 Samples are labeled and ~~tag~~ MW-25 bagged. Vince has gone with John, Sherry, Rick Hardy to conduct Geophysical and FISP. These operations should be completed today. We will resume sampling at my site tomorrow morning.

Gone to eat a late lunch.

Jerry Bland 9-25-90

Quit sampling my site for the day. Must wait for Vince to return to my site tomorrow so we can collect surface soil & sub surface soils.

Note: about the Middle Tyger River:

Just upstream of the waste treatment plant is a damn in the river. This is where the city of Lyman has a surface water intake and filtration plant. This plant serves all of Lyman. I think this plant is operated by Springs Industries. I have to take Vince there to pick-up his sample jars and Springs Ind. people and vehicles are always there. There is a large difference in water clarity before and after the waste treatment plant.

Jerry Bland 9-25-90

16 Wed. 9-26-90

8:00 Arrived on site

Weather is clear and cool.

8:20 Calibrated HNu
Serial # 41539
10.2 probe 9.8 span
checked out ok

8:45 (SS-01) collected at land surface near entrance to landfill. Sample collected for background.

9:05 (SB-01) collected at 6-7 feet below land surface. Soil is a red clay to a depth of 13 feet as seen yesterday. Could not go deeper because we hit a rock or something.

Jerry Bland 9-26-90

9:30 (SS-02) collected at land surface along northeastern edge of land fill. Soil appears to have a little mulch on land surface. Also consists of clay w/ a slight presence of sand. Vince says phenol is commonly associated with pine tree mulch. Many pines in this area.

HNu readings of 7-11 ppm were detected during the augering. Nothing in the breathing zone.

9:45 Augered down to 4'6"s before hitting rock. ~~collected~~ ~~(SB02) at this point~~ TR 9-26-90

Back off hole 2 feet and

Jerry Bland 9-26-90 17

auger down again to a point above rock and collect sample.

SB-02 collected

10:30 SS-03 collected in an area where orange colored water is visible on the ground. Location is on the northwest side of the landfill, down hill.

Augered down to 3 feet and detected 35 ppm w/ HNu. Ground is soft gray clay with water coming into hole, this is understandable since we're so low of the landfill.

Jerry Bland 9-26-90

10:55 SB-03 collected at same location as SS-03. Sample at 3-6 feet below land surface. Soil is a gray clay with some sand.

12:05 SS-04 collected at land surface. Red clay. Hit rock a 1 foot. Scratched SB-04. ✱

12:25 SS-05 collected at land surface. Collected some of the ash on the land surface.

✱ SB-05 not collected. Hit rock at 2 feet bls.

Alan McManus is now present during sampling.

Jerry Bland 9-26-9019

12:50 (SS-06) collected at land surface. Organic type soil.

13:15 (SB-06) collected at 4-5 feet b/s. Soil is very dry and clay. Red color w/ some sand.

13:25 Completed sampling of this site

Much of the land surrounding the site or within a mile of the site has cattle upon it. Fescue is also grown on much of the pasture land for cattle feed.

Jerry Gland 9-26-90

40

[illegible] 9/26/90

Chain of Custody used: 4-1444
1443
1445
1442

Free Sheets (27)

Receipt for Sample Form Used: 4-0362
0360

Case No. 74949

Low Concentration yes/no

Organics

	Media	Lab	Airbill No
17	Soil	Gulf	2828495250
7	Water	Gulf	same

Organics

	Media	Lab	Airbill No
15	Soil	Silver Valley	2828495261
7	Water	Silver Valley	same

TDD #

Date _____ By Whom: _____

Time: _____ # keyed to map: _____

Location: _____

Picture of _____

TDD #

Date _____ By Whom: _____

Time: _____ # keyed to map: _____

Location: _____

Picture of _____

TDD #

Date _____ By Whom: _____

Time: _____ # keyed to map: _____

Location: _____

Picture of _____

TDD #

Date _____ By Whom: _____

Time: _____ # keyed to map: _____

Location: _____

Picture of _____

41

TDD #
Date: By Whom:
Time: # keyed to map:
Location:
Picture of:

TDD #

TDD #

TDD # F4-9007-22
Date: 9-25-90 By Whom: T. Ryland
Time: 8:30 # keyed to map: 1
Location: Facing east along entrance road
Picture of: Entrance road as seen from landfill

TDD # F4-9007-22
9-25-90 T. Ryland
8:30 2
Facing west onto site from road.

TDD # F4-9007-22
9-25-90 T. Ryland
8:30 3
Starlex, S.C.
Facing ~~West~~ SW across site, coal cinders on surface)

48

TDD # F4-9007-22
Date 9-25-90 By Whom: T. Ryland
Time: 8:30 # keyed to map: #4
Location: Stactex, S.C.

Picture of: Facing west across landfill; coal, cinders on land surface

TDD # F4-9007-22
Date 9-25-90 By Whom: T. Ryland
Time 8:30 # keyed to map: #5
Location Stactex, S.C.

Picture of Facing west across site

TDD # F4-9007-22
Date 9-25-90 By Whom: T. Ryland
8:30 #6
Location Stactex, S.C.

Picture of Facing NW across site

STANDARD SAMPLE CODES

Water Samples	Soil Samples
PW - Private well	SS - Surface Soil
PB - Public (Municipal) Well	SB - Subsurface Soil
MW - Monitoring (Permanent) Well	SZ - Saturation Zone
TW - Temporary (Well Point) Well	SD - Sediment
IW - Industrial Well	CS - Composite Soil
SW - Surface Water	LS - Leachate Soil
SP - Spring Water	
LW - Leachate Water	

OTHER CODES

AR - Air	QC - Quality Control
SL - Sludge	AQ - Aquatic (Biological)
WA - Waste	TB - Trip Blank
DR - Drum	

For all samples that are to be analyzed by the in house FIT IV laboratory, the following deviation from the standard codes are to be used: The letter "F" (denoting FIT Lab Analysis) is to be inserted in front of the sample number.

Example: Standard Auto Sampling Investigation - Temporary Well Groundwater Sample - Number 08

Appropriate Code: **SA-TW-F08**

Reference No. 3

NUS CORPORATION AND SUBSIDIARIES		*TELECON NOTE*
CONTROL NO.	**DATE:** 2-20-91	**TIME:** 9:14
DISTRIBUTION: File		
BETWEEN: Gerald Stewart	**OF:** SCDHEC	**PHONE:** (803) 734-5449
AND: Terry Ryland, NUS Corporation		

DISCUSSION:

I asked Mr. Stewart about any RCRA history or permitting of the Old Startex Landfill. He told me the landfill was never permitted and that Springs Industries has recently agreed to stop using the landfill in an effort to avoid having to permit the landfill.

Reference No. 4

RECORD OF COMMUNICATION

_X_ Phone Call
_X_ Discussion
____ Field Trip
____ Conference
____ Other (Specify)

TO: Nick Odom, Env. Manager
Spring Industries Inc.

FROM: Gerald Stewart

DATE: November 28, 1988

TIME: 4:15 PM

SUBJECT: Ownership History and waste disposal practies at the Old Startex Spartanburg County Landfill and Old Lyman Dump.

SUMMARY OF COMMUNICATION

According to Nick Odom, Environmental Manager - Springs Industries Inc., Springs Industries operated the Old Lyman Dump, but the property is owned by the Town of Lyman. The Old Statex Spartanburg County Landfill is owned by Springs Industries Incorporated. Mr. Odom stated that Lyman Dyeing and Finishing Company is now owned and operated by Springs.

Historically, landfill of these types received textile rags, cardboard, brick, blocks, fly ash and a minimum amount of liquid waste, such as organics and inorganics. Most chemical waste (liquids) were drained into the wastewater treatment system.

CONCLUSIONS, ACTION TAKEN OR REQUIRED

The above information was gathered from a phone conversation with Nick Odom and Marshall Bright. Contact Address: Spring Industries Inc.; P.O. Box 70; Fort Mills, SC 29715 - ATTN: Nick Odom.

INFORMATION COPIES
TO: Old Lyman Dump File
Old Startex Spartanburg County File

Reference No. 5

KIRK-OTHMER

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY

THIRD EDITION

VOLUME 13

HYDROGEN-ION ACTIVITY
TO
LAMINATED MATERIALS, GLASS

A WILEY-INTERSCIENCE PUBLICATION
John Wiley & Sons
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According to most historians, writing ink was first prepared and used by the Chinese and the Egyptians as early as 2600 BC. These early inks were probably composed of carbonaceous materials such as lamp black or soot mixed with animal glue or vegetable oil vehicles. Reference is also made to the Chinese invention of solid ink blocks and pellets similar to India ink as it is known today, which had its origin during the period 220–419 AD. Writing-ink formulation became a highly developed art under the Chinese, who were printing from hand-cut blocks in the 11th century AD, 400 years before Gutenberg introduced movable type in Europe. Writing inks differ from printing inks in that the latter are generally applied to a substrate by means of a printing press. Printing inks as supplied to the graphic arts industry are used in much greater volume by far as compared to writing inks. This article is divided into a discussion of printing inks, followed by miscellaneous categories of ink, including ink for ball-point pens, with which by far the greatest amount of ink writing is done in the United States. The number of printing-ink manufacturing establishments in the United States is approximately 700. This includes some 100 captive ink plants. The value of the total printing-ink production in the United States was approximately \$1 $\times 10^6$ in 1979 (see also Printing processes; Reprography).

Printing Inks—General Considerations

Printing ink is a mixture of coloring matter dispersed or dissolved in a vehicle or carrier, which forms a fluid or paste which can be printed on a substrate and dried. The colorants used are generally pigments, toners, and dyes, or combinations of these materials, which are selected to provide color contrast with the background on which the ink is printed. The vehicle used acts as a carrier for the colorant during the printing operation, and in most cases, serves to bind the colorant to the substrate.

Printing inks are applied in thin films on many substrates such as paper, paperboard, metal sheets and metallic foil, plastic films and molded plastic articles, textiles, and glass (see Film and sheeting materials; Paper). Printing inks can be designed to have decorative, protective, or communicative functions. In some cases, combinations of these functions are achieved.

It is generally conceded that there are four classes of printing ink, which vary considerably in physical appearance, composition, method of application, and drying mechanism. They are letterpress and lithographic (litho) inks, which are commonly called oil inks or paste inks, usually of a pasty consistency, and flexographic (flexo) and rotogravure (gravure) inks, which are referred to as solvent or liquid inks (1–3).

Four properties of inks are of cardinal importance—drying, printability (which is largely a function of the rheology of the ink), color, and use properties. Use properties are those considerations that determine how printed substrates function throughout all processing and usage from the time of printing throughout the useful life of the printed product.

Drying. The term drying may be defined as any process that results in the transformation of a fluid-printing ink film into a more or less rigid form. An ink is considered dry when a print does not stick or transfer to another substrate placed in contact with it.

Jacket Design: Ric

Drying is accomplished by one or more of the following physical or chemical mechanisms: absorption, evaporation, precipitation, oxidation, polymerization, cold setting, gelation, and radiation curing.

Absorption. Some inks dry by penetration or absorption into the pores of the printed stock—a blotter or sponge effect. This is accomplished by the gross penetration of the ink into the large pores of the substrate; the partial separation of the vehicle from the pigment; and the diffusion of the vehicle throughout the paper.

The ability of an ink to penetrate into paper depends on the number and size of the air spaces present in the paper, the affinity or receptivity of the stock for the ink, and the mobility of the ink.

Solvent Evaporation. Drying of ink by evaporation of solvent is generally achieved by application of heat, depending upon the volatility of the solvent employed in the ink formulation. Web-offset and letterpress inks which dry by solvent evaporation are of the heat-set type. All flexographic and rotogravure inks contain more volatile solvents than the heat-set publication inks referred to above and do not require as much heat to effect drying. In either case, a balance must be maintained between satisfactory drying of the ink on the printed substrate and adequate stability, or resistance to drying, on the distributing rollers of the printing press.

Resin Precipitation. An ink may also be caused to dry by precipitation of its binder rather than by evaporation of solvent. This is accomplished by adding a diluent, such as water in the form of steam, to a hygroscopic water-miscible solvent ink system, which will cause the solubility of the resin in the ink film to decrease sharply and cause it to precipitate when its tolerance for the diluent is reached. Further drying is accomplished by absorption of the freed solvents into the stock and then by evaporation.

Oxidation. Inks that dry by oxidation behave much like paint films and dry by means of drying oils. They also contain metallic driers, which catalyze the absorption of oxygen by the drying oil (see Driers and metallic soaps; Drying oils; Paint).

Cold Setting. Hot-melt inks are applied to a substrate in a molten state and upon cooling form a dry ink film.

Gelation. Drying by gelation is accomplished by dispersing fine particles of a high molecular weight polymer, such as poly(vinyl chloride) resin, in a plasticizer for the polymer. At room temperature the dispersed polymer behaves like a pigment but at elevated temperatures it solvates, causing an immediate gel formation which is dry to the touch.

Polymerization. Thermal polymerization or curing of an ink film at elevated temperatures can follow many different chemical paths. Condensation and cross-linking reactions may be accomplished with or without the use of catalysts. However, this method of drying generally has not been used widely for printing inks, except for metal and glass decoration.

Radiation Curing. Ultraviolet and electron-beam curing of inks and coatings has progressed markedly in recent years owing largely to the fact that these drying mechanisms produce little or no effluent. They are similar processes in that both involve polymerization by a free-radical mechanism and very high rates of reaction can be achieved with relatively low energy inputs. Uv inks contain a photochemically reactive vehicle species, colorant, and a photosensitizer which initiates the reaction upon exposure to the uv radiation source. Electron-beam inks do not require a photoinitiator, the higher density-energy of the electrons is sufficient to create large numbers of free radicals in the vehicle system (see Radiation curing).

Infrared Drying. Infrared drying is used in some heat-set and evaporative solvent-ink applications where the wavelengths emitted by the radiator can, in principle, be tuned in on the optimum absorbency of the ink vehicle, thereby heating it selectively and not the substrate on which it is printed.

Radio Frequency and Microwave Drying. There are similar mechanisms differing in wavelengths generated and hardware required. Rf operates in the 30–100 MHz range and microwave drying in the 1000–3000 MHz range. Both generate electromagnetic waves which intersect and cause molecular excitation of polar molecules used in the ink film, causing rapid heating and drying to take place (4–5).

It may be noted that with the exception of oxidation- and polymerization-curing mechanisms, all other drying processes described depend upon physical phenomena. The complexity of organic reactions occurring in the nonphysical methods also appear to limit the speed of reaction which can be expected, so that the physical methods generally provide faster drying. Certain specialized methods of drying, such as ionic interaction and decomposition reactions, offer the fastest drying mechanisms but they have not been reduced to practice at this time.

Rheology. The rheology of inks is of the greatest importance. In a Newtonian liquid, any stress produces a flow, and the rate of flow is proportional to the stress. But inks are generally non-Newtonian and the most common terms used by the ink maker to describe rheology are: *viscosity* (resistance to flow); *yield value* (point at which a liquid starts to flow under stress); *thixotropy* (decreasing viscosity with increasing agitation); and *dilatancy* (opposite of thixotropy). Mayonnaise is an example of a material having a high yield value but a low viscosity (6–8).

The ink-distribution systems of flexo and gravure printing presses are very simple and do not provide the means to distribute and level highly viscous inks. Therefore, the viscosity must be low, on the order of 50–100 mPa·s (= cP). Yield value must be low also to permit pumping of ink from reservoir to fountain. Thixotropy should also be avoided for the same reason.

Letterpress and offset inks can vary in viscosity from under 500 mPa·s for a letterpress-type news ink to over 500 Pa·s (5000 P) for special litho ink formulations. The viscous nature of letterpress and litho inks has forced press designers to use a multitude of rollers in the ink distribution unit to ensure uniform and adequate transfer of ink to the printing plate.

In addition to the importance of proper ink rheology as related to roller-to-plate transfer, it is rheology, again, that controls, in large part, the fidelity of printing, drying speed, holdout, and trapping properties obtained on the substrate. In most cases, higher press speeds require lower viscosity inks and vice versa. Low viscosity ink is preferred for fine-line flexography and shallow-cell gravure printing. Printing smooth, dense solids can best be achieved using higher viscosity ink.

Rheology is also an important color-strength determinant. Over-pigmentation leads to a high yield value, thixotropic ink, thereby forcing a compromise between color intensity and rheology.

There are many varieties of instruments designed for measuring viscosity and other rheological properties of inks. These include capillary, orifice, rotational, and other miscellaneous types. Modern ink-rheology measurements are made on instruments such as the Shirley-Ferranti Cone-Plate viscometer, Brookfield Torsion viscometer, and the Haake, Laray, Interchemical, Stormer, and Band viscometers. The Inkometer and Tackoscope are also used to record tackiness as well as ink misting and roller stability (see Rheological measurements).

Color. Color is the third common denominator for all types of ink formulation and may very well be the most important one because it has such a tremendous psychological impact on the ultimate consumer. Color appears in three different dimensions referred to as hue, saturation or chroma, and value (see Color).

Coloring Materials. Pigments are used not only for color but also for other physical properties such as bulk, opacity, specific gravity, viscosity, yield value, and printing qualities. Different pigments of the same color have different permanency to light, heat, chemicals, and bleed or staining in water, oil, alcohol, fat, grease, acid, or alkali (9–10).

Judicious selection of pigment is also required, according to the use of the ink, in considering subsequent operations such as varnishing, waxing, lacquering, or laminating.

Inks make use of inorganic pigments and of dyes, most commonly in the form of pigments, that is to say, rendered insoluble in one of a number of ways (see Pigments, organic). Five dye families that are of interest to ink manufacturers are azo, triphenylmethane, anthraquinone, vat, and phthalocyanine (see Dyes and dye intermediates; Dyes—application) (11–12).

Flushed Colors. Many pigments, although dry when purchased, are prepared in a water phase and are not wetted easily by oil phases. In the process known as flushing, pigments are prepared that obviate this difficulty. Phase transfer is generally accomplished by mixing the pigment presscake with a water-immiscible vehicle in a heavy duty sigma blade (dough) mixer. Most of the water separates and can be removed, although complete dehydration requires further processing, usually heating under agitation for several hours in a vacuum.

Flushed colors result in higher gloss and color strength, and better rheology and economy than their dry-pigment counterparts. Their use is expanding constantly.

Color Concentrates, Easily Dispersible Pigments. In order to provide greater versatility and, at the same time, ease of use, pigment manufacturers offer pigments in the form of color concentrates. These are liquids or pastes with 35–65% of pigment content. Pigments in this form are very well dispersed, requiring little if any mechanical effort to achieve the desired color value or fineness of grind. The concentrates often contain monomeric and resinous dispersants plus a solvent. They are classified according to the solvent used.

Easily dispersible pigments are produced by coating freshly precipitated pigment in the slurry tank with a resinous and/or monomeric dispersant and, eventually, by drying and pulverizing the solids. Such pigments are also called stir-ins as they require minimum grinding effort in order to develop the full color value.

Toners are full strength undiluted pigments used to strengthen tinctorially weak pigments. Occasionally, dyes are utilized as toners.

The most common pigments used in ink manufacture are listed below.

Black Pigments. The only black pigment used to an appreciable extent in inks is carbon black (qv). It is used in newsprint and publication printing, and therefore, in very large quantities. Black pigments are offered in fluffy or bead form.

White Pigments. Opaque white pigments commonly used in inks (listed in order of decreasing opacity) are titanium dioxide, zinc sulfide, and zinc oxide. TiO_2 is by far the most popular white pigment. Mixtures of these are often made with the various colored pigments to add opacity or to lighten the hue.

Transparent pigments (extenders) commonly used in inks (listed in order of de-

creasing transparency) are alumina hydrate (a product of the approximate composition $5Al_2O_3.2SO_3.xH_2O$), magnesium carbonate (magnesia), calcium carbonate, blanc fixe (precipitated barium sulfate), barita (natural barium sulfate), and clay. Extenders are used to reduce the color strength and change the rheology of inks.

Inorganic Color Pigments. Chrome yellow is generally lead chromate, modified with other lead compounds to produce several shades. Chrome orange and molybdate orange are also modified lead compounds. All of the chrome colors are quite fast to light, opaque, and have high specific gravity. They, however, can be toxic and their uses are restricted. They can not be used on articles intended for use by children or in inks that could contact food.

Cadmium yellow, orange, and red are very lightfast pigments and have excellent soap and alkali resistance. Cadmium–mercury reds come in a range of shades from a bright to a deep red. Vermilion red is a brilliant mercury sulfide pigment of high specific gravity. Their use is also restricted as a result of mercury content which is considered toxic.

Iron blue (a complex cyanide) is made in a number of shades such as Milori blue, bronze blue, and Prussian blue. It has poor alkali resistance. Ultramarine blue is very permanent to light but has poor acid resistance.

Organic Color Pigments. Yellow pigments consist mainly of yellow lakes, Hansa yellows, and diarylide yellows. (Lakes are produced from dyes by depositing them on alumina hydrate.) Hansa yellows are very strong and permanent pigments. They are very resistant to most chemicals. They are produced from azo dyes in a number of hues. Diarylide yellows are also very strong, usually not as fast to light as Hansa yellows, but more transparent pigments. They are produced from 3,3′-dichlorobenzidine, a carcinogen that must be handled with care (according to EPA regulations).

Orange pigments include dianisidine orange, benzidine orange, and Persian orange lakes.

Red pigments range in shade from orange to deep maroon, from dirty reds to the very clean, brilliant reds. A few of the more common types are the following. (*1*) The para reds, toluidines, and fire reds are fairly fast to light and semitransparent. They are used in poster and label inks. (*2*) The lithol reds are available in a wide range of shades with moderate permanency to light. (*3*) Phloxine or eosine lakes are very clean, brilliant reds, not fast to light, used in process printing on books and magazines. They also represent toxicity problems owing to lead content. (*4*) Rhodamine reds are brilliant and have much better lightfastness. They are quite costly. (*5*) Red Lake C (CI Pigment Red 53; CI 15585) is used for making the very brilliant orange shades or warm reds. (*6*) Madder lakes have resistance to bleeding and permanency to light. (*7*) Watchung reds or Permanent Red 2B (CI Pigment Red 48; CI 15865) pigments are fairly clean and have fair bleed and product resistance. (*8*) Naphthol reds are relatively permanent and are soap-resistant. They are available in yellow and blue shades.

Blue Pigments. Peacock blue is a clean, brilliant, greenish shade of blue. It is fugitive and is now seldom used. The permanent types are quite expensive.

Phthalocyanine blues are the most useful of the greenish shades. They have excellent lightfastness, very good resistance to most chemicals, and are used in process work. Their precursor crude is, in part, imported.

Victoria blue is the clean, red shade royal blue. It is only moderately fast to light and not too popular an ink pigment.

Alkali blues of deep reddish shades find extensive use in all types of inks, often for toning blacks. Alkali blue toners are supplied in flushed form.

Purple Pigments. Methyl violet is the most commonly used, also for toning purposes. Dioxazine violet, an expensive color, is used where permanence and resistance properties are needed.

Green Pigments. Phthalocyanine green is a permanent and clean pigment. Green Lake is one of the triphenylmethane colors and has its disadvantages. It is difficult to grind, requires more drier to achieve scuff resistant ink film and occasionally bleeds in fat or plasticizer.

Daylight Fluorescent Pigments. These are used in silk screen, gravure, flexographic, letterpress, and offset inks. They are difficult to handle and require heavy films of ink to be effective. They are generally not very fast to light (see Luminescent materials).

Silver Powder. This is usually aluminum flake, and "gold" is generally a mixture of brass and copper flakes, and possibly other metals. The gold effect can also be achieved by toning aluminum flake with a transparent yellow pigment (diarylide yellow).

Other Ingredients

Driers (qv). These are soaps of cobalt, manganese, and lead formed with organic acids such as linolenic, naphthenic, and octanoic acids. They catalyze oxidation of drying oils, and thus should be used in inks that dry by oxidation.

Waxes (qv). These are mainly dispersions of polyethylenes, hydrocarbons, or vegetable and animal waxes in the vehicle system used. They impart slip and scuff-resistance to ink films. Lately, polyolefinic waxes are also used directly in micropulverized form.

Antioxidants (qv). Antioxidants of universal acceptance are eugenol and ionol. They retard premature oxidation of inks on the press at 1% or lower concentrations.

Miscellaneous Additives. These include lubricants, surface-energy reducing agents, thickeners, gellants, defoamers, wetting agents, and shorteners.

Letterpress, Dry Offset, and Lithograph (Paste) Inks

Historically, paste inks were developed much earlier than flexographic and rotogravure (liquid) inks. Since they utilize distinctly different solvents and application techniques, it has been customary to treat them separately.

Dry offset inks are not treated separately since they are quite similar to letterpress inks, except for 20–30% higher color strength and somewhat higher viscosity (6–8).

Table 1 summarizes properties of inks of the three classes, divided among eleven use classifications.

Letterpress and Litho Newsprint Inks. Letterpress newsprint inks are based mainly on mineral oil, which sometimes is combined with a resin. They dry by penetration into the absorbent paper stock. Most litho newsprint inks are based on vehicles that contain rosin-, fossil-, or hydrocarbon-type resins dissolved in aliphatic hydrocarbon solvents (see Hydrocarbon resins; Terpenoids; Resins, natural). The solvents used are fractions of petroleum in the 220–280°C boiling range. Mineral oil is used in these inks to a lesser extent, mainly in the nondrying versions. Mineral oil renders long press stability as it is somewhat higher boiling than the solvents. The heatset litho newsprint inks are heat-dried in ovens of various makes. HVHA (high velocity hot air) dryers

Table 1. Letterpress, Lithographic, and Dry-Offset Inks[a]

Ink type and use	Ink class, printing method	Drying manner	Application, stock feed	Ink consistency	Approx printing speed	Typical vehicle composition
news (papers and comics)	LP, litho	pen, HS	web-fed	liquid medium paste	300–450 m/min	min oil, res–S–O
publications (magazines, periodicals)	LP, litho	HS, QS, uv	web-fed, sheet-fed	soft–medium pastes, medium pastes	300–370 m/min, 3500–7500 sph	res–S–O, acr
commercial (display, document, pamphlet, label)	LP, litho	QS, Ox, ir, uv	sheet-fed	medium pastes	3500–7500 sph	res–O–S, acr
business documents and forms (duplicator, narrow web)	litho	QS, HS, ir	sheet-fed, web-fed	medium pastes	2000–4000 sph, 10–180 m/min	res–S–O, res–S–O–min. oil
folding cartons (food, soap, drug, liquid, parts, detergent)	LP, litho, DO	QS, Ox, uv	sheet-fed	medium–heavy pastes	3500–8000 sph	res–O–S, acr
containers and boxes (corrugated, linear)	LP	Ox, MS, pen, FW	sheet-fed	medium–heavy pastes	2500–5000 sph	res–O, res–G
books (school, directories, religious, library)	LP, litho, DO	Ox, pen	sheet-fed, web-fed	soft–medium pastes	2000–7000 sph, 120–240 m/min	res–O–S, res–min. oil–S
bags (paper, cloth, plastic)	LP, DO	HS, Ox, MS	web-fed	medium pastes	80–180 m/min	res–S–O, res–O, res–G
wrappers (bread, box, produce)	LP	MS, HS	web-fed	medium pastes	120–240 m/min	res–G, res–S
metal containers (beverage and food cans, pails, drums, displays)	litho, DO	HC, uv	sheet-fed, pr. can	medium–heavy pastes	2000–5000 sph, 100–500 cpm	alkyd–S, res–O–S, alkyd–amines–S, acr
plastic (cups, bottles, displays, book covers)	DO, litho	HS, Ox, uv	pr. can, sheet-fed	medium–heavy pastes	100–200 cpm, 2000–4000 sph	res–S, res–O–S, acr

[a] Abbreviations: LP, letterpress; DO, dry offset; pen, penetration; HS, heat-set; ir, infrared; Ox, oxidation; QS, quick-set; FW, fiber wetting; MS, moisture set; uv, ultraviolet; HC, heat cure; pr. can, preformed can; acr, acrylate oligomers; sph, sheets per h; cpm, containers per min; min. oil, mineral oil; res, resin; S, solvent; O, oil; G, glycol.

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are most commonly used but infrared and gas-flame types also are employed occasionally on older presses.

Rotary Heat-Set Publication and Commercial Inks. Most rotary heat-set publication inks for both letterpress and litho presses are based on vehicles containing natural or semisynthetic resins (often gilsonite–hydrocarbon resins in blacks or rosin esters with glycerol or pentaerythritol with hydrocarbon resin and occasionally phenolic modified resin in colors) dissolved in 4°C fractions of aliphatic hydrocarbons that boil between 200–280°C. 5–10% of alkyd is normally contained in the litho versions (see Alkyd resins). These inks dry in 1 s or less by solvent evaporation or by solubilization of dispersed resins at the web temperature of 90–180°C which is achieved in one of the three dryers mentioned above.

Sheet-Fed Commercial Inks. A large segment of commercial printing is done on sheet-fed presses mainly by the litho process. Inks for these presses are based on vehicles containing phenolic, maleic-modified, or rosin-ester resins dissolved in vegetable drying oils and diluted with hydrocarbon solvents. The better inks contain alkyds in place of the oils or, occasionally, these are cross-linked via diisocyanates forming urethane linkages. On coated stocks, most sheet-fed inks quick-set first to a tackfree state by coagulation and solvent separation and then fully dry by oxidation. Air (oxygen) upon reaction with unsaturated oils forms a highly cross-linked (polymerized) tough ink film. Most commonly used oils are linseed, soya, Chinawood, and tall oils. Recently, new acrylic resins have been developed for use in quickset inks. They offer nonskinning properties and prolonged press stability.

Document-Reproduction (Duplicator) and Business Form Inks. Duplicator sheet-fed machines require very press-stable, yet quick setting inks. They must also possess fine lithographic properties of high tolerance for water-fountain solution and of dense and sharp printing properties on a wide variety of papers. The inks contain drying-oil alkyds or plain bodied oils, along with lithographic-type (nonpolar) resins and high boiling (280–370°C) hydrocarbon solvents. The rubber-type inks are based on cyclized (depolymerized) synthetic rubber which exhibits exceptionally fast setting. This property results from rapid release of the solvent.

Business-form inks closely resemble the lithographic heatset news inks (first group); however, they are higher in viscosity and often contain some mineral oil. Recently, business forms have been printed by the jet-dot method (see Ink Jet Printing). The inks are based on glycols, water, and dyes.

Folding-Carton Inks. The majority of folding-carton inks are based on various quick-set vehicles (see above). However, when maximum gloss and high rub and product (ie, grease, soap) resistance are required, they contain glossy oleo–resinous vehicles. These vehicles are composed of phenolic, phenolic-modified, and maleic modified and/or esterified rosin resins which have been dissolved in drying oils or alkyds or both. These vehicles dry by oxidation to form tough, glossy films which, unfortunately, become difficult to print over at a later time. Ultraviolet-light-cured inks are also being used in litho printing of high quality folding cartons (see Uv and Electron-Beam Systems).

Corrugated and Kraft-Liner Container Inks. Ink vehicles for corrugated and kraft-liner containers often consist of oeloresinous materials. They dry by oxidation. In the instances, however, where very fast drying is required and gloss is not of major importance, moisture-set or fiber-wetting inks are employed. Moisture-set inks are based on several acid-bearing resins (fumarated rosin) or their part-esters dissolved in di-

ethylene, dipropylene, or triethylene glycols. They dry by precipitation of the resin solids upon the absorption of moisture by the hygroscopic glycols. Moisture-insensitive fiber-wetting varieties of these inks are prepared by forming alkaline salts of the acid resins. They dry by preferential wetting of the cellulose fiber by the polar glycols (hexylene, di- and tripropylene glycols).

Book, Bag, and Wrapper Inks. Vehicles in book, bag, and wrapper inks essentially are very similar to those already discussed under the commercial and publication inks.

Metal Container Inks. Ink vehicles for metal containers that are printed on special sheet-fed litho presses are based mainly on blends of oleo-resinous and heat-set varnishes containing the previously mentioned resins, alkyds, and oils (see Folding-Carton Inks). Some of these (high bake versions) are composed of nondrying alkyds and melamine resin. Metal-decorating inks dry during a 10 min cure at 150–200°C in 6–30 m gas-fired ovens. Polymerization, oxidation, and cross-linking reactions account for their drying and hardening. Ultraviolet-cured inks also have become very popular in metal decorating (see below).

Preformed Aluminum or Steel Containers. Ink vehicles for dry-offset printing of preformed aluminum or steel containers are essentially based on polyester vehicles used in conjunction with melamine cross-linkers. (Recently developed short-cycle ovens are now used which dry inks in 2–10 s at a temperature as high as 340°C.) The rheology of these inks must be adjusted to the unique geometry of the press. Ferranti, Haake, IC Rotational, or Laray viscometers are being utilized to determine the viscosity and yield value of the inks. In addition to these instruments, the Inkometer is used to determine tack value and press stability. Desired rheological properties are achieved by the use of gellants as well as pigments.

Plastics. Vehicles in inks for plastics (polyethylene, polystyrene, vinyl) are based on hard-drying oleoresinous varnishes which sometimes are diluted with hydrocarbon solvents. Dry-offset inks for polystyrene employ vehicles of somewhat more polar nature. Polyester or other synthetic resins (acrylic) dissolved in glycol ethers and/or esters represent a frequent choice. Uv inks are widely used for decoration of preformed plastic containers.

Manufacture. Paste inks are produced in two ways: (*1*) by mixing predispersed (preground) or flushed pigment concentrates with vehicles, solvents, oils, and compounds, or (*2*) by mixing dry pigments or resin coated pigments with vehicles and compounds and then grinding them on ink mills. Some typical ink formulas are given in Table 2.

Mixing is done in sigma-blade (dough) mixers of various sizes, in plain change-can mixers, or in large agitated tanks which can hold up to 4500 kg. A variety of equipment is being employed, from simple agitator to high speed, saw-bladed or concentric, double-blade dispersor in an attempt to achieve the desired dispersion. Baker-Perkins dough mixers are steam-jacketed, thus they allow hot (90–120°C) mastication mixing (see Mixing and blending).

Milling is done on three- or five-roller horizontal or vertical mills and in shot mills. Softer, more fluid inks are ground in shot mills (vertical and horizontal), in ball mills, and occasionally, in colloid mills.

The three-roller mill is commonly used for grinding viscous paste inks. Its steel rollers are polished and accurately machined to form a crown in the center. A definite speed differential exists in rotation of each of the rollers with respect to each other.

Table 2. Typical Ink Formulas[a]

LP newsprint black			*HS publication blue*		
10 or 15	carbon black		14	phthalocyanine blue	
2 or 3	induline toner		10	alumina hydrate	
85 or 67	mineral oil (1 Pa·s or 10 P)		35	pentaerythritol rosin ester–HC solvent	
3 or 15	mineral oil (low viscosity)		30	HC resin in HC solvent	
100 *100*	*Total*		6	polyethylene wax compound	
Quick-set litho black			5	aliphatic HC solvent (240°C)	
16 or 18	carbon black		*100*	*Total*	
4 or 6	alkali blue toner		*Uv cure ink*		
63 or 58	phenolic resin–oil (HC solvent 280°C)		25	permanent 2B red	
10 or 6	bodied linseed oil or alkyd		5	clay or aluminum hydrate	
2 or 2	cobalt linoleate		50	epoxy diacrylate oligomer	
5 or 10	aliphatic HC solvent (280°C)		10	benzophenone	
			5	wax compound	
			5	trimethylolpropane triacrylate	
100 *100*	*Total*		*100*	*Total*	
Lp moisture-set light blue			*Metal decorating litho white* (sheet fed)		
25	titanium dioxide		50 or 55	titanium dioxide	
3	alkali blue		45 or 25	drying alkyd	
9	iron blue		0 or 15	hard resin–linseed oil	
50	fumarated rosin–TEG		1 or 2	manganese naphthenate	
10	HC wax compound		4 or 3	aliphatic HC solvent (280°C)	
3	TEG				
100	*Total*		*100* *100*	*Total*	

[a] Abbreviations: LP, letterpress; HC, hydrocarbon, TEG, triethylene glycol; HS, heat set.

They also can be set to provide greater or lesser clearance between them. The dispersion of the pigment is accomplished by shearing forces generated by this differential speed as well as by the closeness of roller setting. The shot mills break pigment particles by hammer action of the speeding shots. The smaller the size of the shot and the higher loading and the more complex (tortuous) path in the chamber, the better the dispersion. In order to accommodate the more viscous inks, some mills have a cooled agitator shaft and are equipped with protruding fingers in the chamber.

Finished inks are packed in metal cans (0.5, 1, 2, or 5 kg), in metal or plastic pails (8, 11, and 19 L), or in 114- or 190-L metal or fiber drums and, occasionally, in tote bins. The more fluid inks (news, flexo, or gravure) usually are delivered in tank cars.

Ink vehicles are produced in separate resin-varnish plants. Here 1,900–19,000-L reactor kettles are equipped with powerful agitators, reflux condensers, liquid traps, gas and liquid pumps, and ducts for material charge. Heating is done by multistage Dowtherm or hot-oil jackets, or in some installations, electric (induction) heaters. Older units employ banks of gas-fired ceramic-cup burners. Temperatures and reaction rates are automatically monitored and controlled. Finished vehicles are filtered routinely via cone filters. In order to comply with EPA rules, reactor exhaust is scrubbed or incinerated. Operators should wear protective gear, such as respirators, safety glasses, etc, in order to avoid any health hazards or injury. The plant air is analyzed routinely for the presence of dust or volatiles from organic compounds.

Synthesized resins can be cast in solid form from the reactor kettles or more typically, converted directly into fluid varnishes in a single operation, often employing special blending kettles for this purpose. Recently, reactors used for vinyl-type polymers are of continuous (pipe) design which normally is more economical.

Control and Testing. Control of inks is done by examining their color, strength, hue, tack, rheology, drying rate, stability, and product proofness. Elaborate control equipment and laboratory testing procedures are employed to test the finished inks. Weather-Ometers, Fade-Ometers, glossmeters, colorimeters, spectrophotometers, viscometers, rub testers, and occasionally, gas chromatographs are employed to check production batches or to pretest new submissions or raw materials. Proofing presses and sometimes pilot presses are utilized by ink manufacturers to control the production and test new formulations. The trend toward higher printing speeds and quality, and toward greater economy and reduced air pollution necessitates vigorous ink research and development effort. New regulations, changing cost of raw materials, different substrates, and faster presses require constant updating of the formulations. Considerable research and development time and expenditures have been devoted to lower-temperature drying and nonpolluting inks. Ultraviolet cure for inks and waterborne inks for plastics represent the major programs and radical deviations from the traditional systems (see Uv System).

Lithographic Inks—Special Considerations. As with inks for all other printing processes, lithographic inks must be deposited on the substrate in selected areas only, eg, as required to produce an image. The method of achieving this selectivity, however, is considerably different in the lithographic process. The image on the plate is neither raised nor lowered but is on the same plane as the nonimage. Nevertheless, the ink must be kept from depositing on the nonimage area of the printing plate (see Printing processes) (6–8).

The ability to attain this image selectivity is governed by the physicochemical nature of the process-involving plate, fountain solution, and ink all acting together in a ternary dynamic system. It is this situation that imposes certain requirements upon lithographic inks not common to other printing inks.

Thus, the first requirement is that the vehicle be water-immiscible; indeed, mere water immiscibility is not enough but the interfacial relationship between ink and fountain solution must also prevent easy emulsification. Second, the vehicle must wet the pigment sufficiently well so as to preclude any possibility of the pigment's transferring to the aqueous fountain solution.

Obviously, these two primary characteristics are achieved by proper selection of vehicle and pigment. In general, heat-bodied drying oils, oil-extended alkyds, and solutions of various types of nonpolar resins in water-immiscible solvents serve as satisfactory vehicles. Pigments are selected for their dispersibility in the appropriate vehicle, their tinctorial strength, and their nonbleeding characteristics into the acidic fountain solution. Of course, consideration must be given to any particular use requirements involved, such as resistance to high temperature bake, product resistance and lightfastness.

The requirements of a particular lithographic ink are further governed by the nature of the press itself, such as whether it is single- or multicolor, sheet-fed or web-fed, or whether the ink is aimed at metal decorating. As sheet-fed presses increase in size, they also increase in linear printing speed. Web-offset presses also operate at higher linear printing speeds than the sheet machines. The linear printing speed, therefore, must be considered in adjusting the rheology of the ink; ie, the higher the speed, the lower the ink tack should be. This is necessary to prevent the substrate from sticking to the offset blanket, which can result in picking or tearing the sheet or pulling it from the grippers, or in web breaks in the case of web-fed presses.

Good performance of the ink on the plate is of paramount importance. Aside from the intrinsic characteristics of the ink by reason of the specific formulation, the most important extrinsic factor is the condition of the lithographic plate, particularly that of the nonimage area. The ink must transfer a sharp, clean image to the blanket and thence to the substrate. This means that no ink is permitted to appear in the nonimage area (if this occurs, it is known as scumming). Scumming may result from such causes as improper desensitization of the nonimage area, incorrect fountain solution, or poor dampening, as well as improper surface characteristics of the ink. Color can appear in the nonimage area for other reasons also, such as by running too little fountain solution (a condition known as catchup), by pigment transfer to the aqueous phase or by the ink itself having too low a viscosity.

The web-fed lithographic process (web offset) is one of the fastest growing printing methods. Heatset and paper-penetrating inks are being offered for this application. The presses range from full width (91 cm) to half web and narrow web (30 cm) types, operating from 120 to 490 m/min. In some cases, letterpresses are being partly converted to a hybrid lithographic process called direct litho (di-litho). Here, the printing is done directly from lithographic plate onto the paper, rather than indirectly via a blanket cylinder in classic lithography. Considerable research on the lithographic system led to the introduction of printing plates that are sufficiently selective to the ink in the image and nonimage areas to be able to eliminate the need for water-fountain solution. This variation, however, found only modest acceptance by the industry. Another recent development is the energy conserving low temperature drying (LTD) ink formulation based on the dispersed polymer principle or on co-solvent approaches.

Radiation-Cure Inks

In response to air-pollution regulations, the shortage or high cost of natural gas and because of a general desire to conserve energy, new ink formulations–drying systems have emerged which are based on radiant energy: ultraviolet, electron-beam, and infrared radiation. Lithographic and letterpress inks are now available for web-fed and sheet-fed presses that will cure–dry instantly when exposed to radiators of the required intensity. A brief description of each system follows.

Uv System. In the most simple form, uv inks consist of a reactive (monomeric or oligomeric acrylate) vehicle, photoinitiator (benzophenone), and colorants (conventional pigments). With the absorption of photons from a mercury lamp, the sensitizer becomes excited. It then undergoes electronic transitions and, thereby, becomes very reactive. In this state, it initiates free-radical reaction among the reactive species of the vehicle. This results in hardening (drying) of the ink film. General quality, stability, and safety difficulties must be considered when the manufacture and use of uv inks is attempted. They also tend to be more costly than the conventional types. In spite of these shortcomings, uv inks are now commercial for printing of paper, plastic, and metal because of the environmental and energy conservation benefits (13–17).

Electron-Beam System. Electron-beam-cured inks are similar to their uv counterparts. Electron irradiation, however, does not require photoinitiators in the formula as it readily cross-links the vinyl-rich vehicle, often requiring only 10–20 kGy ((1–2) $\times 10^6$ rad) of energy. The irradiators must be well shielded with a lead plate to be

harmless. The production units are still very costly as the electron-beam system is only in the early development stage for printing applications. At present only a few installations exist. The great energy conservation potential of electron-beam cure (10% of the heat energy) makes the system quite attractive to printers and convertors (15,18).

Ir System. Ir radiation imparts instant intense heat to the substrate and to the ink. It causes evaporation of solvent in heatset inks or quicksetting of sheet-fed inks. The latter application is relatively new and especially effective for inks that gel and penetrate readily into the stock. For many years, gas-fired ir-cup irradiators have been used on web-litho and letterpress machines with good success. The most recent innovation, however, is based on new, electrically (rather than gas) energized elements with sufficiently broad wavelength output to render the beam essentially nonselective to colored inks (see Infrared technology).

Flexographic and Rotogravure Inks

Flexographic and rotogravure inks have many elements in common with inks used for other printing processes. They constitute a distinct class, however, because of the specific characteristics of their printing processes, their application and ingredients, and methods of manufacture. The colorants, pigments, and dyes are the same as those used for letterpress, offset, and other methods. (A possible exception is the use of special surface treatment to provide better wetting and dispersion in flexographic and rotogravure-ink vehicles.) However, the flexographic and rotogravure inks differ from other inks in that they are of very low viscosity, they almost always dry by evaporation of highly volatile solvents, and generally they are produced by different manufacturing processes from those used for other inks (3,6,8).

Solvents. Flexographic and rotogravure printing processes require the use of very volatile solvents such as low boiling point alcohols, esters, aliphatic and aromatic hydrocarbons, ketones, and water. However, the flexographic process requires solvents that do not attack rubber rollers and printing plates, whereas there is no such limitation to gravure. Table 3 shows relevant properties of a number of solvents; those marked are limited to gravure.

High volatility is needed to provide fast enough drying to allow subsequent impressions on multicolor work and to prevent sticking or blocking in rewinds.

The high boiling solvents used for heat-set letterpress and offset inks would cause distortion and, therefore, cannot be used for printing plastic substrates usually printed by flexography and rotogravure.

Gravure inks usually are made to dry faster than flexographic inks because each impression must be completely dry before a subsequent impression. Flexographic inks do not have to be completely dry to receive a second impression but trapping (overprinting) is best when there is a great difference in dryness between the first-impression ink and the second-impression ink at the point of the second impression. This is usually controlled through variation in drying speed of the inks, with the first color printed being the most volatile.

Solvents for inks used for odor-sensitive packaging must be of low residual odor

Table 3. Typical Physical Constants of Commercially Used Flexo and Gravure Solvents[a]

Solvent	Comparative drying time[b]	Boiling range, °C	Flash point, °C	Quantity at 20°C, g/L
Alcohols				
methyl alcohol	10	64–65	16	791
ethyl alcohol, 99% anhydrous	18	75–80	18	791
ethyl alcohol, 95%	20	75–80	18	815
isopropyl alcohol, 99%	27	81–83	21	785
n-propyl alcohol	55	95–98	29	803
sec-butyl alcohol	63	99–100	29	801
isobutyl alcohol	77	106–109	39	801
n-butyl alcohol	125	116–119	46	809
Aliphatic naphthas[a]				
hexane	7	66–70	−18[c]	683
fast diluent naphtha	7	60–82	−18[c]	689
heptane (tolu-sol)	15	93–104	−18[c]	725
lacquer diluent	17	93–116	−1[c]	743
octane	31	102–110	−1	743
VM & P (varnish makers' and painters') naphtha	51	121–149	10	755
mineral spirits	600	154–204	38	779
Aromatic hydrocarbons[d]				
toluene	26	109–112	7	868
xylene	88	135–143	27	870
Esters[e]				
methyl acetate, 80%	5	53–59	−1[c]	899
ethyl acetate, 88%	10	72–80	6	887
isopropyl acetate	12	84–90	16	869
n-propyl acetate	22	95–103	18	881
sec-butyl acetate	33	104–117	32	860
isobutyl acetate	36	110–119	31	863
n-butyl acetate	63	115–130	39	875
amyl acetate	100	120–150	47	863
Cellosolve acetate	330	145–165	49	971
Glycol ethers				
Dowanol PM	88	118–126	38	917
methyl Cellosolve	130	123–126	46	962
Cellosolve	190	132–137	54	928
butyl Cellosolve	1000	166–173	74	804
Ketones[f]				
acetone	5	56–57	−9[c]	791
methyl ethyl ketone	11	78–81	−1[c]	804
methyl isobutyl ketone	37	114–117	24	801
methyl isoamyl ketone	150	143–146	43	813
cyclohexanone	270	130–173	54	944
Nitroparaffin				
2-nitropropane	50	119–120	39	987

[a] Acceptable for flexo if used with buna rubber plates and rollers.

[b] The drying-time comparisons are based on the use of ethyl acetate as standard at 10. Acetone is about twice as fast as ethyl acetate and is listed as 5.

[c] At very low temperatures, flash-point determinations are inconsistent; flash occurs below the temperature shown.

[d] Cannot be used in flexo.

[e] Should not exceed 25% of flexo solvent.

[f] Flexo usage restricted to butyl rubber plates and rollers.

to prevent product contamination. Hydrocarbons, in particular, should be selected to have narrow boiling ranges and negligible mercaptan content.

Solvent volatility, like rheology, is varied to attain the best printability with different types of work and printing speed. Slow drying particularly improves printability of fine detail flexography and gravure highlights. It is thus apparent that the high volatility required for high speed is often compromised with printability. Most flexographic and gravure inks operate best when formulated with a combination of solvents. However, the use of solvent blends causes a problem because the solvent evaporates from ink fountains and must be replaced to maintain viscosity. The constituent solvents in a blend seldom evaporate in the same proportion as they were initially in the ink. Therefore, makeup solvent should be proportioned to duplicate the evaporating proportion.

The evaporation of solvent mixtures can be quite complex, because of the interaction of the solvents. In some cases, such as ethyl acetate and toluene, the more volatile solvent, ethyl acetate, is more volatile from mixtures of all compositions; but ethanol (bp 78.3°C) is more volatile from mixtures containing mostly ethanol, whereas from mixtures containing a low percentage of toluene (bp 110.6°C), the toluene shows enhanced volatility.

Solvent combinations are selected for each type of ink on the basis of printability, drying speed, economy, and odor. Examples of specific flexographic and gravure ink systems are given in the sections dealing with specific inks.

Most volatile solvents constitute a fire hazard, requiring both printing plants and ink-manufacturing facilities that are constructed with fire- and explosionproof equipment.

Resins or Polymers and Other Vehicle Solids. The selection of resins or polymers for flexographic and rotogravure inks depends on the printing process, the solvent, and most important, the substrate to be printed and the ultimate use of the printed matter. Detailed examples are covered under the sections dealing specifically with flexographic inks and rotogravure inks. However, certain general requirements are common to both processes.

Printing Process. The printing process is a resin selection determinant because flexographic rubber rollers and plates preclude the use of aromatic hydrocarbons and limit the use of aliphatics, esters, and ketones. Therefore, resins soluble in aromatics only cannot be used in flexographic inks. Esters and ketones should be used in low concentrations. Chlorinated rubber is a typical example of a resin limited to gravure inks.

Solubility. Resins or polymers must be soluble readily and should provide low viscosity solutions at high solids (25–50%). Generally, the better the solubility, the better the print quality. Certain polymers, such as poly(vinyl acetate), tend to string or cobweb, causing poor printing.

Substrate. Paper and other stocks which partially absorb and mechanically hold inks do not present an adhesion problem. Certain paper or paperboard coatings and many plastic films, however, require that the ink have a chemical affinity for the substrate. This is achieved by proper resin selection. For instance, soluble vinyls are usually used in ink formulations for vinyl substrates.

Ultimate Use. The ink vehicle determines the resistance properties of a printed

substrate. This indicates that the ultimate use of printed matter is an important resin determinant. For instance, a packaging material used for greasy foodstuffs could not be printed with an ink based on aliphatic-soluble resins because grease acts as a solvent causing the print to smear. Similarly, cellophane which is to be heat-sealed should be printed with inks based on resins of high enough melting point to withstand the heat-seal operation. Inks for food packaging and other odor-sensitive applications should not be formulated with odoriferous resins such as phenolics.

Auxiliary Vehicle Components. Plasticizers are used in flexographic and rotogravure inks to provide ink film flexibility and aid adhesion. Excessive use causes a soft film and blocking.

Waxes and lubricants are often added in small quantities to provide scuff resistance.

Manufacture. Manufacturing processes can be related to two operations—vehicle preparation and color dispersion. Vehicle preparation can be as basic as polymerization of resins or as simple as cold dissolving of vehicle solids in appropriate solvents. Therefore, vehicle equipment includes autoclaves for polymerization reactions and high speed mixers for simple dissolving.

Pigment dispersion usually is done in ball mills which lend themselves to volatile fluid formulations. Pebble mills using porcelain balls and linings are used for white and light colors because steel ball mills, although more effective, cause discoloration. Darker colors such as reds, blues, and blacks are usually made in steel ball mills.

Color concentrates and pigment resin dispersions called chips are made in dough mixers and two-roll rubber mills. These high shear methods often result in better dispersion and consequently higher gloss than is achieved with ball mills. Rubber-mill chips are dissolved similarly to resins to provide color concentrates. Dough mixer and chip concentrates must be diluted with solvent and other vehicles to make finished inks. Sand milling is becoming more widely used in both flexo and gravure ink manufacture. Other high speed dispersing units, such as the Morehouse, Cowles, Kady, and others, are also used to advantage.

Flexographic Inks. Flexographic inks comprise an almost infinite variety of specific formulations for specific purposes. They can, however, be classified into five general composition categories: (*1*) alcohol-dilutable inks containing nitrocellulose as a main constituent of the vehicle; (*2*) polyamide inks; (*3*) dye inks; (*4*) acrylic inks; and (*5*) water-based inks. Inks can also be classified by intended use. Examples include paper or carton board, surface-printed foil and plastic films, and reverse-printed plastic films to be subsequently laminated.

Flexographic inks are supplied at a higher viscosity than they are used, and they must be diluted (reduced) just before use. A normal diluting solvent, or a fast-drying solvent may be used, according to conditions.

Alcohol-Dilutable Inks Containing Nitrocellulose as a Main Constituent of the Vehicle. Nitrocellulose (cellulose nitrate) frequently is combined with other resins and plasticizers to satisfy a variety of needs. These inks are used on paper, cartonboard, glassine, foil, cellophane, cellulose acetate, ethyl cellulose, polyester, polystyrene, and, occasionally, treated polyethylene. Dilutability with solvents primarily containing ethanol is a desirable characteristic because it permits the use of highly resilient, long wearing natural-rubber printing plates. The best solubility and consequent printability results from a mixture of 80–90% ethanol, the remainder comprising an ester such as

ethyl, isopropyl, or *n*-propyl acetate, and a glycol ether. The proportion of ester and glycol ether determines drying rate and is, therefore, selected on the basis of press speed and color sequence in multicolor work.

Nitrocellulose-based flexographic inks usually have a little less gloss than the best grades of polyamide type inks. Most nitrocellulose inks have fair to good heat resistance, generally 120–180°C. Nitrocellulose can be combined with acrylic ketone and polyester resins to provide compatibility with laminated adhesives and extruded polyethylene. Adhesive compatibility is required when ink is sandwiched between films to be used as packaging for snacks and other products requiring moisture and gas-barrier properties.

A typical surface-printing nitrocellulose ink formula is: titanium dioxide, 35 wt %; anhydrous ethanol, 30 wt %; esterified fumarated resin, 10 wt %; *n*-propyl acetate, 10 wt %; 0.25-s SS (viscosity measured by Zahn cup) nitrocellulose, 7 wt %; propylene glycol monomethyl ether (retarder), 5 wt %; dibutyl phthalate, 2 wt %; microcrystalline wax, 1 wt %. A typical laminating nitrocellulose ink formula is: titanium dioxide, 35 wt %; anhydrous ethanol, 32 wt %; ketone resin, 18 wt %; *n*-propyl acetate, 8 wt %; 0.25-s SS cellulose nitrate, 7 wt %. The diluents for both are: normal diluent, 90% anhydrous ethanol, 10% *n*-propyl alcohol; fast drying diluent, ethyl acetate; retarder, propylene glycol monomethyl ether (1-methoxy-2-propanol; not for laminating inks); slow drying diluent, 90% *n*-propanol, 10% *n*-propyl acetate. Dry nitrocellulose is explosive; extreme caution should be employed in use and storage. It should be stored in a well-ventilated, cool, isolated place, not in thick sections but in small units with space for ventilation and dissipation of any accumulated heat, not near steam pipes or other source of heat. In case of fire, combat by flooding with water. If fire gets out of control, move personnel out and let it burn. Do not close up space where nitrocellulose is burning; the accumulation of very hot flammable gases explodes violently on contact with air. Avoid inhaling brown fumes from decomposing nitrocellulose.

Polyamide Inks. The most widely used family of flexographic printing inks for printing plastic packaging films are formulated with polyamide resins. Co-solvent polyamide resins are most soluble in a mixture of equal parts of alcohol and aliphatic hydrocarbons. The most common blend is normal propyl alcohol and a low residual odor narrow-cut VM & P (varnish makers' and painters') naphtha. Buna rubber printing plates should be used to accommodate the hydrocarbon solvent.

Co-solvent polyamide resins largely have been replaced with alcohol-soluble varieties. Alcohol-soluble polyamides have the advantage of improved nitrocellulose compatibility and printability with natural-rubber plates. Alcohol-soluble polyamide inks have replaced co-solvent types to prevent odor caused by absorbed hydrocarbon solvents.

A typical co-solvent-type polyamide ink is: *n*-propyl alcohol, 30 wt %; narrow-cut VM & P naphtha, 30 wt %; polyamide resin, 24 wt %; phthalocyanine blue, 15 wt %; polyethylene wax, 1 wt %; normal diluent, 50% *n*-propyl alcohol, 50% VM & P naphtha; fast-drying diluent, 50% isopropyl alcohol, 50% heptane range hydrocarbon (bp 93–113°C).

A typical alcohol-reducible-type polyamide ink is: ethyl alcohol, 33 wt %; alcohol soluble polyamide resin, 28 wt %; phthalocyanine blue, 15 wt %; *n*-propyl alcohol, 15 wt %; *n*-propyl acetate, 8 wt %; polyethylene wax 1 wt %; normal diluent, 90 wt % ethyl alcohol, 10 wt % *n*-propyl acetate; and slow diluent, 90 wt % *n*-propyl alcohol, 10 wt % propyl acetate.

Where heat resistance is not a primary consideration, polyamide-based inks are used almost universally for printing treated polyethylene and treated polypropylene films, poly(vinylidene chloride)-coated films of all types, polyester films, cellulose acetate films, oriented and expanded polystyrene films, and polyamide films. Moderate heat resistance is achieved by replacing part of alcohol-soluble polyamide with nitrocellulose. Polyamide inks containing nitrocellulose have somewhat less gloss than inks containing only polyamide resin.

Slow solvent–low odor hydrocarbons, moderately less volatile than VM & P naphtha, are not generally available. Therefore, the best way to retard drying speed is by increased proportion of *n*-propyl alcohol or by modification with a resin that has slow solvent release (esterified fumarated rosin) (see Polyamides).

Dye Inks. The original flexographic inks were based on dyes dissolved in alcohol and mixed with shellac. The dyes, usually of triphenylmethane type, provide brilliant, intense colors for paper, glassine, and foil. Permanence and bleeding of these inks have been improved through laking with phenolic resin but dye inks are still not considered for packaging films.

A typical dye-ink formula is: methyl violet, 15 wt %; phenolic resin, 30 wt %; ethyl alcohol, 55 wt %; normal diluent, ethanol; slow-drying diluent, glycol ester; fast-drying diluent, ethyl acetate.

Acrylic Inks. Acrylic-type flexographic inks are most widely used where substantial heat resistance, together with their unique properties, are required for printing a wide range of poly(vinyl chloride) and poly(vinylidene chloride) films and coatings, oriented polystyrene, rubber hydrochloride, some grades of polyester films, some grades of cellulose acetate films, polyamide films, and some oriented polypropylene films.

Acrylic inks usually have less gloss than nitrocellulose-based inks. Dried ink films based on acrylic resins are usually very hard and tough with excellent abrasion resistance.

Most of the flexographic inks in this category require a mixture of a minimum of 20% ester solvent with anhydrous proprietary ethanol. In some cases, higher percentages of ester solvent are recommended to obtain good printability. Because of this, either natural-rubber printing plates and rollers or butyl-rubber printing plates and rollers often are recommended. In addition to excellent adhesion on many plastic film surfaces, acrylic-type flexographic inks are distinguished for good block resistance, excellent grease resistance, excellent water resistance, and many other difficult product requirements. With suitably formulated inks, these qualities are frequently combined with good heat-sealing characteristics. Partial replacement of acrylic resin with nitrocellulose provides even better heat-sealing characteristics, heat resistance and compatibility with laminating adhesives.

A typical acrylic ink formula is: ethanol, 32 wt %; titanium dioxide, 30 wt %; alcohol-soluble acrylic resin, 20 wt %; *n*-propyl acetate, 17 wt %; microcrystalline wax, 1 wt %; normal diluent, 65 wt % ethanol, 35 wt % *n*-propyl acetate; slow-drying diluent, glycol ether; and fast-drying diluent, ethyl acetate.

Water-Based Inks. Approximately 30% of all flexographic inks use water as their primary solvent and diluent. Until recently, they contained vehicles based on alkali-soluble proteins such as casein and alpha protein and partially esterified fumurated rosin and shellac. Carboxylated acrylic resins, usually containing styrene, have largely replaced natural resins because they provide better abrasion and water resistance. Ammonia or other volatile amines are used to solubilize carboxylated resins and form

resin salts. The volatile alkali evaporates from the ink film, rendering the printed matter water-resistant.

Water inks differ from acrylic water paints which contain latices. Latices historically have resulted in high yield value, thixotropic inks having poor printing properties. Newer latex concepts, however, have been useful. They benefit ink formulation by increasing vehicle solids. High molecular weight compositions can be varied to provide improved physical properties such as adhesion, gloss, and product resistance.

Water inks historically have been used for a variety of paper and paper board. The excellent heat resistance of proteins make that type of ink particularly useful for kraft liner board which must later withstand the heat of a corrugating process. Main advantages of water inks include excellent press stability printing quality, heat resistance, absence of fire hazard, and the convenience and economy of water for reduction and washup. The historical disadvantages include low gloss and slow drying which limited their use to absorbent stocks. The increasing cost of petroleum-derived organic solvents and air-pollution regulations have led to the development of water inks having excellent gloss, water resistance, and adhesion to foil and plastic film.

A typical low cost, water-based ink formula is: water, 62 wt %; barium lithol red, 15 wt %; isolated soya protein, 5 wt %; octyl alcohol (defoamer), 5 wt %; ammonium hydroxide (density, 0.90 g/cm^3) (29.1 wt % NH_3), 2 wt %; microcrystalline wax, 1 wt %. A typical better wet and dry rub resistance, water-based ink formula is: water, 63.5 wt %; carboxylated acrylic resin, 18 wt %; barium lithol red, 15 wt %; ammonium hydroxide (density, 0.90 g/cm^3) (29.1 wt % NH_3), 2 wt %; polyethylene wax, 1 wt %; fatty acid ester or silicone defoamer, 0.5 wt %. The diluents for both are: normal diluent, water; slow-drying diluent, glycol ether or glycol and fast-drying diluent, ethanol.

Rotogravure Inks. Since there is no rubber contact with solvents in gravure ink formulations, it is permissible to use solvents such as ketones and aromatic hydrocarbons which cannot be tolerated in flexo inks. This provides the gravure ink formulator with much greater latitude with regard to binder selection and constitutes the principal difference between gravure and flexo inks. In other respects the compositions used are on the whole similar (2,6,8).

Straight polyamide ink formulations have been reported to cause trouble on gravure equipment because of poor wiping characteristics. This objection has been compounded by the inability of straight polyamide inks to dry hard enough between color stations to work well at high press speeds. Additions of nitrocellulose to such an ink will improve both performance characteristics. Gravure printing of polyethylene film is limited to only a few converters which have mastered the stretchiness and poor registration problems with polyethylene by using carrier webs—sometimes referred to as slip sheeting. The use of polyamides in protective overlacquers applied by gravure appears to be more important than its use in gravure inks at this time.

Nitrocellulose-based inks are widely used for rotogravure printing of the same variety of plastic films mentioned in the section on flexographic inks. The main difference here again is that the rotogravure process does not involve any solvent restrictions so that solvents, such as isopropyl acetate, toluene, etc, can be used. Alcohol frequently is used as a part of the blend but in minor quantities.

Acrylic-type rotogravure inks are quite widely used for the same combination of properties, product resistance, and use requirements as those listed for flexographic inks. However, the thinner or solvent mixtures for the acrylic inks in rotogravure

printing normally consist of ester solvents such as isopropyl acetate. Little or no alcohol is used in the rotogravure version of the acrylic-type ink formulations.

Another important type of rotogravure ink system for flexible packaging application is that based on chlorinated rubber binder dissolved in aromatic hydrocarbon solvent such as toluene. Inks of this type cannot be used on flexographic printing equipment because of the undesirable solvent swelling of rubber plates and rollers that would result.

As with flexo inks, gravure ink formulations must take into account the following end-use characteristics: adhesion; blocking; alkali resistance; odor; grease and oil resistance; moisture-vapor transmission; paraffin bleed; acid resistance; scuff resistance; heat resistance; and product resistance.

To achieve the above-mentioned end-use characteristics, one must know which substrate is to be printed, ie, paper, film, foil, or board, and then one can select an ink containing the proper binder and solvent combination to satisfy the requirements. All of the various gravure ink systems are not necessarily compatible with one another. Because of this, the system shown in Table 4 has been devised to avoid intermingling incompatible types.

Rotogravure publication inks represent another large segment of the total production of gravure inks made and used in the United States. Inks of this type are used in printing paper substrates used in books, magazines, catalogues, Sunday supplements, preprints, comics, etc. Hydrocarbon solvent systems are generally used for the sake of economy. The binders used are aliphatic or aromatic hydrocarbon-soluble modified rosin types having good solvent release to ensure fast drying and low residual odor. Good gloss and printability are also prime requisites. Publication printing press speeds in the range of 550 m/min are not considered unusual now and progress is being made toward the 760 m/min mark.

A typical rotogravure publication ink (type A blue) formula is: lactol spirits (aliphatic hydrocarbon solvent), 37 wt %; metallated rosin, 35 wt %; clay, 17 wt %; phthalocyanine blue pigment, 11 wt %.

Miscellaneous Inks

Screen-Process Inks. These inks, often known in the past as silk-screen inks, are printed on the substrate by being forced through a screen stencil by means of a squeegee. For many years this was a hand-printing operation, but it has now become largely mechanized. Screen-process inks are dispersions of pigments in vehicles which are, for the most part, solutions of resins in solvents of the boiling range of VM & P naphtha. Drying is usually by evaporation, but in some cases it is a combination of oxidation and evaporation. Various types of binders are used such as rosin esters, phenolics, cellulose derivatives, vinyls and oleoresinous varnishes, depending on the film properties desired. After premixing, the ink is ground on a three-roll mill. The resulting ink should be short and soft so as not to drag on the squeegee and to release the substrate cleanly after the print is made.

The screen-process method of printing can apply a thicker film of ink to the substrate than other printing processes, and for this reason, is particularly adapted to applications where maximum opacity is desired, or where fluorescent pigments are used, or for printing etch-resists for printed circuits. Screen process also is used for printing of both board and paper posters, metal signs, glass, ceramics, and plastics.

Table 4. Gravure Ink Selection Systems

Type	Resin or binder used	Solvents used	Applications
A	metallated rosins, gilsonite, and other hydrocarbon solvent resins	low-cost aliphatic hydrocarbons such as hexane, textile spirits, lactol spirits, VM & P naphtha, mineral spirits	newspaper supplement, catalogue preprint, and similar publication printing
B	ethyl cellulose plus other modifying resins	50% aromatic hydrocarbon solvent 50% aliphatic hydrocarbon solvent	same as above except designed for better performance on coated stock
C	nitrocellulose modified with resins and plasticizers	esters, ketones usually extended with aromatic hydrocarbon solvent diluents such as toluene, xylene	for printing on all papers, films, foils, and paperboard including nitrocellulose-coated cellophane, glassine, acetate, metallized paper, etc
D	polyamides	usually a 50/50 blend of alcohol and aliphatic or aromatic hydrocarbon solvent	printing on foil, paper, boards, polymer-coated cellophane, polyethylene, polyester, and other specialty films; also for hard, tough, glossy, overlacquer application
E	nitrocellulose or ethyl cellulose plus alcohol-soluble resin modifiers and plasticizers	ethanol or other alcohols plus ester solvents such as ethyl acetate	dye inks and pigmented inks for stocks described under type C
T	chlorinated rubber plus other modifying resins and plasticizers	usually aromatic hydrocarbon solvent such as toluene or xylene	for nitrocellulose-coated cellophane, foil, paper and board for labels, wrappers, and cartons; also glossy overlacquers
W	natural or synthetic resins such as shellac, casein, maleated rosins, etc	water plus alcohols when required; ammonia or other	for absorbent stocks such as liner board, wallpaper, gift wrap, laminating inks, board to be waxed, etc
X	any other nonrecognized type required	alkali used also for solubilization of binder	all other miscellaneous applications

The substrate need not be flat as the process will also accommodate round, oval, or other irregularly shaped objects.

Mimeograph Inks. Mimeograph printing is a stencil-printing process used primarily for office duplicating work for reproducing typewritten copy. The film stencil is cut by typewriter or by means of a hand stylus and wrapped around the ink-filled drum of a mimeograph printing machine. Mimeograph inks are therefore rather fluid and nonoxidizing but must dry quickly by absorption into the stock. They are generally made by dispersing carbon black into a glycol vehicle containing one or more of a cellulose binder, castor oil, and lanolin.

Stamp-Pad Inks. These inks are impregnated into a cloth or foam rubber pad and transferred by pressure to rubber type which is then stamped or impressed against the substrate. The inks must be completely nondrying in the pad and yet dry by rapid penetration into the paper. Since it is desirable that the total ink soak into the stock, dyes, such as induline black, are used rather than pigments. The vehicles used are

usually glycols, although other solvents may be used when the ink is for stamping on metal. In the latter case, phenol or cresol is incorporated into the formula.

Collotype Inks. These inks are similar to lithographic inks simply because both printing methods are planographic processes. The collotype plate, also called a photogelatin plate, is coated with sensitized gelatin, which is then exposed through an unscreened negative. The gelatin is hardened in proportion to the light intensity through the various areas. When saturated with glycerol and water, the light-hardened portions take ink, whereas the unhardened portions do not. Dampening rollers are not used and the plate is kept damp by moisture from the atmosphere as well as by renewing the glycerol from time to time. The fact that no halftone screens are used results in continuous-tone printing. The inks are formulated similarly to air-drying lithographic inks using oleoresinous vehicles but have a higher concentration of pigment and are much heavier in body.

Ball-Point Inks. These inks are medium-viscosity semi-Newtonian fluids of high tinctorial strength which must be slow drying and free of particles so as to continue to feed to the paper without clogging. Drying on the paper is accomplished by rapid penetration and some evaporation. These properties are obtained by strong dye solutions and pigment dispersions in vehicles containing oleic acid and castor oil or a sulfonamide plasticizer. Rheology of these inks exhibits modest thixotropy which prevents their leakage through the openings around the ball.

Water-based writing inks consist of very fine pigment dispersions in aqueous media containing small amounts of glycol or glycerol and a dispersing aid. They dry mainly by evaporation and quick wetting of cellulosic fibers in paper substrates.

Steel-Die Inks. Steel-plate printing is an intaglio process inks where the image is etched in continuous nonscreened lines on a steel plate. The ink is applied in a heavy layer to fill the engraving and then wiped off the nonprinting surface with paper or cloth, leaving the ink only in the engraving which is pressed against the paper with rather strong pressure to deposit the ink on the paper. This process is used for high-quality stationery, stock certificates, and paper currency. Owing to the thick film that can be deposited, high strength formulations are not required, but the body of the ink is somewhat short so as to wipe cleanly. Drying is by oxidation or by evaporation of solvent. The pigment, including a large percentage of colorless extender pigment, is dispersed on a three-roll mill in a vehicle composed of heat-bodied drying oil or oleoresinous vehicle, sometimes in combination with a resin–solvent-type vehicle. Owing to the thick film of ink deposited, sufficient drying oil must be present to prevent brittleness on aging.

Electrostatic Inks. Electrostatic printing is accomplished by causing charged colored particles to move in an electrostatic field to a substrate in the form of an image. The image may be formed by a screen stencil or by a gravure cylinder. One of the primary advantages of this process is its ability to print through gaps and thus without pressure. The electrostatic ink, also called an electrostatic toner, is a powder composed of pigment dispersed in a resin. The particles must have the proper electrical properties, particle-size range, and be free-flowing. After the image is deposited on the substrate, it is heat- or solvent-fused to a continuous film. Pigments and resins must be chosen to meet the application requirements and at the same time to satisfy the physical and chemical resistance requirements of the process (see Electrophotography).

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TO
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Diuretics, 1
Driers and metallic soap
Drycleaning and launder
Drying, 75
Drying agents, 114
Drying oils 130
Dye carriers, 151
Dyes and dye intermediate
Dyes, anthraquinone, 212
Dyes, application and evalu
Dyes, natural, 351
Dyes, reactive, 374
Dyes, sensitizing, 393
Economic evaluation, 409

DYES, REACTIVE

Reactive dyes are colored compounds that contain functional groups capable of forming covalent bonds with active sites in fibers such as hydroxyl groups in cellulose, amino, thiol, and hydroxyl groups in wool or amino groups in polyamides. This bond formation between the functional group and the substrate results in high wetfastness properties. These dyes differ fundamentally from other types of dyes that owe their wetfastness to physical adsorption or mechanical retention (see Dyes and dye intermediates). The principal commercial applications of reactive dyes are in the dyeing of cellulose, wool, and nylon, either individually or as components of fiber blends. They have also found use in dyeing silk, hair, and leather (see Dyes, application and evaluation).

Development of Reactive Dyes

The first recorded chemical combination of a dye with cellulose was achieved in 1895 by Cross and Bevan (1). They used a complicated process involving the benzoylation of soda–cellulose, followed by nitration, reduction, diazotization, and finally coupling with phenolic compounds to form the covalently fixed azo dye. Several other attempts were subsequently made to attach dyes to cellulose by means of a covalent bond (2–6). The dominating feature of almost all of this early work was the use of severe conditions such as concentrated caustic soda to prepare soda–cellulose or the use of inert solvents. The use of mild conditions necessary to render the coloration process technically feasible and reasonably efficient was given little or no consideration.

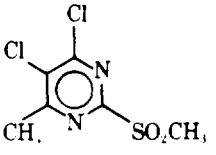
During the 1930s fast dyeings on wool were produced using dyes containing chloroacetylamino groups ($-NHCOCH_2Cl$) (7), and β-chloroethylsulfamoyl groups ($-SO_2NHCH_2CH_2Cl$) (8). It was not realized at that time that the high wetfastness of these dyes was due to the reaction between the labile chlorine atom and the amino groups in the wool.

Dyes prepared from diazo components containing β-sulfatoethyl sulfone groups ($-SO_2CH_2CH_2OSO_3H$) (9), were also patented for application to cellulose acetate and nylon, since they contained no nuclear sulfonic acid groups. Hoechst (10) commenced research work on dyes containing vinyl sulfone and β-sulfatoethyl sulfone substituents, which led to the introduction of the Remalan group of reactive dyes (11). Although it was known that the high fastness of the Remalan dyes was associated with chemical bond formation between the dye and the fiber; the suitability of vinyl sulfone dyes as reactive dyes for cellulose was not realized until after the appearance of the Procion (ICI) reactive dyes.

Previous work on the reaction of soda cellulose with cyanuric chloride (5,12) led to a useful industrial method for the production of dyeings in which a covalent bond was formed between the dye and the fiber (13). This development resulted in the introduction of the first range of reactive dyes for cellulose marketed by ICI in 1956 as the Procion M Dyes. The initial members of this range were all highly reactive dichlorotriazinyl derivatives capable of reaction with cellulose under cold-dyeing conditions. They were quickly followed by the less reactive monochlorotriazinyl dyes requiring hot-dyeing conditions, which were marketed as the Procion H range (14). Direct dyes containing triazine residues patented previously by Ciba were used in the

manufacture of a complete range of monochlorotriazinyl reactive dyes under the name Cibacron (15).

The success of the Procion dyes was followed by extensive research programs by all the major dyestuff manufacturers. As a result, a large number of reactive systems are mentioned in the patent literature (16–17). Consequently, reactive dyes containing 2,4,5-trichloropyrimidinyl groups were introduced under the trade names of Reactone (Ciba-Geigy) (18) and Drimarene (Sandoz) (19). In the early 1960s Bayer developed the Levafix P and E groups based upon 4,5-dichloro-6-methyl-2-methylsulfonylpyrimidine (1) (20) and 2,3-dichloroquinoxaline (2) (21) reactive groups, respectively; and BASF produced the Primazin P range with 4,5-dichloro-6-pyridazinone (3) (22) as the reactive species. Hoechst marketed their vinyl sulfone derivatives as the Remazol group (10). In addition, Bayer introduced similar dyes containing β-sulfatoethylsulfamoyl groups ($—SO_2NHCH_2CH_2OSO_3H$) (21), and BASF extended the Primazin range (23) to include dyes containing β-sulfatopropionamide groups ($—NHCOCH_2CH_2OSO_3H$), which combine with cellulose through nucleophilic addition reactions to form cellulose ether derivatives.



(1)
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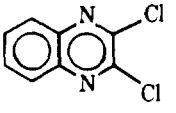

(2)
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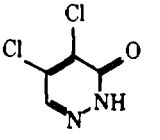

(3)
[932-22-9]

During the mid 1950s the major emphasis was on reactive dyes for cellulosic fibers, but 1959 heralded the introduction of the Procinyl (ICI) group of reactive disperse dyes designed specifically for application to nylon (24). Although reactive dyeing began with wool (7–8,11), it was not until 1963 that the first range of reactive dyes, specifically for application by exhaustion procedures, was marketed by ICI under the trade name Procilan (ICI). These dyes are generally 2:1 premetallized dyes containing reactive acrylamide groups which are not subject to hydrolysis in the dyebath (25–26). Reactive dyes for wool, however, gained importance with the introduction of the Lanasol (Ciba-Geigy) dyes containing the α-bromoacrylamide group ($—NHCOC(Br)=CH_2$) (27–28) which are noted for their bright shades, high reactivity and good wet-fastness properties. Similar properties are exhibited by the Drimalan F (Sandoz), Reactolan (Ciba-Geigy), and Verofix (Bayer) dyestuff groups containing a difluorochloropyrimidinyl group (29–31). The Hostalan dyes (Hoechst) that were developed to overcome the problems of unlevel dyeing (32–34) are the reaction products of Remazol (vinyl sulfone type) dyestuffs and *N*-methyltaurine (4).

$CH_3NHCH_2CH_2SO_3H$
(4)
[107-68-6]

Dichlorotriazinyl and monochlorotriazinyl dyes, although primarily designed for cellulose, have also been applied to wool. The Cibacrolan (Ciba-Geigy) group of monochlorotriazinyl dyes were introduced specifically for wool (35–36).

Tables 1 and 2 illustrate the various commercial types of reactive dyes developed

OSHA has enforced strict, and in some cases, prohibitive control of materials such as lead and chromium salts. The FDA, although not controlling inks that are not in direct contact with food, influences formulations used on meat and poultry packages. The USDA documents acceptability of all such products. Listing of all nonvehicle ingredients under *Title 21, Code of Federal Regulations* is a specific requirement. The Consumer Products Safety Commission limits the amount of lead in children's products (22).

The EPA most significantly affects ink formulation through TSCA, the *Clean Air Act of 1970* and amendments of 1977, the *Resources Conservation and Recovery Act* (RCRA) controlling disposal of waste material, and the *Clean Water Act*. TSCA established an inventory of chemical materials acceptable for manufacture. New chemical compounds require a complex and expensive procedure to gain a manufacturing permit. The *Clean Air Act* has imposed severe restrictions on fuming of common lithographic web-offset and letterpress publication inks. Exhaust of volatile organic compounds (VOC) used as solvent in rotogravure and flexographic ink printing is severely limited because they react in the atmosphere to form ozone and consequent smog. The most economical method to overcome air pollution is through the replacement of VOC with water. Solvent recovery via carbon adsorption and incineration equipment are currently used to satisfy state and Federal emission requirements.

Hazardous waste is defined as anything flammable, corrosive, toxic, or reactive. Many colorants in ink contain lead, chromium and organic compounds defined by RCRA as toxic. Volatile solvents in flexographic and gravure inks are flammable. The *Clean Water Act* controls sewage, severely limiting disposal of wash from corrugated board presses and chemical waste from manufacture of gravure cylinders.

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Decalcomania Inks. Decalcomania is a transfer method of printing. The design is first printed on a temporary base by lithography, letterpress, gravure, or screen process, depending upon the detail and thickness of image desired. Usually the temporary base is paper which has been coated with a water-soluble material. The inks must dry completely on the surface by oxidation or solvent evaporation because the treated paper has no ink absorbency. After the initial printing, the design is transferred to the permanent base by direct contact and soaking with water. Obviously, the formulation of decalcomania inks is governed by the particular printing process employed in printing the transfer paper. Decalcomanias for ceramics require pigments that may be heated to high temperatures. Further, most decalcomanias should use pigments that are fast to light because many are subsequently transferred to outdoor signs or to store windows. Vehicles consist of oleoresinous varnishes containing metallic driers or of resin–solvent types.

Hot-Transfer Inks. Hot-transfer printing is similar to the decalcomania process in that the printing is first done on a temporary substrate, but heat is used as the transfer mechanism rather than water solubility. One type of hot-transfer ink is made with heat-fusible resins and waxes to be transferred to cloth. These inks should penetrate into the cloth and not be affected by subsequent washing of the fabric. In a more recent development for the packaging industry, labels are printed on a web of special coated paper by conventional printing such as gravure. This web is then fed to automatic labeling equipment. The relationship between the paper web and the ink is such that the ink is immediately released by heat and transferred to the surface of the package, such as plastic bottles, to which it then adheres as a permanent label.

Ink-Jet Printing. This is a nonconventional form of printing that has the potential advantage of including all the necessary elements of a printed page in some digitized form in computer memory, thereby eliminating the step of platemaking. One principle of operation involves the issuance of liquid ink from an orifice at very high speed to form a jet which is then broken up by ultrasonic energy to produce uniform droplets that can be charged electrically. These droplets can be deflected electrostatically into a catcher, while the uncharged droplets continue in flight to form dots on the printing surface to construct images. Other principles of operation include pressurized, single-deflected jet; pressurized, multiple-deflected jet; nonpressurized, single-undeflected jet; and nonpressurized, multiple-deflected jet.

Ink-jet technology provides a means of fast, dependable, high quality, single-copy printing. Its nonimpact nature permits printing on uneven surfaces and delicate materials. Computer compatibility permits the encoding of repetitive and nonrepetitive information. Special coated papers are not necessary for ink-jet printing.

The inks formulated for jet printing must be quite fluid, stable, and free of any particles that could cause clogging of the jet nozzles, and be capable of depositing and adhering to a substrate with a minimum of character fogging. They are generally formulated with soluble dye colorant in a suitable resin–solvent vehicle (19–20).

Environmental Considerations

Government regulations are becoming increasingly stringent and have drastically altered the manufacture and use of printing inks and their ingredients (21). The effect of these controls has necessitated the investment of millions of dollars for research to change ink formulation techniques as well as methods of printing.

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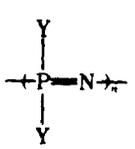
INORGANIC HIGH POLYMERS

The area of inorganic polymers is very extensive. Many inorganic compounds exist in the solid state as three-dimensional networks or two-dimensional layer structures. Inorganic polymers include solid metals, ionic crystals, ceramics, silica, silicates, etc. Such substances embrace a wide part of traditional inorganic chemistry and are adequately discussed elsewhere (see Ceramics; Silica; etc). In addition to these inorganic polymeric materials, there are inorganic polymers that exhibit elastomeric and plastic properties. The polymer backbones consist essentially of inorganic elements and occasionally have organic side groups to modify properties.

In general, inorganic high polymers offer unique property profiles not available with conventional organic polymers. Polysiloxanes are prime examples of inorganic high polymers. They possess a unique combination of high temperature stability and excellent low temperature elastomeric properties. Siloxanes are commercially important inorganic high polymers (see Silicon compounds, silicones).

Poly(phosphazenes)

Poly(phosphazenes) are polymers having alternating phosphorus and nitrogen atoms in the polymer backbone:



where Y can be halogen, pseudohalogen, or alkyl, aryl, alkoxy, aryloxy, arylamino, or alkylamino groups (see Phosphorus compounds; Fluorine compounds, organic, fluoroalkoxyphosphazenes) (1–3).

Table 1. Reactive Dyes for Cellulosic Fiber

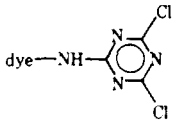
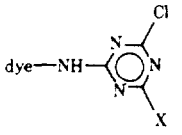
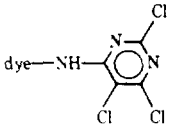
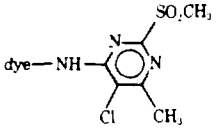
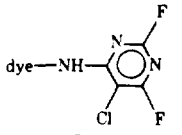
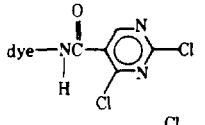
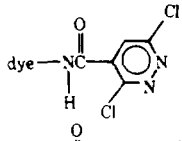
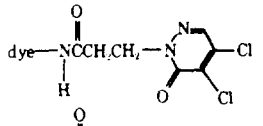
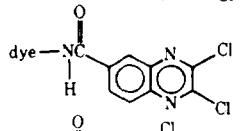
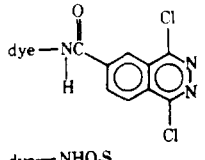
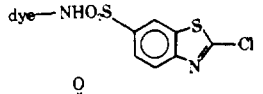
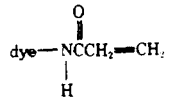
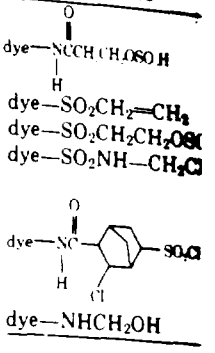
Reactive group: Structure	Name	Trade name	Manufacturer	Refs.
	dichlorotriazine	Procion M	ICI	13,37–40
 X = NH_2, NHR, NHC_6H_5, OR; or SO_3H	monochlorotriazine	Procion H Procion H-E Cibacron Cibacron Pront Procion SP	ICI Ciba-Geigy Ciba-Geigy ICI	13,33,40–41
	trichloropyrimidine	Reactone Drimarene X Drimarene Z	Ciba-Geigy Sandoz	18,33,42
		Levafix P	Bayer	20,42–43
	monochlorodifluoropyrimidine	Drimarene R Drimarene K Levafix EA Levafix PA	Sandoz Bayer	33,37,41
	dichloropyrimidine	Reactofil	Ciba-Geigy	37
	dichloropyridazine	Solidazol	Cassella	33,42
	dichloropyridazinone	Primazin P	BASF	22,33,42
	dichloroquinoxaline	Levafix E Cavalite	Bayer DuPont	14,21
	dichlorophthalazine	Solidazol Reatex Elisiane	Cassella Francolor	33,42
	chlorobenzothiazole	Reatex Elisiane	Francolor	39,42
	acrylamide	Primazin	BASF	23,33

Table 1. (continued)

Reactive group: Structure	Name	Trade name	Manufacturer	Refs.
				

for cellulosic fiber
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trade names. Othe
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patent literature
Davies (16) and R

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Chromophoric
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therefore, needed
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Commonly
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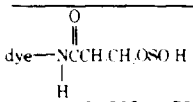
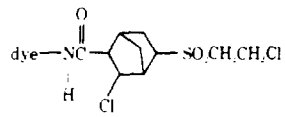
the widest range
products of pyraz
rivatives have gai
for yellow dyes (6

Table 1. *(continued)*

Reactive group		Trade name	Manufacturer	Refs.
Structure	Name			
				
$dye—SO_2CH_2{=}CH_2$	vinyl sulfone	Remazol	Hoechst	10
$dye—SO_2CH_2CH_2OSO_3H$		Cavalite	DuPont	
$dye—SO_2NH—CH_2CH_2OSO_3H$	β-sulfatoethyl-sulfonamide	Levafix	Bayer	21
	β-chloro-ethyl-sulfone	Solidazol N	Cassella	37
$dye—NHCH_2OH$	methylol	Calcobond	Cyanamid	42

for cellulosic fibers, and for wool and polyamide fibers respectively. The tables show the major reactive groups, the corresponding chemical structures, and the common trade names. Other trade names not included in the tables can be found in a summary by Siegel (20) and the *Colour Index* (55) (see Dyes and dye intermediates). Extensive patent literature and publications relating to reactive dyes have been reviewed by Davies (16) and Rosenthal (17) during the period 1967–1975.

Excellent monographs on reactive dyes have been provided (14,37). Comprehensive reviews on this subject have also been published (38–42,53,56–60) and a pertinent bibliography can be found in the *Colour Index* (55).

A reactive dye molecule may, for convenience, be regarded as a combination of the following units:

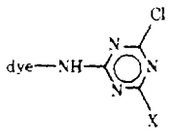
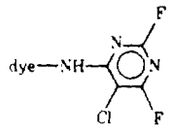
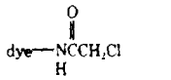
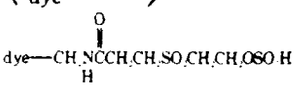
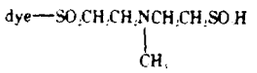
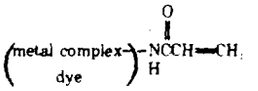
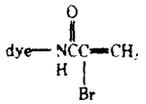
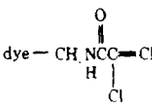
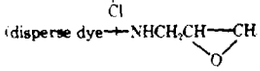
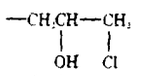
$$dye—B—Y—X$$

where dye is the chromophore (usually an azo, anthraquinone, or phthalocyanine residue); B is a bridging atom or group although this, in many cases, is part of the chromophoric system; Y is the unit carrying the reactive group (the activity of the reactive group depends to a large extent upon the nature of Y); and X is the group that reacts with the fiber. An additional water solubilizing group, which is not part of the chromophoric unit, may be found as part of the reactive group such as the sulfuric acid ester group of β-hydroxyethyl sulfone reactive dyes.

Chromophoric System. In principle, practically any desired chromophoric system can be combined with reactive groups to produce reactive dyes. The properties of the resulting dye, however, are affected by both of these groups. Proper combination is, therefore, needed to obtain dyes with good qualities such as high tinctorial strength, good solubility, good fastness properties, and economy.

Commonly used chromogens include azo, metallized-azo, anthraquinone, phthalocyanine, and metal-complex formazan derivatives. Azo compounds comprise the widest range of shade from greenish-yellow to black. For yellow dyes, coupling products of pyrazolones and aminopyrazoles are commonly used (61). Pyridone derivatives have gained much importance in the recent years as coupling components for yellow dyes (62). Brilliant red colors are usually based on aminohydroxynaphth-

Table 2. Reactive Dyes for Wool and Polyamide Fibers

Reactive group Structure	Name	Trade name	Manufacturer	Refs.
 X = Cl	dichlorotriazine	Procion M	ICI	14–15,35,44
X = NH_2, NHR, NHC_6H_5	monochlorotriazine	Procion H	ICI	
		Cibacron	Ciba-Geigy	
		Cibacrolan	Ciba-Geigy	
X = OR		Cibacron Pront	Ciba-Geigy	
	monochlorodifluoropyrimidine	Drimalan F	Sandoz	29–30,45–46
		Reactolan	Ciba-Geigy	
		Verofix	Bayer	
	ω-chloracetylamino	Cibalan Brilliant	Ciba-Geigy	44,47
		Drimalan	Sandoz	
dye—$SO_2CH{=}CH_2$	vinyl sulfone	Remalan		10–11,43,48
dye—$SO_2CH_2CH_2OSO_3H$	β-sulfatoethylsulfone	Remalan	Hoechst	
		Remazolan		
(metal complex dye)—$SO_2CH_2CH_2OSO_3H$	β-sulfatoethylsulfone	Remalan Fast		
	sulfatoethyl acrylamide sulfone	Lanafix	Sumitomo	33,38
	methyltaurine-ethylsulfone	Hostalan	Hoechst	32–34
	acrylamide	Procilan	ICI	25–26,49–50
	α-bromoacrylamide	Lanasol	Ciba-Geigy	27,51–52
	α-chloroacrylamide	Lanasyn Pure Blue FBL	Sandoz	33,42,53
	epoxide	Procinyl[a]	ICI	24,26,54
 (and others)	3-chloro-2-hydroxypropyl			

[a] Procinyl dyes used specifically for polyamide fibers.

alenedisulfonic acids (63). Chromium, copper and cobalt metal-complex azo dyes comprise the majority of metallized azo dyes. These dyes generally possess excellent lightfastness (64). Brilliant blue and green reactive dyes with high fastness to light are the main contribution of anthraquinone derivatives (65). Copper and nickel phthalocyanine reactive dyes give bright turquoise shades with good washfastness and satisfactory crocking fastness (66). Bright blue to green metal-complex dyes from

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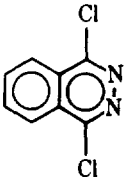
reactive component.

formazan derivatives have been patented (67) and claimed to possess good fastness properties. Other groups mentioned in patent literature are also used as chromophoric systems for reactive dyes, but they have achieved little commercial importance up to the present.

The Bridging Group. The nature of the bridging group between the chromophore and the reactive group not only affects the shade, strength, and affinity of the dye, but can significantly affect its reactivity and the stability of the dye–fiber bond. Thus the use of oxygen or sulfur bridging groups is unsatisfactory, since they are readily hydrolyzed, and aliphatic or aromatic chains tend to lower the water solubility of the dye. In addition the length and flexibility of the bridging group has an affect on the degree of dye–fiber fixation. Therefore, amino and alkylamino groups are generally used as bridging groups in heterocyclic reactive dyes in view of the ease of synthesis, stability to hydrolysis, and minimum interference with solubility. In the case of dichloroquinoxaline (2) and dichlorophthalazine (5) reactive dyes that contain only one reactive chlorine group, the chromophore is attached to the reactive system through an amide bridging group. This bridging group is susceptible to acid hydrolysis, which can result in the rupture of the bond between the chromophore and the reactive system. Sulfonamide and amide bridging groups have been suggested as replacements for the sulfone group in the Remazol dyes. Although the stability of the dye–fiber bond is increased using these groups, a reduction in the reactivity of the dye is observed.



(**5**)
[*4752-10-7*]

The Reactive System. The combined unit Y–X in the above formula can be regarded as the reactive system. Generally, the reactive systems used in commercially available reactive dyes can be classified into two groups: (*1*) reactive systems based on nucleophilic substitution reactions, in which the mobile reactive group X is replaced by an attacking base, and (2) reactive systems based on nucleophilic addition reactions, in which a 1,2 trans addition of a nucleophile occurs across a polarized double bond. Examples of reactive systems (*1*) and (2) are halogeno-heterocyclic and vinyl sulfone systems, respectively. In some cases, both addition and substitution reactions are operable as in the α-bromoacrylamide types.

The reactivity of a reactive dye, therefore, is governed primarily by the chemical structure and arrangement of the reactive system (Y–X) and the variation of the chromophore to which the reactive system is attached.

Synthesis

Reactive dyes have a great advantage over direct dyes in that they do not depend on molecular complexity for adsorption. This allows a brighter spectrum of shades and more rapid diffusion characteristics compared with direct dyes.

The methods of synthesis of reactive dyes depend largely on the nature of the reactive component. Very thorough reviews have been presented of the methods of

production of various types of reactive dyes (14,37). In general, the following methods are used: (*1*) prepare an azo dye containing a nucleophilic group, eg, $—NH_2$, —OH, and then condense the azo dye with a heterocyclic aromatic reactive system, eg, cyanuric chloride, tetrachloropyrimidine etc; (2) combine a diazotized aromatic amine with a coupling component containing a reactive system, or a diazonium compound containing a reactive system with a coupling component; (*3*) condense an aromatic compound containing a reactive system to an anthraquinone derivative, in particular, 1-amino-4-bromoanthraquinone-2-sulfonic acid (bromaminic acid); and (*4*) for phthalocyanine dyes which do not carry a suitable nucleophilic group for the condensation with the reactive system, it is necessary to introduce a bridging group, eg, a sulfonamide, to act as the nucleophile.

Reactive Dyes for Cellulosic Materials, Wool, and Nylon

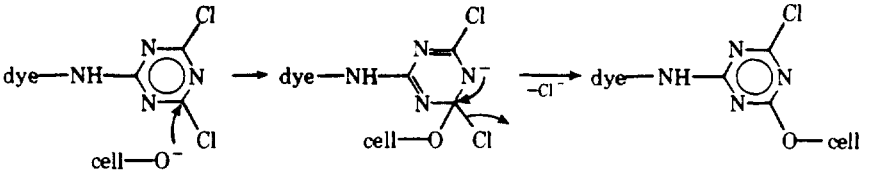
Cellulosic Materials. Cellulose (qv) is a carbohydrate. It consists of (1 → 4)-β-D-glucan and is considered as a polyalcohol with three hydroxyl groups per unit of glucopyranose. As a consequence, any group that is capable of forming a covalent bond with alcoholic hydroxyl groups is a potential reactive system to be used in a dye molecule for cellulosic fiber. However, certain criteria must be met in order for this reactive system to be of practical use.

The most important criterion is that the dye can be applied in an aqueous medium. In this instance, there are two competing reactions. One is the reaction of the dye and the fiber, and the other is the reaction (hydrolysis) between the dye and water. In principle, it is possible to dye cellulosic fibers in an aqueous alkaline medium with water soluble reactive dyes (68–69). Under alkaline conditions, the hydroxyl groups in the cellulose molecules are partially ionized and can act as nucleophilic reagents. The reactive system of the dye molecule can then react either with cell-O^- or OH^-. It has been shown (70–71) that the dissociation constant for cellulose is higher than that of water, thus cell-O^- reacts faster than OH^- with the reactive group of the dyestuff. This preference of dye–fiber interaction has been attributed to the higher nucleophilicity of the aliphatic hydroxyl groups of cellulose (72). In order for the hydroxyl anion of cellulose to attack the reactive system of the dye, they must be in proximity, ie, the dye molecules must be adsorbed onto the fiber. This property, known as substantivity, is the second fundamental condition that must be fulfilled before a dye–fiber interaction can take place.

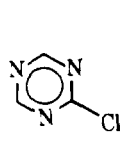
Another important criterion is that the covalent bond formed between the dye and the fiber must be sufficiently stable to resist subsequent aftertreatments. In other words, the dye–fiber interaction must be relatively irreversible. In addition, the dye must have a suitable shelf-life, and be nontoxic and economical to produce.

Reactive systems can be classified into several groups depending upon the reaction mechanism (58):

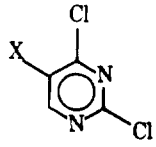
Reactive Systems Based on Nucleophilic Substitution. This generally involves a base-catalyzed addition of a nucleophilic functional group of the cellulose to the electrophilic center of the reactive groups followed by the subsequent displacement of a suitable leaving group. This mechanism applies particularly to heterocyclic aromatic compounds containing labile leaving groups. Shown below is the reaction scheme of a dichlorotriazinyl functional group with cellulose (eg, Procion M dyes).



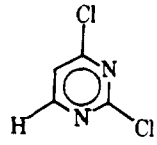
An excellent discussion has been presented of the mechanisms of the reaction of reactive dyes with cellulosic fiber (54). This nucleophilic substitution reaction mechanism also applies to other similar heterocyclic aromatic compounds such as monochloro-*s*-triazine (**6**) derivatives (Procion H and H-E type and Cibacron); 2,4,5-trihalopyrimidine (eg, (**7**)) (Drimarene K, R, X, and Z type, Reactone, Levafix EA and PA); 2,4-dichloropyrimidine (**8**) (Reactofil); 3,6-dichloropyridazine (**9**) (Solidazol); 1-*H*-4,5-dichloro-6-pyridazinone (**3**) (Primazin P); 2,3-dichloroquinoxaline (**2**) (Levafix E, Cavalite); 1,4-dichlorophthalazine (**5**) (Solidazol, Elisiane); and 2-chlorobenzothiazole (**10**) (Elisiane).



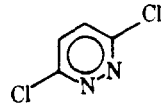
(**6**)
[6153-86-2]



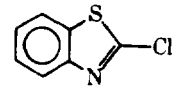
(**7**)
X = Cl
[5750-76-5]



(**8**)
[3934-20-1]



(**9**)
[141-30-0]



(**10**)
[615-20-3]

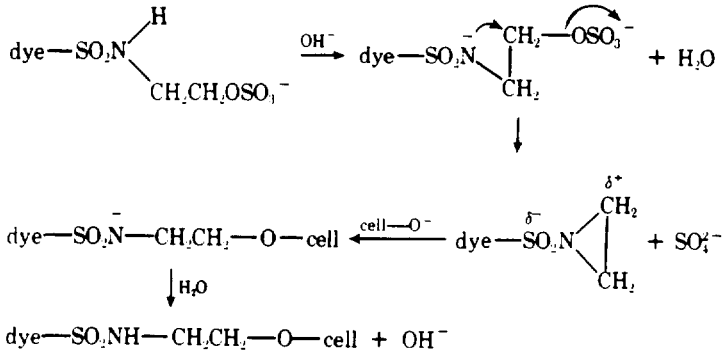
The reactivity of the heterocyclic aromatic systems can be altered by making suitable substitutions in the ring: (*1*) the hetero-atoms in the aromatic ring are important in that they affect the electronegativity of the system; an increase in the number of hetero-atoms favors nucleophilic exchange, and consequently, the reactivity of a triazine derivative is higher than that of a pyrimidine derivative; and (2) replacing the halogen with an electron-attracting group will increase the reactivity, whereas an electron-donating group will decrease the reactivity; eg, replacement with an amine, such as in the case for Procion H and Cibacron dyes, reduces the reactivity.

An important substitution in the pyrimidine system is the replacement of the chlorine atom at the 5-position with an electronegative group such as $—NO_2$, —CN, —COOH, etc. ICI claimed that substituting a nitro group in the 5-position of the pyrimidine ring enhanced the reactivity to such an extent that the dye could be applied to cellulose under much milder conditions than trichloropyrimidyl derivatives (73). However, this was not suitable for practical application because the dye–fiber bond was weakened by the over-activation of the nitro group making the resulting dyeing deficient in washfastness. Dyes containing a cyano group in the 5-position possess high reactivity and afford satisfactory dyeings (13).

When a carboxyl group is substituted into the 5-position of the pyrimidine ring, the reactive system can be attached to the chromophore through an amide bridge. This results in another group of dyes, called Reactofil (74–75), which possess reactivity towards cellulose of the same order as that of a dichlorotriazinyl dye.

In general, the reactivity of *N*-heterocyclic reactive groups increases in the order of: chloropyrimidine < monochloro-*s*-triazine < dichloroquinoxaline < dichloro-*s*-triazine.

Nucleophilic substitution at a saturated carbon is demonstrated in β-substituted ethylamine derivatives. The reaction proceeds via an ethyleneimine intermediate that exhibits high reactivity towards nucleophilic substitution reactions. For cellulosic fiber, the leaving group at the β-position is generally a sulfato group. The neighboring group participation of the nitrogen is essential for the easy formation of the three-member ethyleneimine ring (21).



Reactive Systems Based on Nucleophilic Addition. The mechanism of this reaction generally consists of two steps. The first step is a base-catalyzed elimination of a labile group (eg, $—OSO_3H$ and Cl) generating a reactive double bond, followed by a 1,2 trans addition of the functional group of the cellulosic fiber to the double bond. Two commercially important groups of dyes react according to this mechanism: (*1*) Remazol, a vinyl sulfone derivative (dye$—SO_2CH=CH_2$) produced by Farbwerke Hoechst (10); and (*2*) Primazin, an acrylamide derivative (dye$—NH—CO—CH=CH_2$) produced by BASF (54) (see Acrylamide). Venkataraman and co-workers (76) have illustrated the reaction mechanism of cellulose with β-sulfatoethyl sulfone groups, the precursor of vinyl sulfone (Remazol), according to the following scheme:

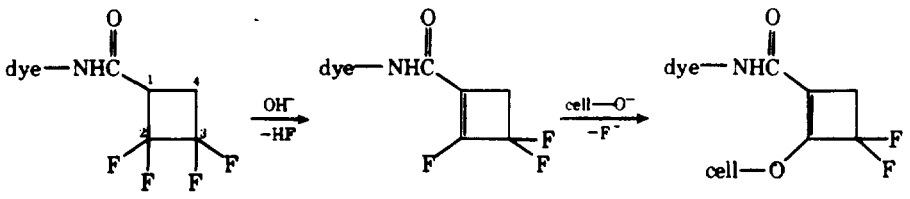
$$\text{dye}—SO_2CH_2CH_2OSO_3Na + NaOH \rightarrow \text{dye}—SO_2CH=CH_2 + Na_2SO_4 + H_2O$$

$$\text{dye}—SO_2CH=CH_2 + \text{cell}—OH \xrightarrow{OH^-} \text{dye}—SO_2CH_2CH_2—O—\text{cell}$$

The electron-withdrawing nature of the bridge sulfonyl group activates the α-methylene hydrogen, thus facilitating the 1,2 elimination by a base. This property has the intrinsic disadvantage that the dye–fiber bond formed in dyeings can also be easily cleaved on subsequent aftertreatments. In fact, dyeings of vinyl sulfone dyes are less fast to boiling dilute sodium carbonate solution than are dyeings of chlorotriazinyl dyes. By substituting a vinyl sulfonamide group ($—NH—SO_2CH=CH_2$) at the bridge, the activating effect is reduced and the dyeings exhibit better alkali fastness (54).

By analogy, β-chloropropionylamides are the precursors of acrylamide. A base elimination of hydrogen chloride provides the reactive acrylamide form. However, this type of dyes (Primazin) has only limited use in dyeing cellulosic fibers and is mainly used for wool dyeing.

Reactive Systems Based on Both Nucleophilic Addition and Substitution. Several patents have been issued to Farbwerke Hoechst covering dyes with 2,2,3,3-tetrafluorocyclobutane-1-carboxamide [*383-76-6*] groups. The fluorine atoms on *C*-2 are activated by the carbonyl group on *C*-1 resulting in high reactivity of such dyes. The probable course of the reaction is shown below (14):



The first step is the base-catalyzed elimination of HF followed by nucleophilic substitution of the fluorine atom remaining on the double-bonded carbon by cellulose anions.

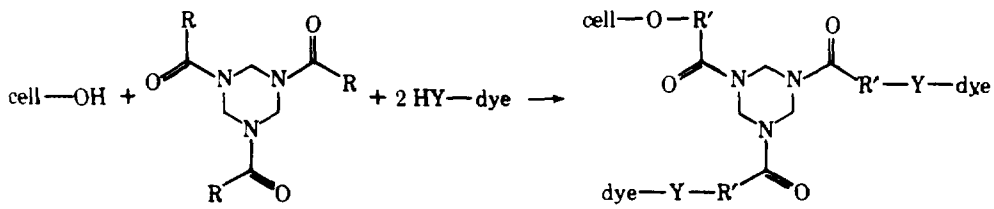
Dyes that React with Fibers Under Acid Conditions. All the reactive dyes mentioned above are applied to cellulosic fiber under alkaline conditions. The Calcobond dyes introduced by American Cyanamid Company are applied under acidic conditions. The reaction system is a methylolated nitrogen. The dye–fiber reaction is promoted by acid and heat and is believed to proceed according to the following mechanism (37):

$$\text{dye—NHCH}_2\text{OH} + \text{H}_3\text{O}^+ \rightleftharpoons \text{dye—NHCH}_2^+ + 2\,\text{H}_2\text{O}$$

$$\text{dye—NHCH}_2^+ + \text{cell—OH} + \text{H}_2\text{O} \rightleftharpoons \text{dye—NHCH}_2\text{—O—cell} + \text{H}_3\text{O}^+$$

Many dyes containing methylol groups attached to the chromophore in different ways are described in the relevant patent literature (77). The advantages mentioned for this type of dyes are: (*1*) they can be used together with disperse dyes, which are generally unstable in alkaline medium, to dye cotton and polyester blends; (2) the reactive system is similar to many textile-finishing agents and, therefore, can be applied together in a single operation. However, these dyes have failed to achieve much practical significance in dyeing of cellulosic fibers because they are incompatible with conventional reactive dyes and the cotton will lose up to 50% in tensile strength under the high temperature acidic fixation step (see also Amino resins).

Polyfunctional Fixing Agents That Form Covalent Bonds with Both the Dyestuff and the Substrate. Another approach to reactive dyeing is the linking of dyestuff molecules containing nucleophilic groups (eg, NH_2 and OH) with the nucleophilic hydroxyl anion of cellulose by means of a colorless polyfunctional component capable of reacting with both dye and fiber. Many different compounds have been disclosed in the patent literature as bridging compounds. Most of these suffer the disadvantage of having too low an affinity for cellulosic fiber and are only suitable for pad-dyeing and printing purposes. The most important polyfunctional reactive system is 1,3,5-triacryloylhexahydro-*s*-triazine (**11**) (triacryloformal). This forms the basis of the Basazol range of dyes (BASF). Hensel and Lützel (22) have postulated the following reaction scheme for structures (**11**) and (**12**):



(**11**) R = CH=CH$_2$ [*959-52-4*]
(**12**) R = CH$_2$CH$_2$OH [*4002-62-4*]
Y = nucleophilic group
R′ = CH$_2$CH$_2$

The color yields of ordinary reactive dyes are usually not higher than 60–85% because of some hydrolysis in the dyebath. Color yields of about 90%, however, have been obtained with 1,3,5-triacryloformal (**11**) as the bridging compound. The reasons for this high yield are: (*1*) the carbonyl group has strong activating effect; and (*2*) contrary to the aromatic triazines, the activity of the substituents is not significantly altered

after one or more of them has reacted. A good review of the general principle of dyestuff fixation by cross-linking agents has been presented (52).

Dyes Containing Several Reactive Groups. Conventional reactive dyes for cellulosic fibers suffer an obvious drawback in that only ca 70% of the dye is fixed onto the fiber, the remainder of the dye undergoes hydrolysis in the dyebath. There has been a continuous search for dyes that will exhibit high fixation efficiency. There are two possible methods to accomplish this goal: (*1*) use a reactive group that is not easily hydrolyzed; and (*2*) incorporate two or more reactive groups in a dye molecule to increase the chance of fixation. The latter method appears to have been the one mainly used in developing high fixation dyes. The high fixation dyes with multireactive groups are based upon statistical probability. That is, with two or more reactive groups there is better chance of fixation to the fiber. Furthermore, if one of the groups is hydrolyzed, the remaining groups may still react with the fiber. It must be stressed, however, that the presence of two or more reactive groups in a dye molecule does not necessarily provide high fixation. Other properties such as solubility, substantivity, and diffusibility are also determining factors.

The reactive groups of the dye can be linked as a reactive packet (17) with another group that does not carry a second chromophore (dye—NH—R_1—B—R_2; R_1 and R_2 = reactive groups; B = bridge). Another type of reactive group is a bridge that contains two chromophores (dye—NH—R_1—B—R_2—HN—dye).

Many patents have appeared covering dyes with two or more reactive groups. The favored group in such dyes is chlorotriazines (78). Two important groups of high fixation reactive dyes, Procion HE and Procion Supra, have achieved commercial importance. Procion Supra dyes (ICI) are intended primarily for use in textile printing applications but may also be employed in continuous dyeing processes.

Wool. The wool (qv) fiber contains many potential sites capable of forming covalent bonds with reactive dyes. Nevertheless, the incentive to invent reactive dyes for wool was not great because a wide variety of shades with high washfastness could be achieved with existing chrome dyes and milling acid dyes.

The reactive dyes first used on wool were designed primarily for application to cellulose. Difficulties were encountered with unlevel dyeing properties and hydrolysis of the dye during dyeing. These problems have now been largely overcome through development of reactive groups with little or no tendency to hydrolyze during the dyeing process, the use of special auxiliary products that minimize unlevel dyeing properties (53), and modification of the dyeing process.

In a review of the mechanism of reaction of proteins with reactive dyes, Shore (79) noted that the reaction with wool was more difficult to interpret than the reactive dye–cellulose systems (54,80) because of: (*1*) a greater variety of reactive groups in wool, the chemical reactions of which are complicated; (2) stronger and more localized interactions between the dye and fiber molecules; (*3*) an effect on dyeing behavior by the morphological structure of wool; and (*4*) susceptibility of the wool fiber degradation during dyeing. Many investigations during the last decade have also been directed towards the characterization of the main groups in the wool fiber that react with the dye (81–90). The reactive dye–wool systems can, however, be classified in the same general manner as the reactive dye–cellulose systems.

Reactive Systems Based on Nucleophilic Substitution. In an investigation of the rate of reaction of a dichlorotriazinyl dye with a series of simple model compounds containing the same functional groups as identifiable amino acids, the principal groups

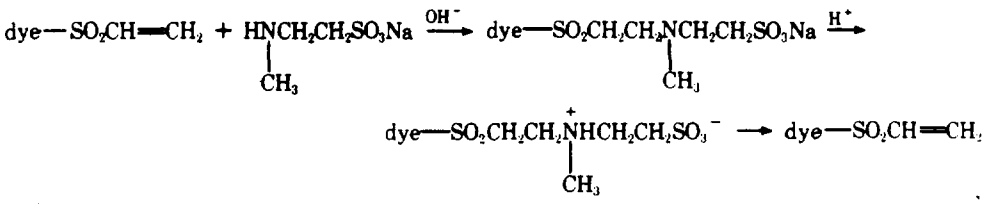
in proteins reacting with this particular dye were cysteine thiol groups, the primary amino groups of lysine and *N*-terminal amino acid residues, and the imidazole group of histidine (91). Several other studies (36,85,92) have also shown that one or more of these principal groups are capable of reaction with halogeno-heterocyclic dyes.

Several manufacturers have recently introduced reactive dyes based on 2,4-difluoro-5-chloropyrimidine, eg, Drimalan F (Sandoz), Reactolan (Ciba-Geigy), Verofix (Bayer), which exhibit a high degree of reactivity and resistance to hydrolysis. This property has been attributed to the capability of both fluorine atoms to react with nucleophiles (30).

Dyes containing chloroacetyl groups react with both the cysteine and histidine residues in wool (26). The reaction of a chloroacetyl dye with cysteine, histidine, and lysine depends upon the pH conditions employed (93–94). Several polymethine dyes (qv) containing *N*-chloroacetyl groups have been examined as fiber-reactive dyes for wool. The washfastness properties were improved significantly compared to the corresponding nonreactive dyes (95).

Reactive Systems Based on Nucleophilic Addition. Remalan dyes containing vinyl sulfone groups undergo considerable hydrolysis under neutral dyeing conditions (48). The Remazolan dyes were introduced to overcome this problem. They are applied to wool by a special method, which ensures complete reaction of the vinyl sulfone group with the fiber producing dyeings with excellent washfastness properties (47).

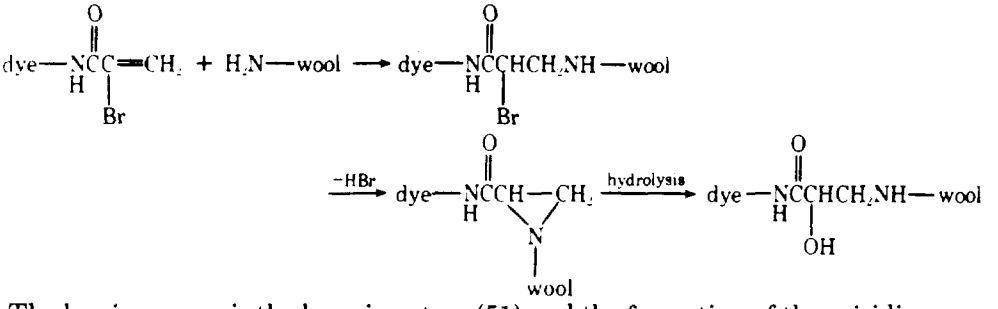
The Remazol dyes originally designed for cellulose can also be applied to wool (96–97). The unlevel dyeing properties of these conventional vinyl sulfone dyes led to the introduction of the Hostalan dyes (32–34). These dyes are prepared by reaction of vinyl sulfone dyes of the Remazol class with *N*-methyltaurine (4) under alkaline conditions. The reactive vinyl sulfone group is then gradually regenerated during the exhaustion dyeing process and level dyeing is attained by raising the dyebath temperature quickly to the boil. The reactions involved can be represented by the following scheme (98–99):



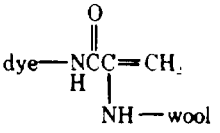
Reactive dyes containing the acrylamide (—NHCOCH=CH_2) or β-chloropropionamide (—$NHCOCH_2CH_2Cl$) group exhibit lower reactivity for cellulose than the corresponding vinyl sulfone dyes. These dyes, therefore, can be applied advantageously to wool where a less reactive group is required to obtain adequate level dyeings. They also show practically no tendency to hydrolyze under normal wool dyeing conditions (26), unlike the triazine and vinyl sulfone types. This property is very desirable for satisfactory washfastness. The acrylamide reactive system forms the basis of the Procilan dyes (50) which exhibit good light- and washfastness properties, resembling those of the chrome dyes.

Reactive Systems Based on Both Nucleophilic Addition and Substitution. The Lanasol reactive dyes (Ciba-Geigy) containing α-bromoacrylamide groups were designed for application to wool. The chemistry of their reaction with wool has been detailed (51,100). Reaction of these dyes with the amino groups in wool proceeds through

nucleophilic addition at the double bond, followed by elimination of HBr and formation of an aziridine compound through nucleophilic substitution. Subsequent hydrolysis and internal rearrangement, with ring opening, forms the stable compound as shown below:



The leaving group is the bromine atom (51) and the formation of the aziridine compound can also proceed by nucleophilic substitution of the bromine through the intermediate:



Reactions Involving Disulfide Bonds. In recent years, dyes have been produced that, during or after application to the fiber, react covalently with themselves to form high molecular weight molecules.

Self-condensation dyes containing *S*-alkylthiosulfate ($R—SSO_3H$) and *S*-arylthiosulfate groups ($Ar—S—SO_3H$), known as Bunte salts (101), have been marketed as the Inthion (Hoechst) (102) and Dykolite (Southern Dyestuff Co.) (103–104) dyes, respectively, for application to cellulosic fibers.

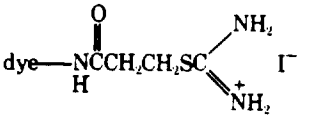
An important member of the Inthion group, namely Wool Fast Turquoise Blue SW ($—SO_2NHCH_2SSO_3H$) (Hoechst) was shown to exhibit excellent wetfastness properties on wool (102). It has been suggested (105–106) that the Bunte salt dyes react with the cysteine thiol groups to form an asymmetrical disulfide, which then disproportionates to the insoluble disulfide dye as shown:

$$\text{dye—SSO}_3\text{Na} + \text{wool—SH} \rightarrow \text{dye—S—S—wool} + \text{NaHSO}_3$$

$$2\,(\text{dye—S—S—wool}) \rightarrow \text{dye—S—S—dye} + \text{wool—S—S—wool}$$

Thus the improved wetfastness exhibited by these dyes could be due to the increased molecular size of the disulfide dye rather than covalent bond formation. It has also been suggested that dyes containing thiol groups form covalent bonds with wool (89,107–109).

Recently dyes containing β-isothioureidopropionamide (13) groups have been found suitable as reactive dyes for wool (110). A study of the mechanism of fixation on wool of several isothiouronium dyes, referred to as the Thiolan dyes, concluded



(13)

[*56919-62-1*]

that the high washfastness was due to insolubilization within the fiber rather than to mixed disulfide formation with cysteine (111). These dyes, therefore, can be regarded as condense dyes (112) rather than classical reactive dyes.

Reactions Involving Modified Wool. The introduction of shrink-resistant machine-washable wool necessitated the use of dyes that exhibit very high washfastness. This property could not be achieved satisfactorily using milling acid dyes, premetallized dyes or even chrome dyes. Fortunately, the newer reactive dyes for wool (eg, Lanasol, Drimalan, Verofix, Hostalan, etc) satisfied the stringent washfastness standards and, in addition, provided popular bright shades.

This modified wool is produced by a chlorine pretreatment followed by application of a resin to the fibers, for example the Chlorine-Hercosett process (113) (International Wool Secretariat), and the Dylan GRB and GRC processes (Precision Processes Textiles Ltd.).

The application of reactive dyes to Chlorine-Hercosett 57- (Hercules Powder Co.) treated wool has been studied in detail (99,114–116). Lewis and Seltzer (114) found that this resin-treated wool has a higher affinity for anionic dyes, owing to the high basicity of the resin, than either chlorinated or untreated wool.

Auxiliary leveling agents, such as Albegal B (Ciba-Geigy), Drimagen F (Sandoz) or Avolan RE (Bayer), which react with both the dye and the fiber, are recommended for use with the newer reactive dyes. These dyeing assistants reduce penetration of the dye into the fiber at low temperatures, but as the temperature is elevated, the auxiliary product–dye complex breaks down allowing the dye to react covalently with the fiber (31). The role of concentrated urea solutions in promoting the rate of reaction of reactive dyes with wool at low temperatures has been studied (117–120). Results of this work ultimately led to the development of a cold pad-batch process (121) which produces level, fast, bright dyeings on wool.

Reactive Dyes for Nylon. The level dyeing of nylon with high washfastness properties was initially unobtainable with conventional acid and disperse dyes, owing to variations in the physical and chemical characteristics of the fiber. The Procinyl reactive dyes were, therefore, developed. They are disperse dyes (devoid of solubilizing groups) containing a group capable of reaction with nylon. The patent literature indicates that the reactive group is not limited to one particular system and can include chlorotriazinyl, epoxy, 2-chloro-1-hydroxyethyl, β-chloroethylsulfamoyl, and aziridine groups. These dyes are stable in water and can be applied as conventional disperse dyes from weakly acid dyebaths. At the conclusion of dyeing, the dyebath is made alkaline in order to promote reaction of the dye and the fiber, resulting in a level dyeing with high fastness properties. Chemical combination of the Procinyl dyes with nylon has been demonstrated (24,122). It is suggested that reactivity is associated not only with the primary amino end groups of the fiber, but also with amide groups in the polymer chain. The possibility that dimerization or polymerization of the dye itself within the fiber has not been ruled out.

Recently the mechanism of fixation of disperse dyes containing a sulfonylazide ($—SO_2N_3$) or an arylazide (ArN_3) group on nylon has been examined (123). It was found that, under aqueous dyeing conditions, reaction occurs with the amino end groups of the polymer through a sulfonamide linkage. During heat-transfer printing, however, the azide group decomposes rapidly to a reactive nitrene species which undergoes insertion into carbon–hydrogen bonds of the polymer forming a nitrogen bridge (see Printing processes).

Analysis

The analysis of reactive dyes requires identification of the chromophore and the reactive system. The chromophore can be identified by the general methods adopted for any class of dyes (124). The identification of the reactive group after reaction with the fiber is a more difficult problem. The identification of reactive dyes on cellulosic fibers is described in refs. 125–126. These methods depend on the relative stability of the dye–fiber bond to acidic and alkaline hydrolysis. The extent of fixation of reactive dyes on wool fibers has been determined by solvent extraction techniques (127–130) (see Dyes, application and evaluation).

Dyestuffs, though not necessarily toxic, add organic carbon and color to waste water, which is objectionable to the public for esthetic reasons. The effective and economical removal of the various classes of dyes, including reactive dyes, from waste waters has been studied using techniques such as chemical coagulation or oxidation (131–132), activated carbon adsorption (133), polymeric adsorption/ion-exchange processes (134–135), high energy radiation (136), and electrolysis (137) (see Dyes and dye intermediates).

Economic Aspects

The annual production and sales figures for reactive dyes in the United States, compared to total dye production, over the period 1960 to 1976 are shown in Table 3.

A rapid growth of reactive dyes clearly occurred during the period 1960–1965 with production increasing by 545%. During the following six years growth continued, but at a slower rate of 234%. Reactive dye production has remained relatively constant since 1971 at approximately 1.2–1.4% of total dye production. A 29% decrease in production occurred in 1975, owing no doubt to the worldwide recession at that time. Sales of reactive dyes, however, increased by 27% during that year indicating that reduced production in the United States was counteracted by imports and overall reduction of inventories.

Table 3. Annual United States Production and Sales of Reactive Dyes[a]

	Production, t			Sales, t		
Year	Total dyes	Fiber-reactive	% of total	Total dyes	Fiber-reactive	% of total
1960	70,700	130	0.2	67,000	100	0.1
1965	94,000	720	0.8	86,200	710	0.8
1970	106,000	1,010	1.0	101,000	1,220	1.2
1971	111,000	1,680	1.5	105,000	1,590	1.5
1972	119,000	1,680	1.4	116,000	1,620	1.4
1973	129,000	1,680	1.3	121,000	1,560	1.3
1974	125,000	1,550	1.2	119,000	1,420	1.2
1975	93,500	1,100	1.2	94,700	1,400	1.5
1976	116,000	1,590	1.4	113,000	1,810	1.6

[a] Ref. 138.

In 1976 a total of 646 metric tons of reactive dyes was imported into the United States, representing 6.2% of the total dye imports. Approximately 97% of these imported reactive dyes were noncompetitive with reactive dyes manufactured in the United States.

In addition, reactive dyes have increased continuously in number since their inception in 1956. Currently, there are a total of 697 reactive dyes listed in the *Colour Index* (55). A breakdown by color is given in Table 4.

Reactive dyes have provided dyers with a full spectrum of shades. They possess high solubility, and good leveling power and are easy to apply. Reactive dyes are particularly compatible with environmental and effluent regulations because objectionable chemicals are not necessary for application. The low temperature method allows economical use of energy. However, the ideals of complete fixation and easy application represent the ultimate targets of dye makers.

Table 4. Reactive Dyes Listed in the *Colour Index*[a]

Color	Year		
	1966	1971	1978
yellow	33	79	134
orange	25	60	86
red	54	115	176
violet	11	22	34
blue	41	101	175
green	0	18	23
brown	15	22	28
black	16	31	41
Total	*195*	*448*	*697*

[a] Ref. 55.

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JOHN ELLIOTT
PATRICK P. YEUNG
Toms River Chemical Corporation

Reference No. 7

COVERAGE

STATE	COUNTY	STATE NAME	COUNTY NAME
45	45	South Carolina	Greenville Co
45	83	South Carolina	Spartanburg Co

CENTER POINT AT STATE : 45 South Carolina
COUNTY : 83 Spartanburg Co

Press RETURN key to continue...

REGION OF THE COUNTRY

Zipcode found: 29385 at a distance of 1.5 Km

STATE	CITY NAME	FIPSCODE	LATITUDE	LONGITUDE
SC	WELLFORD	45083	34.9533	82.1017

Press RETURN key to continue ...

CENSUS DATA

OLD STARTEX
LATITUDE 34:56:30 LONGITUDE 82: 6:35 1980 POPULATION

KM	0 - 1/4 0.00-.400	1/4 - 1/2 .400-.810	1/2 - 1 .810-1.60	1 - 2 1.60-3.20	2 - 3 3.20-4.80	3 - 4 4.80-6.40	SECTOR TOTALS
S 1	0	0	0	0	0	635	635
S 2	0	0	940	1221	718	0	2879
S 3	0	0	0	347	0	8	355
S 4	0	0	731	627	0	0	1358
S 5	0	0	0	1505	0	89	1594
S 6	0	0	0	0	781	222	1003
S 7	0	0	1406	0	1735	0	3141
S 8	0	0	0	0	0	0	0
RING TOTALS	0	0	3077	3700	3234	954	10965

Press RETURN key to continue ...

STAR STATION

INDEX NUMBER	STATION NAME	LATITUDE DEGREE	LONGITUDE DEGREE	PERIOD OF RECORD	STABILITY CLASSES	DISTANCE (km)
03870	GREENVILLE-SPARTANBU	34.9000	82.2167			6 10.79
93804	SPARTANBURG MEM SC	34.9167	81.9500			6 14.81
03812	ASHEVILLE NC	35.4333	82.5333			6 66.80
93846	ANDERSON/COUNTY SC	34.5000	82.7167			6 74.03
13881	CHARLOTTE/DOUGLAS NC	35.2167	80.9333			6111.24
13883	COLUMBIA/MET SC	33.9500	81.1167			6142.88
13873	ATHENS/BEN EPPS GA	33.9500	83.3167			5156.09

Press RETURN key to continue ...

U.S. SOIL DATA

STATE : SOUTH CAROLINA

LATITUDE : 34:56:30 LONGITUDE : 82: 6:35
THE STATION IS INSIDE H.U. 3050107

GROUND WATER ZONE	: 8			
RUNOFF SOIL TYPE	: 2			
EROSION	: 2.6150E-04			CM/MONTH
DEPTH TO GROUND WATER BETWEEN	: 3.0000E+02	AND	1.0000E+03	
FIELD CAPACITY FOR TOP SOIL	: 7.2000E-02			
EFFECTIVE POROSITY BETWEEN	: 1.0000E-02	AND	1.0000E-01	
SEEPAGE TO GROUNDWATER BETWEEN	: 4.6330E+02	AND	9.2660E+02	CM/MONTH
DISTANCE TO DRINKING WELL	: 2.5000E+04			CM

Press RETURN key to continue ...

U.S. CITY

STATE	PLACE NAME	FIPSCODE	LATITUDE	LONGITUDE
SC	DUNCAN	45083	34.9333	82.1483
SC	LYMAN	45083	34.9417	82.1333
SC	STARTEX	45083	34.9083	82.1000
SC	WELLFORD	45083	34.9533	82.1017

Press RETURN key to continue ...

MENU: Geodata Handling Data List procedures

1. Site level retrieval of data (SITERET)
2. Access Census Data (CENSUS)
3. Determine County Coverage (COVERAGE)
4. Geographic Data Management (GEODM)
5. HUCODE/SOIL locator (HUCODE)
6. Convert to Lat/Long (LATLON)
7. Lookup/Examine Star Station Data (STAR)
8. Find US cities (USCITY)
9. Find Soil Survey Status of Counties (SSURVEY)

Reference No. 8

ENDANGERED AND THREATENED SPECIES

U.S. FISH AND WILDLIFE SERVICE

REGION 4 - ATLANTA

SOUTH CAROLINA (cont'd)	State Lists 6/87
Turtle, Kemp's (Atlantic) ridley (*Lepidochelys kempii*) - E	Coastal waters
Turtle, green (*Chelonia mydas*) - T	Coastal waters
Turtle, hawksbill (*Eretmochelys imbricata*) - E	Coastal waters
Turtle, leatherback (*Dermochelys coriacea*) - E	Coastal waters
Turtle, loggerhead (*Caretta caretta*) - T	Coastal waters
Fishes:	
Surgeon, shortnose (*Acipenser brevirostrum*) - E	Coastal rivers
Plants:	
Isotria medeoloides (small whorled pogonia) - E	Oconee County
Lindera melissifolia (pondberry)	Berkeley County
Oxypolis canbyi (Canby's dropwort) - E	Bamburg, Colleton, Richland, Barnwell Counties
Ribes echinellum (Miccosukee gooseberry) - E	McCormick County
Sagittaria fasciculata (bunched arrowhead) - E	Greenville County
Trillium persistens (persistent trillium) - E	Tallulah-Tugaloo River System, Oconee County

Federally Listed Species by State

SOUTH CAROLINA

(E=Endangered; T=Threatened; CH=Critical Habitat determined)

Mammals	General Distribution
Cougar, eastern (Felis concolor cougar) - E	North, East
Manatee, West Indian (Trichechus manatus) - E	Coastal waters
Panther, Florida (Felis concolor coryi) - E	South, West
Whale, finback (Balaenoptera physalus) - E	Coastal waters
Whale, humpback (Megaptera novaeangliae) - E	Coastal waters
Whale, right (Eubalaena glacialis) - E	Coastal waters
Whale, sei (Balaenoptera borealis) - E	Coastal waters
Whale, sperm (Physeter catodon) - E	Coastal waters
Birds	
Eagle, bald (Haliaeetus leucocephalus) - E	Entire state
Falcon, American peregrine (Falco peregrinus anatum) - E	Northwestern mountains
Falcon, Arctic peregrine (Falco peregrinus tundrius) - T	Coast, western mountains
Plover, piping (Charadrius melodus) - T	Coast
Stork, wood (Mycteria americana) - E	Coastal swamps
Warbler, Bachman's (Vermivora bachmanii) - E	East, South
Warbler, Kirtland's (Dendroica kirtlandii) - E	East, North
Woodpecker, ivory-billed (Campephilus principalis) - E	East
Woodpecker, red-cockaded (Picoides (=Dendrocopos) borealis) - E	Entire state
Reptiles:	
Alligator, American (Alligator mississippiensis) - T(S/A)*	Coastal plain
Snake, eastern indigo (Drymarchon corais couperi) - T	Extreme Southeast

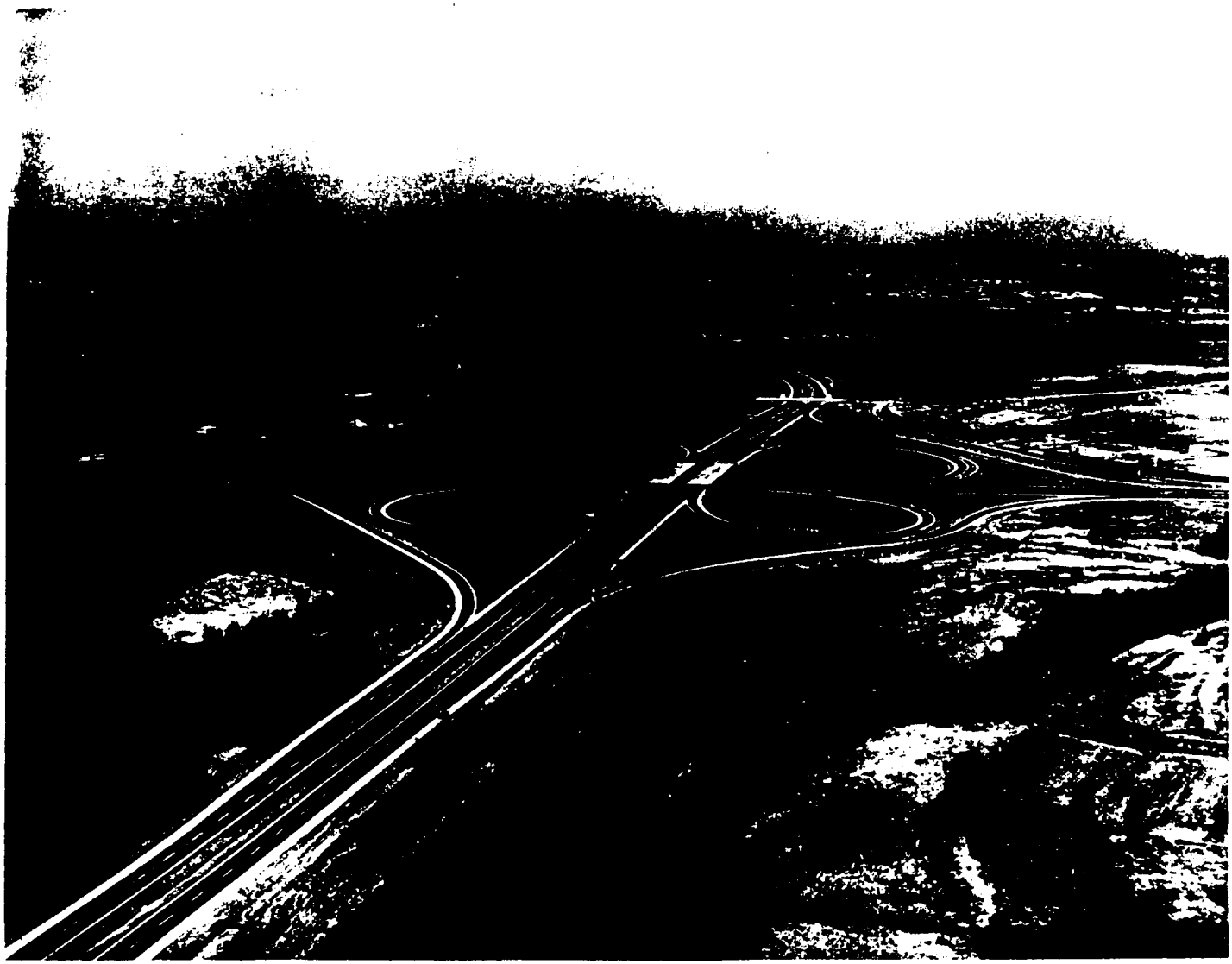
*Alligators are biologically neither endangered nor threatened. For law enforcement purposes they are classified as "Threatened due to Similarity of Appearance." Alligator hunting is regulated in accordance with State law.

Starkex

Reference No. 9

Issued April 1968

SOIL SURVEY
SPARTANBURG COUNTY SOUTH CAROLINA



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION

Contents

	Page
General soil map	1
1. Congaree-Mixed alluvial land association	2
2. Cecil-Madison association	2
3. Hayesville-Cecil association	2
4. Cecil-Davidson-Pacolet association	3
5. Cecil-Musella-Louisburg association	3
6. Cecil-Vance-Appling association	4
7. Cataula-Cecil-Madison association	4
8. Davidson association	4
9. Cecil-Pacolet association	5
10. Cecil-Appling-Pacolet association	5
How this survey was made	5
Descriptions of the soils	6
Appling series	8
Cataula series	9
Cecil series	11
Congaree series	13
Davidson series	14
Durham series	16
Enon series	17
Hayesville series	18
Hiwassee series	19
Iredell series	20
Local alluvial land	20
Lockhart series	21
Louisa series	21
Louisburg series	22
Made land	23
Madison series	24
Mecklenburg series	26
Mine pits and dumps	27
Mixed alluvial land, wet	28
Moderately gullied land	28
Musella series	29
Pacolet series	30
Severely gullied land	31
Stony land, moderately steep	32
Vance series	33
Wickham series	34
Wilkes series	34
Worsham series	35
Use and management of soils	36
Capability groups of soils	36
Management by capability units	37
Suitability of soils for crops	42
Estimated yields	42
Use of soils as woodland	42
Woodland suitability groups of soils	42
Wildlife and fish	51
Wildlife suitability groups of soils	52
Planning for wildlife management	54
Engineering applications	54
Engineering test data	55
Soil properties significant to engineering	55
Engineering interpretations of the soils	55
Sanitary, highway, and conservation engineering	62
Use of soils in community development	68
Formation and classification of soils	68
Factors of soil formation	68
Parent material	68
Climate	69
Living organisms	69
Time	74
Relief	74
Processes of horizon differentiation	74
Classification of soils	75
Additional facts about the county	76
Climate	76
Physiography, drainage, and geology	79
Glossary	79
Literature cited	80
Guide to mapping units	Facing 80

NOTICE TO LIBRARIANS

Series year and series number are no longer shown on soil surveys. See explanation on the next page.

Issued April 1968

SOIL SURVEY OF SPARTANBURG COUNTY, SOUTH CAROLINA

BY WALLACE J. CAMP, SOIL CONSERVATION SERVICE

SOILS SURVEYED BY V. A. ROGERS, E. C. HERREN, AND WALLACE J. CAMP, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION

SPARTANBURG COUNTY is in the northwestern part of South Carolina (fig. 1). The county occupies approximately 832 square miles, or 532,480 acres. Of this area, 5 square miles is water, mostly that of Lake Bowen, on the South Pacolet River, and of Lake Lyman, on the Middle Tyger River. Spartanburg, the county seat, is in the northeastern part of the county.

The first settlements in Spartanburg County were made on the Pacolet and Tyger Rivers between 1750 and 1760. The early settlers were of Scotch-Irish descent and came from northern Ireland and from Pennsylvania, Maryland, Virginia, and North Carolina. A few English settlers came from Virginia and the eastern part of South Carolina.

Practically all of the county is in farms. Most of the soils are loamy, and a large acreage is suitable for cotton, corn, grain sorghum, and other row crops. The soils most used for cultivated crops are the Cecil, Appling, and Madison. These soils are well drained, but the more sloping areas are susceptible to erosion. Many areas are protected against erosion by grassed waterways and other means. Pasture or woodland is a good use in many of the steeper areas. In 1959 about 4 percent of the county was pasture, and about 53 percent was woodland, of which about one-half was pastured.

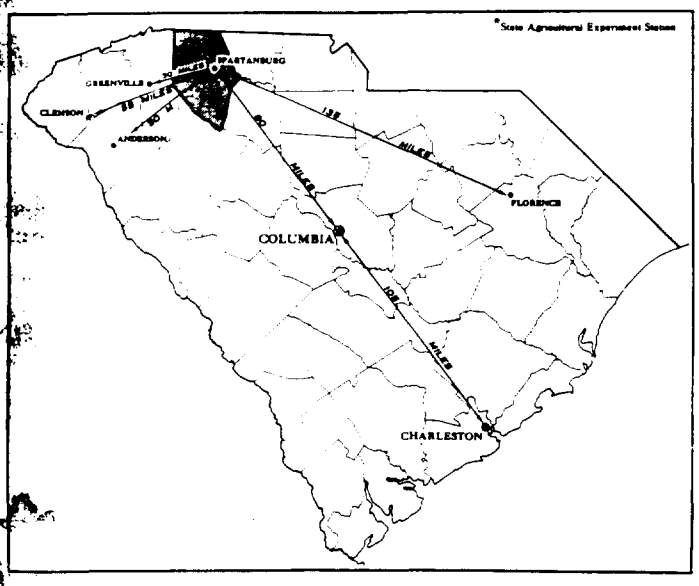


Figure 1.—Location of Spartanburg County in South Carolina.

Most of the farm income is from the sale of peaches, cotton, and livestock or livestock products. As the canning industry grows in the county, there is an increase in the production of plums, pears, apples, grapes, and other fruits, and of tomatoes and other vegetables.

Manufacture of textiles began early in Spartanburg County (*11*)[1], and other industries also have established plants. Vermiculite is mined in the southern part of the country, and rock is quarried at Pacolet and an area west of Cashville.

Streams, ponds, and wells are the chief sources of water for livestock. Dug or drilled wells furnish water for most homes, but the county is divided into water districts, and water for some rural homes is furnished by the Spartanburg City Water Works.

Among the recreational facilities in the county are parks, athletic fields, playgrounds, tennis courts, and golf courses. Swimming and picnicking are enjoyed at Rainbow Lake, Croft State Park, Lake Bowen, and Lake Lyman. Lake Bowen and Lake Lyman also provide water skiing.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Spartanburg County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

[1] Italicized numbers in parentheses refer to Literature Cited, page 80.

6. Cecil-Vance-Appling Association

Deep, well drained and moderately well drained, gently sloping soils that are on broad ridges and have a red to brownish-yellow, firm to very firm clayey subsoil

This association consists of broad, gently sloping ridges and a few long, shallow drainageways. The slopes adjacent to streams are long. Those facing north are long and have gradients of more than 10 percent. South-facing slopes are less than 10 percent. Narrow, nearly level areas are along the larger streams. This association, locally called the flatwoods, occupies slightly less than 3 percent of the county.

The Cecil soils make up about 40 percent of this association; Vance soils, about 22 percent; Appling soils, about 18 percent; and minor soils, the remaining 20 percent.

The Cecil soils normally have a dark-brown to grayish-brown sandy loam surface layer, but eroded areas have a red clay loam surface layer. The subsoil is red clay. The Vance soils occupy sloping and gently sloping areas adjacent to shallow drainageways and to upland depressions. These soils have a dark grayish-brown sandy loam surface layer and a yellowish-brown, very firm clay subsoil that is mottled or streaked with light red. The Appling soils occupy broad, gently sloping ridgetops and have a light grayish-brown to yellowish-brown, very friable sandy loam surface layer. Their subsoil is brownish-yellow to yellowish-red, firm sandy clay to clay.

The minor soils of this association are the yellowish-brown, moderately well drained Durham loamy sands on uplands; the mottled yellowish-brown and gray, somewhat poorly drained Worsham soils along drainageways and on bottom lands; and Mixed alluvial land, wet.

Most of this association is in peach orchards and pasture; the rest is in mixed forest or is used for nonfarm purposes. The trend is toward increased use of soils for pasture, for recreation, and for housing developments. The average farm contains about 200 acres and is operated by its owner. The main income is from the sale of small grain, corn, cotton, peaches, soybeans, and some truck crops.

The main kinds of recreation in this association are golfing; fishing and swimming in farm ponds; skating at amusement centers; and hunting.

The soils of this association have moderate to severe limitations as foundation material for roads or buildings, as embankments for ponds, and as disposal fields for septic tanks.

7. Cataula-Cecil-Madison Association

Deep to moderately deep, moderately well drained to well drained, gently sloping to steep soils that are on irregular ridges and have a red, very firm to firm clayey subsoil

This association consists of irregular ridges that have gently sloping crests and strongly sloping to steep sides adjacent to streams. The long, crooked, well-defined drainageways are of a dendritic pattern, and bottom land adjacent to the streams is either narrow or nonexistent. This association occupies about 14 percent of the county.

Cataula soils make up about 40 percent of this association; Cecil soils, about 25 percent; Madison soils, about 20 percent; and minor soils, the remaining 15 percent.

The Cataula soils occur throughout this association, except in moderately steep and steep areas. These soils have a brown to grayish-brown sandy loam to clay loam surface layer and a red to mottled red and brown, very firm clay subsoil. The Cecil soils occupy long gentle slopes and the crests of moderately broad ridges. These soils have a dark-brown to grayish-brown sandy loam to clay loam surface layer and a red clay subsoil. The Madison soils occur on the moderately steep to steep side slopes. These soils have a dark-brown to red sandy loam to clay loam surface layer and a red clay subsoil. Mica is common throughout the profile.

The minor soils on uplands in this association are the red, well drained, moderately steep Pacolet; the grayish-brown, well drained Appling sandy loams; the grayish-brown, well drained Lockhart sandy loams; the grayish-brown, moderately well drained Durham loamy sands; and the shallow, weakly developed, excessively drained Wilkes fine sandy loams. On the bottom lands are the Congaree fine sandy loams to clay loams.

8. Davidson Association

Deep, well-drained, sloping to strongly sloping soils that are on broad ridges and have a dark-red, firm clay subsoil

This association consists mainly of broad, gently sloping ridges and long, shallow drainageways. The slopes adjacent to larger streams are strong. This association occupies about 3 percent of the county.

The Davidson soils make up about 60 percent of this association, and minor soils make up the remaining 40 percent.

The Davidson soils have a dusky-red to weak-red loam to clay loam surface layer and a dark-red clay subsoil. They are well drained.

The minor soils of this association are the Cecil, Enon, Iredell, Mecklenburg, and Wilkes. The Cecil soils are red and well drained and the Enon soils are yellowish brown and moderately well drained. The Iredell soils have a dark grayish-brown fine sandy loam surface layer and a yellowish-brown, very firm, plastic clay subsoil. The Mecklenburg soils have a dark reddish-brown fine sandy loam surface layer and a yellowish-red, firm clay subsoil. The Wilkes soils are shallow, weakly developed, excessively drained fine sandy loams.

Except for the strongly sloping areas, this association has been cleared and cultivated. About 25 percent now is cultivated, and the rest is forested, idle, or used for nonfarm purposes. The trend is toward idle land and woodland. Farms range from 100 to 200 acres in size.

The soils of this association are suited to locally grown crops and pasture plants. Pasture grasses grow well. Because erosion is a severe hazard, practices are needed that prevent soil loss where these soils are cultivated.

On this association recreation is limited mainly to hunting in season. The soils of this association have moderate to severe limitations as foundation material for roads and for buildings and as embankments for dams. Limitations to use as disposal fields for septic tanks are severe.

TABLE 1.—*Approximate acreage and proportionate extent of soils*

Soil	Area	Extent
	Acres	*Percent*
and Cecil sandy loams, 2 to 6 percent	18, 252	3. 4
and Cecil sandy loams, 6 to 10 percent es, eroded	4, 083	. 8
sandy loam, 2 to 6 percent slopes	999	. 2
clay loam, 2 to 6 percent slopes, se- eroded	3, 905	. 7
clay loam, 6 to 10 percent slopes, y eroded	12, 388	2. 3
clay loam, 10 to 15 percent slopes, ely eroded	6, 786	1. 3
sandy loam, 2 to 6 percent slopes, ded	7, 610	1. 4
ila sandy loam, 6 to 10 percent slopes, ded	8, 845	1. 7
la sandy loam, 10 to 15 percent slopes, ded	3, 855	. 7
clay loam, 2 to 6 percent slopes, severely oded	11, 606	2. 2
clay loam, 6 to 10 percent slopes, severely ded	30, 656	5. 7
clay loam, 10 to 15 percent slopes, se- ely eroded	19, 233	3. 6
sandy loam, 2 to 6 percent slopes, eroded	97, 530	18. 3
sandy loam, 6 to 10 percent slopes, ded	57, 890	10. 9
sandy loam, 10 to 15 percent slopes, ded	22, 197	4. 1
ree soils	18, 500	3. 5
dson clay loam, 2 to 6 percent slopes, rely eroded	2, 165	. 4
dson clay loam, 6 to 10 percent slopes, rely eroded	6, 509	1. 2
vidson clay loam, 10 to 15 percent slopes, severely eroded	3, 746	. 7
vidson loam, 2 to 6 percent slopes, eroded	574	. 1
vidson loam, 6 to 10 percent slopes, eroded	304	. 1
vidson sandy clay loam, 2 to 6 percent opes, eroded	12, 650	2. 4
vidson sandy clay loam, 6 to 10 percent lopes, eroded	8, 335	1. 6
vidson sandy clay loam, 10 to 15 percent slopes, eroded	3, 150	. 6
rham loamy sand, 2 to 6 percent slopes	442	. 1
n sandy loam, 2 to 6 percent slopes, eroded	4, 604	. 9
n sandy loam, 6 to 10 percent slopes, eroded	2, 819	. 5
n sandy loam, 10 to 15 percent slopes, roded	838	. 1
yesville sandy loam, 6 to 15 percent slopes	244	(1)
yesville sandy loam, 15 to 25 percent slopes	423	. 1
ville sandy loam, 25 to 40 percent slopes	239	(1)
see sandy loam, 2 to 8 percent slopes, oded	192	(1)
dell fine sandy loam, 2 to 6 percent slopes	605	. 1
al alluvial land	1, 624	. 3
khart sandy loam, 4 to 10 percent slopes, roded	295	. 1
isa sandy loam, 6 to 10 percent slopes, roded	266	(1)
uisa sandy loam, 10 to 15 percent slopes, eroded	290	. 1
Louisa sandy loam, 15 to 25 percent slopes, eroded	339	. 1
Louisburg loamy sand, 6 to 10 percent slopes	580	. 1
Louisburg loamy sand, 10 to 15 percent slopes	478	. 1
Louisburg loamy sand, 15 to 25 percent slopes	3, 176	. 6
Made land	1, 903	. 3
Madison clay loam, 2 to 6 percent slopes, severely eroded	344	0. 1
Madison clay loam, 6 to 10 percent slopes, severely eroded	995	. 2
Madison clay loam, 10 to 15 percent slopes, severely eroded	1, 086	. 2
Madison clay loam, 15 to 40 percent slopes, severely eroded	9, 065	1. 7
Madison sandy loam, 2 to 6 percent slopes, eroded	2, 336	. 4
Madison sandy loam, 6 to 10 percent slopes, eroded	2, 099	. 4
Madison sandy loam, 10 to 15 percent slopes, eroded	1, 231	. 2
Madison sandy loam, 15 to 25 percent slopes, eroded	13, 282	2. 5
Madison sandy loam, 25 to 40 percent slopes, eroded	2, 570	. 5
Madison sandy loam, thin solum variant, 2 to 6 percent slopes, eroded	658	. 1
Madison sandy loam, thin solum variant, 6 to 10 percent slopes, eroded	694	. 1
Mecklenburg fine sandy loam, 2 to 6 percent slopes, eroded	516	. 1
Mecklenburg fine sandy loam, 6 to 10 percent slopes, eroded	279	. 1
Mine pits and dumps	558	. 1
Mixed alluvial land, wet	11, 583	2. 2
Moderately gullied land, firm materials	3, 958	. 7
Moderately gullied land, friable materials, 2 to 10 percent slopes	1, 518	. 3
Moderately gullied land, friable materials, 10 to 40 percent slopes	7, 939	1. 5
Musella clay loam, 6 to 10 percent slopes, severely eroded	270	. 1
Musella clay loam, 10 to 25 percent slopes, severely eroded	3, 786	. 7
Musella fine sandy loam, 6 to 10 percent slopes, eroded	294	. 1
Musella fine sandy loam, 10 to 15 percent slopes, eroded	866	. 1
Musella fine sandy loam, 15 to 40 percent slopes, eroded	2, 369	. 4
Pacolet clay loam, 15 to 25 percent slopes, severely eroded	16, 500	3. 1
Pacolet sandy loam, 15 to 25 percent slopes	4, 435	. 8
Pacolet sandy loam, 15 to 25 percent slopes, eroded	27, 366	5. 1
Pacolet sandy loam, 25 to 40 percent slopes	3, 564	. 7
Severely gullied land	653	. 1
Stony land, moderately steep	163	(1)
Vance sandy loam, 2 to 6 percent slopes, eroded	2, 174	. 4
Vance sandy loam, 6 to 10 percent slopes, eroded	374	. 1
Wickham sandy loam, 2 to 6 percent slopes, eroded	1, 021	. 2
Wickham sandy loam, 6 to 10 percent slopes, eroded	241	(1)
Wilkes fine sandy loam, 2 to 6 percent slopes, eroded	205	(1)
Wilkes fine sandy loam, 6 to 10 percent slopes, eroded	1, 556	. 3
Wilkes fine sandy loam, 10 to 15 percent slopes, eroded	1, 530	. 3
Wilkes fine sandy loam, 15 to 40 percent slopes, eroded	12. 625	2. 4
Worsham fine sandy loam, 0 to 6 percent slopes	7, 452	1. 4
Water	3, 200	. 6
Total	532, 480	100. 0

[1] Less than 0.05 percent.

enters and passes through these soils at a moderately rapid rate. The available water capacity is medium to high.

Most of the acreage is in pasture. Corn, truck crops, and pasture plants are suited and respond to good management. Flooding is the chief hazard to management. (Capability unit IIw–2; woodland suitability group 1; wildlife suitability group 6)

Davidson Series

The soils of the Davidson series are deep and well drained. Locally they are called push dirt. These soils formed in material that weathered from gabbro, diorite, hornblende schist, and hornblende gneiss. Depth to hard rock is more than 15 feet.

Typical profile in a pasture, 3 miles northeast of Glenn Springs, on a slope of 4 percent facing southeast:

Ap—0 to 5 inches, dusky-red (10R 3/3) loam; weak, fine, granular structure; friable when moist, hard when dry, sticky when wet; many fine roots; few, fine, dark concretions; pH 6.3; abrupt, smooth boundary.

B21t—5 to 20 inches, dusky-red (10R 3/4) clay; moderate, fine, subangular blocky structure; firm when moist, hard when dry, very sticky when wet; common fine and medium roots; discontinuous thin clay films; pH 5.8; clear, smooth boundary.

B22t—20 to 61 inches, dark-red (10R 3/6) clay; moderate, medium, subangular blocky structure; firm when moist, hard when dry, very sticky when wet; continuous thick clay films; pH 5.8.

The surface layer is loam, sandy clay loam, or clay loam. It is clay loam where accelerated erosion has removed the original surface soil. The surface layer ranges from 1 to 6 inches in thickness and from dusky red to dark brown in color. The B2t horizon is dark-red to dusky-red, firm clay 48 to 72 inches thick.

The Davidson soils occur with the Cecil, Mecklenburg, and Iredell soils. The Davidson soils have a redder surface layer and a darker red subsoil than those soils.

The Davidson soils are moderately high in natural fertility, and crops on them respond to added fertilizer. The content of organic matter is moderate. Infiltration is moderately slow, permeability is moderate, and available water capacity is medium. The root zone is deep.

In this county, the Davidson soils occur on gently sloping and sloping ridgetops. The native trees were oak, hickory, redcedar, yellow-poplar, and some pine. The understory was dogwood, holly, vines, briers, and native grasses. These soils are suited to cultivation, and crops on them respond to good management. Most of the acreage is in cultivated crops, peach orchards, and pasture.

Davidson clay loam, 2 to 6 percent slopes, severely eroded (DaB3).—This is a deep, well-drained soil that formed in material weathered from diorite and from hornblende gneiss.

The surface layer is dusky-red to dark-red, friable clay loam 1 to 3 inches thick. The subsoil, which is exposed in most places, is dusky-red to dark-red, firm clay.

Included in areas mapped as this soil are patches that have a loam to sandy clay loam surface layer. Also included are patches with slopes ranging from 6 to 10 percent. Other inclusions are small areas of Cecil soils and of Mecklenburg soils. These included areas make up less than 7 percent of this mapping unit.

The plow layer is generally in poor tilth and can be worked without clodding only through a narrow range of moisture content. This soil is moderately high in natural fertility and low in content of organic matter. Water enters this soil at a slow rate and passes through it at a moderate rate. Runoff is rapid, and the available water capacity is medium.

Most of the acreage is in pasture and forest. Corn, small grain, soybeans, pasture plants, and peach trees produce average yields. In managing this soil the main concerns are controlling erosion and improving tilth. (Capability unit IIIe–1; woodland suitability group 6; wildlife suitability group 3)

Davidson clay loam, 6 to 10 percent slopes, severely eroded (DaC3).—This is a deep, well-drained soil that formed in material weathered from hornblende gneiss and diorite.

The surface layer is dusky-red to dark-red, friable clay loam 1 to 3 inches thick. The subsoil is dusky-red to dark-red, firm clay.

Included in areas mapped as this soil are patches that have a loam to sandy clay loam surface layer. Also included are patches with slopes ranging from 2 to 6 percent. Other inclusions are small areas of Cecil soils and of Mecklenburg soils. These included areas make up less than 10 percent of this mapping unit.

Good tilth in the plow layer is difficult to maintain. The plow layer can be worked without clodding only through a narrow range of moisture content. This soil is moderately high in natural fertility and low in content of organic matter. Water enters this soil at a slow rate and passes through it at a moderate rate. Runoff is rapid, and the available water capacity is medium.

Most of this soil is in forest, but fair yields of small grain and pasture plants are produced. In managing this soil the main concerns are controlling erosion and improving tilth. (Capability unit IVe–1; woodland suitability group 6; wildlife suitability group 3)

Davidson clay loam, 10 to 15 percent slopes, severely eroded (DaD3).—This is a deep, well-drained soil that formed in material weathered from hornblende gneiss and diorite.

The surface layer is reddish-brown to dark-red, friable clay loam 1 to 4 inches thick. The subsoil is exposed in most places and consists of dark-red, firm clay. Rills and shallow gullies are common.

Included in areas mapped as this soil are patches that have a sandy clay loam surface layer. Also included are small areas with slopes ranging from 6 to 10 percent. Other inclusions throughout the county are small areas of Cecil soils and of Wilkes soils. Inclusions in the northern part of the county are small areas of Musella soils and in the southern part are small areas of Cataula soils. These included areas make up less than 9 percent of this mapping unit.

On this soil runoff is rapid and abundant. Organic-matter content and natural fertility are moderate. Water enters the soil at a slow rate and passes through it at a moderate rate. Available water capacity is medium.

Most of this soil is in pine forest. Kudzu and sericea lespedeza are adapted, but it is not practical to use this forested soil for cultivated crops or pasture. Erosion is the chief hazard to management. (Capability unit IVe–1; woodland suitability group 6; wildlife suitability group 3)

...dson loam, 2 to 6 percent slopes, eroded (DdB2).—... is a deep, well-drained soil that overlies diorite and ...blende schist.

...e surface layer is dusky-red, friable loam 2 to 5 inches ... The subsoil is exposed in many small- and me...-sized areas and consists of dusky-red to dark-red, ...lay. There are a few rills and galled areas.

...luded in areas mapped as this soil are patches that ... a clay loam surface layer. Also included are patches ... slopes ranging from 6 to 10 percent. Other inclusions ...mall areas of Cecil soils and of Mecklenburg soils. ...included areas make up less than 6 percent of this ...ng unit.

...ecause this soil is sticky, keeping it in good tilth is ...ult. The plow layer can be worked without clodding ...through a narrow range of moisture content. Tilth ...enerally poor where the subsoil material is exposed. ... soil is moderately high in natural fertility and mod... in content of organic matter, but response to added ...izer is good. Water enters this soil at a moderately ... rate and passes through it at a moderate rate. ...ilable water capacity is medium.

...ost of this soil is in crops or pasture. Yields are ...orable for corn, small grain, soybeans, pasture plants, ...peach trees. In managing this soil the main concerns ...controlling erosion and improving tilth. (Capability ... IIe–1; woodland suitability group 3; wildlife ...bility group 1)

Davidson loam, 6 to 10 percent slopes, eroded (DdC2).—This is a deep, well-drained soil that overlies diorite and hornblende gneiss.

The surface layer is dusky-red, friable loam 2 to 5 inches thick. The subsoil is exposed in many small- and medium-sized areas and consists of dusky-red to dark-red, firm clay. A few rills and galled areas occur.

Included in areas mapped as this soil are patches that have a clay loam surface layer. Also included are patches with slopes ranging from 2 to 6 percent. Other inclusions are small areas of Cecil soils and of Mecklenburg soils. These included areas make up less than 5 percent of this mapping unit.

Because this soil is sticky, keeping it in good tilth is difficult. The plow layer can be worked without clodding only through a narrow range of moisture content. Tilth is generally poor where the subsoil material is exposed. This soil is moderately high in natural fertility and moderate to low in content of organic matter, but response to added fertilizer is good. Water enters this soil at a moderately slow rate and passes through it at a moderate rate. Available water capacity is medium.

Most of this soil is in crops or pasture. Yields are favorable for corn, small grain, soybeans, pasture plants, and peach trees. In managing this soil the main concerns are controlling erosion and improving tilth. (Capability unit IIIe–1; woodland suitability group 4; wildlife suitability group 1)

Davidson sandy clay loam, 2 to 6 percent slopes, eroded (DsB2).—This is a deep, well-drained soil that overlies hornblende gneiss and hornblende schist.

The surface layer is dark reddish-brown to reddish-brown, friable sandy clay loam 2 to 6 inches thick. The subsoil is exposed in a few small- and medium-sized areas and consists of dark-red, firm clay. Some areas are rilled, and there are a few shallow gullies.

Included in areas mapped as this soil are patches that have a sandy loam or clay loam surface layer. Also included are patches with slopes that range from 6 to 10 percent. Other inclusions in the northern and northwestern parts of the county are small areas of Cecil soils and of Appling soils, and in the southern part are small areas of Mecklenburg and of Cataula soils. These included areas make up less than 11 percent of this mapping unit.

In most places the plow layer is easily kept in good tilth. It can be worked within a medium range of moisture content without clodding, but tilth is generally poor in areas where the subsoil material is exposed. Tillage extends into the subsoil in most places. This soil is low in organic-matter content and moderate in natural fertility. Crops on it respond to added fertilizer and lime. Water enters and passes through this soil at a moderate rate, and available water capacity is medium.

Most of this soil is in cultivated crops, peach orchards, or pasture. Yields of all crops commonly grown in the county are favorable. Erosion is the chief hazard to management. (Capability unit IIe-1; woodland suitability group 3; wildlife suitability group 1)

Davidson sandy clay loam, 6 to 10 percent slopes, eroded (DsC2).—This is a deep, well-drained soil that overlies hornblende gneiss and hornblende schist.

The surface layer is dark-brown, very friable sandy clay loam 2 to 5 inches thick. The subsoil is exposed in a few small areas and consists of dark-red, firm clay.

Included in areas mapped as this soil are a few patches with slopes ranging from 2 to 6 percent and a few with slopes ranging from 10 to 15 percent. Other inclusions are small areas of Cecil soils and, in the northwestern part of the county, small areas of Appling soils. Inclusions in the southern part of the county are small areas of Mecklenburg soils and of Cataula soils. These included areas make up less than 10 percent of this mapping unit.

The plow layer is easily kept in good tilth, and it can be worked through a medium range of moisture content without clodding. Tillage extends into the subsoil. This soil is low in content of organic matter and moderate in natural fertility. Its response to added lime and fertilizer is good. Water enters and passes through this soil at a moderate rate, and the available water capacity is medium.

Most of this soil is in cultivated crops. Yields of all crops commonly grown in the county are favorable. Erosion is the chief hazard to management. (Capability unit IIIe-1; woodland suitability group 4; wildlife suitability group 1)

Davidson sandy clay loam, 10 to 15 percent slopes, eroded (DsD2).—This is a deep, well-drained soil that overlies hornblende gneiss and hornblende schist.

The surface layer is dark reddish-brown to reddish-brown, friable sandy clay loam 2 to 5 inches thick. The subsoil is exposed in a few small- and medium-sized areas and consists of dark-red, firm clay. Rills are common, and there are a few shallow gullies.

Included in areas mapped as this soil are patches that have a sandy loam or clay loam surface layer. Also included are a few small areas with slopes ranging from 6 to 10 percent. Other inclusions are small areas of Cecil soils and, in the northwestern and northern parts of the county, small areas of Musella soils. Included in the southern part of the county are small areas of Cataula

soils. These included areas make up less than 11 percent of this mapping unit.

The plow layer can be kept in good tilth fairly easily, though it can be worked without clodding through only a narrow range of moisture content. Tillage extends into the subsoil. This soil is low in organic-matter content and natural fertility, but crops on it respond well to added lime and fertilizer. Water enters this soil at a moderately slow rate and passes through it at a moderate rate. Runoff is rapid, and the available water capacity is medium.

Most of the acreage is in forest, pasture, and peach orchards (fig. 3). Under good management, pasture and peach orchards produce average yields. Erosion is the chief hazard to management. (Capability unit IVe-1; woodland suitability group 4; wildlife suitability group 2)

Durham Series

The soils of the Durham series are deep and moderately well drained. These soils formed in material that weathered from granite and gneiss. Depth to hard rock is more than 15 feet.

Typical profile in an idle field, three-fourths of a mile southeast of Abney Church near State Route 101, on a southeast-facing slope of 3 percent:

Ap—0 to 5 inches, brown (10YR 5/3) loamy sand; weak, fine, granular structure; very friable; many fine and medium roots; pH 7.4; clear, smooth boundary.

A2—5 to 9 inches, grayish-brown (2.5Y 5/2) loamy sand; weak, fine, granular structure; very friable; many fine and medium roots; pH 7.1; clear, smooth boundary.

B1t—9 to 18 inches, olive-yellow (2.5Y 6/6) sandy clay loam; weak, medium, subangular blocky structure; friable when moist, slightly sticky when wet; common fine and medium roots; thin patchy clay films; pH 5.7; clear, smooth boundary.

B21t—18 to 24 inches, olive-yellow (2.5Y 6/6) sandy clay to clay; mottled with yellowish brown; moderate, medium, blocky structure; firm when moist, sticky when wet, hard when dry; few medium roots; patchy clay films; pH 5.7; clear, smooth boundary.

B22t—24 to 32 inches, brownish-yellow (10YR 6/6) clay; common, medium, distinct mottles of light red; strong, coarse, blocky structure; firm to very firm; sticky when wet, hard when dry; few medium roots; continuous clay films on ped faces; pH 5.6; clear, smooth boundary.

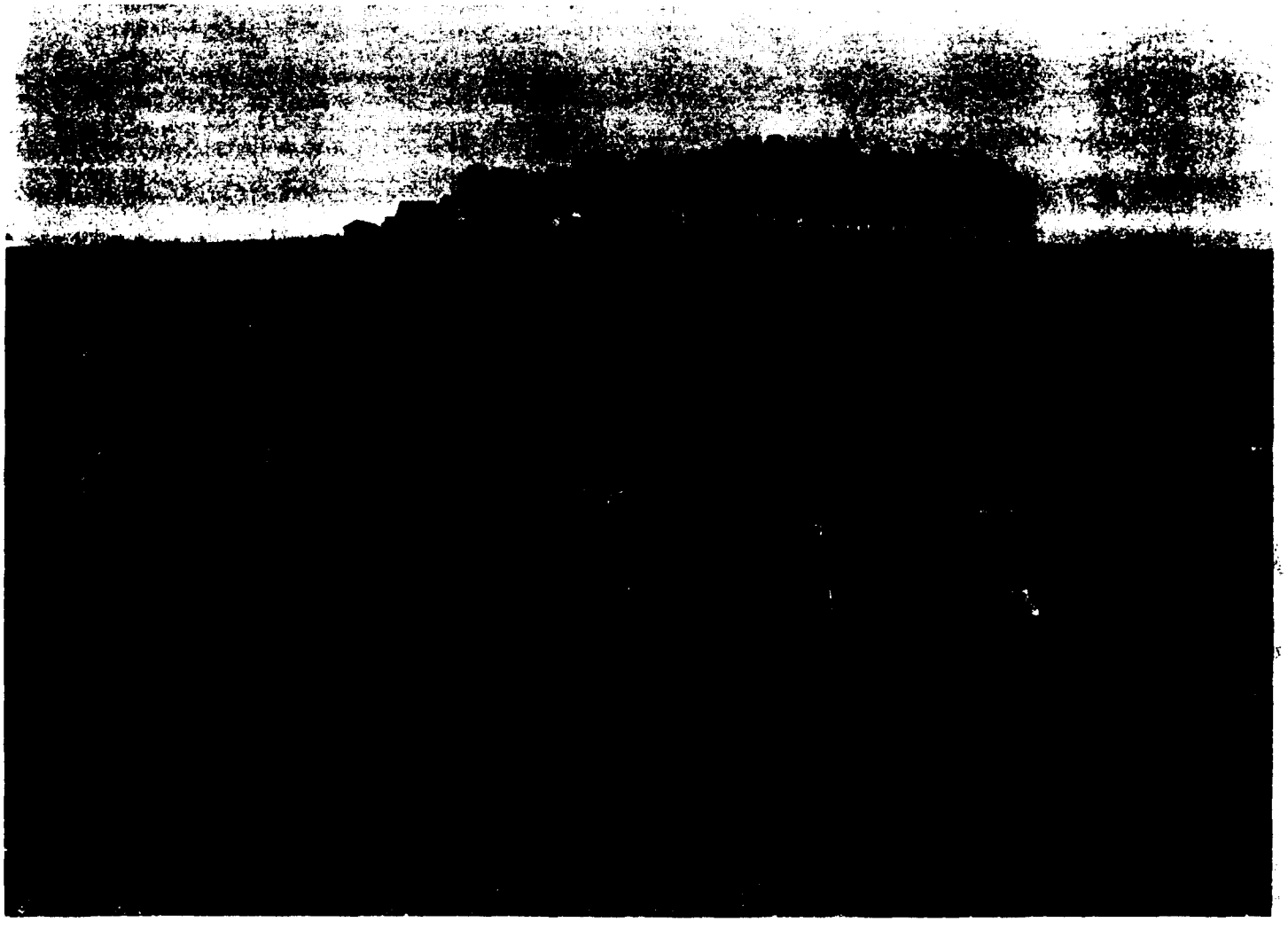


Figure 3.—**Fescue makes good pasture on Davidson sandy clay loam, 10 to 15 percent slopes, eroded.**

TABLE 6.—*Engineer*

[Tests performed by the South Carolina State Highway Department in cooperation with the U.S. Department of Commer

Soil name and location	Parent material	South Carolina report No.	Depth	Horizon
			Inches	
Cataula sandy loam:				
1 mile N. of Switzer and 4 miles SW. of Moore. (Modal)	Mica gneiss and some hornblende gneiss.	F30295	0–6	Ap
		F30296	16–27	B2
		F30297	37–72	C
1 mile SW. of Moore and 2 miles NE. of Switzer. (Modal)	Hornblende gneiss.	F30325	0–5	Ap
		F30326	23–37	B2
		F30327	44–72	C
5.5 miles N. of Woodruff and 2.5 miles SW. of Poplar Springs. (Some properties of Vance soils)	Mica gneiss and some hornblende gneiss.	F30298	0–5	Ap
		F30299	5–12	B2
		F30300	47–60	C
1 mile N. of Woodruff and 2 miles SE. of Selma Church. (Some properties of Davidson soils)	Mica gneiss and some hornblende gneiss.	F30301	0–6	Ap
		F30302	8–29	B2
		F30303	59–72	C
Cecil sandy loam:				
2 miles SW. of Carlisle School and 8 miles NE. of Spartanburg. (Modal)	Schist.	F30304	0–7	Ap
		F30305	12–28	B2
		F30306	43–72	C
2 miles SE. of Pauline and 4 miles W. of Walnut Grove Church. (Some properties of Appling soils)	Granitized gneiss.	F30310	0–7	Ap
		F30311	12–26	B2
		F30312	59–72	C
2 miles N. of Pauline and 4 miles E. of Stone Station. (Some properties of Madison soils)	Mica schist.	F30307	0–8	Ap
		F30308	21–35	B2
		F30309	47–60	C
Davidson sandy clay loam:				
1 mile E. of Snoddy and 6 miles W. of Spartanburg. (Modal)	Hornblende gneiss.	F30313	0–7	Ap
		F30314	7–20	B2
		F30315	69–72	C
3 miles N. of Lyman and 6 miles NW. of Wellford. (Modal)	Hornblende gneiss.	F30316	0–7	Ap
		F30317	10–42	B2
		F30318	65–84	C
3 miles NE. of Lyman and 2 miles N. of Wellford. (Some properties of Cecil soils)	Hornblende gneiss and some mica gneiss.	F30322	0–6	Ap
		F30323	11–38	B2
		F30324	55–75	C
3 miles S. of Glenn Springs and 2 miles E. of Friendship Church. (Some properties of Mecklenburg soils)	Hornblende gneiss.	F30319	0–8	Ap
		F30320	25–48	B2
		F30321	66–75	C
2 miles N. of Cross Anchor and 5 miles S. of Friendship Church. (Some properties of Cataula soils)	Hornblende gneiss.	F30328	0–5	Ap
		F30329	13–32	B2
		F30330	60–73	C
1 mile W. of Cedar Spring School and 5 miles S. of Spartanburg. (Some properties of Cataula soils)	Hornblende gneiss.	F30331	0–6	Ap
		F30332	10–24	B2
		F30333	49–60	C
Lockhart sandy loam:				
5 miles SW. of Pauline and 0.5 mile SE. of Friendship Church. (Modal)	Granite.	F30334	0–8	Ap
		F30335	16–27	B2
		F30336	39–72	C

See footnotes at end of table.

TABLE 7.—*Estimated physic*

Soil series, type, and map symbols	Depth from surface	Classification	
		USDA texture	Unified
Cecil:	*Inches*		
Clay loam (CeB3, CeC3, CeD3).	0–5	Clay loam	ML
	5–43	Clay	MH
	43–72	Clay loam	ML
Sandy loam (CIB2, CIC2, CID2).	0–7	Sandy loam	SM
	7–43	Clay	MH
	43–72	Clay loam	ML
Congaree (Co).	0–10	Clay loam to sandy clay loam	ML
	10–31	Clay loam	CL
	31–60	Fine sandy loam	ML
Davidson:			
Clay loam (DaB3, DaC3, DaD3).	0–3	Clay loam	CL
	3–20	Clay	MH
	20–61	Clay	MH
Loam (DdB2, DdC2).	0–5	Loam	ML
	5–20	Clay	MH
	20–61	Clay	MH
Sandy clay loam (DsB2, DsC2, DsD2).	0–11	Sandy clay loam	SM
	11–55	Clay	MH
	55–75	Sandy clay loam	CL
Durham (DvB).	0–10	Loamy sand	SM
	10–38	Sandy clay loam to sandy clay	MH
	38–62	Clay	MH or CH
Enon (EnB2, EnC2, EnD2).	0–6	Sandy loam	SM
	6–34	Clay	MH
	34–42	Sandy clay loam	ML or CL
Hayesville (HaD, HaE, HaF).	0–12	Sandy loam	SM
	12–35	Sandy clay loam	ML or CL
	35–44	Sandy clay loam	ML or CL
Hiwassee (HwC2).	0–6	Sandy loam	SM
	6–45	Clay	MH or CL
	45–53	Loam	ML
Iredell (IdB).	0–6	Fine sandy loam	SM
	6–23	Clay	CH
	23–33	Fine sandy loam	SC
Lockhart (LcC2).	0–11	Sandy loam	SM
	11–39	Clay	MH
	39–72	Sandy clay loam	SM
Louisa (LoC2, LoD2, LoE2).	0–6	Sandy loam	SM
	6–14	Sandy clay	CL
	14–24	Sandy clay loam	SM or SC
Louisburg (LuC, LuD, LuE).	0–11	Loamy sand	SM
	11–40	Fine sandy loam	SM
Madison:			
Clay loam (McB3, McC3, McD3, McF3).	0–4	Clay loam	CL
	4–36	Clay	MH
	36–72	Sandy clay loam	SC
Sandy loam (MdB2, MdC2, MdD2, MdE2, MdF2).	0–7	Sandy loam	SM
	7–36	Clay	MH
	36–76	Sandy clay loam	SC

...nical properties of soils—Continued

...sification—Continued	Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential
AASHO	No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
				Inches per hour	*Inches per inch of soil*	*pH*	
----------	100	100	50–60	0. 63–2. 0	0. 11	5. 8–6. 2	Low.
----------	100	100	70–80	0. 63–2. 0	. 13	5. 3–5. 5	Moderate.
----------	100	100	50–60	0. 63–2. 0	. 12	5. 0–5. 2	Low.
----------	85–100	80–95	20–30	2. 0–6. 3	. 10	5. 8–6. 2	Low.
----------	100	100	70–80	0. 63–2. 0	. 13	5. 3–5. 7	Moderate.
----------	100	100	50–60	0. 63–2. 0	. 12	5. 0–5. 3	Low.
----------	100	100	60–70	2. 0–6. 3	. 13	5. 7–5. 8	Low.
A–4 ----------	100	100	65–75	2. 0–6. 3	. 13	5. 7–5. 9	Low.
A– ----------	100	100	50–60	2. 0–6. 3	. 09	5. 8–6. 1	Low.
----------	100	100	60–70	0. 63–2. 0	. 13	6. 5–6. 8	Low.
----------	100	100	60–90	0. 63–2. 0	. 15	5. 6–5. 8	Moderate.
----------	100	100	85–95	0. 63–2. 0	. 15	5. 3–5. 5	Moderate.
A– ----------	100	100	50–60	0. 63–2. 0	. 12	6. 3–7. 2	Low.
----------	100	100	60–90	0. 63–2. 0	. 14	5. 7–5. 8	Moderate.
----------	100	100	85–95	0. 63–2. 0	. 15	5. 0–5. 7	Moderate.
A– ----------	100	95–100	40–50	2. 0–6. 3	. 10	6. 0–5. 7	Low.
A– ----------	100	100	75–90	0. 63–2. 0	. 14	5. 4–5. 9	Moderate.
A–5, A–7 ----------	100	100	50–65	0. 63–2. 0	. 13	5. 3–5. 9	Low.
A–2 ----------	100	100	20–25	2. 0–6. 3	. 08	4. 9–5. 3	Low.
A– ----------	100	100	50–60	0. 63–2. 0	. 17	5. 2–5. 3	Moderate.
A–7 ----------	100	100	55–65	0. 2–0. 63	. 19	4. 9–5. 1	Moderate.
A–3 ----------	100	100	25–35	2. 0–6. 3	. 09	5. 2–5. 5	Low.
A–7 ----------	100	100	70–80	0. 2–0. 63	. 14	5. 1–5. 4	Moderate.
A–4, A–6 ----------	100	90	50–60	0. 63–2. 0	. 12	5. 4–5. 7	Low.
A–2 ----------	100	100	30–35	2. 0–6. 3	. 12	5. 5–5. 7	Low.
A–6 ----------	100	100	50–60	0. 63–2. 0	. 15	5. 1–5. 7	Moderate.
A–6 ----------	100	100	50–60	0. 63–2. 0	. 14	5. 1–5. 4	Low.
A–2 ----------	100	90–100	25–35	2. 0–6. 3	. 12	6. 3–6. 6	Low.
A–7 ----------	100	100	60–70	0. 63–2. 0	. 19	5. 6–5. 7	Moderate.
A–4 ----------	100	100	60–70	0. 63–2. 0	. 17	5. 4–5. 6	Low.
A–4 ----------	100	95–100	35–45	2. 0–6. 3	. 12	5. 8–5. 0	Low.
A–7 ----------	100	100	80–90	<. 063	. 25	5. 8–5. 9	Very high.
A–6, A–7 ----------	100	100	40–50	0. 63–0. 2	. 20	5. 8–6. 0	Moderate.
A–2 ----------	100	95–100	25–30	2. 0–6. 3	. 09	5. 3–5. 5	Low.
A–7 ----------	100	100	50–60	0. 63–2. 0	. 16	5. 4–5. 7	Moderate.
A–5 ----------	100	100	35–45	0. 63–2. 0	. 10	5. 3–5. 4	Low.
A–2 ----------	100	80–84	25–35	2. 0–6. 3	. 10	5. 5–5. 8	Low.
A–7 ----------	100	100	50–60	2. 0–6. 3	. 15	5. 4–5. 6	Low.
A–4 ----------	100	100	40–50	>6. 3	. 05	5. 5–5. 7	Low.
A–2 ----------	100	70–80	20–25	>6. 3	. 08	5. 7–6. 0	Low.
A–2 ----------	90–100	72–75	20–35	>6. 3	. 05	5. 2–5. 4	Low.
A–6 ----------	100	100	50–60	0. 63–2. 0	. 12	5. 5–5. 8	Moderate.
A–7 ----------	100	100	70–80	0. 63–2. 0	. 12	5. 0–5. 2	Moderate.
A–6 ----------	100	100	20–25	2. 0–6. 3	. 10	5. 3–5. 5	Low.
A–2 ----------	100	75–85	25–30	>6. 3	. 09	5. 5–6. 0	Low.
A–7 ----------	100	100	70–80	0. 63–2. 0	. 12	5. 0–5. 2	Moderate.
A–6 ----------	100	100	20–25	2. 0–6. 3	. 10	5. 3–5. 5	Low.

TABLE 8.—*Engineeri*

[Local alluvial land (La); Made land (Ma); Mine pits and dumps (Mh); Mixed alluvial land, wet (Mk); Moderately gullied land (Mm, Mn

Soil series and symbol	Suitability as a source of—		Soil features adversely affecting—		
	Topsoil	Road fill	Highway location	Sewage lagoons	Farm ponds: Reservoir area
Appling (AcB, AcC2, ApB) (For interpretations of Cecil soils in mapping units AcB and AcC2, refer to the Cecil series).	Fair to good.	Fair	Severe erodibility; moderate shrink-swell potential; slopes.	Moderate permeability; slopes of more than 6 percent.	Moderate permeability.
Cataula (CaB3, CaC3, CaD3, CdB2, CdC2, CdD2).	Poor	Poor	Very severe erodibility; moderate shrink-swell potential; slopes of more than 10 percent; poor traffic-supporting capacity.	Slopes of more than 6 percent.	None
Cecil (CeB3, CeC3, CeD3, ClB2, ClC2, ClD2).	Fair	Fair	Severe erodibility; moderate shrink-swell potential; slopes of more than 10 percent.	Moderate permeability; slopes of more than 6 percent.	Moderate permeability
Congaree soils (Co)	Good	Poor	High water table; frequent flooding.	Rapid permeability; frequent flooding.	Rapid permeability.
Davidson (DaB3, DaC3, DaD3, DdB2, DdC2, DsB2, DsC2, DsD2).	Fair	Poor	Severe erodibility; moderate shrink-swell potential; slopes of more than 10 percent.	Moderate permeability; slopes of more than 6 percent.	Moderate permeability.
Durham (DvB)	Fair	Fair	Severe erodibility; moderate shrink-swell potential.	Moderate permeability.	Moderate permeability.
Enon (EnB2, EnC2, EnD2)	Poor	Poor	Very severe erodibility; moderate shrink-swell potential; slopes of more than 10 percent.	Slopes of more than 6 percent.	None
Hayesville (HaD, HaE, HaF)	Fair	Fair	Severe erodibility; moderate shrink-swell potential; slopes of more than 10 percent.	Moderate permeability; slopes of more than 6 percent.	Moderate permeability.
Hiwassee (HwC2)	Fair	Fair	Severe erodibility; moderate shrink-swell potential.	Moderate permeability; slopes of more than 6 percent.	Moderate permeability.
Iredell (IdB)	Poor	Poor	Very severe erodibility; very high shrink-swell potential; poor traffic-supporting capacity.	None	None
Lockhart (LcC2)	Fair	Fair	Severe erodibility; moderate shrink-swell potential.	Slopes of more than 6 percent.	None

...tions of soils

...everely gullied land (Se); and Stony land, moderately steep (StE), are variable, and interpretations for them were not made]

...onds—Continued ...mbankment	Soil features adversely affecting—Continued: Agricultural drainage	Sprinkler irrigation	Terraces and diversions	Waterways	Degree of limitation for septic tank filter fields
...e permeability; ...e erodibility.	Not needed	None	Severe erodibility; slopes.	Severe erodibility; slopes.	Slight; moderate permeability.
...rate shrink-swell ...ential; very severe ...ibility.	Not needed	Slow infiltration; slow permeability; slopes of more than 10 percent.	Very severe erodibility; slopes.	Very severe erodibility; slopes.	Severe; percolation rate is more than 75 minutes per inch; some slopes more than 10 percent.
...e erodibility	Not needed	Slopes of more than 10 percent.	Severe erodibility; slopes.	Severe erodibility	Slight for slopes of less than 10 percent; moderate for slopes of 10 to 15 percent; moderate permeability.
...d permeability; poor ...ear strength; high ...isture content.	Seasonally high water table; frequent flooding.	None	Not needed	Not needed	Severe; high water table; frequent flooding.
...erate shrink-swell ...otential; severe erod...ibility; poor shear ...ength.	Not needed	Moderate to moderately slow infiltration.	Severe erodibility; slopes.	Severe erodibility; slopes.	Slight for slopes of less than 10 percent; moderate for slopes of more than 10 percent; moderate permeability.
Moderate shrink-swell potential; severe erodibility.	Not needed	None	Severe erodibility	Severe erodibility	Slight for slopes of less than 10 percent; moderate permeability.
Moderate shrink-swell potential; very severe erodibility.	Slow permeability.	Slow intake rate; slopes of more than 10 percent.	Very severe erodibility; slopes.	Poor productivity; very severe erodibility; slopes.	Moderate for slopes of less than 10 percent; severe for slopes of more than 10 percent; percolation more than 75 minutes per inch; slow permeability.
Moderate shrink-swell potential; severe erodibility; moderate permeability.	Not needed	Slopes of more than 10 percent.	Severe erodibility; slopes.	Severe erodibility; slopes.	Severe for slopes of more than 10 percent; moderate permeability; hard rock at a depth of less than 4 feet.
Severe erodibility; moderate shrink-swell potential.	Not needed	None	Severe erodibility; slopes.	Severe erodibility; slopes.	Slight for slopes of less than 10 percent.
Very high shrink-swell potential; very severe erodibility; poor workability.	Very slow permeability.	Very slow intake rate.	Very severe erodibility; poor workability.	Very severe erodibility.	Severe; percolation more than 75 minutes per inch.
Severe erodibility; moderate shrink-swell potential.	Not needed	Slow permeability	Severe erodibility; slopes.	Severe erodibility; slopes.	Slight for slopes of less than 10 percent; moderate permeability.

and (4) stabilizing embankments and emergency spillways by establishing suitable plants.

Terraces can be constructed on soils that have slopes of 2 to 10 percent. The spacing between the terraces depends on the percentage of slope. The gradient of the terrace depends on the soil texture. Terraces on fine-textured, nonerodible soils can have steeper grades than terraces on light, erodible soils. Various grades, however, are used to improve terrace alinement and spacing, since crooked and unevenly spaced terraces make cultivation difficult. Waterways are constructed in all natural draws to serve as outlets for terraces. All natural draws and depressions should be seeded or sodded to adapted perennial grasses. The deepening of shallow depressions may be required so that drainage for terraces and rows is adequate.

Some soils in the county are not suitable for terracing. Constructing terraces on the Wilkes and Louisburg soils is difficult because they are shallow. The Iredell soil is plastic and is not suitable for terracing. It is not feasible to build terraces on slopes that are less than 2 percent or more than 10 percent.

Land smoothing may be desirable on some of the better, deeper soils where peaches or other crops of high value are grown. Land smoothing permits better row arrangement and better row drainage. The Appling, Cecil, and Davidson soils are suitable for this practice.

Most of the soils on the flood plains of the rivers and creeks have a high water table, or are subject to frequent overflow, or both. For favorable production, most areas of these soils need some type of open drain. Depending on the use of the land, either a trapezoidal ditch or a shallow V-ditch or W-ditch is generally needed.

On pastures, which are damaged less than row crops by flooding, the drainage system need not be so elaborate as that normally used for row crops. Very little tile is used in Spartanburg County.

Irrigation in the county is limited mostly to peach orchards and truck crops. In recent years a few vineyards have been established and irrigated. Most irrigation in Spartanburg County is done with sprinklers. Because most soils have a low rate of infiltration, irrigation is generally limited to sprinklers that deliver only a half inch of water per hour or less.

Use of Soils in Community Development

Table 9 rates the limitation of soils when they are used as foundations for dwellings, campsites, intensive play areas, golf fairways, picnic areas, sites for light industries, and trafficways. The ratings are *slight*, *moderate*, *severe*, and *very severe*. Also given, for all ratings except slight, are the soil properties that mainly determine the rating. A rating of slight means that the soils have few or no limitations, or that the limitations can be easily overcome. A rating of moderate indicates that the limitations should be recognized, but that they can be overcome by practical means. A rating of severe indicates that suitability of the soils for the specified use is questionable because the limitations are difficult to overcome. A rating of very severe indicates that the limitations are so restrictive that overcoming them may be impractical.

Listed in the following paragraphs, are the soil properties considered when the limitations were rated for the specified use.

Foundations for dwellings.—Limitations are rated soils used as the foundations for dwellings of three stori or less that have public or community sewage system The factors used in rating the limitations are bearing c pacity, shrink-swell potential, height of the water tabl hazard of flooding, and depth to bedrock. Engineers an others should not apply specific values to the estimat given for bearing capacity of soils.

Recreational sites.—The chief factors that limit the us of soils for recreational sites are slope, trafficability, erod ibility, height of the water table, and depth to bedroc Limitations are rated for campsites, intensive play area golf fairways, and picnic areas.

Sites for light industries.—These are sites for building of three stories or less. Public or community facilitie for sewage disposal are assumed to be available. Th factors considered in rating the limitations are bearing capacity, rate of percolation, slope, height of the wate table, hazard of flooding, and depth to bedrock. Here, as under "Foundations for dwellings," engineers and others should not apply specific values to the estimates given for bearing capacity of soils.

Trafficways.—Trafficways consist of streets in residential areas and roads that can be built at low cost. Required in construction are only small cuts and fills and little preparation of subgrade. Factors used in rating the limitations are slope, depth to bedrock, height of the water table, hazard of flooding, erodibility, and traffic-supporting capacity.

Formation and Classification of Soils

This section tells how the factors of soil formation affected the development of soils in Spartanburg County, and it describes some of the processes responsible for the development of horizons. Then the current system of soil classification is explained, and each soil series in the county is placed in this system, as well as in the system adapted in 1938.

Factors of Soil Formation

Soil is the product of soil-forming processes acting on accumulated or deposited geologic materials. The five important factors in soil formation are parent material, climate, living organisms (plants and animals), relief, and time.

Climate and living organisms are the active forces of soil formation. Their effect on the parent material is modified by relief and by the length of time the parent material has been in place, The relative importance of each factor differs from place to place. In some places one factor dominates in the formation and fixes most of the properties of the soil formed, but normally the interaction of all five factors determines what kind of soil is formed at any given place.

Although soil formation is complex, some understanding of the soil-forming processes may be gained by considering each of the five factors separately.

Parent material

Parent material is the unconsolidated mass from which a soil is formed. It has much to do with the mineral and chemical composition of the soils. In Spartanburg County

material was derived from two sources, residuum e parent rocks and alluvium deposited by streams. al parent material is formed in place through the ing of the underlying rock. Soils formed in this occupy about 93 percent of the county. For t part, the rocks of Spartanburg County are (1) anitized mica gneiss; (2) hornblende gneiss; (3) ist; (4) massive or weakly foliated granite; and te and gabbro that contain intrusions or ultramafic

eiss and schist are Precambrian rocks (*12*). The ss contains deeply weathered minerals of quartz, and mica. The chief minerals in hornblende e quartz, feldspar, and hornblende, but in places contains variable amounts of biotite mica and The thick layers of residuum consist of clay with fragments of gneiss and with the minerals and mica. The Cecil and Cataula soils formed is kind of parent material.

ranite, diorite, and gabbro are Paleozoic rocks (*2*). anite is massive or weakly foliated. It is as an n into the gneiss and schist rocks. In general, consists of quartz, orthoclase and plagioclase r, biotite and muscovite mica, and of vermiculite her accessory minerals in variable amounts. The m covering the granite ranges from a few inches y feet in thickness. In Spartanburg County the rmed from weathered granite are the Appling, m, and Louisburg.

eas where the soils formed from diorite and gabbro, cks generally are intermediate between a true and a gabbro. These rocks are coarse textured, ctly massive, and not closely jointed. They consist ly of hornblende, pyroxene, and plagioclase feldspar, er with varying amounts of quartz and of accessory als. In some places flat rocks showing little hering crop out, but in most places the rocks are ply weathered and are covered with a thick layer of The Mecklenburg and Iredell soils formed from thered diorite and gabbro.

The ultramafic intrusions consist chiefly of peridotite pyroxenite rocks. The chief mineral of peridotite is olivine, and that of pyroxenite is pyroxene. The ultramafic rocks have been altered a great deal by metamorphism and by hydration, but weathering is slow, and bedrock crops out in places. When the ultramafic intrusions do disintegrate, the product is stiff, yellow to reddish-brown clay. The Mecklenburg, Enon, and Iredell soils formed from this clay.

In Spartanburg County recent alluvium consists of a mixture of gravel, sand, silt, and clay. Much of this alluvium weathered from rocks in the uplands nearby, but some weathered from granite and metamorphosed rocks of the Piedmont Plateau and of the mountains farther north. The soils that formed in recent alluvium are on the bottom lands and terraces. The soils on first bottoms are weakly developed and still receive deposits during floods, but the soils on old, high terraces and on benches have been in place long enough to show developed horizons. The recent deposits along the smaller streams show little development, but along drainageways and in depressions throughout the uplands, narrow strips of local alluvium have been modified to some extent by the soil-forming processes. In this county the Congaree soils formed in recent alluvium, and the Hiwassee and Wickham soils formed in older alluvium on high stream terraces.

Climate

The climate of Spartanburg County is important in the formation of soils. The county has a temperate climate, and rainfall is well distributed throughout the year. Temperature and precipitation are discussed in a subsection on climate in the section "Additional Facts About the County."

Climate, particularly precipitation and temperature, affects the physical, chemical, and biological relationships in the soil. Water dissolves minerals, aids chemical and biological activity, and transports the dissolved mineral and organic material through the soil profile. Large amounts of rainwater promote leaching of the soluble bases and the translocation of the less soluble and colloidal material downward through the soil profile. A long frost-free season and high rainfall result in the downward movement of fine-textured soil material and the loss of plant nutrients.

The amount of water that percolates through the soil depends on the amount of rainfall, the relative humidity, and the length of the frost-free season. Percolation, or the downward movement of water, also is affected by relief, or lay of the land, and by permeability of the soil material. Weathering of the parent material is intensified if the percolation is interrupted only by brief periods of freezing that is shallow. A high average temperature therefore speeds weathering. A high average temperature also increases the number and kinds of living organisms in the soil, and the organisms, in turn, affect soil formation.

Living organisms

The number and kinds of plants and animals that live in and on the soil are determined mainly by the climate but, to a lesser extent, by parent material, relief, and age of the soil.

Bacteria, fungi, and other micro-organisms are indispensable in soil formation. They hasten the weathering of rock and the decomposing of organic matter. Larger plants alter the soil microclimate, furnish organic matter, and transfer chemical elements from the subsoil to the surface soil.

Most of the fungi, bacteria, and other micro-organisms in the soils of Spartanburg County are in the upper few inches of soil. The activity of earthworms and other small invertebrates is chiefly in the A horizon and upper part of the B horizon, where these organisms slowly but continuously mix the soil material. Bacteria and fungi decompose organic matter and release nutrients for plant use.

Animals play a secondary role in soil formation, but their influence is very great. By eating plants they perform one step in returning plant material to the soil.

In Spartanburg County the native vegetation in the uplands was chiefly oak, hickory, shortleaf pine, Virginia pine, and loblolly pine. On the well-drained bottom lands it was mainly yellow-poplar, sweetgum, ash, and sycamore trees and an abundant growth of canes. The trees on the poorly drained bottom lands were chiefly willow, birch, and beech.

TABLE 10.—*Soil series classified according to the current and the older systems* [1] *of classification*

Series	Current classification			1938 classification
	Family	Subgroup	Order	Great soil group
Appling	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Cataula	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Cecil	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Congaree	Fine loamy, mixed, thermic	Fluventic Dystrochrepts	Inceptisols	Alluvial soils.
Davidson	Clayey, kaolinitic, thermic	Humic Paleudults	Ultisols	Reddish-Brown Lateritic soils.
Durham	Fine loamy, siliceous, thermic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Enon	Fine, mixed, thermic	Typic Hapludults	Alfisols	Red-Yellow Podzolic soils.
Hayesville	Clayey, kaolinitic, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Hiwassee	Clayey, kaolinitic, thermic	Typic Rhodudults	Ultisols	Reddish-Brown Lateritic soils.
Iredell	Fine, montmorillonitic, thermic	Vertic Hapludalfs	Alfisols	Planosols.
Lockhart	Clayey, mixed, thermic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Louisa	Fine loamy, micaceous, thermic	Ruptic-Ultic Dystrochrepts	Inceptisols	Lithosols.
Louisburg	Coarse loamy, siliceous, thermic	Typic Dystrochrepts	Inceptisols	Lithosols.
Madison	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Mecklenburg	Clayey, mixed, thermic	Alfic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Musella	Fine loamy, mixed, thermic	Typic Rhodudults	Ultisols	Reddish-Brown Lateritic soils.
Pacolet	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Vance	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Wickham	Fine loamy, mixed, thermic	Typic Paleudults	Ultisols	Red-Yellow Podzolic soils.
Wilkes	Fine loamy, mixed, thermic	Ruptic-Alfic Dystrochrepts	Inceptisols	Lithosols.
Worsham	Clayey, kaolinitic, thermic	Typic Ochraquults	Ultisols	Low-Humic Gley soils.

[1] Placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

great group, however, is the last word in the name of the subgroup.

SUBGROUP: The subgroups are subdivisions of the great group and are defined in terms of reference to the great groups. One of the subgroups represents the central (typic) concept of the great group, and others, called intergrades, have properties of one great group that are dominant and also weakly expressed properties of another great group, suborder, or order. Subgroups may also be made where there is some soil property unlike that of the great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Hapludult (a typical Hapludult).

FAMILIES: Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, consistence, permeability, reaction, mineralogy, soil temperature, and thickness of horizons. An example is the clayey, kaolinitic, thermic family of Typic Hapludults.

SERIES: The series consists of a group of soils that formed from a particular kind of parent material and having genetic horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

New soil series must be established and concepts of some established series, especially older ones that have been used little in recent years, must be revised in the course of the soil survey program across the country. A proposed new series has tentative status until review of the series concept at state, regional, and national levels of responsibility for soil classification result in a judgment that the new series should be established. All of the soil series described in this survey except the Pacolet series have been established earlier. The Pacolet series had tentative status when the survey was sent to the printer.

Additional Facts About the County

The climate and the physiography, relief, and geology of Spartanburg County are discussed in this section.

Climate [6]

The climate of Spartanburg County is mild, and rainfall is well distributed throughout the year. The day-to-day weather is controlled mostly by the movement of pressure systems across the county, but complete changes of air masses are relatively few in summer, since masses of tropical maritime air persist for long periods.

The prevailing winds are from the southwest most of the year but are from the northeast late in summer and early in fall. The average velocity is about 8 miles per hour. In the Greenville area the highest wind velocity recorded for a 1-minute period in recent years was 79 miles per hour. This wind was from the north. The average relative humidity at 1:00 p.m. ranges from a maximum of 57 percent in winter to a minimum of 47 percent in April and May. The average relative humidity for the year is approximately 70 percent.

In the average year, about 76 days have one-tenth of an inch or more of rain, about 33 have one-half of an inch or more, and about 14 have 1 inch or more. The highest rainfall in the county in the last 50 years was 73.93 inches in 1929. The lowest annual rainfall recorded was 31.16 inches in 1954 (*3, 17*).

[6] By NATHAN KRONBERG, State climatologist, U.S. Weather Bureau.

The average annual sunshine is about 62 percent of the possible. The range in percent is from the middle and high fifties in winter to the middle sixties in summer. Skies are cloudy or overcast about 43 percent of the time. The clouds are below 500 feet for about 4 percent of the time and are below 1,000 feet for about 9 percent of the time.

Warm weather generally lasts from some time in May into September, and there are few breaks in the heat during midsummer. Typically, temperatures of 100°F. or more are recorded on about 3 days: 1 day, each, in June, July, and August. Temperatures of 90° or higher are recorded on an average of 50 days. Most summers have 1 day or more when the temperature exceeds 100°. About 25 percent of the annual rainfall occurs in summer, chiefly in local thundershowers.

Fall generally is the most pleasant season, especially from late in September to early in November. During this period, rainfall is light, the percentage of sunshine is high, and the temperature is generally moderate. Heavy rains and gale-force winds resulting from nearby tropical storms have occurred about five times in the past 30 years. Damage from these storms generally have been minor in the county. About 23 percent of the total annual rainfall is in fall.

Winters are mild and relatively short, though about 60 days have temperatures at freezing or below. The chance is good that a snow flurry will occur in winter, but a significant snowfall and extended snow cover are unusual. In the average winter, the temperature is 20° or lower in about 4 days and 15° or lower in about 3 days. During the last 30 years, only 2 days with a temperature of lower than 10° have been reported. About 26 percent of the annual rainfall occurs in winter, mainly in steady rains.

Spring is the most changeable season. March is frequently cold and windy, but May is generally warm and pleasant. Severe thunderstorms and tornadoes are most likely in spring. Spartanburg County has had about six tornadoes in the past 40 years. About 26 percent of the total annual rainfall occurs in spring.

The climate of the county is favorable for the principal crops: peaches, cotton, corn, small grain, soybeans, hay, and vegetables. Moisture accumulates in the soils during winter and spring, and in most years the soils are at field capacity at planting time. Dry periods are sufficient, however, to permit tillage. The probabilities of the last freezing temperatures in spring and the first in fall are shown in table 11 (*3*, *4*). The average growing season is about 227 days, or long enough to allow crops to mature, even if they are planted over a period of weeks or months.

The amount of rainfall in the growing season normally is enough for crop development and maturity, but in some years it is either inadequate or excessive. Table 12 shows that extreme monthly and annual deficiencies may occur 1 year in 10, and extreme excesses, 1 year in 10. For example, the average rainfall in July is 4.4 inches, but in 1 year in 10 rainfall may be less than 2.4 inches, and in another July, in the same 10-year period, rainfall may be more than 6.8 inches.

Droughts were disastrous in 1925 and 1954, but they generally are less severe and occur once or twice in every 10 years. By definition, a drought occurs when no water in the soil is available to plants. A drought day is a day during which no water in the soil is available to plants. Calculation of drought days is based on the capacity of the soil to hold available water, on the amount of precipitation, and on the amount of water used or transpired by plants. Even in a normal year, there are periods when rainfall does not meet the need of most crops. Supplementary irrigation is needed for maximum crop production during most years. During a severe drought, however, almost no water is available for irrigation.

The probabilities of stated numbers of drought days are shown in table 13. These estimates were obtained by using the Penman method for computing evapotranspiration and by defining a drought day in terms stated earlier. The total possible amount of stored moisture available to plants varies with the soils and with the depth of the roots of different plants. Table 13, therefore, shows the estimated number of drought days for five levels of storage capacity and five probabilities. For example, in Spartanburg County for a soil that has a 2-inch storage capacity, the chance is fifty-fifty, or 5 in 10, that there will be 10 drought days in July (*19*).

The duration and amount of rainfall for the period 1941–61 was recorded by an automatic rain gauge at Spartanburg. Maximum intensity for the period is shown in the following list.

Duration (hours):	*Inches*
1	3.20
2	3.52
3	4.42
6	6.19
12	6.67

TABLE 11.—*Probabilities of last freezing temperatures in spring and first in fall (3, 4)*

Probability	Dates for given probability and temperature		
	24° F. or less	28° F. or less	32° F. or less
Spring:			
1 year in 10 later than	March 21	April 1	April 19
2 years in 10 later than	March 14	March 25	April 12
5 years in 10 later than	February 28	March 11	March 29
Fall:			
1 year in 10 earlier than	November 14	November 7	October 27
2 years in 10 earlier than	November 20	November 13	November 1
5 years in 10 earlier than	December 2	November 23	November 11

TABLE 12.—*Temperature and precipitation (18)*

Month	Temperature				Precipitation			
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average monthly total	One year in 10 will have—		Average snowfall
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—	
	°F.	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
January	53	35	68	20	4.3	1.9	7.0	0.8
February	55	35	70	23	4.0	1.6	7.5	1.4
March	62	40	76	28	4.6	2.1	7.3	.8
April	72	50	85	39	4.0	1.8	6.6	0
May	81	59	90	48	3.2	1.3	5.4	0
June	88	67	95	59	3.0	1.6	4.6	0
July	89	69	96	64	4.4	2.4	6.8	0
August	88	68	95	63	4.3	2.3	6.5	0
September	82	63	92	54	3.9	1.4	6.7	0
October	73	52	83	40	3.4	.7	7.0	0
November	62	41	75	27	2.9	.8	5.3	[1]
December	53	34	68	22	3.8	1.5	6.7	.6
Year	71	51	[2] 99	[3] 13	45.8	35.7	55.6	3.6

[1] Trace: Less than 0.05 inch. [2] Average highest annual maximum. [3] Average annual lowest minimum.

TABLE 13.—*Probabilities of drought days on soils of five different moisture-storage capacities (19)*

Month[1]	Probability	Minimum number of drought days if soil has a moisture-storage capacity of [2]—				
		1 inch	2 inches	3 inches	4 inches	5 inches
April	1 in 10	15	0	0	0	0
	2 in 10	12	0	0	0	0
	3 in 10	11	0	0	0	0
	5 in 10	8	0	0	0	0
May	1 in 10	24	23	17	10	3
	2 in 10	21	17	12	3	0
	3 in 10	18	15	7	0	0
	5 in 10	15	9	0	0	0
June	1 in 10	25	24	22	18	15
	2 in 10	19	17	16	15	14
	3 in 10	17	14	13	12	11
	5 in 10	15	10	9	8	3
July	1 in 10	21	20	20	20	18
	2 in 10	19	17	16	15	14
	3 in 10	17	14	13	12	11
	5 in 10	15	10	9	8	3
August	1 in 10	20	17	16	15	14
	2 in 10	17	13	11	10	9
	3 in 10	15	10	5	5	4
	5 in 10	12	4	3	0	0
September	1 in 10	24	22	19	17	15
	2 in 10	21	17	14	11	9
	3 in 10	19	14	10	7	4
	5 in 10	15	9	3	0	0
October	1 in 10	27	26	24	12	20
	2 in 10	23	21	18	15	12
	3 in 10	20	17	14	10	7
	5 in 10	15	11	7	0	0

[1] Months of January, February, March, November and December are not shown, because crops are seldom damaged by drought in these months.

[2] The depth that a soil can hold water and make it available to plants.

iography, Drainage, and Geology

partanburg County is mainly on the Piedmont Pla-, but its northwestern corner is on the foothills of the ue Ridge Mountains. The general slope is southeast-rd, which is the general direction of the main drainage-ys. The land ranges from nearly level to steep, but st areas are gently sloping to moderately steep.

he total area of the flood plains and stream terraces is all. Except for moderately steep and steep escarp-nts adjacent to the flood plains, stream terraces are tly undulating to sloping. The highest point in the nty, about 1,480 feet, is on Bird Mountain in the north-tern part. In the central part the elevation ranges m 750 to 900 feet. In the northern part of the county, ries of hills rises about 200 feet above the surrounding d and does not conform to the general pattern of relief. he lowest elevation is on the Enoree River in the extreme utheastern part of the county near the Union County e.

The rivers and smaller streams in the county form a endritic pattern of drainage. Except for a small area in northeast corner, the main streams flow southeastward. the northeast corner the streams flow northeastward o the Broad River. The major streams that drain the unty are the Pacolet, Tyger, and Enoree Rivers (*5*). eir chief tributaries are Page, Motlow, Holston, Law-s Fork, Fairforest, Buck, Big Ferguson, Little Fer-on, Abner, Dutchman, Jimmies, and Cedar Shoals eeks.

Thirteen geologic formations are in Spartanburg County These formations are made up of alluvium, fine-ined rocks, medium-grained rocks, fine-grained to arse-grained rocks, and coarse-grained rocks. Alluvium nsists of material recently deposited on flood plains. e fine-grained rocks are quartzite, diabase, taluca quartz nzonite, and sericite schist. The medium-grained ks are granite, biotite gneiss, and migmatite. The fine-ained to coarse-grained rocks are biotite schist, York-lle quartz monzonite, and hornblende schist. The arse-grained rocks are hornblende gneiss, coarse-grained anite, and muscovite pegmatite dikes.

Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity. The capacity of a soil to hold water in a form available to plants. Amount of moisture held in soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent; soil will not hold together in a mass.

Friable.—When moist, soil crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, soil crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, soil readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, soil adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, soil is moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, soil breaks into powder or individual grains under very slight pressure.

Cemented.—Soil is hard and brittle; little affected by moistening.

Erosion. The wearing away of the land surface by wind, running water, and other geologic agents.

Gleyed soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Morphology, soil. The makeup of the soil, including the texture, structure, consistence, color, and other physical, mineralogical, and biological properties of the various horizons of the soil profile.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few*, *common*, and *many;* size—*fine*, *medium*, and *coarse;* and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *Fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Natural drainage. Refers to the conditions that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets (*9*).

Nutrient, plant. Any element taken in by a plant that is essential to its growth, and is used by the plant in producing food and tissue. Important plant nutrients obtained from the soil are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps others. Those obtained largely from the air and water are carbon, hydrogen, and oxygen.

Parent material (soil). The horizon of weathered rock or partly weathered soil material from which soil has formed; C horizon in the soil profile.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow*, *slow*, *moderately slow*, *moderate*, *moderately rapid*, *rapid*, and *very rapid*.

Plastic limit (soil engineering). The moisture content at which a soil changes from a semisolid to a plastic state.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

[For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs.

[See table 1, page 7, for approximate acreage and proportionate extent of soils and table 3, page 44, for estimated average acre yields of principal crops. For information significant to engineering, see section beginning on page 54]

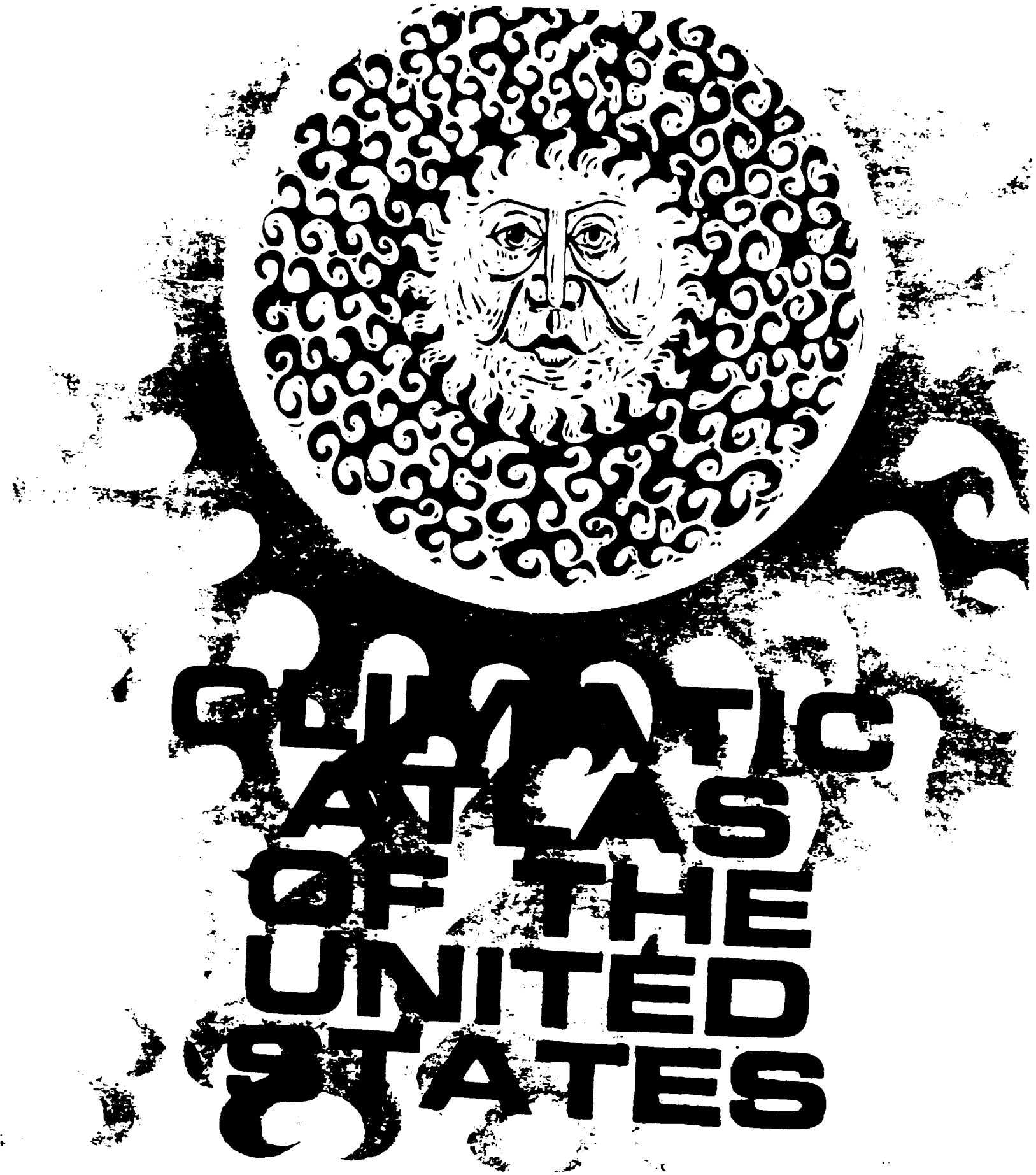
Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group		Wildlife suitability group	
			Symbol	Page	Number	Page	Number	Page
AcB	Appling and Cecil sandy loams, 2 to 6 percent slopes	8	IIe-2	37	3	47	1	52
AcC2	Appling and Cecil sandy loams, 6 to 10 percent slopes, eroded	8	IIIe-2	40	4	47	1	52
ApB	Appling sandy loam, 2 to 6 percent slopes	9	IIe-2	37	3	47	1	52
CaB3	Cataula clay loam, 2 to 6 percent slopes, severely eroded	10	IIIe-3	40	9	50	3	52
CaC3	Cataula clay loam, 6 to 10 percent slopes, severely eroded	10	IVe-2	40	9	50	3	52
CaD3	Cataula clay loam, 10 to 15 percent slopes, severely eroded	10	VIe-3	41	9	50	3	52
CdB2	Cataula sandy loam, 2 to 6 percent slopes, eroded	10	IIe-3	38	10	50	4	52
CdC2	Cataula sandy loam, 6 to 10 percent slopes, eroded	11	IIIe-3	40	10	50	4	52
CdD2	Cataula sandy loam, 10 to 15 percent slopes, eroded	11	IVe-2	40	10	50	4	52
CeB3	Cecil clay loam, 2 to 6 percent slopes, severely eroded	12	IIIe-1	39	6	48	3	52
CeC3	Cecil clay loam, 6 to 10 percent slopes, severely eroded	12	IVe-1	40	6	48	3	52
CeD3	Cecil clay loam, 10 to 15 percent slopes, severely eroded	12	VIe-1	41	6	48	3	52
ClB2	Cecil sandy loam, 2 to 6 percent slopes, eroded	12	IIe-1	37	3	47	1	52
ClC2	Cecil sandy loam, 6 to 10 percent slopes, eroded	13	IIIe-1	39	3	47	1	52
ClD2	Cecil sandy loam, 10 to 15 percent slopes, eroded	13	IVe-1	40	4	47	2	52
Co	Congaree soils	13	IIw-2	38	1	46	6	54
DaB3	Davidson clay loam, 2 to 6 percent slopes, severely eroded	14	IIIe-1	39	6	48	3	52
DaC3	Davidson clay loam, 6 to 10 percent slopes, severely eroded	14	IVe-1	40	6	48	3	52
DaD3	Davidson clay loam, 10 to 15 percent slopes, severely eroded	14	IVe-1	40	6	48	3	52
DdB2	Davidson loam, 2 to 6 percent slopes, eroded	15	IIe-1	37	3	47	1	52
DdC2	Davidson loam, 6 to 10 percent slopes, eroded	15	IIIe-1	39	4	47	1	52
DsB2	Davidson sandy clay loam, 2 to 6 percent slopes, eroded	15	IIe-1	37	3	47	1	52
DsC2	Davidson sandy clay loam, 6 to 10 percent slopes, eroded	15	IIIe-1	39	4	47	1	52
DsD2	Davidson sandy clay loam, 10 to 15 percent slopes, eroded	15	IVe-1	40	4	47	2	52
DvB	Durham loamy sand, 2 to 6 percent slopes	17	IIe-2	37	3	47	1	52
EnB2	Enon sandy loam, 2 to 6 percent slopes, eroded	17	IIe-3	38	10	50	4	52
EnC2	Enon sandy loam, 6 to 10 percent slopes, eroded	18	IIIe-3	40	10	50	4	52
EnD2	Enon sandy loam, 10 to 15 percent slopes, eroded	18	IVe-2	40	10	50	4	52

GUIDE TO MAPPING UNITS--Continued

Symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group		Wildlife suitability group	
			Symbol	Page	Number	Page	Number	Page
C3	Musella clay loam, 6 to 10 percent slopes, severely eroded	29	IVe-1	40	6	48	3	52
3	Musella clay loam, 10 to 25 percent slopes, severely eroded	29	VIe-1	41	7	48	3	52
C2	Musella fine sandy loam, 6 to 10 percent slopes, eroded	29	IIIe-1	39	4	47	1	52
D2	Musella fine sandy loam, 10 to 15 percent slopes, eroded	30	IVe-1	40	4	47	2	52
F2	Musella fine sandy loam, 15 to 40 percent slopes, eroded	30	VIIe-1	41	5	48	2	52
3	Pacolet clay loam, 15 to 25 percent slopes, severely eroded	31	VIIe-1	41	7	48	3	52
E	Pacolet sandy loam, 15 to 25 percent slopes	31	VIe-1	41	5	48	2	52
E2	Pacolet sandy loam, 15 to 25 percent slopes, eroded	31	VIe-1	41	5	48	2	52
F	Pacolet sandy loam, 25 to 40 percent slopes	31	VIIe-1	41	5	48	2	52
Se	Severely gullied land	31	VIIe-2	42	14	51	--	--
tE	Stony land, moderately steep	32	VIs-1	41	14	51	5	53
aB2	Vance sandy loam, 2 to 6 percent slopes, eroded	33	IIe-3	38	10	50	4	52
aC2	Vance sandy loam, 6 to 10 percent slopes, eroded	33	IIIe-3	40	10	50	4	52
cB2	Wickham sandy loam, 2 to 6 percent slopes, eroded	34	IIe-1	37	3	47	1	52
cC2	Wickham sandy loam, 6 to 10 percent slopes, eroded	34	IIIe-1	39	4	47	1	52
WkB2	Wilkes fine sandy loam, 2 to 6 percent slopes, eroded	35	IIIe-5	40	11	50	5	53
WkC2	Wilkes fine sandy loam, 6 to 10 percent slopes, eroded	35	IVe-3	40	11	50	5	53
WkD2	Wilkes fine sandy loam, 10 to 15 percent slopes, eroded	35	VIe-2	41	11	50	5	53
WkF2	Wilkes fine sandy loam, 15 to 40 percent slopes, eroded	35	VIIe-2	42	11	50	5	53
WoB	Worsham fine sandy loam, 0 to 6 percent slopes	36	Vw-1	41	13	51	7	54

(Joins sheet 22)
LYMAN
Wesleyan Church
New Trinity Church
James F. Byrnes School
SEWAGE DISPOSAL
SOUTHERN
NORTHERN
Site

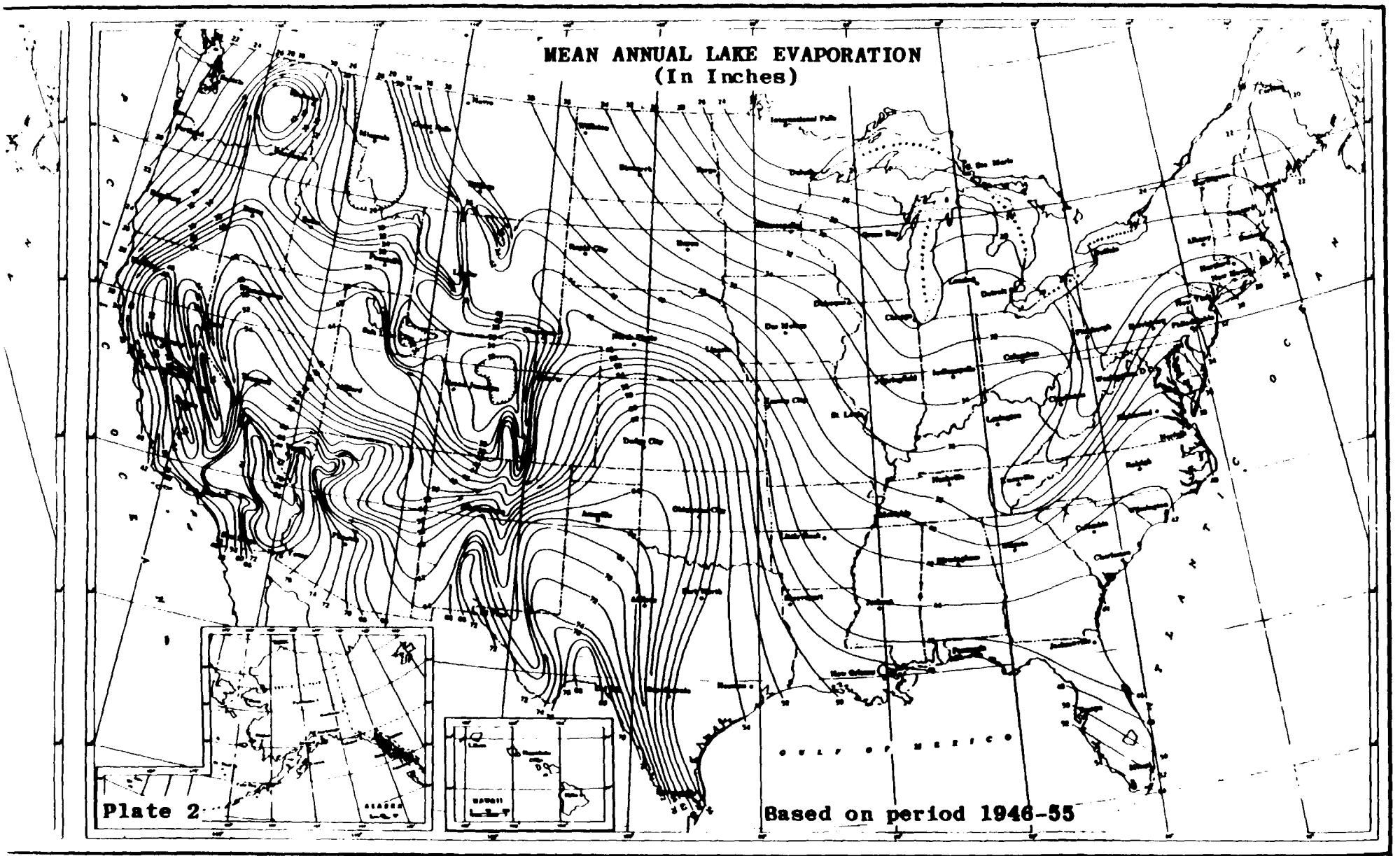
sheet 28

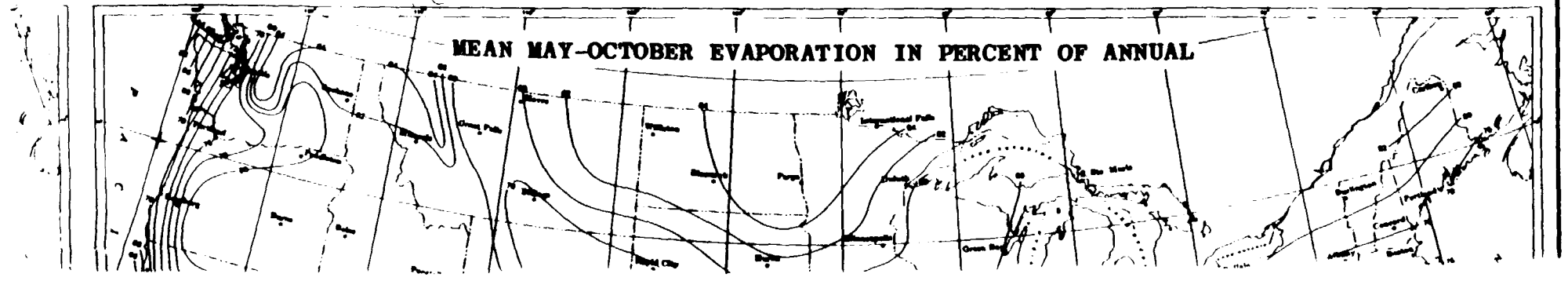


CLIMATIC ATLAS OF THE UNITED STATES

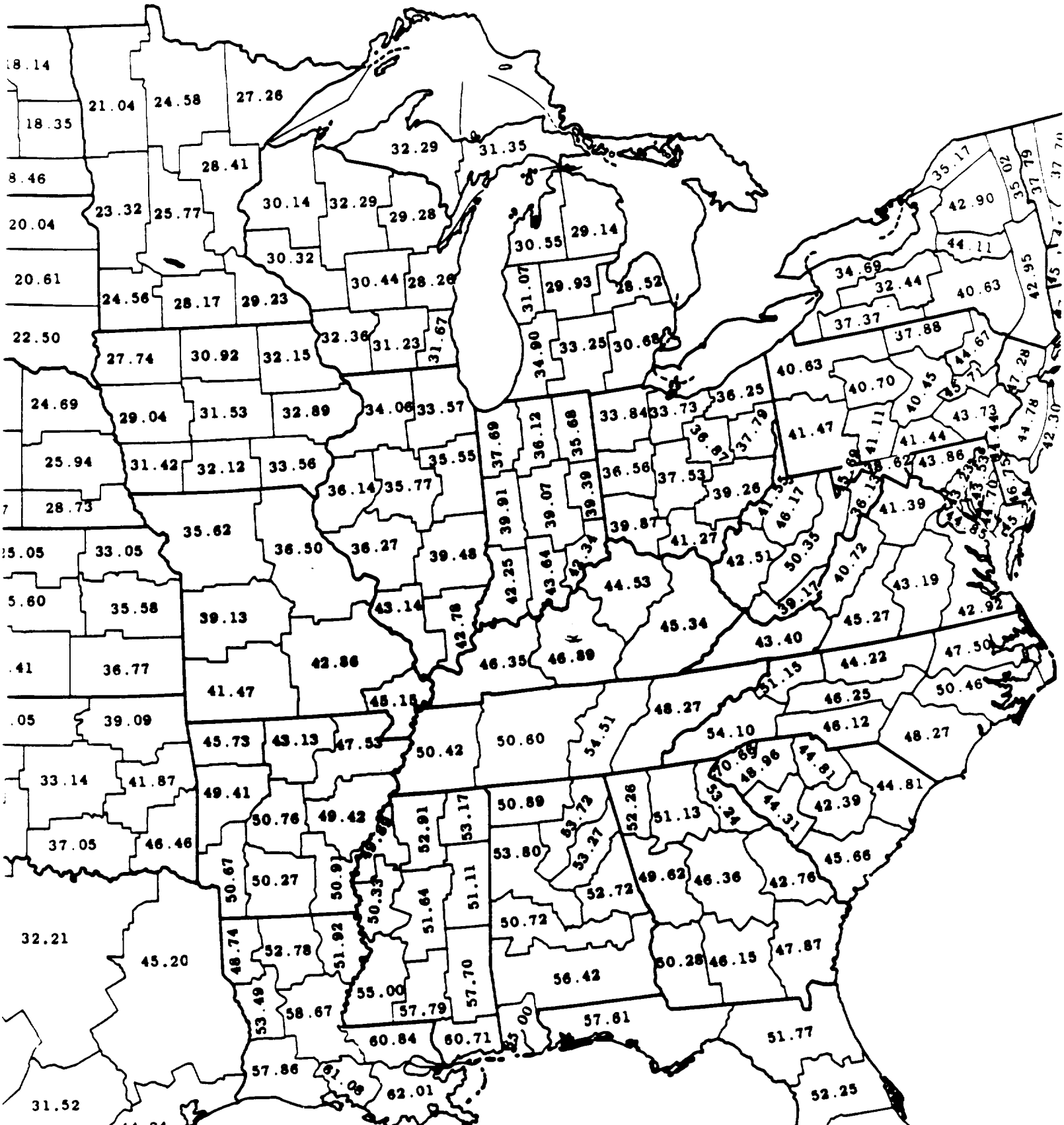
mental Science Services Administration • Environmental Data

Columbus
Springfield
Indianapolis
Charleston
Washington, D.C.
Lexington
Richmond
Norfolk
Nashville
Knoxville
Raleigh
Memphis
Wilmington
Columbia
Atlanta
Charleston
Birmingham
Jackson
Jacksonville
Pensacola
New Orleans
Tampa
Miami
ATLANTIC OCEAN
GULF OF MEXICO
35°
30°
25°
90°
85°
80°
75°
0 50 100 200 300 400 500 MILES
PS EQUAL AREA PROJECTION — STANDARD PARALLELS 29½ AND 45½°
BASED ON PERIOD 1931-60
Caution should be used in interpolating on these generalized maps, particularly in mountainous areas.
PUERTO RICO AND VIRGIN ISLANDS
SAN JUAN
ALEX. HAMILTON FLD
67°00
66°00
65°00
18° 30
18° 00
66°30
65°30
64°30


MEAN ANNUAL LAKE EVAPORATION
(In Inches)
Plate 2
Based on period 1946-55


MEAN MAY-OCTOBER EVAPORATION IN PERCENT OF ANNUAL

ON (inches) BY STATE CLIMATIC DIVISIONS



DEPARTMENT OF COMMERCE
Sinclair Weeks, Secretary

WEATHER BUREAU
F. W. Reichelderfer, Chief

TECHNICAL PAPER NO. 40

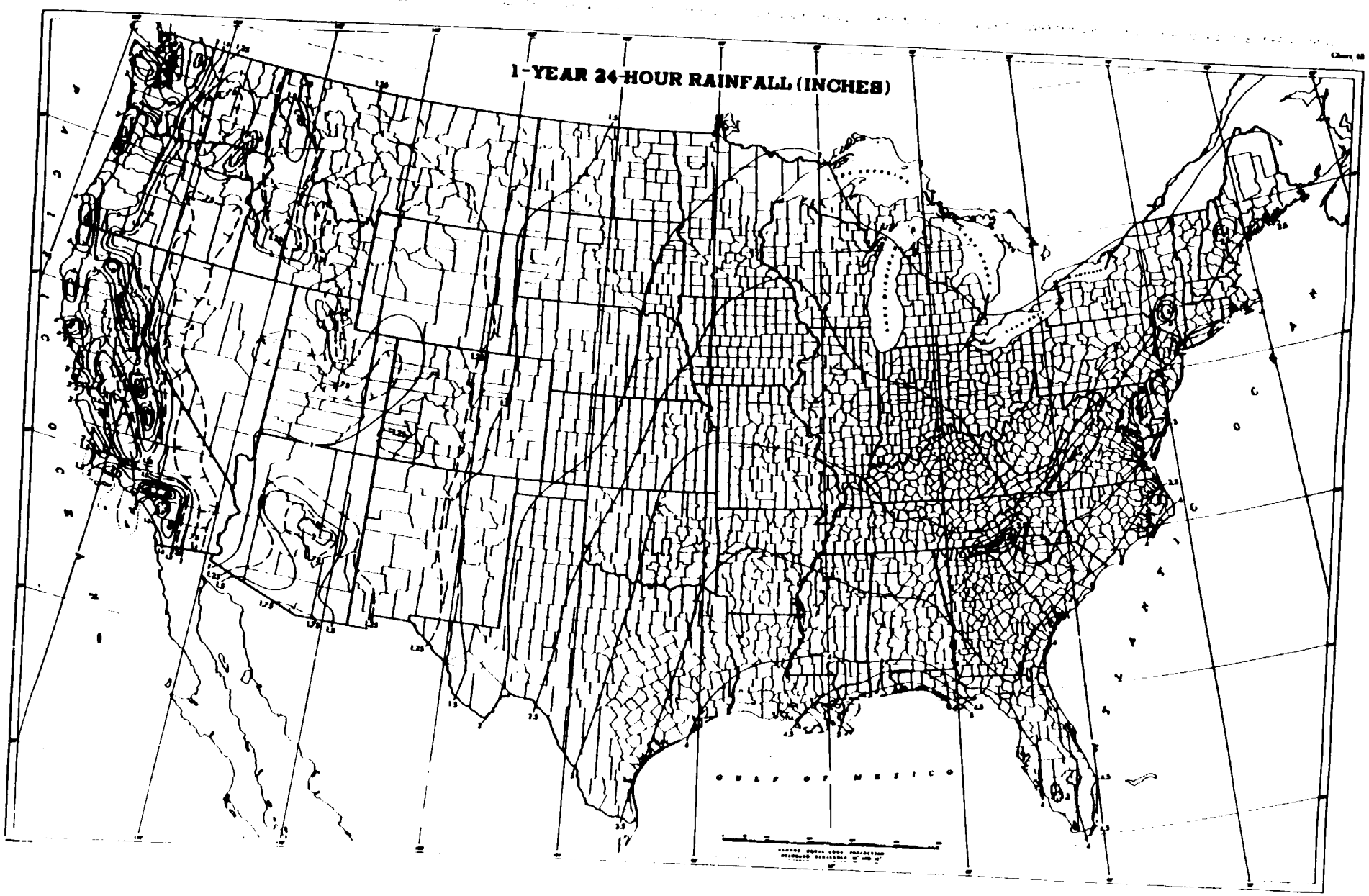
RAINFALL FREQUENCY ATLAS OF THE UNITED STATES

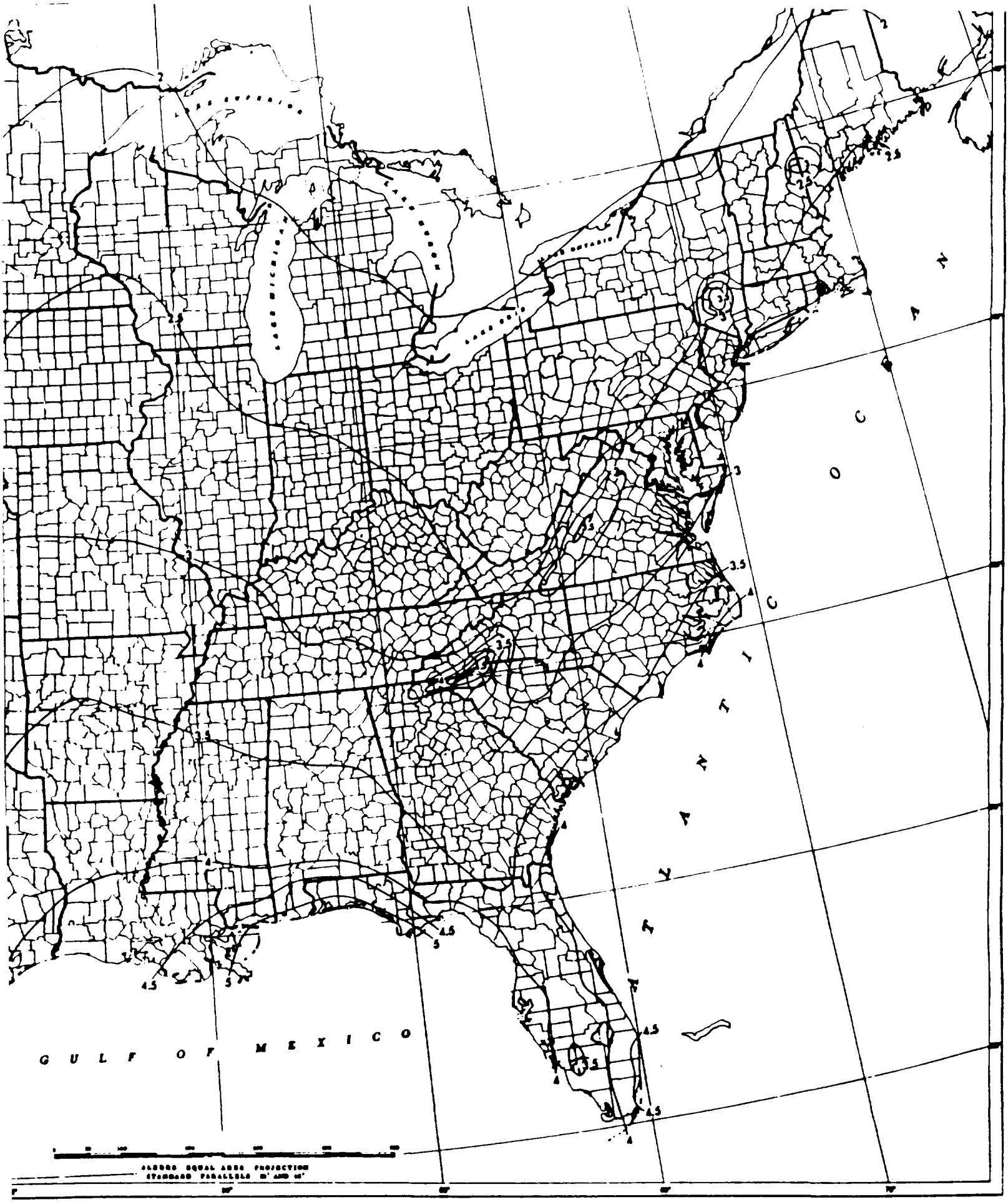
for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years

Prepared by
DAVID M. HERSHFIELD
Cooperative Studies Section, Hydrologic Services Division
for
Engineering Division, Soil Conservation Service
U.S. Department of Agriculture

Reference No. 11

PROPERTY OF EPA
FIT IV


1-YEAR 24-HOUR RAINFALL (INCHES)
GULF OF MEXICO


GULF OF MEXICO
ATLANTIC OCEAN
ALBERS EQUAL AREA PROJECTION
STANDARD PARALLELS 29° AND 45°

NUS CORPORATION

1927 LAKESIDE PARKWAY
SUITE 614
TUCKER, GEORGIA 30084
404-938-7710

Reference No. 12

C-586-8-0-92

August 7, 1990

Mr. Randy Geddings
District I
S.C. Wildlife and Marine Resources Dept.
Post Office Box 1645
Clemson, South Carolina 29633

Subject: Request for Information

Dear Mr. Geddings:

As per our conversation, I am requesting that you provide to me any information on endangered species, threatened species, sensitive environments, river quality and critical habitats in the area of my concern. This area includes the Middle Tyger River, starting from the town of Lyman and extending roughly to where the combined Middle and North Tyger rivers join the South Tyger River. I have enclosed a map which shows this area. Please send all information to my attention at NUS. If you have any comments or questions, please feel free to call me at 800-888-7710. I look forward to hearing from you, and thank you for your efforts and consideration.

Very truly yours,

John Schendel

JS/dwf

cc: Jim Bulak

Approved:

Middle Tyger River, Greenville and Spartanburg Counties, U.S.G.S. quad. Greer, Inman, Tigerville (Figure 11)

The Middle Tyger River rises in the mountain-Piedmont transition zone of upper Greenville and Spartanburg Counties. Its headwater streams are generally shallow, sandy bottomed with limited cover in the form of undercut banks and accumulations of debris. With a considerable amount of shallow, flat water over unstable beds of sand and silt, the stream's productive potential is relatively low. This condition predominates downstream to Lyman Lake where it is pooled in a domestic water supply reservoir. Below this lake the stream widens and deepens but continues to experience heavy siltation. It is impounded in several small reservoirs again at Lyman, Startex and Fairmont communities before emptying into the North Tyger River.

In the vicinity of Lyman a very significant change occurs in the ecology and water quality of this stream brought about by the daily discharge of eight million gallons of domestic and industrial sewage. This pollution has seriously degraded the scenic and aesthetic values as well as reduced the fisheries populations of this stream.

Section A-B

From the vicinity of Glassy Mountain in Upper Greenville County downstream to the city of Lyman, the Middle Tyger remains a typical small upper Piedmont stream, unpolluted, with a wide

variety of fishes but rather unproductive due to the low fertility and heavy siltation.

Max. temp.: 71°F
Avg. Flow: 26 cfs.
pH: 6.5
Total Length: 20.3 mi.
Total Hardness: 10 ppm
Area: 36.7 acres
Dissolved Oxygen: 8 ppm

Resident Species:

Largemouth bass
Bluegill
Redbreast
Creek chub
Hornyhead chub
~~Saffron~~ shiner
Striped jumprock
Darter

Section B-C

In the vicinity of the Lyman sewage treatment plant the complexion of this river changes abruptly. At this point a conglomerate of domestic and industrial wastes are discharged with significant effects on the environment. Pollutants of a similar nature are also released in the Startex area, 300,000 gallons of which receives no primary treatment. The resulting effects on the stream are discoloration, emittance of offensive odors, higher than

normal levels of pH for streams of this area, and alkalinities with severe fluctuations in oxygen levels. The uppermost sampling station in this section was located approximately 1 mile below the last waste outfall (Figure 11) to allow for adequate mixing and stablization of these materials. Conditions were at their most extreme at this sampling point and progressively improved downstream. Though most species of fish were represented in this section, their numbers were reduced significantly. It was difficult to document this reduction as increased depth and swiftness of the stream required a change in sampling technique making quantitative comparisons between upstream and downstream population levels invalid. However, rotenone samples in the lower sections recovered 85% fewer fish than was collected in the upper sections of the Middle Tyger and population diversity was significantly reduced.

Max. temp.: 78°F Avg. Flow: 46 cfs.

pH: 7.5 Total Length: 11.3 mi.

Total Hardness: 15 ppm Area: 54.8 acres

Dissolved Oxygen: 4 ppm

Resident Species:

Largemouth bass

Bluegill

Brown bullhead

Hornyhead chub

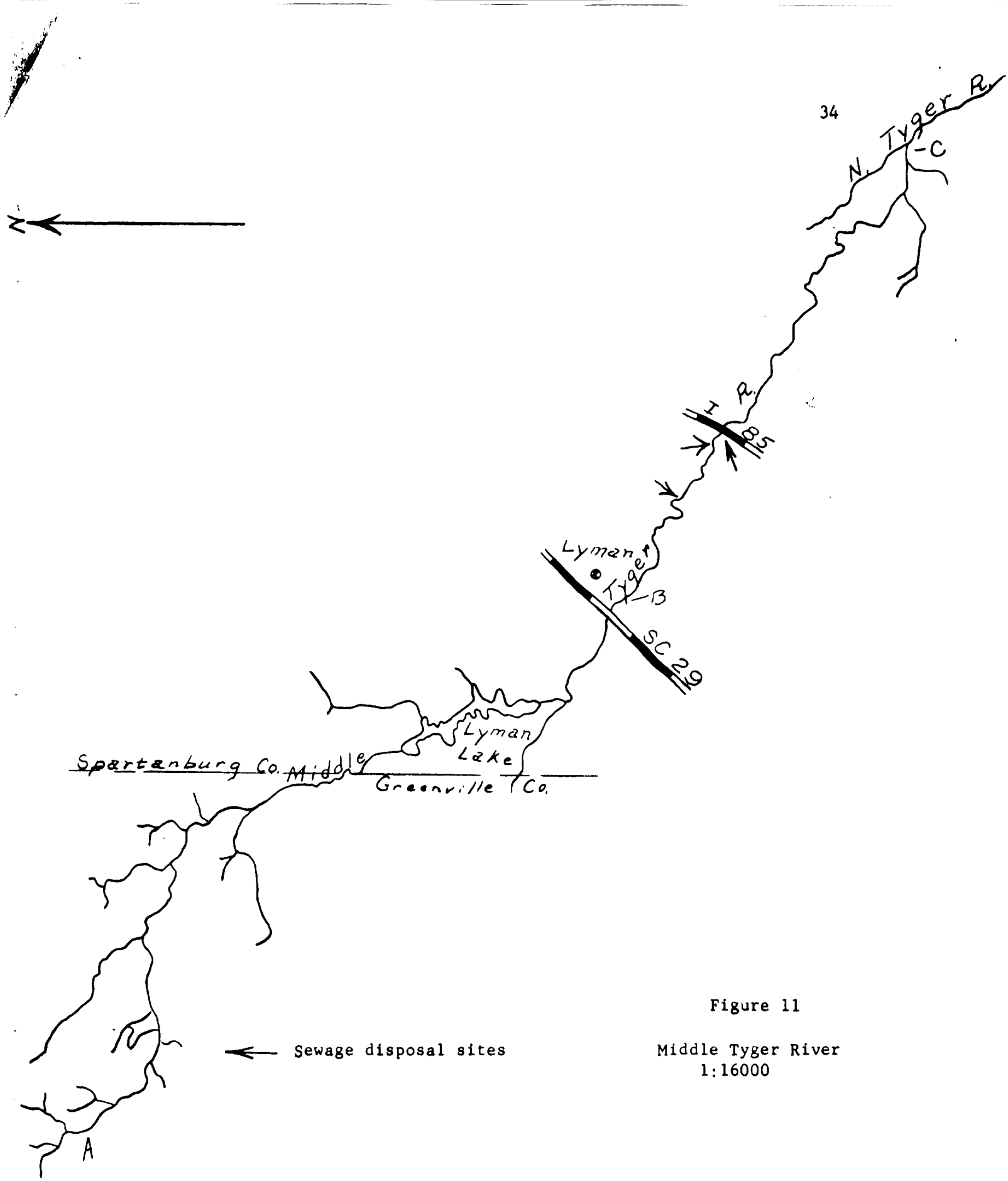


Figure 11

Middle Tyger River
1:16000

NUS CORPORATION AND SUBSIDIARIES **TELECON NOTE**

Reference No. 13

CONTROL NO.	DATE: 1-31-91	TIME: 1:11

DISTRIBUTION:

File

BETWEEN: Randy Geddings	OF: S.C. Wildlife & Marine Resources	PHONE: (803) 654-6346

AND: Terry Ryland, NUS Corporation

DISCUSSION:

Mr. Geddings says he believes there is fishing in the Middle Tyger River downstream of Startex. The wastes deposited in the river by the treatment plant mostly settles out, and the water quality improves downstream of Startex. Fishing also occurs in the North Tyger River downstream of the confluence with the Middle Tyger River.

Reference No. 14

"Rite in the Rain"®

ALL-WEATHER

LEVEL

Notebook No. 311

F4-2429

TDD # F4-9007-23

OLD LYMAN DUMP

LYMAN SPARTANBURG COUNTY

SOUTH CAROLINA

PROJECT MANAGER: JOHN SCHENDEL

PRE-SAMPLING ON-SITE RECONNAISSANCE

AUGUST 14, 1990

LOGBOOK REQUIREMENTS
REVISED NOVEMBER 28, 1990

ALL LANGUAGE SHOULD BE FACTUAL AND OBJECTIVE

Record on front cover of the Logbook: TDD No., Site Name, Site Location, Project Manager.

All entries are made using ink. Draw a single line through errors. Initial and date corrections.

Plan
bers'

and

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ite.

led

all

oto

OFFICE (803) 439-9171
HOME (803) 439-2411

WILLIAM H. (BILL) GROCE
MAYOR
TOWN OF LYMAN

GROCE ROAD
LYMAN, SO. CAR. 29365
(803) 439-3453

10. Maintain photo log by completing the stamped information at the end of the logbook.

11. If no site representative is on hand to accept the receipt for samples, an entry to that effect must be placed in the logbook.

12. Record I.D. numbers of COC and receipt for sample forms. Also record numbers of destroyed documents.

[illegible] information in the space provided.

8/14/90

The undersigned arranged to perform an onsite reconnaissance of the Old Lyman Dump in order to delineate the boundaries of the dump and to determine the appropriate sampling strategy. This arrangement was made with the knowledge and approval of both the EPA and the owner of the site, namely, the town of Lyman (represented by the Mayor, Mr. Bill Groce)

No study plan, safety plan or work plan were prepared for this phase of the investigation of Old Lyman Dump. The only person to record notes in this logbook will be John Schendel. Photo notes will be loged in at the end of the logbook. Signed,

John Schendel
JOHN SCHENDEL
8/14/90

2 8/14/90 - Tuesday

9:00 AM Weather - clear, hot, muggy (humid)

9:12 AM EST

John Schendel arrives at Lyman Town Hall.

Met with: Marshall Bright
Bill Groce
Allen McManus

J explained to them why I was here - to survey the Old Lyman Dump site in order to determine sampling locations. I briefly explained the process with which EPA investigates potential waste sites, namely, first an offsite reconnaissance and then "light" sampling (Hand) etc... I mentioned that sampling would commence on Sept 24 1990. I also mentioned that Old Station Dump would be investigated the same week.

Mr. McManus, speaking for Mayor Groce, suggested that while EPA can force the town of Lyman to allow

8/14/90

the investigation to proceed, the town did not want to give permission for the investigation until the sampling plan was provided to Mr. Groce. Mr. McManus said that it was their desire to work with DHES and the EPA in an amicable and friendly fashion. I assured them that this was also my desire. I informed them that, while the final word was not mine to give, a study plan for the investigation could probably be sent to Mr. Groce by me or through the EPA.

We also discussed how split sample will be offered to Mr. Groce, and that if these samples were accepted, Mr. Groce would have to provide his own containers.

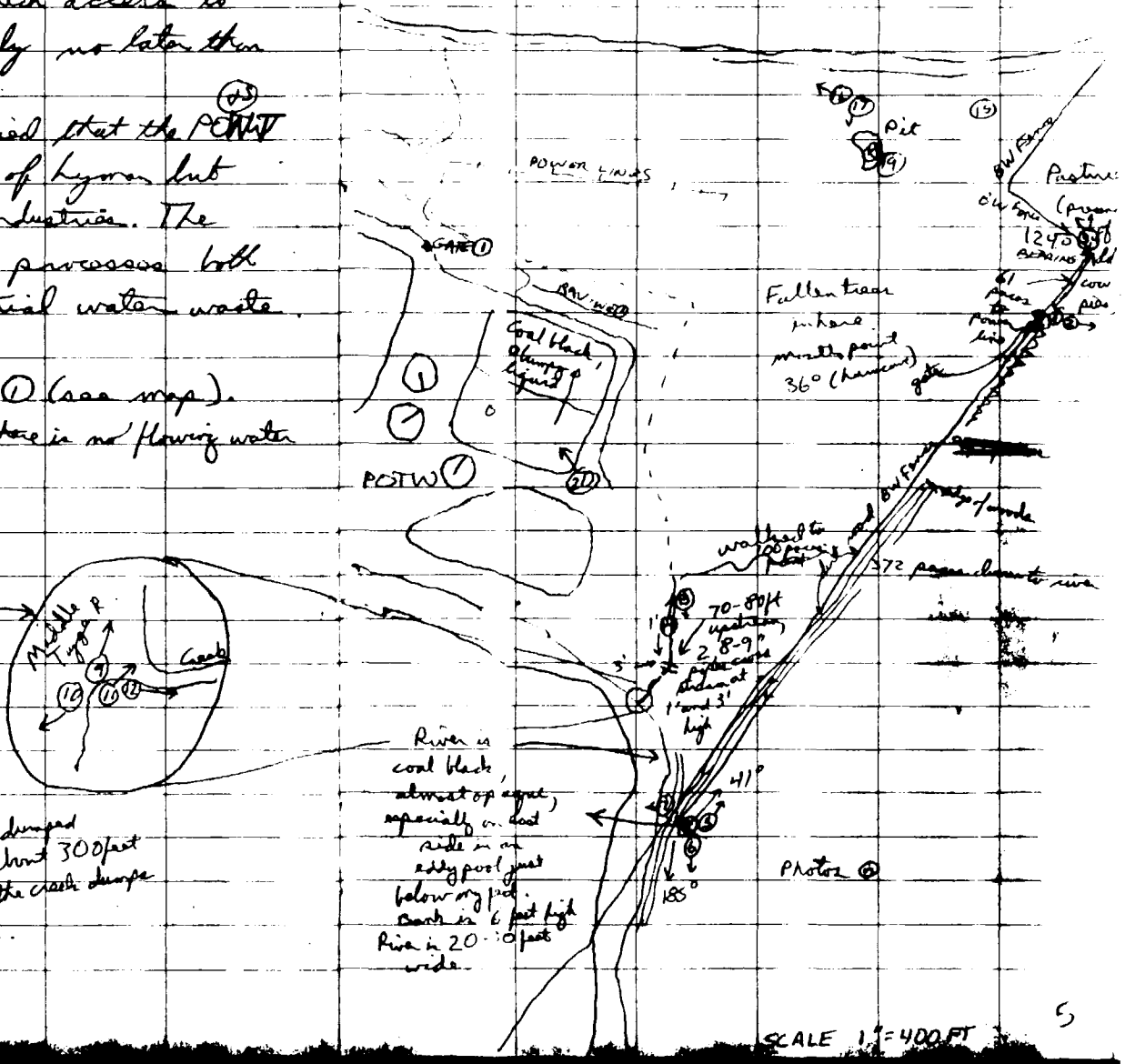
Mr. McManus asked that, for today's work, I check in with Mr. Bright (who works at the POTW) before leaving the site, and that I check in with Mr. Groce before leaving town today. Mr. McManus also spoke for

4 8/14/90 8/14/90 John Schendel

Mr. Bright by requesting that I leave the POTW (through which access to the station is achieved) by no later than 5:00 P.M.

Mr. Bright also verified that the POTW was owned by the town of Lyman but operated by Spring Industries. The plant receives and processes both domestic and industrial water waste.

10:45 AM - Arrive at GATE ① (see map). Soil is moist but there is no flowing water



Schendel

5

12:20PM - I just remembered something else the gentlemen said to me at this morning's meeting. Mr. Croce said that the dump was opened before the town of Lyman was ever incorporated. It was used as an industrial dump and as an unofficial public dump. It was, apparently, not run by any municipal govt., at least in the early years of operation. Also, Mr. McManus said that the dump site was deeded over to the city of Lyman by M. Lowenstein, before M. Lowenstein was bought out by Spring Industries.

12:45 - On creek that cuts through supposed site. At perhaps 100-150 feet up the creek from where it dumps into the Middle Tyger River, I begin to see human-derived refuse in the creek bed - bottles of large glass container
triangular piece of metal
bricks
glass jars

John Schendel

glass bottles
stone slabs
marble or slate (white) plates → □
→ (I see minnows in creek)
(Creek bank is perhaps 4 feet high)
I see a broken clear glass jar on ground 5 feet from eastern edge of creek. The refuse in the creek covers a large portion of creek bed for 50-75 feet upstream from original point of discovery.

12:55 PM - arrived on dirt road after walking up woodland from creek (area where refuse is in creek.

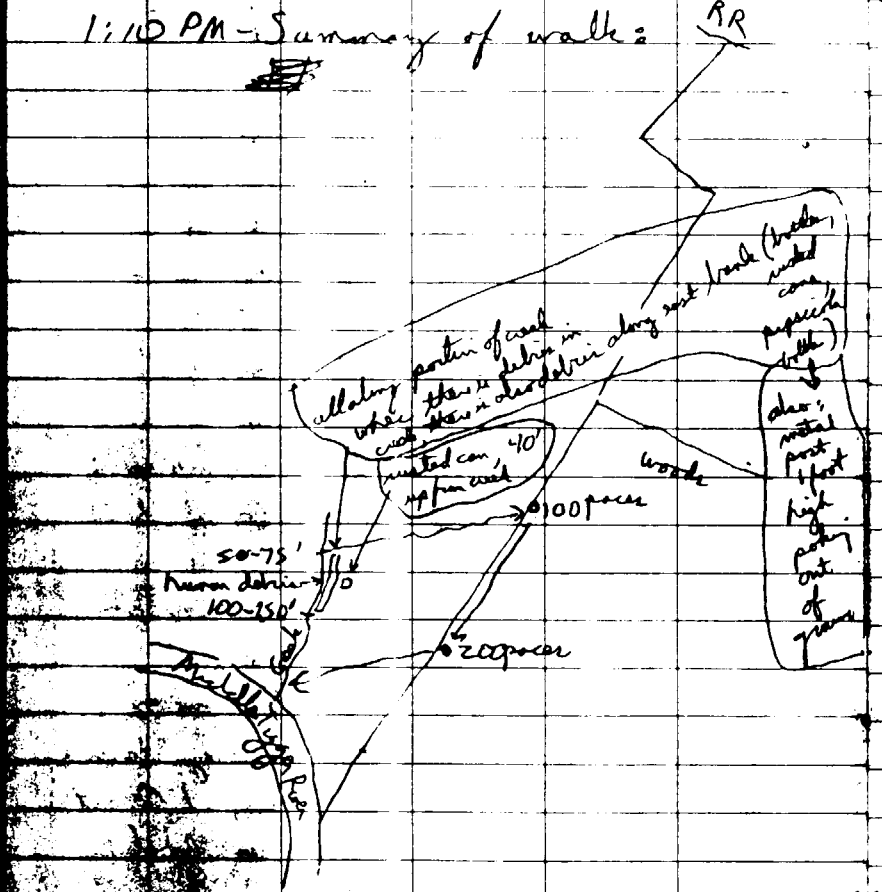
1:02 PM - arrived at 200 paces along road. Head due west, toward creek. At 50-75 feet from creek, I found an old clear glass bottle of Laundry Starch: Texize Products For The Home, 1 Quart No Dumping, No cooking, Just Add. "The Mild In The Bottle"

Another brown glass bottle was found 3 feet away. Both bottles had old, rusted caps on them. Both bottles are just east of a fallen down, bark less pine tree.

John Schendel

8 8/14/90

1:10 PM - Summary of walk:

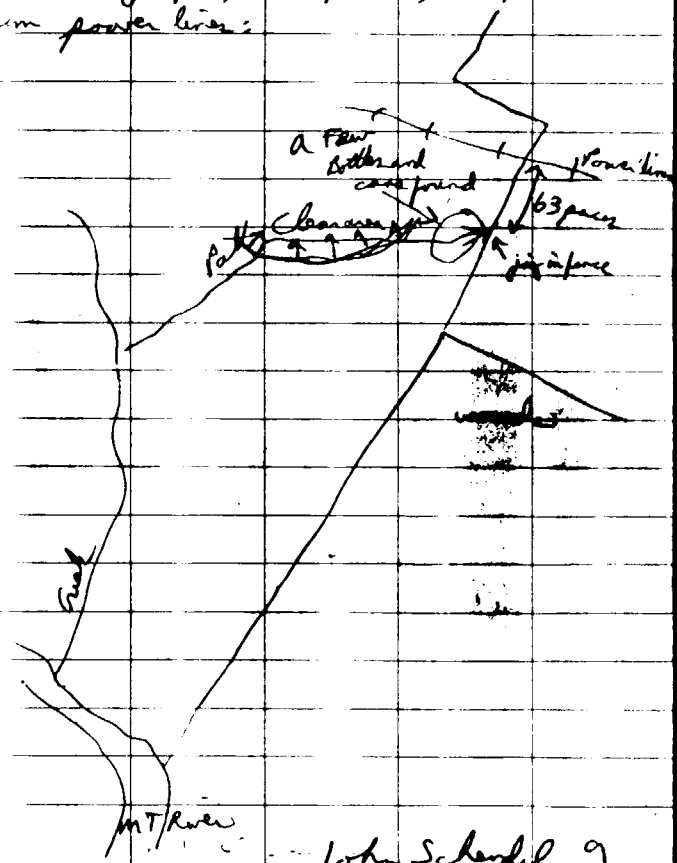


1:11 PM - Headed back up creek.

John Schardel

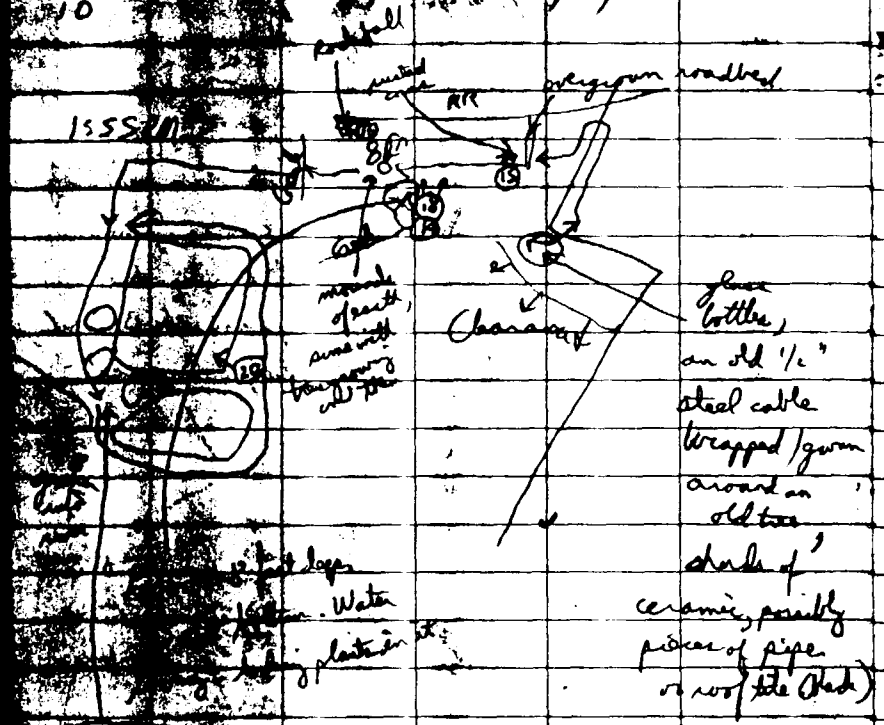
8/14/90

1:45 PM Walked up, roughly due east, from creek; midway up slope discovered a relatively clean area (lots of thorns, a few trees, some shrubs and small trees). Kept heading due east. Arrived at a jog in the Barbed Wire fence at edge of grass field, 63 paces down from power lines:



John Schardel 9

8/14/90



2:50 PM Man at POWT told me [illegible] Woodward would know about the area 433-4239. He also said that the two lines that run east from [illegible] (the ones I saw running over creek) [illegible] was a water line to Startex; the [illegible] was a forced sewer line from Hardees + businesses in the area of Hardees.

John Schendel

8/14/90

3:00 PM Saw Mr Bright. He said that the Springs Industries - run POWT supplies water to Lyman and to Startex (via the 8" pipe I saw crossing the creek at the site). The SJWD supplies water to the area surrounding Lyman. Springs Industries gets its water from the Middle Tyger River, just upstream from the dam which is just upstream of the POWT.

3:45 - Arrive at SJWD Water District office on US 29 in Lyman
Danny Blackwell and Larry Plemmons
Danny Blackwell: no intakes for potable water south of [illegible] for 15 miles at least to where S. Tyger [illegible] No intakes [illegible] Tyger (but SJWD wants to [illegible] on N. Tyger: EPA has them [illegible] due to a wetland issue). On [illegible] Tyger; Green has an intake [illegible] a dammed-up lake.
Maps 8+14 - handwritten
Startex (Spartanburg) Bill Blackwood.
Blackwood + Associates.

John Schendel

8/14/90

Danny Blackwell told me these things:

① SJWD owns and operates all water lines in Lyman and outside of Lyman. The town of Lyman owns and operates its own sewer system. SJWD buys water from Spring Industries intake on the Middle Tyger River to supply the town of Lyman with water. All other areas around Lyman get water from SJWD's purchase of water from Spartanburg (Lake Bowen).

② On the water line maps I was given, I can tell which lines are Lyman Villages (water from Spring Ind) and lines that get water from Spartanburg:

On pages 8 and 14, the handwritten roads are the Village of Lyman's lines.

③ Startex gets its water from Spring Ind. To find out their distribution, call Bill Blackwood of Blackwood and Associates in Spartanburg.

John Schendel

8/14/90

The waterline map previously mentioned is presented as an attachment to this logbook. The map's official title is: Startex ~ Jackson ~ Wellford ~ Duncan Water District

John Schendel

8/16/90

The following is a summary of the reconnaissance. The information given here is taken from the previous pages and from memory.

I. Please refer to MAP 1 (attachment to this logbook). 10:15 - 11:00 AM EST.

A. My first effort was to go down to the creek which cuts through the site. It was difficult to find a way down to the creek, as the thickets were quite prevalent, even under the tree canopy. Fallen trees also made the going rough. I spotted a 1-2 foot long snake (with a ~~worm~~ worm-looking head) along the west bank of the creek at the location of my 2nd creek encounter of this segment of the recon (where thickets were very dense - I had to crawl to get to the creek)

B. Notice the dry ravine that was just below one of the waste treatment ponds. This ravine led down to the creek, sloping toward the east.

C. The entire area west of the creek

John Schendel

sloped gently to the east toward the creek.

II. Please refer to MAP 2 (attachment to this logbook). 11:00 AM - 12:15 PM.

III. Please refer to MAP 3 (attachment to this logbook). 12:15 PM - 1:10 PM.

A. Thorough recon of lower (south) portion of site.

IV. Please refer to MAP 4 (attachment to this logbook). 1:11 PM - 2:55 PM.

Thorough recon of northern portion of site and of eastern portion of waste water treatment plant.

John Schendel

Case No. _____

Low Concentration yes/no

Organics

No. _____ Media Soil Water Lab _____ Airbill No. _____

Inorganics

No. _____ Media Soil Water Lab _____ Airbill No. _____

TDD # F4-9007-23

Date 8/14/90 By Whom: John Schendel

Time: 11:15 AM # keyed to map: (1)

Location: east of site, on city limits border

Picture of: power lines stretching toward east

TDD # F4-9007-23

Date 8/14/90 By Whom: John Schendel

Time: 11:15AM # keyed to map: (2)

Location: east of site, at city limits border

Picture of: power lines stretching through site toward the west

TDD # F4-9007-23

Date 8/14/90 By Whom: John Schendel

Time: 11:20AM # keyed to map: (3)

Location: City limits, east of site

Picture of: 1/2 of panorama looking off toward north

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time: 11:20AM # keyed to map: (4)
Location: city limits, east of site.

Picture of: 1/2 of panorama looking off toward north. Old Starter dump may be in background.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time: 11:45AM # keyed to map: (5)
Location: South point of site.

Picture of: looking back up dirt road (41° bearing) from where I had come.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time 11:45AM # keyed to map: (6)
Location: south point of site

Picture of: looking down dirt road (185° bearing) that continues southward from where it intersects Middle Tyger River

TDD # F4-9007-23
Date 8/14/90 By Whom: (7) John Schendel
Time: 11:50AM # keyed to map: (7)
Location: Middle Tyger River, south end of site

Picture of: Middle Tyger River - notice the water is very brownish, almost opaque.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time: 11:55AM # keyed to map: (8)
Location: south point of site.

Picture of: looking across Middle Tyger River toward the barren - looking hill on the other side. Looking roughly S-SW.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time 12:15 PM # keyed to map: (9)
Location: Confluence of site creek and Middle Tyger River.

Picture of: looking up Middle Tyger River; notice dumping of effluent into river (center of photo) by sewage treatment plant.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time: 12:15PM # keyed to map: (10)
Location: Confluence of site creek and Middle Tyger River.
Picture of: looking downstream on Middle Tyger River.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel
Time: 12:15 PM # keyed to map: (11)
Location: Confluence of site creek and Middle Tyger River.
Picture of: The confluence itself; creek goes upstream toward the right.

TDD # F4-9007-23
Date 8/14/90
Time 12:15 PM John Schendel (12)
Location: Confluence of site creek and Middle Tyger River.
Picture of: Looking upstream of creek from confluence.

TDD # F4-9007-23
Date 8/14/90 By Whom: (13)
Time 12:45PM # keyed to map:
Location: Upstream on the creek that runs through the site.
Picture of: Refuse (rusty can) in ground near east bank of creek.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schendel (14)
Time 12:45PM # keyed to map:
Location: upstream on the creek that runs through the site.
Picture of: looking up the creek; notice refuse (cans, bottles, tires, etc.) in the creek.

TDD # F4-9007-23
Date 8/14/90 John Schendel (15)
Time 2:05 1:45 PM (13) (15)
Location: northeast end of site.
Picture of: Rusty can in ground.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schardt
2:15 1:20 PM # keyed to map (16)
(15)
Location: north end of site

Picture of: sackfill near the railroad tracks (human-made structure of rocks used to support tracks across site ravine).

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schardt
2:15 1:20PM # keyed to map (17)
(15)
Location: north central portion of site

Picture of: earth mounds, some with trees growing on them

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schardt
2:20 1:20PM (18)
(13)
Location: north part of site, at the "pit"

Picture of: north edge of pit, looking north from inside the pit itself.

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schardt
2:12 1:30PM # keyed to map (19)
(13)
Location: north part of site, at the "pit"

Picture of: north and northwest edge of pit, taken from inside pit in same place as photo (18).

TDD # F4-9007-23
Date 8/14/90 By Whom: John Schardt
Time 2:55PM # keyed to map: (20)
Location: at eastern edge of the sewage treatment plant

Picture of: one of the treatment ponds at the plant.

TDD #
Date By Whom:
Time # keyed to map:
Location:

Picture of:

Polaroid Photos

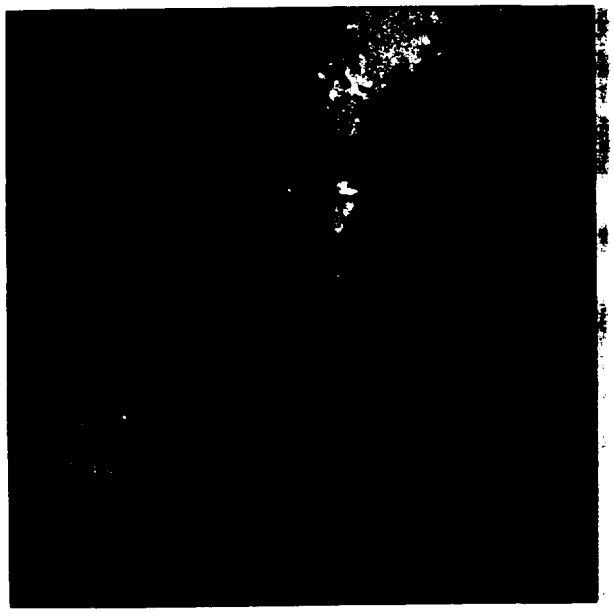
(2)

(1)

(4)

(3)

(6)



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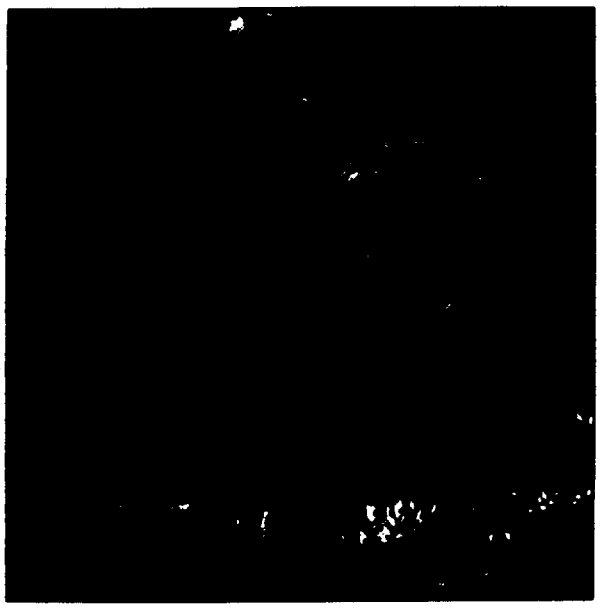

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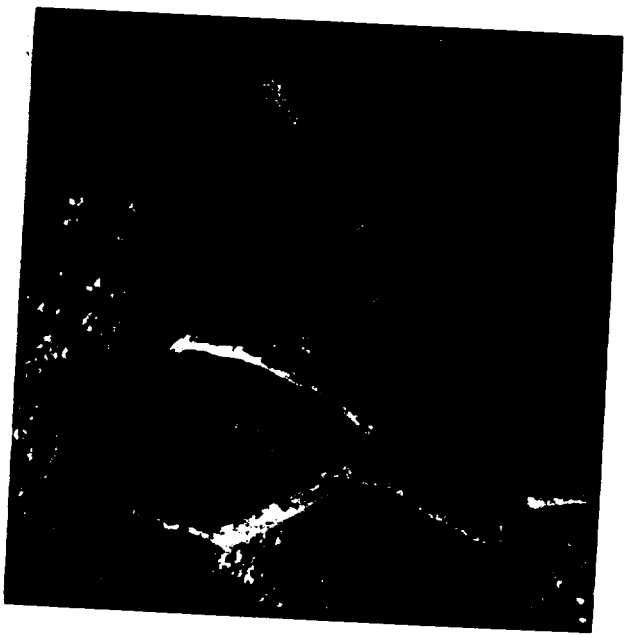

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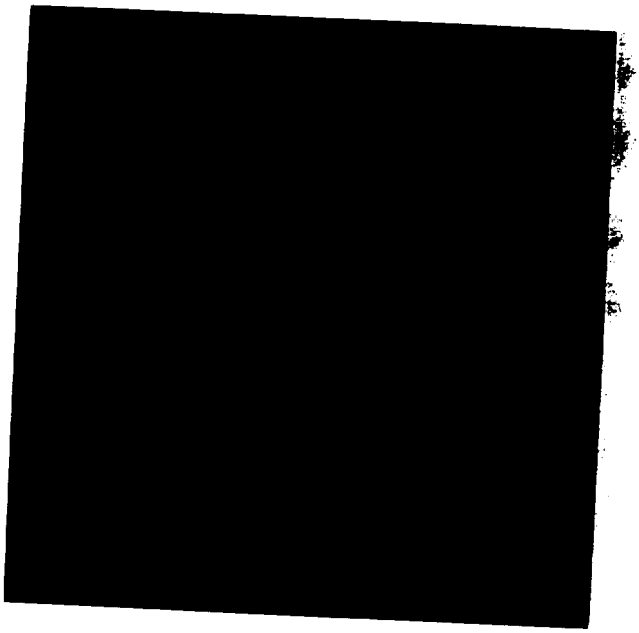

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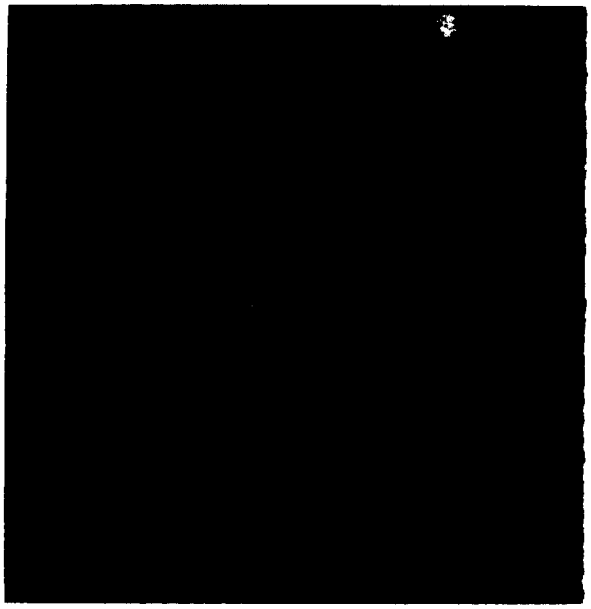

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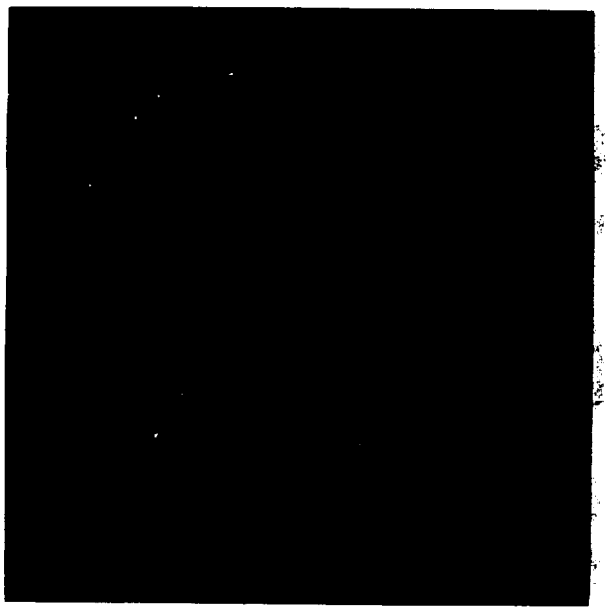

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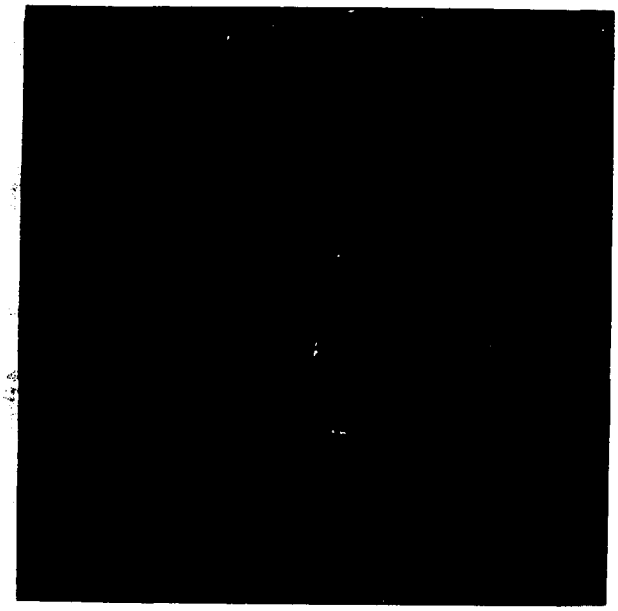

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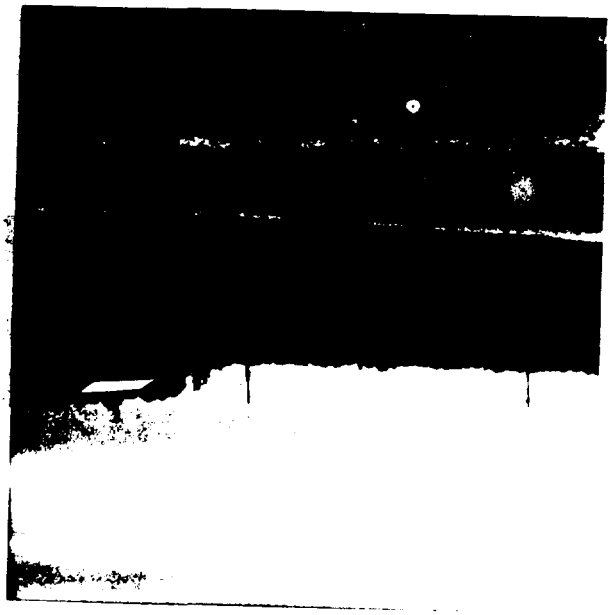

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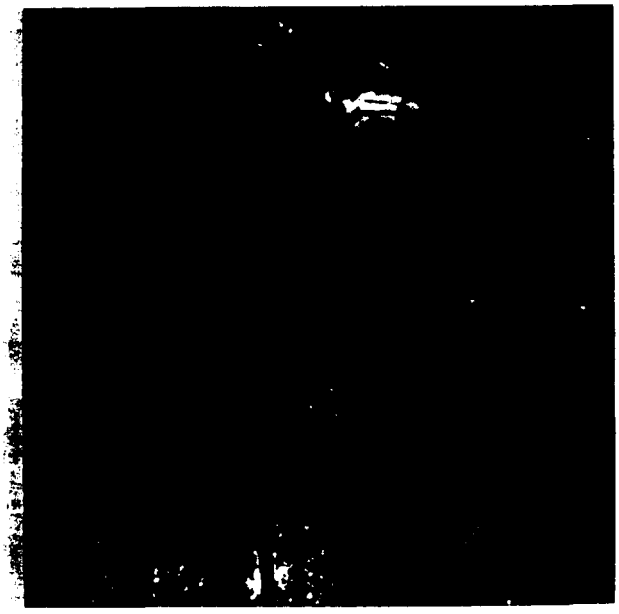

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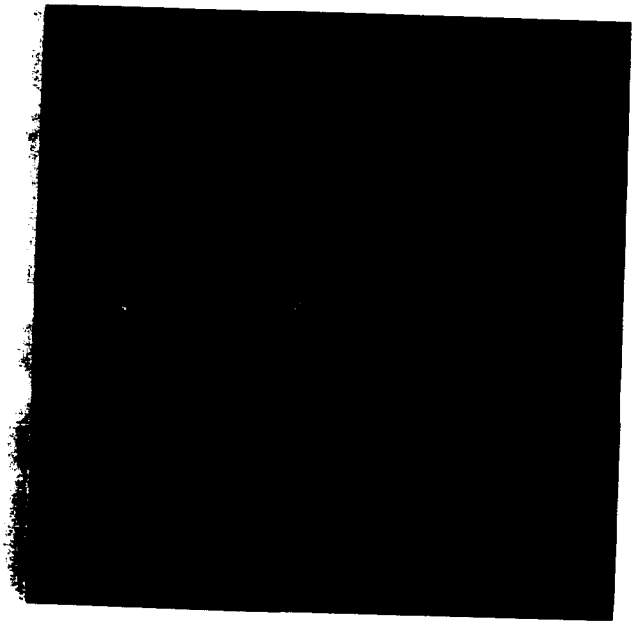

Reference No. 15

"Rite in the Rain"
WEATHERPROOF

LEVEL

NOTEBOOK NO. 311

FY-1439

Safety Kleen
Greer, Spartanburg County, SC
FY-8904-15

If found return to
NUS Corporation
1927 Lakeside Pkwy, Suite 600
Tucker, GA 30084

23

LOGBOOK REQUIREMENTS
REVISED - NOVEMBER 29, 1988

NOTE: ALL LANGUAGE SHOULD BE FACTUAL AND OBJECTIVE

1. Record on front cover of the Logbook: TDD No., Site Name, Site Location, Project Manager
2. All entries are made using ink. Draw a single line though errors. Initial and date corrections.
3. Statement of Work Plan, Study Plan, and Safety Plan discussion and distribution to field team with team member signatures.
5. Sign and date each page. Project Manager is to review and sign off on each logbook daily
6. Document all calibration and pre-operational checks of equipment. Provide serial numbers of equipment used onsite.
7. Provide reference to Sampling Field Sheets for detailed sampling information.
8. Describe sampling locations in detail and document all changes from project planning documents.
9. Provide a site sketch with sample locations and photo locations.
10. Maintain photo log by completing the stamped information at the end of the logbook.
11. If no site representative is on hand to accept the receipt for samples an entry to that effect must be placed in the logbook.
12. Record I.D. numbers of COC and receipt for sample forms used. Also record numbers of destroyed documents.
13. Complete SMO information in the space provided.

The undersigned have read and understand the site safety plan and work plan for this project. The ~~undersigned~~ 5/31/89 undersigned also understand the scope and objective of this project

John Jenkins Project MANAGER
John Jenkins

Site Safety Officer
KEN MALLARY
Ken Mallary

5-31-89

000001

000002

5/31/89

5-31-89 Humid + Hot temperatures expected to be in the mid 90's

9:15 Left NUS to drive to Greenville, S.C.

11:45 Arrived in Greenville and checked into motel.

11:55 Drove to Court House to try + obtain a county map prior to visiting Water Departments. We were referred to City Hall

12:20 Arrived at City Hall + was referred to the Chamber of Commerce

000003

000004

5/31/89 dd

12:30 Ate Lunch

12:45 We went to search for the Chamber of Commerce

12:55 Arrived at the Chamber of Commerce and obtained a map of Greenville County, S.C. We were referred to a Map store in Greenville to get a Spartanburg County MAP.

1:10 Arrived at MAP store + bought MAP

1:20 Left MAP store

5/31/89 dd

1:45 Arrived At the Greer Water Dept. Operations Center to meet Dennis Arrington + Buddy Culp. Mr Arrington traced out dd 5/31/89 the Greer distribution area, intake location, and areas likely to have private well users. The Greer system has 1 intake that is located at the eastern end of Lake Cunningham. There is also A filter plant there. The system services approximately 9500 meters. and

000005

5/31/89

they also sell approximately 1,000,000 gallons per day (via master meter) to the community of blue ridge.

They knew of no water intakes along the Enoree River (migratory pathway) within 15 miles of the facility area, but they did suggest we talk with people with the Startex - Jackson - Wellford - Duncan (SJWD) water system and ask them where the community of Woodruff obtains water.

5/31/89

2:35 Left the Greer Water Dept. to go to the SJWD water dept. in Lyman.

2:55 Arrived at SJWD and met with Mr Danny Blackwell, MANAGER.

- Mr Blackwell stated that they buy water from Spartanburg and also have two auxiliary wells aquired when SJWD took over the old Piedmont System.

5/31/89 JJ

- The two Piedmont wells are located north of Lyman in Inman. They didn't know the depth of the wells.

SJWD services approximately 10,400 meters in the area.

Approximately 80-90% of all individuals in Spartanburg County are supplied by municipal systems.

The community of Woodruff obtains it's water from Spartanburg

5/31/89 JJ

Mr. Blackwell showed us a map showing areas that aren't served by municipal supplies. Our study area is just north of this area.

We took photographs of this map & traced the area nearest our facility onto a county map which will be added as part of this logbook.

5/31/89

Mr Blackwell gave us a map showing the territories of each of the water systems in Spartanburg County. He also showed us where the Spartanburg intake is. The Spartanburg intake is located on William C. Bowen lake approximately 16 miles north of the facility.

5/31/89

He suggested that we visit mr. Charles Notess at the Spartanburg County Planning and development Dept to get an accurate population per house estimate for our study area.

3:50 Left SJWD water dept.

4:10 Met with Mr. Charles Notess
& he supplied 5/31 us
with a map showing populations
per house for various areas of
Spartanburg County

4:30 Left Planning Dept.

5:30 Returned to hotel.

5/31/89

Reference No. 16

SOUTH CAROLINA

WATER RESOURCES COMMISSION

Report No 3

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Planning
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FIT IV

Water Resources of Spartanburg County, South Carolina

By

W. M. Bloxham, George E. Siple, and T. Ray Cummings

Prepared by
U.S. Geological Survey, Water Resources Division
in cooperation with
Spartanburg County Planning And Development Commission
Spartanburg, South Carolina
1970

Water Resources of Spartanburg County

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Columbia, South Carolina

1970

CONTENTS

	Page
Abstract	1
Introduction	2
Purpose and scope of the investigation	2
Method of investigation	3
Previous investigations	3
Stream- and well-numbering system	3
Acknowledgments	5
Geography	5
Location and extent of the area	5
Topography	7
Climate	7
Drainage	9
Geology	13
Population	13
Industrialization	15
Current utilization of water	15
Source of supply	15
Quantity used	17
Stream development	19
Effect on streamflow	21
Diversion	23
Farm ponds	23
Surface water characteristics	25
Variation in streamflow	25
Prediction of supply	27
Frequency of low flow	31
Storage of streamflow	35
Short-term records	39
Tributary flow	41
Quality of water	43
Water-quality criteria	44
Collection of data	45
Field measurements of water quality	47
Specific conductance	47
Hardness	48
pH	48
Dissolved oxygen	49
Laboratory analyses	51
Relation of water quality to discharge	53
Temperature of surface water	53

Page

Ground water characteristics---------- 55
Description of water-bearing rocks---------- 57
Occurrence of ground water---------- 57
General hydrologic conditions---------- 57
Recharge and discharge---------- 58
Well yield---------- 59
Factors affecting well yield---------- 61
Topography---------- 62
Rock type---------- 62
Structure---------- 65
Well depth---------- 69
Thickness of saprolite---------- 69
Water levels---------- 73
Quality of ground water---------- 75
Water quality as affected by lithologic units------- 77
Suitability of water for use---------- 79
Temperature of ground water---------- 81
Conclusions---------- 82
Selected references---------- 86
Appendix---------- 88

Water wells within the county are numbered serially, the number being derived from a two-letter abbreviation for the county name, followed by a number indicating the chronological order in which the well data were obtained. For example, SP-1 indicates the first well inventoried in Spartanburg County.

Plate 1 shows the locations of surface-water sites and selected wells.

Acknowledgments

The authors acknowledge the cooperation and assistance of municipal and industrial officials throughout the county who contributed information concerning the nature and utilization of their water-supply facilities. The cooperation and assistance of individual well owners is also acknowledged. In addition, well drillers and well-drilling companies, including Willis S. Gowan, Robbins Brothers, Inc., and Harold Lee provided information from their records concerning wells drilled within the area. This information was particularly useful in the description and evaluation of ground-water characteristics of Spartanburg County.

GEOGRAPHY

The water resources of a region are related to climate, topography, drainage pattern, and geology. The amount of precipitation in an area, which varies seasonally and yearly, directly affects the amount of streamflow and the amount of water stored in ground-water bodies. As water moves over the land surface, the rate of flow depends on such factors as surface slope, soil type, and vegetation. The areal distribution of streams is influenced by topography, and their drainage patterns give an indication of the nature of the underlying strata. Geologic characteristics affect the availability and quality of water that seeps into the ground and, to a large extent, determine the low flow of streams.

Location and Extent of the Area

Spartanburg County occupies an area of 830 square miles in northwestern South Carolina. It is bounded on the west by Greenville County, on the south by Laurens County and the Enoree River, and on the east by Cherokee and Union Counties. On the north, it is bounded by the North Carolina State line.

Topography

Spartanburg County lies just southeast of the Blue Ridge Mountain in the Piedmont province, which is characterized by subdued topographic features and moderate relief. The land surface is inclined so that elevations exceed 1,000 feet in the northwest section of the county but decrease to less than 600 feet in the southeast. The hills have a well-rounded appearance with no conspicuously prominent ridges or peaks. Valley floors are generally about 100 feet deep with well-developed water courses. There are few swamplike areas.

Climate

A humid, temperate climate characterizes the area. Spartanburg County is located on the lee side of the mountains, which provide protection from the cold air masses that move southeastward during the winter. At Spartanburg, temperatures usually are between 32°F and 90°F for 8 months of the year; the average daily temperature for the county is about 60°F. Table 1 shows temperature and precipitation extremes at the U. S. Weather Bureau station at Spartanburg.

Figure 1 shows the rainfall-distribution pattern in Spartanburg County. Average annual rainfall is about 50 inches--an amount that exceeds the national average by 20 inches. Rainfall is usually well distributed throughout the year. Depending upon location, accumulations may vary from 30 inches in a dry year to over 80 inches in a wet year. Figure 2 illustrates variability of annual rainfall at Rainbow Lake adjacent to South Pacolet River Reservoir. For example, it is probable that an average yearly precipitation of 35 inches at Rainbow Lake will occur once in 20 years, and equally probable that an average precipitation of 67 inches will occur once in 20 years. Snowfall adds little to the annual precipitation. Average annual snow, most of which falls in two or three minor storms, is 3.7 inches per year at Spartanburg.

Evaporation and transpiration of plants reduce the amount of water available for man's use. In Spartanburg County more than half the average annual precipitation is returned to the atmosphere each year by evaporation and the transpiration of plants. The combined effect, evapotranspiration, is greatest during the warm growing season.

Water loss by evaporation from a body of water depends on many factors and it may exceed precipitation. Since 1965 the U. S. Weather Bureau has recorded the daily evaporation at Rainbow Lake. The average yearly evaporation rate is about 48 inches and monthly rates vary from less than 1 inch during the winter to more than 7 inches in the summer.

Currently about 1 inch of rainfall sustains all of man's municipal and industrial water requirements in Spartanburg County.

Drainage

Spartanburg County extends into three parallel drainage basins. (See fig. 3.) Consequent or trunk streams in this area resulted from the initial tilt of the land surface, and streamflow is toward the southeast at a general slope of about 15 feet per mile. Described as in a youthful stage, in geologic terms, the streams are capable of carrying all the sediment load from the tributaries and are in the process of deepening their channels. Rapids form where the rocks are particularly resistant to erosion, and narrow flood plains at some locations indicate that the streams are approaching an early stage of maturity. Figure 4 shows the relation of stream length to drainage area in Spartanburg County. About 3.5 square miles of the basin are drained for each mile in length along a mainstem.

One measure of natural drainage development is drainage density or the ratio of the total length of streams in a basin to the drainage area of the basin. In Spartanburg County, the ratio is estimated to be about 1.5 miles per square mile, indicating a fairly wide spacing of stream channels and a relatively long overland travel of surface water.

The tributary stream patterns are dendritic, or treelike, because there is little variation in the resistance of the rock structure to influence the direction of flow. Slopes of tributary streams are greater than those of mainstems, and their juncture with larger streams is usually at right angles. The total length of tributaries is about five times that of the mainstems.

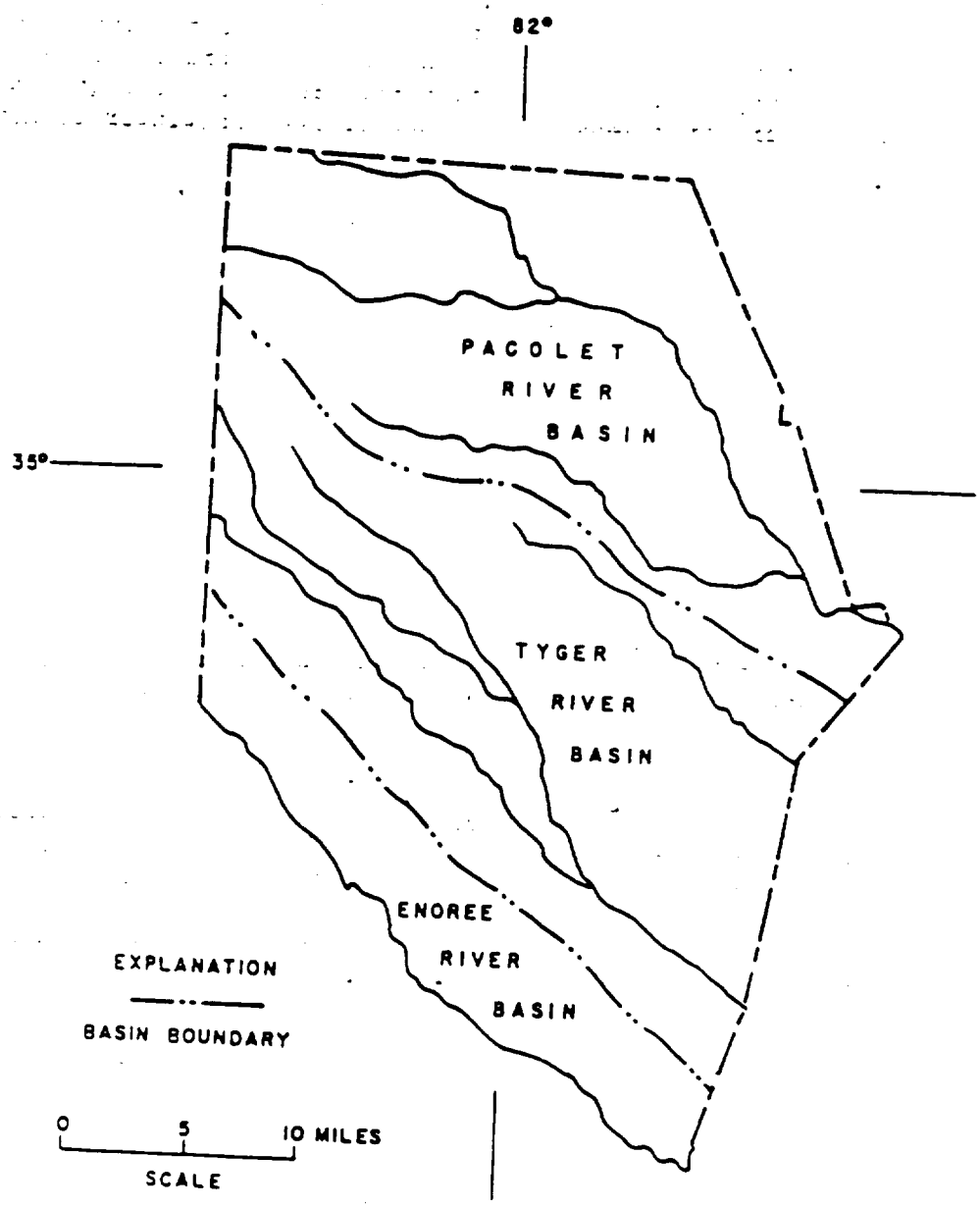

Figure 3.--Major drainage basins of Spartanburg County

Geology

Nearly all of Spartanburg County, except for some small areas in the southeastern part bordering Union County, lies within the Inner Piedmont belt, a major sub-division of crystalline rocks in the Piedmont province (King, 1955). The small area in the southeastern part of the county contains rocks typical of the Kings Mountain belt. The Inner Piedmont belt includes metamorphic rock types such as biotite gneiss, biotite schist, quartzite, hornblende gneiss, and other rocks of gabbroic nature. The Kings Mountain belt is characterized by the presence of sericite schist, hornblende schist, quartz monzonite, and minor amounts of quartzite and marble (King, 1955).

The geologic belts east of the Brevard belt (a narrow strike-slip fault zone separating the rocks of the Inner Piedmont belt from those of the Blue Ridge belt) are distinguished principally by modifications of the original sedimentary rocks by folding, regional metamorphism, and igneous intrusion (Overstreet and Bell, 1965b, p. 16). As such, they represent metamorphic zones superimposed on a regional stratigraphic sequence.

Intrusive rocks, in addition to the monzonite, include unnamed granites, mafic dikes, muscovite-pegmatite dikes, and fine-grained diabase dikes.

Over much of the county, the hard crystalline rock has weathered to a soft clayey or sandy material (saprolite), which maintains many of the original rock structures and extends from ground surface to depths of as much as 140 feet.

A geologic map of Spartanburg County, figure 5, has been adapted from Overstreet and Bell (1965a). Some recent modifications not shown include a fairly significant plutonic body southwest of Pacolet and a manganese-rich zone delineated along the east boundary of Croft State Park (Henry Bell, III, oral commun., 1969).

Population

About 75 percent of the county's total population of about 165,000 is concentrated in the central part, which includes the city of Spartanburg and other urban and manufacturing centers. In recent years, economic factors have caused a movement to urban localities, but much of the county remains rural. The northern section, with thriving peach farms, supports about 15 percent of the total population, whereas the southern section is generally thinly populated and of diminished agricultural activity.

During October 1966 to September 1968, continuous temperature recorders were operated on North Tyger River near Fairmont and Enoree River near Enoree. Appendix table 11 shows the maximum and minimum monthly temperatures[1/] recorded at these stations. The highest temperature recorded at either station was 28°C in August 1968 on the Enoree River; the lowest temperature recorded was 2°C in February 1968, also at Enoree River.

Figure 25 is a frequency curve of daily mean water temperatures of Enoree River near Enoree. Ten percent of the time the mean temperature equaled or exceeded 24°C; 50 percent of the time, 16°C; and 90 percent of the time, 6°C.

Appendix table 12 lists average monthly water temperatures at gaging stations in Spartanburg County during 1949-67, when the gaging stations were visited to make discharge measurements. Average monthly temperatures do not differ appreciably from station to station. The temperature of Middle Tyger River at Lyman, however, seems to be higher than the other streams. This may be the result of heated waste waters raising the temperature of the stream.

GROUND WATER CHARACTERISTICS

Ground water is one of the most important natural resources of Spartanburg County. It is the principal source of water for rural homes and farms, small to medium-sized industries, and some supplemental irrigation. The quantity of water available from wells drilled in consolidated rock is usually less than that which may be obtained from surface-water sources. However, the importance of ground water lies in the fact that in moderate amounts, it is available in a large part of the area and thus can satisfy the requirements for most domestic, stock, and small industrial use. The consistency of ground-water quality and temperature are additional factors that enhance its utility and economic value.

1/ In October 1967 the Geological Survey began reporting temperature data in degrees Celsius (°C). Degrees Celsius are equivalent to the more familiar degrees centigrade.

Description of Water-Bearing Rocks

The distribution of specific rock types throughout Spartanburg County is shown on figure 5, which was adapted from Overstreet and Bell (1965a). Although 10 rock units are shown as cropping out within the county, all but a small percentage of the rocks exposed are contained within five major units. These are the biotite schist, biotite gneiss and migmatite, quartz monzonite, hornblende gneiss, and hornblende schist. Descriptions of these units are given in appendix table 13 and are adapted principally from those of Overstreet and Bell (1965b).

Occurrence of Ground Water

General Hydrologic Conditions

In areas underlain by crystalline rocks, such as those found in Spartanburg County, ground water occurs in both the mantle of weathered rock, or saprolite, overlying the hard rock and in the secondary fractures, such as joints, faults, bedding planes, or foliation planes within the hard rock. Where the rock is composed of water-soluble minerals, the fractures may become enlarged by solution from circulating ground water. Owing to the increasing load of overburden with increasing depth, both the number and size of the fracture openings decrease with depth. Because of this, most of the higher yields from wells in the Piedmont occurs in those wells drilled to depths less than 250 feet. At depths greater than about 300 feet the number and size of fractures tend to diminish to a degree where only small quantities of water circulate through them. Some fractures formed at depths greater than 1,000 feet by deep-seated orogenic or seismic activity may contain significant amounts of water, but generally the water is highly mineralized. Only minor amounts of water may collect and move through the intergranular spaces in the rock itself, because of the extremely low porosity and permeability of unfractured crystalline rock.

Water movement in the saprolite is controlled to a large extent by the permeability of the unit. Where the saprolite is comparatively less permeable than the underlying fractured rock, it can act as a confining bed. The saprolite layer usually functions as a reservoir to receive and store percolating rain water and subsequently supply ground water over protracted periods of below-normal rainfall.

Early development of ground water in Spartanburg County consisted predominantly of dug wells or springs. In fact, several springs were utilized in the development of spas or health resorts. Some spring waters are still bottled and marketed today, for example, the water of Glenn Springs (pl. 1). The dug wells were generally 2 to 3 feet in diameter and lined with wood, stone, or brick curbing. They were dug by hand and usually obtained water from the saprolite or from the top few feet of the underlying hard rock. The bottom of such a well was usually only a few feet below the normal water table. Thus, in sustained drought, the water table would recede below this depth and the well became dry.

Both water-table and artesian conditions are characteristic of the area, although the former is more typical. Under water-table conditions, the surface of the zone of saturation (or water table) is under atmospheric pressure and is free to move upward or downward, without being confined by impermeable, or nearly impermeable, material. Under artesian conditions the potentiometric surface (an imaginary surface that coincides everywhere with the head of water in the aquifer) usually occurs above the saprolite-hard rock contact. The water table may fluctuate across this contact. Where percolating waters enter an inclined fracture zone, the water level in a well intercepting these fractures at depth will rise above the top of the fracture zone, and might rise above the top of the casing and flow if the well is at a lower elevation than the area of recharge.

Recharge and Discharge

The source of all ground water in Spartanburg County is the precipitation (mostly in the form of rainfall) within the county plus the underflow across county boundaries. Approximately one-quarter to one-third of the precipitation filters down into the zone of saturation, whereas the remainder is lost to surface runoff or evapotranspiration. The proportion of rainfall that finally reaches the water table is affected by several factors. The intensive summer storms of short duration contribute a much smaller amount of recharge than the steady light rains characteristic of the fall and winter seasons. A high rate of evapotranspiration during the growing season likewise diminishes the amount of rainfall that might otherwise reach the water table.

Reference No. 17

South Carolina Department of Health and Environmental Control

2600 Bull Street
Columbia, S.C. 29201

Commissioner
Michael D. Jarrett

Board
Harry M. Hallman, Jr., Chairman
Toney Graham, Jr. M.D., Vice-Chairman
John B. Pate, M.D., Secretary
Oren L. Brady, Jr.
Moses H. Clarkson, Jr.
Euta M. Colvin, M.D.
Henry S. Jordan, M.D.

MEMORANDUM

TO: John Cresswell, Manager
Site Screening Section
Bureau of Solid and Hazardous Waste Management

FROM: Judy Canova, Hydrologist JC
Superfund and Solid Waste Section
Division of Hydrogeology
Bureau of Solid and Hazardous Waste Management

DATE: November 22, 1988

RE: Old Startex Spartanburg County Landfill
SCD 98Ø 558 191
Spartanburg County
Preliminary Assessment - Hydrogeologic Review

A hydrogeologic review of the referenced site has been conducted to assist in completing a preliminary assessment for the Superfund program. The purpose of the hydrogeologic review is to provide information regarding the ground-water migration route of potential contaminants. It includes information obtained from South Carolina Water Resources Commission well tabulations, available site specific information from state files, a target survey using United States Geological Survey topographic quadrangles, and a literature review.

According to Bloxham et al. (197Ø), the following geologic units underlie the site:

Name	Description	Depth of Occurrence
Saprolite	Weathering products of bedrock containing a heterogeneous mixture of sands, silts, and clays	From ground surface to variable depths
Bedrock	Igneous and metamorphic crystalline rock	Variable

The aquifer of concern includes the bedrock and saprolite. The aquifer does not appear to be the sole source of potable water in the area. The referenced facility is not in an area of karst topography.

The 1968 Soil Survey of Spartanburg County classifies soils on site as Davidson sandy clay loam containing an average of sixty percent clay. Soils of this composition have an approximate saturated hydraulic conductivity of 10^{-4} to 10^{-7} cm/sec. Based on topographic relief and surface drainage, the depth to ground-water is estimated to be between ten and twenty feet. The predominant ground-water flow direction appears to be towards the west in the surficial unconfined aquifer.

A well inventory within a radius of four miles of the site reveals the following uses of ground-water from the aquifer of concern: domestic water supply.

From available information, it appears that the nearest domestic well developed within the aquifer of concern is 0.3 miles to the east of the site.

The number of homes within a four mile radius of the site not located on a public water supply line (therefore assumed to utilize domestic wells), as identified from topographic quadrangles, are as follows:

Radius	Number of Houses
1 Mile	49
2 Miles	62
3 Miles	93
4 Miles	257
Total	461

References Cited:

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Reference No. 18

KIRK-OTHMER

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY

THIRD EDITION

VOLUME 18

PLANT-GROWTH SUBSTANCES
TO
POTASSIUM COMPOUNDS

A WILEY-INTERSCIENCE PUBLICATION
John Wiley & Sons
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Plant-growth
Plant layout, 2
Plant location
Plant safety, 6
Plastic buildin
Plasticizers, 1
Plastics proce
Plastics testin
Platinum-grou
Platinum-grou
comp
Plutonium an
comp
Poisons, eco
Polishes, 321
Polyamides,
Poly(biscycl
poly
Polyblends,

Floor

Early floor-polish formulations were based on wax (14). An improvement in polish formulation was the dissolution of wax in turpentine to form a liquid. Buffable paste-wax formulations are used on wooden floors, although liquid products are more common. Vegetable waxes, particularly carnauba wax, largely replaced beeswax. Carnauba produces a harder, more durable film and is fairly easy to disperse in water. The early self-polishing floor-wax emulsions were based on carnauba wax and shellac. In recent years, synthetic polymers have replaced natural products in most floor polishes, the main exception being products that are used to maintain wooden floors. Floor polishes are subject to more mechanical abuse than other polish films and, therefore, should be resistant to abrasion, soiling, water, and detergents. Polymers, which generally are of higher molecular weight than natural waxes, can be formulated to provide films with these properties. In addition, the ability to tailor the properties of synthetic polymers has produced self-polishing aqueous formulations, which result in the deposition of films with high gloss, low color, durability, little tendency to powder, and built-in mechanisms for easy removal.

Reviews of floor-polish formulations are given in refs. 6, 13, and 15–16. Aqueous, self-polishing, polymeric formulations generally contain two or three polymeric film formers, coalescents, leveling aids, plasticizers, zinc complexes, ammonia, and wetting and emulsifying agents. The polymer generally is a styrene–acrylic copolymer or an acrylic copolymer (15–16) (see Acrylic ester polymers). The monomers used are styrene (qv); acrylic acid (qv); acrylic acid esters, eg, butyl acrylate; methacrylic acid; methacrylic acid esters; acrylonitrile (qv). In some cases, the polymer partially reacts with aziridine to provide improved film durability (17) (see Imines, cyclic). The polymer may be used in the formulation as an emulsion, but if sufficient acid monomer is incorporated and base is added, the emulsion particles swell and, in some cases, the polymer dissolves: this is the form used in water-clear floor polishes (18–19). The polymer usually is the principal film former. Resins, which are low molecular weight, high acid-content polymers, form clear dispersions of low viscosity at high solids content (15). They may be styrene–maleic anhydride copolymers, various styrene–acrylic copolymers, rosin maleates, or terpene–phenolics (see Styrene plastics; Terpenoids; Phenolic resins). They sometimes are called leveling resins because they can be used to increase the solids content without excessively increasing the viscosity. However, in an emulsion product which otherwise might be of low viscosity, resins can be used to increase the application viscosity and, thereby, provide a thicker film.

Waxes are added to formulations in the form of emulsions. The trend in recent years has been the use of low molecular weight polyethylenes, which are made somewhat polar by oxidation or by copolymerization with carboxylic acid monomers to make them readily emulsifiable (20). Waxes provide buffability to polish films and increase their abrasion resistance. Plasticizers (qv) are used in emulsion products to lower the minimum film-forming temperature (MFT) below that at which the coating is applied. Below MFT, polymer emulsion particles do not coalesce to provide a coherent film. The plasticizer may be a phthalate ester, phosphate ester, glycol ether, or glycol (21). Phosphate esters, particularly **tris(butoxyethyl) phosphate**, are plasticizers but are more important as leveling agents (22). The glycol ethers are classed as coalescing agents and differ from plasticizers in that they are fugitive (see Glycols). They reduce MFT but evaporate when the film dries, yielding a hard film (21).

Health and Safety Factors

Liquid polishes and waxes containing 1 wt % or more petroleum distillates must be contained in childproof packaging (46). General experience indicates that natural waxes and polyethylene waxes are nontoxic (47). Although nonsolvent floor polishes are relatively nontoxic, a concern with floor waxes continues to be slip resistance (48). With regard to aerosol-dispensed polishes, the trend from fluorocarbon propellants to hydrocarbons during the 1970s has increased concerns about the flammability of aerosols particularly in warehouse storage (49–50).

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FRANCIS J. RANDALL
SEAN G. DWYER
S. C. Johnson & Son, Inc.

POLLUTION. See Air, noise, water pollution.

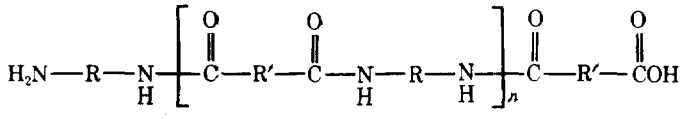
POLYAMIDES

General, 328
Polyamide fibers, 372
Polyamide plastics, 406
Caprolactam, 425

GENERAL

Polyamides are condensation products that contain recurring amide groups as integral parts of the main polymer chains. Linear polyamides are formed from condensation of bifunctional monomers. If the monomers are amino acids, eg, 6-aminohexanoic acid, the polymers are called AB types (A representing amine groups and B representing carboxyl groups). If the polymers are formed from condensation of diamines and dibasic acids, they are called AABB types. Polyamides are frequently referred to as nylons. Although they generally are considered as condensation polymers, polyamides also are formed by addition polymerization. This method of preparation is especially important for some AB polymers, in which the monomers are cyclic lactams, eg, ϵ-caprolactam (3,4,5,6-hexahydro-2*H*-azepin-2-one) or 2-pyrrolidinone (γ-aminobutyrolactam).

Typical structural formulas of linear polyamides may be represented as



HAZARD RANKING SYSTEM SCORING SUMMARY

FOR

OLD STARTEX, SPARTANBURG COUNTY LANDFILL
EPA SITE NUMBER SCD980558191
STARTEX
SPARTANBURG COUNTY, SC
EPA REGION: 4

SCORE STATUS: IN PREPARATION

SCORED BY TERRY RYLAND
OF NUS CORPORATION
ON 01/31/91

DATE OF THIS REPORT: 01/31/91
DATE OF LAST MODIFICATION: 01/31/91

GROUND WATER ROUTE SCORE	43.45
SURFACE WATER ROUTE SCORE	9.45
AIR ROUTE SCORE	0.00
MIGRATION SCORE	55.14

HRS GROUND WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
DEPTH TO WATER TABLE	20 FEET		
DEPTH TO BOTTOM OF WASTE	15 FEET		
DEPTH TO AQUIFER OF CONCERN	5 FEET	3	6
PRECIPITATION	38.0 INCHES		
EVAPORATION	40.0 INCHES		
NET PRECIPITATION	-2.0 INCHES	0	0
PERMEABILITY	1.0X10-5 CM/SEC	1	1
PHYSICAL STATE		3	3
TOTAL ROUTE CHARACTERISTICS SCORE:			10
3. CONTAINMENT		3	3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:BARIUM			18
WASTE QUANTITY CUBIC YDS	250:		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	250: CU. YDS	3	3
TOTAL WASTE CHARACTERISTICS SCORE:			21
5. TARGETS			
GROUND WATER USE		2	6
DISTANCE TO NEAREST WELL	1584 FEET		
AND	MATRIX VALUE	20	20
TOTAL POPULATION SERVED	775 PERSONS		
NUMBER OF HOUSES	304		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			26

GROUND WATER ROUTE SCORE (Sgw) = 42.43

HRS SURFACE WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
SITE LOCATED IN SURFACE WATER	NO		
SITE WITHIN CLOSED BASIN	NO		
FACILITY SLOPE	1.0 %		
INTERVENING SLOPE	4.2 %	1	1
24-HOUR RAINFALL	3.5 INCHES	3	3
DISTANCE TO DOWN-SLOPE WATER	500 FEET	2	4
TYPE OF STATE	3		3
TOTAL ROUTE CHARACTERISTICS SCORE:			13
3. CONTAINMENT	3		3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:BARIUM			18
WASTE QUANTITY CUBIC YDS	2501		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	2501 CU. YDS	2	2
TOTAL WASTE CHARACTERISTICS SCORE:			36
5 TARGETS			
SURFACE WATER USE		2	2
DISTANCE TO SENSITIVE ENVIRONMENTS		0	0
COASTAL WETLANDS	NONE		
FRESH-WATER WETLANDS	NONE		
CRITICAL HABITAT	NONE		
DISTANCE TO STATIC WATER	> 3 MILES		
DISTANCE TO WATER SUPPLY INTAKE	> 3 MILES		
AND	MATRIX VALUE	0	0
TOTAL POPULATION SERVED	0		
NUMBER OF HOUSES	0		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			2

SURFACE WATER ROUTE SCORE (S_{sw}) = 9.45

HRS AIR ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. WASTE CHARACTERISTICS			
REACTIVITY:		MATRIX VALUE	
INCOMPATIBILITY			
TOXICITY			
WASTE QUANTITY CUBIC YARDS			
DRUMS			
GALLONS			
TONS			
TOTAL			
TOTAL WASTE CHARACTERISTICS SCORE:			N/A
3. TARGETS			
POPULATION WITHIN 4-MILE RADIUS			
0 to 0.25 mile			
0 to 0.50 mile			
0 to 1.0 mile			
0 to 4.0 miles			
DISTANCE TO SENSITIVE ENVIRONMENTS			
COASTAL WETLANDS			
FRESH-WATER WETLANDS			
CRITICAL HABITAT			
DISTANCE TO LAND USES			
COMMERCIAL/INDUSTRIAL			
PARK/FOREST/RESIDENTIAL			
AGRICULTURAL LAND			
PRIME FARMLAND			
HISTORIC SITE WITHIN VIEW?			
TOTAL TARGETS SCORE:			N/A

AIR ROUTE SCORE (Sa) = 0.00

HAZARD RANKING SYSTEM SCORING CALCULATIONS
FOR
SITE: OLD STARTEX, SPARTANBURG COUNTY LANDFILL
AS OF 01/31/91

GROUND WATER ROUTE SCORE

ROUTE CHARACTERISTICS		12
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	26
TARGETS	X	25

= 24336 /57,330 X 100 = 42.45 = S_{gw}

SURFACE WATER ROUTE SCORE

ROUTE CHARACTERISTICS		13
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	26
TARGETS	X	6

= 5084 /64,350 X 100 = 9.45 = S_{sw}

AIR ROUTE SCORE

OBSERVED RELEASE 0 /35,100 X 100 = 0.00 = S_{air}

SUMMARY OF MIGRATION SCORE CALCULATIONS

	S	S^2
GROUND WATER ROUTE SCORE (S_{gw})	42.45	1802.10
SURFACE WATER ROUTE SCORE (S_{sw})	9.45	89.30
AIR ROUTE SCORE (S_{air})	0.00	0.00
$S^2_{gw} + S^2_{sw} + S^2_{air}$		1891.30
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}$		43.49
$S_M = \sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}/1.73$		25.14

APPENDIX A

Topographic Map

OVERSIZED

DOCUMENT

APPENDIX B

Analytical Results

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50976 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01S COLLECTION START: 09/24/90 0830 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y300

UG/KG	ANALYTICAL RESULTS
11U	CHLOROMETHANE
11U	BROMOMETHANE
11U	VINYL CHLORIDE
11U	CHLOROETHANE
8U	METHYLENE CHLORIDE
20U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
11U	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
11U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
11U	METHYL ISOBUTYL KETONE
11U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES
9	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50976	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: TB-01S			COLLECTION START: 09/24/90 0830 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y300 MD NO:

ANALYTICAL RESULTS UG/KG

20JN	TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-01 COLLECTION START: 09/26/90 0845 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y286

UG/KG	ANALYTICAL RESULTS
11U	CHLOROMETHANE
11U	BROMOMETHANE
11U	VINYL CHLORIDE
11U	CHLOROETHANE
9U	METHYLENE CHLORIDE
11U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
11U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
11U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
11U	METHYL ISOBUTYL KETONE
11U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
13	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-02 COLLECTION START: 09/26/90 0930 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y288

UG/KG	ANALYTICAL RESULTS
11U	CHLOROMETHANE
11U	BROMOMETHANE
11U	VINYL CHLORIDE
11U	CHLOROETHANE
20U	METHYLENE CHLORIDE
11U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
11U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
11U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
11U	METHYL ISOBUTYL KETONE
11U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
12	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL
SOURCE:
STATION ID: SS-03

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1030 STOP: 00/00/00

D. NO.: Y290

UG/KG	ANALYTICAL RESULTS
48U	CHLOROMETHANE
48U	BROMOMETHANE
48U	VINYL CHLORIDE
48U	CHLOROETHANE
60U	METHYLENE CHLORIDE
630	ACETONE
24U	CARBON DISULFIDE
24U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
24U	1,1-DICHLOROETHANE
24U	1,2-DICHLOROETHENE (TOTAL)
24U	CHLOROFORM
24U	1,2-DICHLOROETHANE
48U	METHYL ETHYL KETONE
24U	1,1,1-TRICHLOROETHANE
24U	CARBON TETRACHLORIDE
48U	VINYL ACETATE
24U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
24U	1,2-DICHLOROPROPANE
24U	CIS-1,3-DICHLOROPROPENE
24U	TRICHLOROETHENE(TRICHLOROETHYLENE)
24U	DIBROMOCHLOROMETHANE
24U	1,1,2-TRICHLOROETHANE
24U	BENZENE
24U	TRANS-1,3-DICHLOROPROPENE
24U	BROMOFORM
48U	METHYL ISOBUTYL KETONE
48U	METHYL BUTYL KETONE
24U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
24U	1,1,2,2-TETRACHLOROETHANE
24U	TOLUENE
29	CHLOROBENZENE
24U	ETHYL BENZENE
24U	STYRENE
24U	TOTAL XYLENES
79	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-04 COLLECTION START: 09/26/90 1205 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y292

UG/KG	ANALYTICAL RESULTS	UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE	6U	1,2-DICHLOROPROPANE
12U	BROMOMETHANE	6U	CIS-1,3-DICHLOROPROPENE
12U	VINYL CHLORIDE	6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
12U	CHLOROETHANE	6U	DIBROMOCHLOROMETHANE
7U	METHYLENE CHLORIDE	6U	1,1,2-TRICHLOROETHANE
12U	ACETONE	6U	BENZENE
6U	CARBON DISULFIDE	6U	TRANS-1,3-DICHLOROPROPENE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)	6U	BROMOFORM
6U	1,1-DICHLOROETHANE	12U	METHYL ISOBUTYL KETONE
6U	1,2-DICHLOROETHENE (TOTAL)	12U	METHYL BUTYL KETONE
6U	CHLOROFORM	6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,2-DICHLOROETHANE	6U	1,1,2,2-TETRACHLOROETHANE
12U	METHYL ETHYL KETONE	6U	TOLUENE
6U	1,1,1-TRICHLOROETHANE	6U	CHLOROBENZENE
6U	CARBON TETRACHLORIDE	6U	ETHYL BENZENE
12U	VINYL ACETATE	6U	STYRENE
6U	BROMODICHLOROMETHANE	6U	TOTAL XYLENES
		19	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-05

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1225 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y293

UG/KG	ANALYTICAL RESULTS
14U	CHLOROMETHANE
14U	BROMOMETHANE
14U	VINYL CHLORIDE
14U	CHLOROETHANE
30U	METHYLENE CHLORIDE
14U	ACETONE
7U	CARBON DISULFIDE
7U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
7U	1,1-DICHLOROETHANE
7U	1,2-DICHLOROETHENE (TOTAL)
7U	CHLOROFORM
7U	1,2-DICHLOROETHANE
14U	METHYL ETHYL KETONE
7U	1,1,1-TRICHLOROETHANE
7U	CARBON TETRACHLORIDE
14U	VINYL ACETATE
7U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
7U	1,2-DICHLOROPROPANE
7U	CIS-1,3-DICHLOROPROPENE
7U	TRICHLOROETHENE(TRICHLOROETHYLENE)
7U	DIBROMOCHLOROMETHANE
7U	1,1,2-TRICHLOROETHANE
7U	BENZENE
7U	TRANS-1,3-DICHLOROPROPENE
7U	BROMOFORM
14U	METHYL ISOBUTYL KETONE
14U	METHYL BUTYL KETONE
7U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
7U	1,1,2,2-TETRACHLOROETHANE
7U	TOLUENE
7U	CHLOROBENZENE
7U	ETHYL BENZENE
7U	STYRENE
7U	TOTAL XYLENES
26	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-06 COLLECTION START: 09/26/90 1250 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y294

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
20U	METHYLENE CHLORIDE
12U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
17	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-01 COLLECTION START: 09/26/90 0845 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y286 MD NO: Y286

ANALYTICAL RESULTS UG/KG

40JN TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50968	SAMPLE TYPE: SOIL	PROG ELEM: NSF
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX
STATION ID: SS-02			COLLECTION START: 09/26/90 0930
CASE NO.: 14949	SAS NO.:		D. NO.: Y288

COLLECTED BY: T RYLAND
ST: SC
STOP: 00/00/00
MD NO: Y288

ANALYTICAL RESULTS UG/KG

50JN	TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50970	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE:			CITY: STARTEX ST: SC
STATION ID: SS-03			COLLECTION START: 09/26/90 1030 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y290 MD NO: Y290

ANALYTICAL RESULTS UG/KG

80JN	TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50972	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SS-04			COLLECTION START 09/26/90 1205 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y292 MD NO: Y292

ANALYTICAL RESULTS UG/KG

20JN	TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS. GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50973	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SS-05			COLLECTION START. 09/26/90 1225 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y293 MD NO: Y293

ANALYTICAL RESULTS UG/KG

30JN	TETRAMETHYLBUTANE
4JN	PROPADIENE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50974	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SS-06			COLLECTION START: 09/26/90 1250 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y294 MD NO: Y294

ANALYTICAL RESULTS UG/KG

60JN TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-01 COLLECTION START: 09/26/90 0845 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y286

UG/KG	ANALYTICAL RESULTS
380U	PHENOL
380U	BIS(2-CHLOROETHYL) ETHER
380U	2-CHLOROPHENOL
380U	1,3-DICHLOROBENZENE
380U	1,4-DICHLOROBENZENE
380U	BENZYL ALCOHOL
380U	1,2-DICHLOROBENZENE
380U	2-METHYLPHENOL
380UR	BIS(2-CHLOROISOPROPYL) ETHER
380U	(3-AND/OR 4-)METHYLPHENOL
380U	N-NITROSODI-N-PROPYLAMINE
380U	HEXACHLOROETHANE
380U	NITROBENZENE
380U	ISOPHORONE
380U	2-NITROPHENOL
380U	2,4-DIMETHYLPHENOL
1800U	BENZOIC ACID
380U	BIS(2-CHLOROETHOXY) METHANE
380U	2,4-DICHLOROPHENOL
380UR	1,2,4-TRICHLOROBENZENE
380U	NAPHTHALENE
380U	4-CHLOROANILINE
380U	HEXACHLOROBUTADIENE
380U	4-CHLORO-3-METHYLPHENOL
380U	2-METHYLNAPHTHALENE
380U	HEXACHLOROCYCLOPENTADIENE (HCCP)
380U	2,4,6-TRICHLOROPHENOL
1800U	2,4,5-TRICHLOROPHENOL
380UR	2-CHLORONAPHTHALENE
1800U	2-NITROANILINE
380U	DIMETHYL PHTHALATE
380U	ACENAPHTHYLENE
380U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1800U	3-NITROANILINE
380U	ACENAPHTHENE
1800U	2,4-DINITROPHENOL
1800U	4-NITROPHENOL
380U	DIBENZOFURAN
380U	2,4-DINITROTOLUENE
380U	DIETHYL PHTHALATE
380U	4-CHLOROPHENYL PHENYL ETHER
380U	FLUORENE
1800U	4-NITROANILINE
1800U	2-METHYL-4,6-DINITROPHENOL
380U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
380U	4-BROMOPHENYL PHENYL ETHER
380U	HEXACHLOROBENZENE (HCB)
1800UJ	PENTACHLOROPHENOL
380U	PHENANTHRENE
380U	ANTHRACENE
380U	DI-N-BUTYLPHTHALATE
380U	FLUORANTHENE
380U	PYRENE
380U	BENZYL BUTYL PHTHALATE
760U	3,3'-DICHLOROBENZIDINE
380U	BENZO(A)ANTHRACENE
380U	CHRYSENE
380U	BIS(2-ETHYLHEXYL) PHTHALATE
380U	DI-N-OCTYLPHTHALATE
380U	BENZO(B AND/OR K)FLUORANTHENE
380U	BENZO-A-PYRENE
380U	INDENO (1,2,3-CD) PYRENE
380U	DIBENZO(A,H)ANTHRACENE
380U	BENZO(GHI)PERYLENE
13	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-02 COLLECTION START: 09/26/90 0930 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y288

UG/KG	ANALYTICAL RESULTS
380U	PHENOL
380U	BIS(2-CHLOROETHYL) ETHER
380U	2-CHLOROPHENOL
380U	1,3-DICHLOROBENZENE
380U	1,4-DICHLOROBENZENE
380U	BENZYL ALCOHOL
380U	1,2-DICHLOROBENZENE
380U	2-METHYLPHENOL
380UR	BIS(2-CHLOROISOPROPYL) ETHER
380U	(3-AND/OR 4-)METHYLPHENOL
380U	N-NITROSODI-N-PROPYLAMINE
380U	HEXACHLOROETHANE
380U	NITROBENZENE
380U	ISOPHORONE
380U	2-NITROPHENOL
380U	2,4-DIMETHYLPHENOL
1800U	BENZOIC ACID
380U	BIS(2-CHLOROETHOXY) METHANE
380U	2,4-DICHLOROPHENOL
380UR	1,2,4-TRICHLOROBENZENE
380U	NAPHTHALENE
380U	4-CHLOROANILINE
380U	HEXACHLOROBUTADIENE
380U	4-CHLORO-3-METHYLPHENOL
380U	2-METHYLNAPHTHALENE
380U	HEXACHLOROCYCLOPENTADIENE (HCCP)
380U	2,4,6-TRICHLOROPHENOL
1800U	2,4,5-TRICHLOROPHENOL
380UR	2-CHLORONAPHTHALENE
1800U	2-NITROANILINE
380U	DIMETHYL PHTHALATE
380U	ACENAPHTHYLENE
380U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1800U	3-NITROANILINE
380U	ACENAPHTHENE
1800U	2,4-DINITROPHENOL
1800U	4-NITROPHENOL
380U	DIBENZOFURAN
380U	2,4-DINITROTOLUENE
380U	DIETHYL PHTHALATE
380U	4-CHLOROPHENYL PHENYL ETHER
380U	FLUORENE
1800U	4-NITROANILINE
1800U	2-METHYL-4,6-DINITROPHENOL
380U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
380U	4-BROMOPHENYL PHENYL ETHER
380U	HEXACHLOROBENZENE (HCB)
1800UJ	PENTACHLOROPHENOL
520	PHENANTHRENE
100J	ANTHRACENE
380U	DI-N-BUTYLPHTHALATE
1100	FLUORANTHENE
1100	PYRENE
380U	BENZYL BUTYL PHTHALATE
760U	3,3'-DICHLOROBENZIDINE
430	BENZO(A)ANTHRACENE
570	CHRYSENE
380U	BIS(2-ETHYLHEXYL) PHTHALATE
380U	DI-N-OCTYLPHTHALATE
770J	BENZO(B AND/OR K)FLUORANTHENE
370J	BENZO-A-PYRENE
230J	INDENO (1,2,3-CD) PYRENE
130J	DIBENZO(A,H)ANTHRACENE
260J	BENZO(GHI)PERYLENE
12	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL
SOURCE:
STATION ID: SS-03

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1030 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y290

UG/KG	ANALYTICAL RESULTS
1600U	PHENOL
1600U	BIS(2-CHLOROETHYL) ETHER
1600U	2-CHLOROPHENOL
1600U	1,3-DICHLOROBENZENE
1600U	1,4-DICHLOROBENZENE
1600U	BENZYL ALCOHOL
1600U	1,2-DICHLOROBENZENE
1600U	2-METHYLPHENOL
1600UR	BIS(2-CHLOROISOPROPYL) ETHER
1600U	(3-AND/OR 4-)METHYLPHENOL
1600U	N-NITROSODI-N-PROPYLAMINE
1600U	HEXACHLOROETHANE
1600U	NITROBENZENE
1600U	ISOPHORONE
1600U	2-NITROPHENOL
1600U	2,4-DIMETHYLPHENOL
7600U	BENZOIC ACID
1600U	BIS(2-CHLOROETHOXY) METHANE
1600U	2,4-DICHLOROPHENOL
1600UR	1,2,4-TRICHLOROBENZENE
1600U	NAPHTHALENE
1600U	4-CHLOROANILINE
1600U	HEXACHLOROBUTADIENE
1600U	4-CHLORO-3-METHYLPHENOL
1600U	2-METHYLNAPHTHALENE
1600U	HEXACHLOROCYCLOPENTADIENE (HCCP)
1600U	2,4,6-TRICHLOROPHENOL
7600U	2,4,5-TRICHLOROPHENOL
1600UR	2-CHLORONAPHTHALENE
7600U	2-NITROANILINE
1600U	DIMETHYL PHTHALATE
1600U	ACENAPHTHYLENE
1600U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
7600U	3-NITROANILINE
1600U	ACENAPHTHENE
7600U	2,4-DINITROPHENOL
7600U	4-NITROPHENOL
1600U	DIBENZOFURAN
1600U	2,4-DINITROTOLUENE
600J	DIETHYL PHTHALATE
1600U	4-CHLOROPHENYL PHENYL ETHER
1600U	FLUORENE
7600U	4-NITROANILINE
7600U	2-METHYL-4,6-DINITROPHENOL
1600U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
1600U	4-BROMOPHENYL PHENYL ETHER
1600U	HEXACHLOROBENZENE (HCB)
7600UJ	PENTACHLOROPHENOL
1600U	PHENANTHRENE
1600U	ANTHRACENE
1600U	DI-N-BUTYLPHTHALATE
210J	FLUORANTHENE
380J	PYRENE
1600U	BENZYL BUTYL PHTHALATE
3100U	3,3'-DICHLOROBENZIDINE
1600U	BENZO(A)ANTHRACENE
1600U	CHRYSENE
1600U	BIS(2-ETHYLHEXYL) PHTHALATE
1600U	DI-N-OCTYLPHTHALATE
1600U	BENZO(B AND/OR K)FLUORANTHENE
1600U	BENZO-A-PYRENE
1600U	INDENO (1,2,3-CD) PYRENE
1600U	DIBENZO(A,H)ANTHRACENE
1600U	BENZO(GHI)PERYLENE
79	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-04 COLLECTION START: 09/26/90 1205 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y292

UG/KG	ANALYTICAL RESULTS	UG/KG	ANALYTICAL RESULTS
410U	PHENOL	2000U	3-NITROANILINE
410U	BIS(2-CHLOROETHYL) ETHER	410U	ACENAPHTHENE
410U	2-CHLOROPHENOL	2000U	2,4-DINITROPHENOL
410U	1,3-DICHLOROBENZENE	2000U	4-NITROPHENOL
410U	1,4-DICHLOROBENZENE	410U	DIBENZOFURAN
410U	BENZYL ALCOHOL	410U	2,4-DINITROTOLUENE
410U	1,2-DICHLOROBENZENE	410U	DIETHYL PHTHALATE
410U	2-METHYLPHENOL	410U	4-CHLOROPHENYL PHENYL ETHER
410UR	BIS(2-CHLOROISOPROPYL) ETHER	410U	FLUORENE
410U	(3-AND/OR 4-)METHYLPHENOL	2000U	4-NITROANILINE
410U	N-NITROSODI-N-PROPYLAMINE	2000U	2-METHYL-4,6-DINITROPHENOL
410U	HEXACHLOROETHANE	410U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
410U	NITROBENZENE	410U	4-BROMOPHENYL PHENYL ETHER
410U	ISOPHORONE	410U	HEXACHLOROBENZENE (HCB)
410U	2-NITROPHENOL	2000UJ	PENTACHLOROPHENOL
410U	2,4-DIMETHYLPHENOL	410U	PHENANTHRENE
2000U	BENZOIC ACID	410U	ANTHRACENE
410U	BIS(2-CHLOROETHOXY) METHANE	410U	DI-N-BUTYLPHTHALATE
410U	2,4-DICHLOROPHENOL	76J	FLUORANTHENE
410UR	1,2,4-TRICHLOROBENZENE	110J	PYRENE
410U	NAPHTHALENE	410U	BENZYL BUTYL PHTHALATE
410U	4-CHLOROANILINE	820U	3,3'-DICHLOROBENZIDINE
410U	HEXACHLOROBUTADIENE	410U	BENZO(A)ANTHRACENE
410U	4-CHLORO-3-METHYLPHENOL	410U	CHRYSENE
410U	2-METHYLNAPHTHALENE	1900	BIS(2-ETHYLHEXYL) PHTHALATE
410U	HEXACHLOROCYCLOPENTADIENE (HCCP)	410U	DI-N-OCTYLPHTHALATE
410U	2,4,6-TRICHLOROPHENOL	410U	BENZO(B AND/OR K)FLUORANTHENE
2000U	2,4,5-TRICHLOROPHENOL	410U	BENZO-A-PYRENE
410UR	2-CHLORONAPHTHALENE	410U	INDENO (1,2,3-CD) PYRENE
2000U	2-NITROANILINE	410U	DIBENZO(A,H)ANTHRACENE
410U	DIMETHYL PHTHALATE	410U	BENZO(GHI)PERYLENE
410U	ACENAPHTHYLENE	19	PERCENT MOISTURE
410U	2,6-DINITROTOLUENE		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-05

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1225 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y293

UG/KG	ANALYTICAL RESULTS
450U	PHENOL
450U	BIS(2-CHLOROETHYL) ETHER
450U	2-CHLOROPHENOL
450U	1,3-DICHLOROBENZENE
450U	1,4-DICHLOROBENZENE
450U	BENZYL ALCOHOL
450U	1,2-DICHLOROBENZENE
450U	2-METHYLPHENOL
450UR	BIS(2-CHLOROISOPROPYL) ETHER
450U	(3-AND/OR 4-)METHYLPHENOL
450U	N-NITROSODI-N-PROPYLAMINE
450U	HEXACHLOROETHANE
450U	NITROBENZENE
450U	ISOPHORONE
450U	2-NITROPHENOL
450U	2,4-DIMETHYLPHENOL
2200U	BENZOIC ACID
450U	BIS(2-CHLOROETHOXY) METHANE
450U	2,4-DICHLOROPHENOL
450UR	1,2,4-TRICHLOROBENZENE
450U	NAPHTHALENE
450U	4-CHLOROANILINE
450U	HEXACHLOROBUTADIENE
450U	4-CHLORO-3-METHYLPHENOL
450U	2-METHYLNAPHTHALENE
450U	HEXACHLOROCYCLOPENTADIENE (HCCP)
450U	2,4,6-TRICHLOROPHENOL
2200U	2,4,5-TRICHLOROPHENOL
450UR	2-CHLORONAPHTHALENE
2200U	2-NITROANILINE
450U	DIMETHYL PHTHALATE
450U	ACENAPHTHYLENE
450U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2200U	3-NITROANILINE
450U	ACENAPHTHENE
2200U	2,4-DINITROPHENOL
2200U	4-NITROPHENOL
450U	DIBENZOFURAN
450U	2,4-DINITROTOLUENE
450U	DIETHYL PHTHALATE
450U	4-CHLOROPHENYL PHENYL ETHER
450U	FLUORENE
2200U	4-NITROANILINE
2200U	2-METHYL-4,6-DINITROPHENOL
450U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
450U	4-BROMOPHENYL PHENYL ETHER
450U	HEXACHLOROBENZENE (HCB)
2200UJ	PENTACHLOROPHENOL
450U	PHENANTHRENE
450U	ANTHRACENE
450U	DI-N-BUTYLPHTHALATE
450U	FLUORANTHENE
450U	PYRENE
450U	BENZYL BUTYL PHTHALATE
890U	3,3'-DICHLOROBENZIDINE
450U	BENZO(A)ANTHRACENE
450U	CHRYSENE
450U	BIS(2-ETHYLHEXYL) PHTHALATE
450U	DI-N-OCTYLPHTHALATE
450U	BENZO(B AND/OR K)FLUORANTHENE
450U	BENZO-A-PYRENE
450U	INDENO (1,2,3-CD) PYRENE
450U	DIBENZO(A,H)ANTHRACENE
450U	BENZO(GHI)PERYLENE
26	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-06

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1250 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y294

UG/KG	ANALYTICAL RESULTS
400U	PHENOL
400U	BIS(2-CHLOROETHYL) ETHER
400U	2-CHLOROPHENOL
400U	1,3-DICHLOROBENZENE
400U	1,4-DICHLOROBENZENE
400U	BENZYL ALCOHOL
400U	1,2-DICHLOROBENZENE
400U	2-METHYLPHENOL
400UR	BIS(2-CHLOROISOPROPYL) ETHER
400U	(3-AND/OR 4-)METHYLPHENOL
400U	N-NITROSODI-N-PROPYLAMINE
400U	HEXACHLOROETHANE
400U	NITROBENZENE
400U	ISOPHORONE
400U	2-NITROPHENOL
400U	2,4-DIMETHYLPHENOL
1900U	BENZOIC ACID
400U	BIS(2-CHLOROETHOXY) METHANE
400U	2,4-DICHLOROPHENOL
400UR	1,2,4-TRICHLOROBENZENE
400U	NAPHTHALENE
400U	4-CHLOROANILINE
400U	HEXACHLOROBUTADIENE
400U	4-CHLORO-3-METHYLPHENOL
400U	2-METHYLNAPHTHALENE
400U	HEXACHLOROCYCLOPENTADIENE (HCCP)
400U	2,4,6-TRICHLOROPHENOL
1900U	2,4,5-TRICHLOROPHENOL
400UR	2-CHLORONAPHTHALENE
1900U	2-NITROANILINE
400U	DIMETHYL PHTHALATE
400U	ACENAPHTHYLENE
400U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1900U	3-NITROANILINE
400U	ACENAPHTHENE
1900U	2,4-DINITROPHENOL
1900U	4-NITROPHENOL
400U	DIBENZOFURAN
400U	2,4-DINITROTOLUENE
400U	DIETHYL PHTHALATE
400U	4-CHLOROPHENYL PHENYL ETHER
400U	FLUORENE
1900U	4-NITROANILINE
1900U	2-METHYL-4,6-DINITROPHENOL
400U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
400U	4-BROMOPHENYL PHENYL ETHER
400U	HEXACHLOROBENZENE (HCB)
1900UJ	PENTACHLOROPHENOL
400U	PHENANTHRENE
400U	ANTHRACENE
400U	DI-N-BUTYLPHTHALATE
400U	FLUORANTHENE
400U	PYRENE
400U	BENZYL BUTYL PHTHALATE
800U	3,3'-DICHLOROBENZIDINE
400U	BENZO(A)ANTHRACENE
400U	CHRYSENE
400U	BIS(2-ETHYLHEXYL) PHTHALATE
400U	DI-N-OCTYLPHTHALATE
400U	BENZO(B AND/OR K)FLUORANTHENE
400U	BENZO-A-PYRENE
400U	INDENO (1,2,3-CD) PYRENE
400U	DIBENZO(A,H)ANTHRACENE
400U	BENZO(GHI)PERYLENE
17	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-02 COLLECTION START 09/26/90 0930 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y288 MD NO: Y288

ANALYTICAL RESULTS UG/KG

200JN	BENZOFLUORANTHENE (NOT B OR K)
500JN	PINENE
400J	1 UNIDENTIFIED COMPOUND

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50970	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE:			CITY: STARTEX ST: SC
STATION ID: SS-03			COLLECTION START: 09/26/90 1030 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y290 MD NO: Y290

ANALYTICAL RESULTS UG/KG

90000J	15 UNIDENTIFIED COMPOUNDS
N	PETROLEUM PRODUCT
2000JN	BENZOTHIAZOLONE
4000JN	HEXADECANOIC ACID
3000JN	BUTOXYETHANOLPHOSPHATE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50972	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SS-04			COLLECTION START: 09/26/90 1205 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y292 MD NO: Y292

ANALYTICAL RESULTS UG/KG

3000J 6 UNIDENTIFIED COMPOUNDS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-05 COLLECTION START: 09/26/90 1225 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y293 MD NO: Y293

ANALYTICAL RESULTS UG/KG

800J 1 UNIDENTIFIED COMPOUND

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50974	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SS-06			COLLECTION START: 09/26/90 1250 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y294 MD NO: Y294

ANALYTICAL RESULTS UG/KG

10000J	10 UNIDENTIFIED COMPOUNDS
N	PETROLEUM PRODUCT
1000JN	HEXADECANOIC ACID

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-01
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 0845 STOP: 00/00/00
D. NUMBER: Y286

UG/KG	ANALYTICAL RESULTS
9.2U	ALPHA-BHC
9.2U	BETA-BHC
9.2U	DELTA-BHC
9.2U	GAMMA-BHC (LINDANE)
9.2U	HEPTACHLOR
9.2U	ALDRIN
9.2U	HEPTACHLOR EPOXIDE
9.2U	ENDOSULFAN I (ALPHA)
18U	DIELDRIN
18U	4,4'-DDE (P,P'-DDE)
18U	ENDRIN
18U	ENDOSULFAN II (BETA)
18U	4,4'-DDD (P,P'-DDD)
18U	ENDOSULFAN SULFATE
18U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
92U	METHOXYCHLOR
18U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
92U	GAMMA-CHLORDANE /2
92U	ALPHA-CHLORDANE /2
180U	TOXAPHENE
92U	PCB-1016 (AROCLOR 1016)
92U	PCB-1221 (AROCLOR 1221)
92U	PCB-1232 (AROCLOR 1232)
92U	PCB-1242 (AROCLOR 1242)
92U	PCB-1248 (AROCLOR 1248)
180U	PCB-1254 (AROCLOR 1254)
180U	PCB-1260 (AROCLOR 1260)
13	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-02
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 0930 STOP: 00/00/00
D. NUMBER: Y288

UG/KG	ANALYTICAL RESULTS
9.1U	ALPHA-BHC
9.1U	BETA-BHC
9.1U	DELTA-BHC
9.1U	GAMMA-BHC (LINDANE)
9.1U	HEPTACHLOR
9.1U	ALDRIN
9.1U	HEPTACHLOR EPOXIDE
9.1U	ENDOSULFAN I (ALPHA)
18U	DIELDRIN
18U	4,4'-DDE (P,P'-DDE)
18U	ENDRIN
18U	ENDOSULFAN II (BETA)
18U	4,4'-DDD (P,P'-DDD)
18U	ENDOSULFAN SULFATE
18U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
91U	METHOXYCHLOR
18U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
91U	GAMMA-CHLORDANE /2
91U	ALPHA-CHLORDANE /2
180U	TOXAPHENE
91U	PCB-1016 (AROCLOR 1016)
91U	PCB-1221 (AROCLOR 1221)
91U	PCB-1232 (AROCLOR 1232)
91U	PCB-1242 (AROCLOR 1242)
91U	PCB-1248 (AROCLOR 1248)
180U	PCB-1254 (AROCLOR 1254)
180U	PCB-1260 (AROCLOR 1260)
12	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL
SOURCE:
STATION ID: SS-03
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1030 STOP: 00/00/00
D. NUMBER: Y290

UG/KG	ANALYTICAL RESULTS
38U	ALPHA-BHC
38U	BETA-BHC
38U	DELTA-BHC
38U	GAMMA-BHC (LINDANE)
38U	HEPTACHLOR
38U	ALDRIN
38U	HEPTACHLOR EPOXIDE
38U	ENDOSULFAN I (ALPHA)
76U	DIELDRIN
76U	4,4'-DDE (P,P'-DDE)
76U	ENDRIN
76U	ENDOSULFAN II (BETA)
76U	4,4'-DDD (P,P'-DDD)
76U	ENDOSULFAN SULFATE
76U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
380U	METHOXYCHLOR
76U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
380U	GAMMA-CHLORDANE /2
380U	ALPHA-CHLORDANE /2
760U	TOXAPHENE
380U	PCB-1016 (AROCLOR 1016)
380U	PCB-1221 (AROCLOR 1221)
380U	PCB-1232 (AROCLOR 1232)
380U	PCB-1242 (AROCLOR 1242)
380U	PCB-1248 (AROCLOR 1248)
760U	PCB-1254 (AROCLOR 1254)
760U	PCB-1260 (AROCLOR 1260)
79	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-04
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1205 STOP: 00/00/00
D. NUMBER: Y292

UG/KG	ANALYTICAL RESULTS
9.9U	ALPHA-BHC
9.9U	BETA-BHC
9.9U	DELTA-BHC
9.9U	GAMMA-BHC (LINDANE)
9.9U	HEPTACHLOR
9.9U	ALDRIN
9.9U	HEPTACHLOR EPOXIDE
9.9U	ENDOSULFAN I (ALPHA)
20U	DIELDRIN
20U	4,4'-DDE (P,P'-DDE)
20U	ENDRIN
20U	ENDOSULFAN II (BETA)
20U	4,4'-DDD (P,P'-DDD)
20U	ENDOSULFAN SULFATE
20U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
99U	METHOXYCHLOR
20U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
99U	GAMMA-CHLORDANE /2
99U	ALPHA-CHLORDANE /2
200U	TOXAPHENE
99U	PCB-1016 (AROCLOR 1016)
99U	PCB-1221 (AROCLOR 1221)
99U	PCB-1232 (AROCLOR 1232)
99U	PCB-1242 (AROCLOR 1242)
99U	PCB-1248 (AROCLOR 1248)
200U	PCB-1254 (AROCLOR 1254)
200U	PCB-1260 (AROCLOR 1260)
19	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-05
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1225 STOP: 00/00/00
D. NUMBER: Y293

UG/KG	ANALYTICAL RESULTS
11U	ALPHA-BHC
11U	BETA-BHC
11U	DELTA-BHC
11U	GAMMA-BHC (LINDANE)
11U	HEPTACHLOR
11U	ALDRIN
11U	HEPTACHLOR EPOXIDE
11U	ENDOSULFAN I (ALPHA)
22U	DIELDRIN
22U	4,4'-DDE (P,P'-DDE)
22U	ENDRIN
22U	ENDOSULFAN II (BETA)
22U	4,4'-DDD (P,P'-DDD)
22U	ENDOSULFAN SULFATE
22U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
110U	METHOXYCHLOR
22U	ENDRIN KETONE
--	CHLORDANE (TECH. MIXTURE) /1
110U	GAMMA-CHLORDANE /2
110U	ALPHA-CHLORDANE /2
220U	TOXAPHENE
110U	PCB-1016 (AROCLOR 1016)
110U	PCB-1221 (AROCLOR 1221)
110U	PCB-1232 (AROCLOR 1232)
110U	PCB-1242 (AROCLOR 1242)
110U	PCB-1248 (AROCLOR 1248)
220U	PCB-1254 (AROCLOR 1254)
220U	PCB-1260 (AROCLOR 1260)
26	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-06
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1250 STOP: 00/00/00
D. NUMBER: Y294

UG/KG	ANALYTICAL RESULTS
9.6U	ALPHA-BHC
9.6U	BETA-BHC
9.6U	DELTA-BHC
9.6U	GAMMA-BHC (LINDANE)
9.6U	HEPTACHLOR
9.6U	ALDRIN
9.6U	HEPTACHLOR EPOXIDE
9.6U	ENDOSULFAN I (ALPHA)
19U	DIELDRIN
19U	4,4'-DDE (P,P'-DDE)
19U	ENDRIN
19U	ENDOSULFAN II (BETA)
19U	4,4'-DDD (P,P'-DDD)
19U	ENDOSULFAN SULFATE
19U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
96U	METHOXYCHLOR
19U	ENDRIN KETONE
--	CHLORDANE (TECH. MIXTURE) /1
96U	GAMMA-CHLORDANE /2
96U	ALPHA-CHLORDANE /2
190U	TOXAPHENE
96U	PCB-1016 (AROCLOR 1016)
96U	PCB-1221 (AROCLOR 1221)
96U	PCB-1232 (AROCLOR 1232)
96U	PCB-1242 (AROCLOR 1242)
96U	PCB-1248 (AROCLOR 1248)
190U	PCB-1254 (AROCLOR 1254)
190U	PCB-1260 (AROCLOR 1260)
17	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-01 COLLECTION START: 09/26/90 0845 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y286

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
89000	ALUMINUM	130	MANGANESE
20U	ANTIMONY	.16U	MERCURY
13J	ARSENIC	9.1U	NICKEL
52	BARIUM	290U	POTASSIUM
.33U	BERYLLIUM	.98UJ	SELENIUM
1.3U	CADMIUM	1.3U	SILVER
430	CALCIUM	30U	SODIUM
65J	CHROMIUM	.65U	THALLIUM
2.3U	COBALT	NA	TIN
32	COPPER	220	VANADIUM
73000	IRON	29	ZINC
58J	LEAD	38	PERCENT MOISTURE
490	MAGNESIUM		

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-02 COLLECTION START: 09/26/90 0930 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y288

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
21000	ALUMINUM	390	MANGANESE
6.6U	ANTIMONY	.11U	MERCURY
2.6J	ARSENIC	7.8	NICKEL
54	BARIUM	580U	POTASSIUM
.23U	BERYLLIUM	1.9	SELENIUM
.91U	CADMIUM	.91U	SILVER
480	CALCIUM	18U	SODIUM
54J	CHROMIUM	.46U	THALLIUM
5.2	COBALT	NA	TIN
17	COPPER	64	VANADIUM
24000	IRON	73	ZINC
18J	LEAD	12	PERCENT MOISTURE
410	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-03 COLLECTION START: 09/26/90 1030 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y290

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
33000	ALUMINUM	1400	MANGANESE
30U	ANTIMONY	.48U	MERCURY
8UJ	ARSENIC	30	NICKEL
230	BARIUM	1400	POTASSIUM
.96U	BERYLLIUM	2.9U	SELENIUM
3.8U	CADMIUM	3.8U	SILVER
2000	CALCIUM	150	SODIUM
44J	CHROMIUM	1.9U	THALLIUM
240	COBALT	NA	TIN
38	COPPER	80	VANADIUM
100000	IRON	120	ZINC
51J	LEAD	79	PERCENT MOISTURE
1600	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-04 COLLECTION START: 09/26/90 1205 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y292

MG/KG	ANALYTICAL RESULTS
61000	ALUMINUM
8.4U	ANTIMONY
.87UR	ARSENIC
110	BARIUM
.29U	BERYLLIUM
1.2U	CADMIUM
790	CALCIUM
88J	CHROMIUM
9	COBALT
40	COPPER
63000	IRON
34J	LEAD
2000	MAGNESIUM
170	MANGANESE
.14U	MERCURY
19	NICKEL
2100	POTASSIUM
.87U	SELENIUM
1.2U	SILVER
30U	SODIUM
.58U	THALLIUM
NA	TIN
180	VANADIUM
33	ZINC
31	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-05 COLLECTION START: 09/26/90 1225 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y293

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
11000	ALUMINUM	65	MANGANESE
7.8U	ANTIMONY	.14U	MERCURY
11J	ARSENIC	16	NICKEL
200	BARIUM	900U	POTASSIUM
2U	BERYLLIUM	2U	SELENIUM
1.1U	CADMIUM	1.1U	SILVER
4400	CALCIUM	190	SODIUM
13J	CHROMIUM	1U	THALLIUM
8	COBALT	NA	TIN
35	COPPER	44	VANADIUM
10000	IRON	20U	ZINC
11J	LEAD	26	PERCENT MOISTURE
760	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

METALS DATA REPORT 11/13/90

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-06 COLLECTION START: 09/26/90 1250 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y294

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
26000	ALUMINUM	450	MANGANESE
7.2U	ANTIMONY	.12U	MERCURY
3UJ	ARSENIC	7U	NICKEL
140	BARIUM	1200U	POTASSIUM
.25U	BERYLLIUM	.75U	SELENIUM
1U	CADMIUM	2.9JN	SILVER
3100	CALCIUM	20U	SODIUM
44J	CHROMIUM	.50U	THALLIUM
7.4	COBALT	NA	TIN
23	COPPER	73	VANADIUM
28000	IRON	38	ZINC
33J	LEAD	20	PERCENT MOISTURE
1000	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-01 COLLECTION START: 09/26/90 0845 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y286 MD NO: Y286

RESULTS	UNITS	PARAMETER
1.6U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-02 COLLECTION START: 09/26/90 0930 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y288 MD NO: Y288

RESULTS	UNITS	PARAMETER
1.1U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-03 COLLECTION START: 09/26/90 1030 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y290 MD NO: Y290

RESULTS	UNITS	PARAMETER
4.8U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-04 COLLECTION START: 09/26/90 1205 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y292 MD NO: Y292

RESULTS	UNITS	PARAMETER
1.4U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-05 COLLECTION START: 09/26/90 1225 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y293 MD NO: Y293

RESULTS	UNITS	PARAMETER
1.4U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-06 COLLECTION START: 09/26/90 1250 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y294 MD NO: Y294

RESULTS	UNITS	PARAMETER
1.2U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS. GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-01 COLLECTION START: 09/26/90 0905 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y287

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
20U	METHYLENE CHLORIDE
30U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
14	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-01 COLLECTION START: 09/26/90 0905 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y287 MD NO: Y287

ANALYTICAL RESULTS UG/KG

90JN TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE: PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: CITY: STARTEX ST: SC
STATION ID: SB-02 COLLECTION START: 09/26/90 1000 STOP: 00/00/00
CASE NO.: 14949 SAS NO.: D. NO.: Y289

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
20U	METHYLENE CHLORIDE
12U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
14	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS. GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-03 COLLECTION START: 09/26/90 1055 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y291

UG/KG	ANALYTICAL RESULTS
15U	CHLOROMETHANE
15U	BROMOMETHANE
15U	VINYL CHLORIDE
15U	CHLOROETHANE
20U	METHYLENE CHLORIDE
50U	ACETONE
7U	CARBON DISULFIDE
7U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
7U	1,1-DICHLOROETHANE
7U	1,2-DICHLOROETHENE (TOTAL)
7U	CHLOROFORM
7U	1,2-DICHLOROETHANE
15U	METHYL ETHYL KETONE
7U	1,1,1-TRICHLOROETHANE
7U	CARBON TETRACHLORIDE
15U	VINYL ACETATE
7U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
7U	1,2-DICHLOROPROPANE
7U	CIS-1,3-DICHLOROPROPENE
7U	TRICHLOROETHENE(TRICHLOROETHYLENE)
7U	DIBROMOCHLOROMETHANE
7U	1,1,2-TRICHLOROETHANE
7U	BENZENE
7U	TRANS-1,3-DICHLOROPROPENE
7U	BROMOFORM
15U	METHYL ISOBUTYL KETONE
15U	METHYL BUTYL KETONE
7U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
7U	1,1,2,2-TETRACHLOROETHANE
7U	TOLUENE
19	CHLOROBENZENE
9	ETHYL BENZENE
7U	STYRENE
22	TOTAL XYLENES
33	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50971	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SB-03			COLLECTION START: 09/26/90 1055 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y291 MD NO: Y291

ANALYTICAL RESULTS UG/KG

10JN	TETRAMETHYLBUTANE
100JN	ETHYLMETHYBENZENE (2 ISOMERS)

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-06 COLLECTION START: 09/26/90 1315 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y295

UG/KG	ANALYTICAL RESULTS
11U	CHLOROMETHANE
11U	BROMOMETHANE
11U	VINYL CHLORIDE
11U	CHLOROETHANE
50U	METHYLENE CHLORIDE
11U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
11U	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
11U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
11U	METHYL ISOBUTYL KETONE
11U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES
7	PERCENT MOISTURE

REMARKS ***REMARKS***

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50975	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SB-06			COLLECTION START 09/26/90 1315 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y295 MD NO: Y295

ANALYTICAL RESULTS UG/KG

20J 1 UNIDENTIFIED COMPOUND

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-01 COLLECTION START: 09/26/90 0905 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y287

UG/KG	ANALYTICAL RESULTS
380U	PHENOL
380U	BIS(2-CHLOROETHYL) ETHER
380U	2-CHLOROPHENOL
380U	1,3-DICHLOROBENZENE
380U	1,4-DICHLOROBENZENE
380U	BENZYL ALCOHOL
380U	1,2-DICHLOROBENZENE
380U	2-METHYLPHENOL
380UR	BIS(2-CHLOROISOPROPYL) ETHER
380U	(3-AND/OR 4-)METHYLPHENOL
380U	N-NITROSODI-N-PROPYLAMINE
380U	HEXACHLOROETHANE
380U	NITROBENZENE
380U	ISOPHORONE
380U	2-NITROPHENOL
380U	2,4-DIMETHYLPHENOL
1900U	BENZOIC ACID
380U	BIS(2-CHLOROETHOXY) METHANE
380U	2,4-DICHLOROPHENOL
380UR	1,2,4-TRICHLOROBENZENE
380U	NAPHTHALENE
380U	4-CHLOROANILINE
380U	HEXACHLOROBUTADIENE
380U	4-CHLORO-3-METHYLPHENOL
380U	2-METHYLNAPHTHALENE
380U	HEXACHLOROCYCLOPENTADIENE (HCCP)
380U	2,4,6-TRICHLOROPHENOL
1900U	2,4,5-TRICHLOROPHENOL
380UR	2-CHLORONAPHTHALENE
1900U	2-NITROANILINE
380U	DIMETHYL PHTHALATE
380U	ACENAPHTHYLENE
380U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1900U	3-NITROANILINE
380U	ACENAPHTHENE
1900U	2,4-DINITROPHENOL
1900U	4-NITROPHENOL
380U	DIBENZOFURAN
380U	2,4-DINITROTOLUENE
380U	DIETHYL PHTHALATE
380U	4-CHLOROPHENYL PHENYL ETHER
380U	FLUORENE
1900U	4-NITROANILINE
1900U	2-METHYL-4,6-DINITROPHENOL
380U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
380U	4-BROMOPHENYL PHENYL ETHER
380U	HEXACHLOROBENZENE (HCB)
1900UJ	PENTACHLOROPHENOL
380U	PHENANTHRENE
380U	ANTHRACENE
380U	DI-N-BUTYLPHTHALATE
380U	FLUORANTHENE
380U	PYRENE
380U	BENZYL BUTYL PHTHALATE
770U	3,3'-DICHLOROBENZIDINE
380U	BENZO(A)ANTHRACENE
380U	CHRYSENE
900	BIS(2-ETHYLHEXYL) PHTHALATE
380U	DI-N-OCTYLPHTHALATE
380U	BENZO(B AND/OR K)FLUORANTHENE
380U	BENZO-A-PYRENE
380U	INDENO (1,2,3-CD) PYRENE
380U	DIBENZO(A,H)ANTHRACENE
380U	BENZO(GHI)PERYLENE
14	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE:
SOURCE:
STATION ID: SB-02

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1000 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y289

UG/KG	ANALYTICAL RESULTS
390U	PHENOL
390U	BIS(2-CHLOROETHYL) ETHER
390U	2-CHLOROPHENOL
390U	1,3-DICHLOROBENZENE
390U	1,4-DICHLOROBENZENE
390U	BENZYL ALCOHOL
390U	1,2-DICHLOROBENZENE
390U	2-METHYLPHENOL
390UR	BIS(2-CHLOROISOPROPYL) ETHER
390U	(3-AND/OR 4-)METHYLPHENOL
390U	N-NITROSODI-N-PROPYLAMINE
390U	HEXACHLOROETHANE
390U	NITROBENZENE
390U	ISOPHORONE
390U	2-NITROPHENOL
390U	2,4-DIMETHYLPHENOL
1900U	BENZOIC ACID
390U	BIS(2-CHLOROETHOXY) METHANE
390U	2,4-DICHLOROPHENOL
390UR	1,2,4-TRICHLOROBENZENE
390U	NAPHTHALENE
390U	4-CHLOROANILINE
390U	HEXACHLOROBUTADIENE
390U	4-CHLORO-3-METHYLPHENOL
390U	2-METHYLNAPHTHALENE
390U	HEXACHLOROCYCLOPENTADIENE (HCCP)
390U	2,4,6-TRICHLOROPHENOL
1900U	2,4,5-TRICHLOROPHENOL
390UR	2-CHLORONAPHTHALENE
1900U	2-NITROANILINE
390U	DIMETHYL PHTHALATE
390U	ACENAPHTHYLENE
390U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1900U	3-NITROANILINE
390U	ACENAPHTHENE
1900U	2,4-DINITROPHENOL
1900U	4-NITROPHENOL
390U	DIBENZOFURAN
390U	2,4-DINITROTOLUENE
390U	DIETHYL PHTHALATE
390U	4-CHLOROPHENYL PHENYL ETHER
390U	FLUORENE
1900U	4-NITROANILINE
1900U	2-METHYL-4,6-DINITROPHENOL
390U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
390U	4-BROMOPHENYL PHENYL ETHER
390U	HEXACHLOROBENZENE (HCB)
1900UJ	PENTACHLOROPHENOL
390U	PHENANTHRENE
390U	ANTHRACENE
390U	DI-N-BUTYLPHTHALATE
390U	FLUORANTHENE
390U	PYRENE
390U	BENZYL BUTYL PHTHALATE
770U	3,3'-DICHLOROBENZIDINE
390U	BENZO(A)ANTHRACENE
390U	CHRYSENE
390U	BIS(2-ETHYLHEXYL) PHTHALATE
390U	DI-N-OCTYLPHTHALATE
390U	BENZO(B AND/OR K)FLUORANTHENE
390U	BENZO-A-PYRENE
390U	INDENO (1,2,3-CD) PYRENE
390U	DIBENZO(A,H)ANTHRACENE
390U	BENZO(GHI)PERYLENE
14	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-03

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1055 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y291

UG/KG	ANALYTICAL RESULTS
490U	PHENOL
490U	BIS(2-CHLOROETHYL) ETHER
490U	2-CHLOROPHENOL
490U	1,3-DICHLOROBENZENE
490U	1,4-DICHLOROBENZENE
490U	BENZYL ALCOHOL
490U	1,2-DICHLOROBENZENE
490U	2-METHYLPHENOL
490UR	BIS(2-CHLOROISOPROPYL) ETHER
490U	(3-AND/OR 4-)METHYLPHENOL
490U	N-NITROSODI-N-PROPYLAMINE
490U	HEXACHLOROETHANE
490U	NITROBENZENE
490U	ISOPHORONE
490U	2-NITROPHENOL
490U	2,4-DIMETHYLPHENOL
2400U	BENZOIC ACID
490U	BIS(2-CHLOROETHOXY) METHANE
490U	2,4-DICHLOROPHENOL
490UR	1,2,4-TRICHLOROBENZENE
490U	NAPHTHALENE
490U	4-CHLOROANILINE
490U	HEXACHLOROBUTADIENE
490U	4-CHLORO-3-METHYLPHENOL
490U	2-METHYLNAPHTHALENE
490U	HEXACHLOROCYCLOPENTADIENE (HCCP)
490U	2,4,6-TRICHLOROPHENOL
2400U	2,4,5-TRICHLOROPHENOL
490UR	2-CHLORONAPHTHALENE
2400U	2-NITROANILINE
490U	DIMETHYL PHTHALATE
490U	ACENAPHTHYLENE
490U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2400U	3-NITROANILINE
490U	ACENAPHTHENE
2400U	2,4-DINITROPHENOL
2400U	4-NITROPHENOL
490U	DIBENZOFURAN
490U	2,4-DINITROTOLUENE
490U	DIETHYL PHTHALATE
490U	4-CHLOROPHENYL PHENYL ETHER
490U	FLUORENE
2400U	4-NITROANILINE
2400U	2-METHYL-4,6-DINITROPHENOL
490U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
490U	4-BROMOPHENYL PHENYL ETHER
490U	HEXACHLOROBENZENE (HCB)
2400UJ	PENTACHLOROPHENOL
490U	PHENANTHRENE
490U	ANTHRACENE
490U	DI-N-BUTYLPHTHALATE
490U	FLUORANTHENE
490U	PYRENE
490U	BENZYL BUTYL PHTHALATE
990U	3,3'-DICHLOROBENZIDINE
490U	BENZO(A)ANTHRACENE
490U	CHRYSENE
490U	BIS(2-ETHYLHEXYL) PHTHALATE
490U	DI-N-OCTYLPHTHALATE
490U	BENZO(B AND/OR K)FLUORANTHENE
490U	BENZO-A-PYRENE
490U	INDENO (1,2,3-CD) PYRENE
490U	DIBENZO(A,H)ANTHRACENE
490U	BENZO(GHI)PERYLENE
33	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS, GA.

11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-03 COLLECTION START 09/26/90 1055 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y291 MD NO: Y291

ANALYTICAL RESULTS UG/KG

2000JN	BUTOXYETHANOLPHOSPHATE
2000JN	BENZOTHIAZOLONE
10000J	14 UNIDENTIFIED COMPOUNDS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-06

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1315 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y295

UG/KG	ANALYTICAL RESULTS
350U	PHENOL
350U	BIS(2-CHLOROETHYL) ETHER
350U	2-CHLOROPHENOL
350U	1,3-DICHLOROBENZENE
350U	1,4-DICHLOROBENZENE
350U	BENZYL ALCOHOL
350U	1,2-DICHLOROBENZENE
350U	2-METHYLPHENOL
350UR	BIS(2-CHLOROISOPROPYL) ETHER
350U	(3-AND/OR 4-)METHYLPHENOL
350U	N-NITROSODI-N-PROPYLAMINE
350U	HEXACHLOROETHANE
350U	NITROBENZENE
350U	ISOPHORONE
350U	2-NITROPHENOL
350U	2,4-DIMETHYLPHENOL
1700U	BENZOIC ACID
350U	BIS(2-CHLOROETHOXY) METHANE
350U	2,4-DICHLOROPHENOL
350UR	1,2,4-TRICHLOROBENZENE
350U	NAPHTHALENE
350U	4-CHLOROANILINE
350U	HEXACHLOROBUTADIENE
350U	4-CHLORO-3-METHYLPHENOL
350U	2-METHYLNAPHTHALENE
350U	HEXACHLOROCYCLOPENTADIENE (HCCP)
350U	2,4,6-TRICHLOROPHENOL
1700U	2,4,5-TRICHLOROPHENOL
350UR	2-CHLORONAPHTHALENE
1700U	2-NITROANILINE
350U	DIMETHYL PHTHALATE
350U	ACENAPHTHYLENE
350U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1700U	3-NITROANILINE
350U	ACENAPHTHENE
1700U	2,4-DINITROPHENOL
1700U	4-NITROPHENOL
350U	DIBENZOFURAN
350U	2,4-DINITROTOLUENE
350U	DIETHYL PHTHALATE
350U	4-CHLOROPHENYL PHENYL ETHER
350U	FLUORENE
1700U	4-NITROANILINE
1700U	2-METHYL-4,6-DINITROPHENOL
350U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
350U	4-BROMOPHENYL PHENYL ETHER
350U	HEXACHLOROBENZENE (HCB)
1700UJ	PENTACHLOROPHENOL
350U	PHENANTHRENE
350U	ANTHRACENE
350U	DI-N-BUTYLPHTHALATE
350U	FLUORANTHENE
350U	PYRENE
350U	BENZYL BUTYL PHTHALATE
710U	3,3'-DICHLOROBENZIDINE
350U	BENZO(A)ANTHRACENE
350U	CHRYSENE
350U	BIS(2-ETHYLHEXYL) PHTHALATE
350U	DI-N-OCTYLPHTHALATE
350U	BENZO(B AND/OR K)FLUORANTHENE
350U	BENZO-A-PYRENE
350U	INDENO (1,2,3-CD) PYRENE
350U	DIBENZO(A,H)ANTHRACENE
350U	BENZO(GHI)PERYLENE
7	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-01
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 0905 STOP: 00/00/00
D. NUMBER: Y287

UG/KG	ANALYTICAL RESULTS
9.3U	ALPHA-BHC
9.3U	BETA-BHC
9.3U	DELTA-BHC
9.3U	GAMMA-BHC (LINDANE)
9.3U	HEPTACHLOR
9.3U	ALDRIN
9.3U	HEPTACHLOR EPOXIDE
9.3U	ENDOSULFAN I (ALPHA)
19U	DIELDRIN
19U	4,4'-DDE (P,P'-DDE)
19U	ENDRIN
19U	ENDOSULFAN II (BETA)
19U	4,4'-DDD (P,P'-DDD)
19U	ENDOSULFAN SULFATE
19U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
93U	METHOXYCHLOR
19U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
93U	GAMMA-CHLORDANE /2
93U	ALPHA-CHLORDANE /2
190U	TOXAPHENE
93U	PCB-1016 (AROCLOR 1016)
93U	PCB-1221 (AROCLOR 1221)
93U	PCB-1232 (AROCLOR 1232)
93U	PCB-1242 (AROCLOR 1242)
93U	PCB-1248 (AROCLOR 1248)
190U	PCB-1254 (AROCLOR 1254)
190U	PCB-1260 (AROCLOR 1260)
14	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.
*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE:
SOURCE:
STATION ID: SB-02
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1000 STOP: 00/00/00
D. NUMBER: Y289

UG/KG	ANALYTICAL RESULTS
9.3U	ALPHA-BHC
9.3U	BETA-BHC
9.3U	DELTA-BHC
9.3U	GAMMA-BHC (LINDANE)
9.3U	HEPTACHLOR
9.3U	ALDRIN
9.3U	HEPTACHLOR EPOXIDE
9.3U	ENDOSULFAN I (ALPHA)
19U	DIELDRIN
19U	4,4'-DDE (P,P'-DDE)
19U	ENDRIN
19U	ENDOSULFAN II (BETA)
19U	4,4'-DDD (P,P'-DDD)
19U	ENDOSULFAN SULFATE
19U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
93U	METHOXYCHLOR
19U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
93U	GAMMA-CHLORDANE /2
93U	ALPHA-CHLORDANE /2
190U	TOXAPHENE
93U	PCB-1016 (AROCLOR 1016)
93U	PCB-1221 (AROCLOR 1221)
93U	PCB-1232 (AROCLOR 1232)
93U	PCB-1242 (AROCLOR 1242)
93U	PCB-1248 (AROCLOR 1248)
190U	PCB-1254 (AROCLOR 1254)
190U	PCB-1260 (AROCLOR 1260)
14	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.
*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-03 COLLECTION START: 09/26/90 1055 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y291

UG/KG	ANALYTICAL RESULTS
12U	ALPHA-BHC
12U	BETA-BHC
12U	DELTA-BHC
12U	GAMMA-BHC (LINDANE)
12U	HEPTACHLOR
12U	ALDRIN
12U	HEPTACHLOR EPOXIDE
12U	ENDOSULFAN I (ALPHA)
24U	DIELDRIN
24U	4,4'-DDE (P,P'-DDE)
24U	ENDRIN
24U	ENDOSULFAN II (BETA)
24U	4,4'-DDD (P,P'-DDD)
24U	ENDOSULFAN SULFATE
24U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
120U	METHOXYCHLOR
24U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
120U	GAMMA-CHLORDANE /2
120U	ALPHA-CHLORDANE /2
240U	TOXAPHENE
120U	PCB-1016 (AROCLOR 1016)
120U	PCB-1221 (AROCLOR 1221)
120U	PCB-1232 (AROCLOR 1232)
120U	PCB-1242 (AROCLOR 1242)
120U	PCB-1248 (AROCLOR 1248)
240U	PCB-1254 (AROCLOR 1254)
240U	PCB-1260 (AROCLOR 1260)
33	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-06
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1315 STOP: 00/00/00
D. NUMBER: Y295

UG/KG	ANALYTICAL RESULTS
8.6U	ALPHA-BHC
8.6U	BETA-BHC
8.6U	DELTA-BHC
8.6U	GAMMA-BHC (LINDANE)
8.6U	HEPTACHLOR
8.6U	ALDRIN
8.6U	HEPTACHLOR EPOXIDE
8.6U	ENDOSULFAN I (ALPHA)
17U	DIELDRIN
17U	4,4'-DDE (P,P'-DDE)
17U	ENDRIN
17U	ENDOSULFAN II (BETA)
17U	4,4'-DDD (P,P'-DDD)
17U	ENDOSULFAN SULFATE
17U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
86U	METHOXYCHLOR
17U	ENDRIN KETONE
--	CHLORDANE (TECH. MIXTURE) /1
86U	GAMMA-CHLORDANE /2
86U	ALPHA-CHLORDANE /2
170U	TOXAPHENE
86U	PCB-1016 (AROCLOR 1016)
86U	PCB-1221 (AROCLOR 1221)
86U	PCB-1232 (AROCLOR 1232)
86U	PCB-1242 (AROCLOR 1242)
86U	PCB-1248 (AROCLOR 1248)
170U	PCB-1254 (AROCLOR 1254)
170U	PCB-1260 (AROCLOR 1260)
7	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-01 COLLECTION START: 09/26/90 0905 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y287

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
61000	ALUMINUM	410	MANGANESE
20U	ANTIMONY	.12U	MERCURY
.70UR	ARSENIC	17	NICKEL
180	BARIUM	6800	POTASSIUM
.23U	BERYLLIUM	.70U	SELENIUM
.93U	CADMIUM	.93U	SILVER
20U	CALCIUM	20U	SODIUM
40J	CHROMIUM	.47U	THALLIUM
18	COBALT	NA	TIN
92	COPPER	170	VANADIUM
68000	IRON	87	ZINC
39J	LEAD	14	PERCENT MOISTURE
7700	MAGNESIUM		

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-02 COLLECTION START: 09/26/90 1000 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y289

MG/KG	ANALYTICAL RESULTS
80000	ALUMINUM
6.9U	ANTIMONY
2UJ	ARSENIC
60	BARIUM
.24U	BERYLLIUM
.95U	CADMIUM
200	CALCIUM
130J	CHROMIUM
8.5	COBALT
71	COPPER
94000	IRON
24J	LEAD
800	MAGNESIUM

MG/KG	ANALYTICAL RESULTS
400	MANGANESE
.12U	MERCURY
28	NICKEL
980U	POTASSIUM
3.7J	SELENIUM
.95U	SILVER
20U	SODIUM
.47U	THALLIUM
NA	TIN
250	VANADIUM
45	ZINC
16	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-03 COLLECTION START: 09/26/90 1055 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y291

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
6500	ALUMINUM	900	MANGANESE
9.2U	ANTIMONY	.16U	MERCURY
.95UR	ARSENIC	8.9U	NICKEL
52	BARIUM	250U	POTASSIUM
.32U	BERYLLIUM	.95U	SELENIUM
1.3U	CADMIUM	1.3U	SILVER
350	CALCIUM	25U	SODIUM
18J	CHROMIUM	.63U	THALLIUM
48	COBALT	NA	TIN
2.8	COPPER	16	VANADIUM
4300	IRON	7U	ZINC
9.8J	LEAD	37	PERCENT MOISTURE
290	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-06
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1315 STOP: 00/00/00
MD NUMBER: Y295

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
39000	ALUMINUM	290	MANGANESE
6.3U	ANTIMONY	.11U	MERCURY
2UJ	ARSENIC	7.5	NICKEL
75	BARIUM	920U	POTASSIUM
1U	BERYLLIUM	.65U	SELENIUM
.87U	CADMIUM	3.7JN	SILVER
330	CALCIUM	20U	SODIUM
140J	CHROMIUM	.44U	THALLIUM
6	COBALT	NA	TIN
29	COPPER	100	VANADIUM
37000	IRON	27	ZINC
16J	LEAD	08	PERCENT MOISTURE
880	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-01 COLLECTION START: 09/26/90 0905 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y287 MD NO: Y287

RESULTS	UNITS	PARAMETER
1.2U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-02 COLLECTION START: 09/26/90 1000 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y289 MD NO: Y289

RESULTS	UNITS	PARAMETER
1.2U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-03 COLLECTION START: 09/26/90 1055 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y291 MD NO: Y291

RESULTS	UNITS	PARAMETER
1.6U	MG/KG	CYANIDE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-06 COLLECTION START: 09/26/90 1315 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y295 MD NO: Y295

RESULTS	UNITS	PARAMETER
1.1U	MG/KG	CYANIDE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y278

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
200U	METHYLENE CHLORIDE
12U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
17	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50958	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SD-01			COLLECTION START 09/25/90 0855 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y278 MD NO: Y278

ANALYTICAL RESULTS UG/KG

50J 3 UNIDENTIFIED COMPOUNDS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-02

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1040 STOP: 00/00/00

D. NO.: Y280

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
20U	METHYLENE CHLORIDE
20U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
19	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-02 COLLECTION START: 09/25/90 1040 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y280 MD NO: Y280

ANALYTICAL RESULTS UG/KG

10JN TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-03

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1250 STOP: 00/00/00

D. NO.: Y282

UG/KG	ANALYTICAL RESULTS
13U	CHLOROMETHANE
13U	BROMOMETHANE
13U	VINYL CHLORIDE
13U	CHLOROETHANE
30U	METHYLENE CHLORIDE
13U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
13U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
13U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
13U	METHYL ISOBUTYL KETONE
13U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
22	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-03 COLLECTION START 09/25/90 1250 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y282 MD NO: Y282

ANALYTICAL RESULTS UG/KG

20JN	TETRAMETHYLBUTANE	

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-04 COLLECTION START: 09/25/90 1240 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y284

UG/KG	ANALYTICAL RESULTS
13U	CHLOROMETHANE
13U	BROMOMETHANE
13U	VINYL CHLORIDE
13U	CHLOROETHANE
9U	METHYLENE CHLORIDE
30U	ACETONE
7U	CARBON DISULFIDE
7U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
7U	1,1-DICHLOROETHANE
7U	1,2-DICHLOROETHENE (TOTAL)
7U	CHLOROFORM
7U	1,2-DICHLOROETHANE
13U	METHYL ETHYL KETONE
7U	1,1,1-TRICHLOROETHANE
7U	CARBON TETRACHLORIDE
13U	VINYL ACETATE
7U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
7U	1,2-DICHLOROPROPANE
7U	CIS-1,3-DICHLOROPROPENE
7U	TRICHLOROETHENE(TRICHLOROETHYLENE)
7U	DIBROMOCHLOROMETHANE
7U	1,1,2-TRICHLOROETHANE
7U	BENZENE
7U	TRANS-1,3-DICHLOROPROPENE
7U	BROMOFORM
13U	METHYL ISOBUTYL KETONE
13U	METHYL BUTYL KETONE
7U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
7U	1,1,2,2-TETRACHLOROETHANE
7U	TOLUENE
7U	CHLOROBENZENE
7U	ETHYL BENZENE
7U	STYRENE
7U	TOTAL XYLENES
25	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-04 COLLECTION START: 09/25/90 1240 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y284 MD NO: Y284

ANALYTICAL RESULTS UG/KG

20JN TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y278

UG/KG	ANALYTICAL RESULTS
400U	PHENOL
400U	BIS(2-CHLOROETHYL) ETHER
400U	2-CHLOROPHENOL
400U	1,3-DICHLOROBENZENE
400U	1,4-DICHLOROBENZENE
400U	BENZYL ALCOHOL
400U	1,2-DICHLOROBENZENE
400U	2-METHYLPHENOL
400UR	BIS(2-CHLOROISOPROPYL) ETHER
400U	(3-AND/OR 4-)METHYLPHENOL
400U	N-NITROSODI-N-PROPYLAMINE
400U	HEXACHLOROETHANE
400U	NITROBENZENE
400U	ISOPHORONE
400U	2-NITROPHENOL
400U	2,4-DIMETHYLPHENOL
1900U	BENZOIC ACID
400U	BIS(2-CHLOROETHOXY) METHANE
400U	2,4-DICHLOROPHENOL
400UR	1,2,4-TRICHLOROBENZENE
400U	NAPHTHALENE
400U	4-CHLOROANILINE
400U	HEXACHLOROBUTADIENE
400U	4-CHLORO-3-METHYLPHENOL
400U	2-METHYLNAPHTHALENE
400U	HEXACHLOROCYCLOPENTADIENE (HCCP)
400U	2,4,6-TRICHLOROPHENOL
1900U	2,4,5-TRICHLOROPHENOL
400UR	2-CHLORONAPHTHALENE
1900U	2-NITROANILINE
400U	DIMETHYL PHTHALATE
400U	ACENAPHTHYLENE
400U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1900U	3-NITROANILINE
400U	ACENAPHTHENE
1900U	2,4-DINITROPHENOL
1900U	4-NITROPHENOL
400U	DIBENZOFURAN
400U	2,4-DINITROTOLUENE
400U	DIETHYL PHTHALATE
400U	4-CHLOROPHENYL PHENYL ETHER
400U	FLUORENE
1900U	4-NITROANILINE
1900U	2-METHYL-4,6-DINITROPHENOL
400U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
400U	4-BROMOPHENYL PHENYL ETHER
400U	HEXACHLOROBENZENE (HCB)
1900UJ	PENTACHLOROPHENOL
400U	PHENANTHRENE
400U	ANTHRACENE
400U	DI-N-BUTYLPHTHALATE
400U	FLUORANTHENE
400U	PYRENE
400U	BENZYL BUTYL PHTHALATE
800U	3,3'-DICHLOROBENZIDINE
400U	BENZO(A)ANTHRACENE
400U	CHRYSENE
400U	BIS(2-ETHYLHEXYL) PHTHALATE
400U	DI-N-OCTYLPHTHALATE
400U	BENZO(B AND/OR K)FLUORANTHENE
400U	BENZO-A-PYRENE
400U	INDENO (1,2,3-CD) PYRENE
400U	DIBENZO(A,H)ANTHRACENE
400U	BENZO(GHI)PERYLENE
17	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-02 COLLECTION START: 09/25/90 1040 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y280

UG/KG	ANALYTICAL RESULTS
410U	PHENOL
410U	BIS(2-CHLOROETHYL) ETHER
410U	2-CHLOROPHENOL
410U	1,3-DICHLOROBENZENE
410U	1,4-DICHLOROBENZENE
410U	BENZYL ALCOHOL
410U	1,2-DICHLOROBENZENE
410U	2-METHYLPHENOL
410UR	BIS(2-CHLOROISOPROPYL) ETHER
410U	(3-AND/OR 4-)METHYLPHENOL
410U	N-NITROSODI-N-PROPYLAMINE
410U	HEXACHLOROETHANE
410U	NITROBENZENE
410U	ISOPHORONE
410U	2-NITROPHENOL
410U	2,4-DIMETHYLPHENOL
2000U	BENZOIC ACID
410U	BIS(2-CHLOROETHOXY) METHANE
410U	2,4-DICHLOROPHENOL
410UR	1,2,4-TRICHLOROBENZENE
410U	NAPHTHALENE
410U	4-CHLOROANILINE
410U	HEXACHLOROBUTADIENE
410U	4-CHLORO-3-METHYLPHENOL
410U	2-METHYLNAPHTHALENE
410U	HEXACHLOROCYCLOPENTADIENE (HCCP)
410U	2,4,6-TRICHLOROPHENOL
2000U	2,4,5-TRICHLOROPHENOL
410UR	2-CHLORONAPHTHALENE
2000U	2-NITROANILINE
410U	DIMETHYL PHTHALATE
410U	ACENAPHTHYLENE
410U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2000U	3-NITROANILINE
410U	ACENAPHTHENE
2000U	2,4-DINITROPHENOL
2000U	4-NITROPHENOL
410U	DIBENZOFURAN
410U	2,4-DINITROTOLUENE
410U	DIETHYL PHTHALATE
410U	4-CHLOROPHENYL PHENYL ETHER
410U	FLUORENE
2000U	4-NITROANILINE
2000U	2-METHYL-4,6-DINITROPHENOL
410U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
410U	4-BROMOPHENYL PHENYL ETHER
410U	HEXACHLOROBENZENE (HCB)
2000UJ	PENTACHLOROPHENOL
410U	PHENANTHRENE
410U	ANTHRACENE
410U	DI-N-BUTYLPHTHALATE
410U	FLUORANTHENE
410U	PYRENE
410U	BENZYL BUTYL PHTHALATE
820U	3,3'-DICHLOROBENZIDINE
410U	BENZO(A)ANTHRACENE
410U	CHRYSENE
410U	BIS(2-ETHYLHEXYL) PHTHALATE
410U	DI-N-OCTYLPHTHALATE
410U	BENZO(B AND/OR K)FLUORANTHENE
410U	BENZO-A-PYRENE
410U	INDENO (1,2,3-CD) PYRENE
410U	DIBENZO(A,H)ANTHRACENE
410U	BENZO(GHI)PERYLENE
19	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTAN8
STATION ID: SD-03

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1250 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y282

UG/KG	ANALYTICAL RESULTS
420U	PHENOL
420U	BIS(2-CHLOROETHYL) ETHER
420U	2-CHLOROPHENOL
420U	1,3-DICHLOROBENZENE
420U	1,4-DICHLOROBENZENE
420U	BENZYL ALCOHOL
420U	1,2-DICHLOROBENZENE
420U	2-METHYLPHENOL
420UR	BIS(2-CHLOROISOPROPYL) ETHER
420U	(3-AND/OR 4-)METHYLPHENOL
420U	N-NITROSODI-N-PROPYLAMINE
420U	HEXACHLOROETHANE
420U	NITROBENZENE
420U	ISOPHORONE
420U	2-NITROPHENOL
420U	2,4-DIMETHYLPHENOL
2100U	BENZOIC ACID
420U	BIS(2-CHLOROETHOXY) METHANE
420U	2,4-DICHLOROPHENOL
420UR	1,2,4-TRICHLOROBENZENE
420U	NAPHTHALENE
420U	4-CHLOROANILINE
420U	HEXACHLOROBUTADIENE
420U	4-CHLORO-3-METHYLPHENOL
420U	2-METHYLNAPHTHALENE
420U	HEXACHLOROCYCLOPENTADIENE (HCCP)
420U	2,4,6-TRICHLOROPHENOL
2100U	2,4,5-TRICHLOROPHENOL
420UR	2-CHLORONAPHTHALENE
2100U	2-NITROANILINE
420U	DIMETHYL PHTHALATE
420U	ACENAPHTHYLENE
420U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2100U	3-NITROANILINE
420U	ACENAPHTHENE
2100U	2,4-DINITROPHENOL
2100U	4-NITROPHENOL
420U	DIBENZOFURAN
420U	2,4-DINITROTOLUENE
420U	DIETHYL PHTHALATE
420U	4-CHLOROPHENYL PHENYL ETHER
420U	FLUORENE
2100U	4-NITROANILINE
2100U	2-METHYL-4,6-DINITROPHENOL
420U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
420U	4-BROMOPHENYL PHENYL ETHER
420U	HEXACHLOROBENZENE (HCB)
2100UJ	PENTACHLOROPHENOL
420U	PHENANTHRENE
420U	ANTHRACENE
420U	DI-N-BUTYLPHTHALATE
420U	FLUORANTHENE
420U	PYRENE
420U	BENZYL BUTYL PHTHALATE
850U	3,3'-DICHLOROBENZIDINE
420U	BENZO(A)ANTHRACENE
420U	CHRYSENE
420U	BIS(2-ETHYLHEXYL) PHTHALATE
420U	DI-N-OCTYLPHTHALATE
420U	BENZO(B AND/OR K)FLUORANTHENE
420U	BENZO-A-PYRENE
420U	INDENO (1,2,3-CD) PYRENE
420U	DIBENZO(A,H)ANTHRACENE
420U	BENZO(GHI)PERYLENE
22	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-04

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1240 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y284

UG/KG	ANALYTICAL RESULTS
440U	PHENOL
440U	BIS(2-CHLOROETHYL) ETHER
440U	2-CHLOROPHENOL
440U	1,3-DICHLOROBENZENE
440U	1,4-DICHLOROBENZENE
440U	BENZYL ALCOHOL
440U	1,2-DICHLOROBENZENE
440U	2-METHYLPHENOL
440UR	BIS(2-CHLOROISOPROPYL) ETHER
440U	(3-AND/OR 4-)METHYLPHENOL
440U	N-NITROSODI-N-PROPYLAMINE
440U	HEXACHLOROETHANE
440U	NITROBENZENE
440U	ISOPHORONE
440U	2-NITROPHENOL
440U	2,4-DIMETHYLPHENOL
2100U	BENZOIC ACID
440U	BIS(2-CHLOROETHOXY) METHANE
440U	2,4-DICHLOROPHENOL
440UR	1,2,4-TRICHLOROBENZENE
440U	NAPHTHALENE
440U	4-CHLOROANILINE
440U	HEXACHLOROBUTADIENE
440U	4-CHLORO-3-METHYLPHENOL
440U	2-METHYLNAPHTHALENE
440U	HEXACHLOROCYCLOPENTADIENE (HCCP)
440U	2,4,6-TRICHLOROPHENOL
2100U	2,4,5-TRICHLOROPHENOL
440UR	2-CHLORONAPHTHALENE
2100U	2-NITROANILINE
440U	DIMETHYL PHTHALATE
440U	ACENAPHTHYLENE
440U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2100U	3-NITROANILINE
440U	ACENAPHTHENE
2100U	2,4-DINITROPHENOL
2100U	4-NITROPHENOL
440U	DIBENZOFURAN
440U	2,4-DINITROTOLUENE
440U	DIETHYL PHTHALATE
440U	4-CHLOROPHENYL PHENYL ETHER
440U	FLUORENE
2100U	4-NITROANILINE
2100U	2-METHYL-4,6-DINITROPHENOL
440U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
440U	4-BROMOPHENYL PHENYL ETHER
440U	HEXACHLOROBENZENE (HCB)
2100UJ	PENTACHLOROPHENOL
440U	PHENANTHRENE
440U	ANTHRACENE
440U	DI-N-BUTYLPHTHALATE
440U	FLUORANTHENE
440U	PYRENE
440U	BENZYL BUTYL PHTHALATE
880U	3,3'-DICHLOROBENZIDINE
440U	BENZO(A)ANTHRACENE
440U	CHRYSENE
440U	BIS(2-ETHYLHEXYL) PHTHALATE
440U	DI-N-OCTYLPHTHALATE
440U	BENZO(B AND/OR K)FLUORANTHENE
440U	BENZO-A-PYRENE
440U	INDENO (1,2,3-CD) PYRENE
440U	DIBENZO(A,H)ANTHRACENE
440U	BENZO(GHI)PERYLENE
25	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-01
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 0855 STOP: 00/00/00
D. NUMBER: Y278

UG/KG	ANALYTICAL RESULTS
9.6U	ALPHA-BHC
9.6U	BETA-BHC
9.6U	DELTA-BHC
9.6U	GAMMA-BHC (LINDANE)
9.6U	HEPTACHLOR
9.6U	ALDRIN
9.6U	HEPTACHLOR EPOXIDE
9.6U	ENDOSULFAN I (ALPHA)
19U	DIELDRIN
19U	4,4'-DDE (P,P'-DDE)
19U	ENDRIN
19U	ENDOSULFAN II (BETA)
19U	4,4'-DDD (P,P'-DDD)
19U	ENDOSULFAN SULFATE
19U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
96U	METHOXYCHLOR
19U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
96U	GAMMA-CHLORDANE /2
96U	ALPHA-CHLORDANE /2
190U	TOXAPHENE
96U	PCB-1016 (AROCLOR 1016)
96U	PCB-1221 (AROCLOR 1221)
96U	PCB-1232 (AROCLOR 1232)
96U	PCB-1242 (AROCLOR 1242)
96U	PCB-1248 (AROCLOR 1248)
190U	PCB-1254 (AROCLOR 1254)
190U	PCB-1260 (AROCLOR 1260)
17	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.
*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-02
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1040 STOP: 00/00/00
D. NUMBER: Y280

UG/KG	ANALYTICAL RESULTS
9.9U	ALPHA-BHC
9.9U	BETA-BHC
9.9U	DELTA-BHC
9.9U	GAMMA-BHC (LINDANE)
9.9U	HEPTACHLOR
9.9U	ALDRIN
9.9U	HEPTACHLOR EPOXIDE
9.9U	ENDOSULFAN I (ALPHA)
20U	DIELDRIN
20U	4,4'-DDE (P,P'-DDE)
20U	ENDRIN
20U	ENDOSULFAN II (BETA)
20U	4,4'-DDD (P,P'-DDD)
20U	ENDOSULFAN SULFATE
20U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
99U	METHOXYCHLOR
20U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
99U	GAMMA-CHLORDANE /2
99U	ALPHA-CHLORDANE /2
200U	TOXAPHENE
99U	PCB-1016 (AROCLOR 1016)
99U	PCB-1221 (AROCLOR 1221)
99U	PCB-1232 (AROCLOR 1232)
99U	PCB-1242 (AROCLOR 1242)
99U	PCB-1248 (AROCLOR 1248)
200U	PCB-1254 (AROCLOR 1254)
200U	PCB-1260 (AROCLOR 1260)
19	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-03
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1250 STOP: 00/00/00
D. NUMBER: Y282

UG/KG	ANALYTICAL RESULTS
10U	ALPHA-BHC
10U	BETA-BHC
10U	DELTA-BHC
10U	GAMMA-BHC (LINDANE)
10U	HEPTACHLOR
10U	ALDRIN
10U	HEPTACHLOR EPOXIDE
10U	ENDOSULFAN I (ALPHA)
21U	DIELDRIN
21U	4,4'-DDE (P,P'-DDE)
21U	ENDRIN
21U	ENDOSULFAN II (BETA)
21U	4,4'-DDD (P,P'-DDD)
21U	ENDOSULFAN SULFATE
21U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
100U	METHOXYCHLOR
21U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
100U	GAMMA-CHLORDANE /2
100U	ALPHA-CHLORDANE /2
210U	TOXAPHENE
100U	PCB-1016 (AROCLOR 1016)
100U	PCB-1221 (AROCLOR 1221)
100U	PCB-1232 (AROCLOR 1232)
100U	PCB-1242 (AROCLOR 1242)
100U	PCB-1248 (AROCLOR 1248)
210U	PCB-1254 (AROCLOR 1254)
210U	PCB-1260 (AROCLOR 1260)
22	PERCENT MOISTURE

REMARKS ***REMARKS***

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-04 COLLECTION START: 09/25/90 1240 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y284

UG/KG	ANALYTICAL RESULTS
11U	ALPHA-BHC
11U	BETA-BHC
11U	DELTA-BHC
11U	GAMMA-BHC (LINDANE)
11U	HEPTACHLOR
11U	ALDRIN
11U	HEPTACHLOR EPOXIDE
11U	ENDOSULFAN I (ALPHA)
21U	DIELDRIN
21U	4,4'-DDE (P,P'-DDE)
21U	ENDRIN
21U	ENDOSULFAN II (BETA)
21U	4,4'-DDD (P,P'-DDD)
21U	ENDOSULFAN SULFATE
21U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
110U	METHOXYCHLOR
21U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
110U	GAMMA-CHLORDANE /2
110U	ALPHA-CHLORDANE /2
210U	TOXAPHENE
110U	PCB-1016 (AROCLOR 1016)
110U	PCB-1221 (AROCLOR 1221)
110U	PCB-1232 (AROCLOR 1232)
110U	PCB-1242 (AROCLOR 1242)
110U	PCB-1248 (AROCLOR 1248)
210U	PCB-1254 (AROCLOR 1254)
210U	PCB-1260 (AROCLOR 1260)
25	PERCENT MOISTURE

REMARKS ***REMARKS***

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y278

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
6500	ALUMINUM	76	MANGANESE
20U	ANTIMONY	.18U	MERCURY
3UJ	ARSENIC	20U	NICKEL
34	BARIUM	1400U	POTASSIUM
.36U	BERYLLIUM	1.1U	SELENIUM
1.5U	CADMIUM	1.5U	SILVER
98	CALCIUM	30U	SODIUM
46J	CHROMIUM	.73U	THALLIUM
2.6U	COBALT	NA	TIN
9.6	COPPER	22	VANADIUM
7900	IRON	20U	ZINC
8J	LEAD	45	PERCENT MOISTURE
1000	MAGNESIUM		

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-02 COLLECTION START: 09/25/90 1040 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y280

MG/KG	ANALYTICAL RESULTS
6100	ALUMINUM
8.8U	ANTIMONY
.91UR	ARSENIC
18	BARIUM
.30U	BERYLLIUM
1.2U	CADMIUM
56	CALCIUM
100J	CHROMIUM
2.1U	COBALT
6U	COPPER
29000	IRON
5.8J	LEAD
380	MAGNESIUM
75	MANGANESE
.15U	MERCURY
8.5U	NICKEL
710U	POTASSIUM
.91U	SELENIUM
1.2U	SILVER
30U	SODIUM
.61U	THALLIUM
NA	TIN
84	VANADIUM
8U	ZINC
34	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-03 COLLECTION START: 09/25/90 1250 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y282

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
1900	ALUMINUM	160	MANGANESE
7.5U	ANTIMONY	.13U	MERCURY
2UJ	ARSENIC	7.2U	NICKEL
9.6	BARIUM	200U	POTASSIUM
.26U	BERYLLIUM	.78U	SELENIUM
1U	CADMIUM	1U	SILVER
50U	CALCIUM	27	SODIUM
4.6J	CHROMIUM	.52U	THALLIUM
1.8U	COBALT	NA	TIN
2U	COPPER	7.1	VANADIUM
3200	IRON	9U	ZINC
2.5J	LEAD	23	PERCENT MOISTURE
130	MAGNESIUM		

FOOTNOTES
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*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

METALS DATA REPORT 11/13/90

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-04 COLLECTION START: 09/25/90 1240 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y284

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
6600	ALUMINUM	130	MANGANESE
7.8U	ANTIMONY	.13U	MERCURY
2U	ARSENIC	7.5U	NICKEL
29	BARIUM	1000U	POTASSIUM
.27U	BERYLLIUM	.80U	SELENIUM
1.1U	CADMIUM	1.1U	SILVER
99	CALCIUM	23	SODIUM
19J	CHROMIUM	.54U	THALLIUM
2.4	COBALT	NA	TIN
8.5	COPPER	18	VANADIUM
7800	IRON	20U	ZINC
7.4J	LEAD	25	PERCENT MOISTURE
650	MAGNESIUM		

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y278 MD NO: Y278

RESULTS	UNITS	PARAMETER
1.8U	MG/KG	CYANIDE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-02 COLLECTION START: 09/25/90 1040 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y280 MD NO: Y280

RESULTS	UNITS	PARAMETER
1.5U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-03 COLLECTION START: 09/25/90 1250 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y282 MD NO: Y282

RESULTS	UNITS	PARAMETER
1.3U	MG/KG	CYANIDE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-04 COLLECTION START: 09/25/90 1240 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y284 MD NO: Y284

RESULTS	UNITS	PARAMETER
1.3U	MG/KG	CYANIDE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01 COLLECTION START: 09/25/90 0800 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y275

UG/L	ANALYTICAL RESULTS
10U	CHLOROMETHANE
10U	BROMOMETHANE
10U	VINYL CHLORIDE
10U	CHLOROETHANE
70U	METHYLENE CHLORIDE
10U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
10UR	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
10U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/L	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
10U	METHYL ISOBUTYL KETONE
10U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01 COLLECTION START: 09/25/90 0800 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y275

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
10U	PHENOL	50U	3-NITROANILINE
10U	BIS(2-CHLOROETHYL) ETHER	10U	ACENAPHTHENE
10U	2-CHLOROPHENOL	50U	2,4-DINITROPHENOL
10U	1,3-DICHLOROBENZENE	50U	4-NITROPHENOL
10U	1,4-DICHLOROBENZENE	10U	DIBENZOFURAN
10U	BENZYL ALCOHOL	10U	2,4-DINITROTOLUENE
10U	1,2-DICHLOROBENZENE	10U	DIETHYL PHTHALATE
10U	2-METHYLPHENOL	10U	4-CHLOROPHENYL PHENYL ETHER
10U	BIS(2-CHLOROISOPROPYL) ETHER	10U	FLUORENE
10U	(3-AND/OR 4-)METHYLPHENOL	50U	4-NITROANILINE
10U	N-NITROSODI-N-PROPYLAMINE	50U	2-METHYL-4,6-DINITROPHENOL
10U	HEXACHLOROETHANE	10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	NITROBENZENE	10U	4-BROMOPHENYL PHENYL ETHER
10U	ISOPHORONE	10U	HEXACHLOROBENZENE (HCB)
10U	2-NITROPHENOL	50U	PENTACHLOROPHENOL
10U	2,4-DIMETHYLPHENOL	10U	PHENANTHRENE
50U	BENZOIC ACID.	10U	ANTHRACENE
10U	BIS(2-CHLOROETHOXY) METHANE	10UJ	DI-N-BUTYLPHTHALATE
10U	2,4-DICHLOROPHENOL	10U	FLUORANTHENE
10U	1,2,4-TRICHLOROBENZENE	10U	PYRENE
10U	NAPHTHALENE	10U	BENZYL BUTYL PHTHALATE
10U	4-CHLOROANILINE	20U	3,3'-DICHLOROBENZIDINE
10U	HEXACHLOROBUTADIENE	10U	BENZO(A)ANTHRACENE
10U	4-CHLORO-3-METHYLPHENOL	10U	CHRYSENE
10U	2-METHYLNAPHTHALENE	10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)	10U	DI-N-OCTYLPHTHALATE
10U	2,4,6-TRICHLOROPHENOL	10U	BENZO(B AND/OR K)FLUORANTHENE
50U	2,4,5-TRICHLOROPHENOL	10U	BENZO-A-PYRENE
10U	2-CHLORONAPHTHALENE	10U	INDENO (1,2,3-CD) PYRENE
50U	2-NITROANILINE	10U	DIBENZO(A,H)ANTHRACENE
10U	DIMETHYL PHTHALATE	10U	BENZO(GHI)PERYLENE
10U	ACENAPHTHYLENE		
10U	2,6-DINITROTOLUENE		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y279

UG/L	ANALYTICAL RESULTS
10U	CHLOROMETHANE
10U	BROMOMETHANE
10U	VINYL CHLORIDE
10U	CHLOROETHANE
20U	METHYLENE CHLORIDE
100U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
10UR	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
10U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/L	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
10U	METHYL ISOBUTYL KETONE
10U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE: PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: CITY: STARTEX ST: SC
STATION ID: SW-02 COLLECTION START: 09/25/90 1050 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y281

UG/L	ANALYTICAL RESULTS
10U	CHLOROMETHANE
10U	BROMOMETHANE
10U	VINYL CHLORIDE
10U	CHLOROETHANE
30U	METHYLENE CHLORIDE
30U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
10UR	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
10U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/L	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
10U	METHYL ISOBUTYL KETONE
10U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-03 COLLECTION START: 09/25/90 1300 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y283

UG/L	ANALYTICAL RESULTS
10U	CHLOROMETHANE
10U	BROMOMETHANE
10U	VINYL CHLORIDE
10U	CHLOROETHANE
30U	METHYLENE CHLORIDE
30U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
10UR	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
10U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/L	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
10U	METHYL ISOBUTYL KETONE
10U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE: PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: CITY: STARTEX ST: SC
STATION ID: SW-04 COLLECTION START: 09/25/90 1245 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y285

UG/L	ANALYTICAL RESULTS
10U	CHLOROMETHANE
10U	BROMOMETHANE
10U	VINYL CHLORIDE
10U	CHLOROETHANE
20U	METHYLENE CHLORIDE
20U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
10UR	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
10U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/L	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
10U	METHYL ISOBUTYL KETONE
10U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS, GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA
SOURCE: OLD STARTEX SPARTANB
STATION ID: SW-01

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 0855 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y279

UG/L	ANALYTICAL RESULTS
10U	PHENOL
10U	BIS(2-CHLOROETHYL) ETHER
10U	2-CHLOROPHENOL
10U	1,3-DICHLOROBENZENE
10U	1,4-DICHLOROBENZENE
10U	BENZYL ALCOHOL
10U	1,2-DICHLOROBENZENE
10U	2-METHYLPHENOL
10U	BIS(2-CHLOROISOPROPYL) ETHER
10U	(3-AND/OR 4-)METHYLPHENOL
10U	N-NITROSODI-N-PROPYLAMINE
10U	HEXACHLOROETHANE
10U	NITROBENZENE
10U	ISOPHORONE
10U	2-NITROPHENOL
10U	2,4-DIMETHYLPHENOL
50U	BENZOIC ACID
10U	BIS(2-CHLOROETHOXY) METHANE
10U	2,4-DICHLOROPHENOL
10U	1,2,4-TRICHLOROBENZENE
10U	NAPHTHALENE
10U	4-CHLOROANILINE
10U	HEXACHLOROBUTADIENE
10U	4-CHLORO-3-METHYLPHENOL
10U	2-METHYLNAPHTHALENE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)
10U	2,4,6-TRICHLOROPHENOL
50U	2,4,5-TRICHLOROPHENOL
10U	2-CHLORONAPHTHALENE
50U	2-NITROANILINE
10U	DIMETHYL PHTHALATE
10U	ACENAPHTHYLENE
10U	2,6-DINITROTOLUENE

UG/L	ANALYTICAL RESULTS
50U	3-NITROANILINE
10U	ACENAPHTHENE
50U	2,4-DINITROPHENOL
50U	4-NITROPHENOL
10U	DIBENZOFURAN
10U	2,4-DINITROTOLUENE
10U	DIETHYL PHTHALATE
10U	4-CHLOROPHENYL PHENYL ETHER
10U	FLUORENE
50U	4-NITROANILINE
50U	2-METHYL-4,6-DINITROPHENOL
10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	4-BROMOPHENYL PHENYL ETHER
10U	HEXACHLOROBENZENE (HCB)
50U	PENTACHLOROPHENOL
10U	PHENANTHRENE
10U	ANTHRACENE
10UJ	DI-N-BUTYLPHTHALATE
10U	FLUORANTHENE
10U	PYRENE
10U	BENZYL BUTYL PHTHALATE
20U	3,3'-DICHLOROBENZIDINE
10U	BENZO(A)ANTHRACENE
10U	CHRYSENE
10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	DI-N-OCTYLPHTHALATE
10U	BENZO(B AND/OR K)FLUORANTHENE
10U	BENZO-A-PYRENE
10U	INDENO (1,2,3-CD) PYRENE
10U	DIBENZO(A,H)ANTHRACENE
10U	BENZO(GHI)PERYLENE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE:
SOURCE:
STATION ID: SW-02

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1050 STOP: 00/00/00

D. NO.: Y281

UG/L	ANALYTICAL RESULTS
10U	PHENOL
10U	BIS(2-CHLOROETHYL) ETHER
10U	2-CHLOROPHENOL
10U	1,3-DICHLOROBENZENE
10U	1,4-DICHLOROBENZENE
10U	BENZYL ALCOHOL
10U	1,2-DICHLOROBENZENE
10U	2-METHYLPHENOL
10U	BIS(2-CHLOROISOPROPYL) ETHER
10U	(3-AND/OR 4-)METHYLPHENOL
10U	N-NITROSODI-N-PROPYLAMINE
10U	HEXACHLOROETHANE
10U	NITROBENZENE
10U	ISOPHORONE
10U	2-NITROPHENOL
10U	2,4-DIMETHYLPHENOL
50U	BENZOIC ACID
10U	BIS(2-CHLOROETHOXY) METHANE
10U	2,4-DICHLOROPHENOL
10U	1,2,4-TRICHLOROBENZENE
10U	NAPHTHALENE
10U	4-CHLOROANILINE
10U	HEXACHLOROBUTADIENE
10U	4-CHLORO-3-METHYLPHENOL
10U	2-METHYLNAPHTHALENE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)
10U	2,4,6-TRICHLOROPHENOL
50U	2,4,5-TRICHLOROPHENOL
10U	2-CHLORONAPHTHALENE
50U	2-NITROANILINE
10U	DIMETHYL PHTHALATE
10U	ACENAPHTHYLENE
10U	2,6-DINITROTOLUENE

UG/L	ANALYTICAL RESULTS
50U	3-NITROANILINE
10U	ACENAPHTHENE
50U	2,4-DINITROPHENOL
50U	4-NITROPHENOL
10U	DIBENZOFURAN
10U	2,4-DINITROTOLUENE
10U	DIETHYL PHTHALATE
10U	4-CHLOROPHENYL PHENYL ETHER
10U	FLUORENE
50U	4-NITROANILINE
50U	2-METHYL-4,6-DINITROPHENOL
10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	4-BROMOPHENYL PHENYL ETHER
10U	HEXACHLOROBENZENE (HCB)
50U	PENTACHLOROPHENOL
10U	PHENANTHRENE
10U	ANTHRACENE
10UJ	DI-N-BUTYLPHTHALATE
10U	FLUORANTHENE
10U	PYRENE
10U	BENZYL BUTYL PHTHALATE
20U	3,3'-DICHLOROBENZIDINE
10U	BENZO(A)ANTHRACENE
10U	CHRYSENE
10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	DI-N-OCTYLPHTHALATE
10U	BENZO(B AND/OR K)FLUORANTHENE
10U	BENZO-A-PYRENE
10U	INDENO (1,2,3-CD) PYRENE
10U	DIBENZO(A,H)ANTHRACENE
10U	BENZO(GHI)PERYLENE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-03 COLLECTION START: 09/25/90 1300 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y283

UG/L	ANALYTICAL RESULTS
10U	PHENOL
10U	BIS(2-CHLOROETHYL) ETHER
10U	2-CHLOROPHENOL
10U	1,3-DICHLOROBENZENE
10U	1,4-DICHLOROBENZENE
10U	BENZYL ALCOHOL
10U	1,2-DICHLOROBENZENE
10U	2-METHYLPHENOL
10U	BIS(2-CHLOROISOPROPYL) ETHER
10U	(3-AND/OR 4-)METHYLPHENOL
10U	N-NITROSODI-N-PROPYLAMINE
10U	HEXACHLOROETHANE
10U	NITROBENZENE
10U	ISOPHORONE
10U	2-NITROPHENOL
10U	2,4-DIMETHYLPHENOL
50U	BENZOIC ACID
10U	BIS(2-CHLOROETHOXY) METHANE
10U	2,4-DICHLOROPHENOL
10U	1,2,4-TRICHLOROBENZENE
10U	NAPHTHALENE
10U	4-CHLOROANILINE
10U	HEXACHLOROBUTADIENE
10U	4-CHLORO-3-METHYLPHENOL
10U	2-METHYLNAPHTHALENE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)
10U	2,4,6-TRICHLOROPHENOL
50U	2,4,5-TRICHLOROPHENOL
10U	2-CHLORONAPHTHALENE
50U	2-NITROANILINE
10U	DIMETHYL PHTHALATE
10U	ACENAPHTHYLENE
10U	2,6-DINITROTOLUENE

UG/L	ANALYTICAL RESULTS
50U	3-NITROANILINE
10U	ACENAPHTHENE
50U	2,4-DINITROPHENOL
50U	4-NITROPHENOL
10U	DIBENZOFURAN
10U	2,4-DINITROTOLUENE
10U	DIETHYL PHTHALATE
10U	4-CHLOROPHENYL PHENYL ETHER
10U	FLUORENE
50U	4-NITROANILINE
50U	2-METHYL-4,6-DINITROPHENOL
10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	4-BROMOPHENYL PHENYL ETHER
10U	HEXACHLOROBENZENE (HCB)
50U	PENTACHLOROPHENOL
10U	PHENANTHRENE
10U	ANTHRACENE
10UJ	DI-N-BUTYLPHTHALATE
10U	FLUORANTHENE
10U	PYRENE
10U	BENZYL BUTYL PHTHALATE
20U	3,3'-DICHLOROBENZIDINE
10U	BENZO(A)ANTHRACENE
10U	CHRYSENE
10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	DI-N-OCTYLPHTHALATE
10U	BENZO(B AND/OR K)FLUORANTHENE
10U	BENZO-A-PYRENE
10U	INDENO (1,2,3-CD) PYRENE
10U	DIBENZO(A,H)ANTHRACENE
10U	BENZO(GHI)PERYLENE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE:
SOURCE:
STATION ID: SW-04

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1245 STOP: 00/00/00

D. NO.: Y285

UG/L	ANALYTICAL RESULTS
10U	PHENOL
10U	BIS(2-CHLOROETHYL) ETHER
10U	2-CHLOROPHENOL
10U	1,3-DICHLOROBENZENE
10U	1,4-DICHLOROBENZENE
10U	BENZYL ALCOHOL
10U	1,2-DICHLOROBENZENE
10U	2-METHYLPHENOL
10U	BIS(2-CHLOROISOPROPYL) ETHER
10U	(3-AND/OR 4-)METHYLPHENOL
10U	N-NITROSODI-N-PROPYLAMINE
10U	HEXACHLOROETHANE
10U	NITROBENZENE
10U	ISOPHORONE
10U	2-NITROPHENOL
10U	2,4-DIMETHYLPHENOL
50U	BENZOIC ACID
10U	BIS(2-CHLOROETHOXY) METHANE
10U	2,4-DICHLOROPHENOL
10U	1,2,4-TRICHLOROBENZENE
10U	NAPHTHALENE
10U	4-CHLOROANILINE
10U	HEXACHLOROBUTADIENE
10U	4-CHLORO-3-METHYLPHENOL
10U	2-METHYLNAPHTHALENE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)
10U	2,4,6-TRICHLOROPHENOL
50U	2,4,5-TRICHLOROPHENOL
10U	2-CHLORONAPHTHALENE
50U	2-NITROANILINE
10U	DIMETHYL PHTHALATE
10U	ACENAPHTHYLENE
10U	2,6-DINITROTOLUENE

UG/L	ANALYTICAL RESULTS
50U	3-NITROANILINE
10U	ACENAPHTHENE
50U	2,4-DINITROPHENOL
50U	4-NITROPHENOL
10U	DIBENZOFURAN
10U	2,4-DINITROTOLUENE
10U	DIETHYL PHTHALATE
10U	4-CHLOROPHENYL PHENYL ETHER
10U	FLUORENE
50U	4-NITROANILINE
50U	2-METHYL-4,6-DINITROPHENOL
10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	4-BROMOPHENYL PHENYL ETHER
10U	HEXACHLOROBENZENE (HCB)
50U	PENTACHLOROPHENOL
10U	PHENANTHRENE
10U	ANTHRACENE
10UJ	DI-N-BUTYLPHTHALATE
2J	FLUORANTHENE
3J	PYRENE
10U	BENZYL BUTYL PHTHALATE
20U	3,3'-DICHLOROBENZIDINE
10U	BENZO(A)ANTHRACENE
10U	CHRYSENE
10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	DI-N-OCTYLPHTHALATE
10U	BENZO(B AND/OR K)FLUORANTHENE
10U	BENZO-A-PYRENE
10U	INDENO (1,2,3-CD) PYRENE
10U	DIBENZO(A,H)ANTHRACENE
10U	BENZO(GHI)PERYLENE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y279 MD NO: Y279

ANALYTICAL RESULTS UG/L

4JN HEXANEDIOIC ACID, ETHYLHEXYLESTER

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y279

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS ***REMARKS***

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE:
SOURCE:
STATION ID: SW-02
CASE NUMBER: 14949 SAS NUMBER:
PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1050 STOP: 00/00/00
D. NUMBER: Y281

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-03 COLLECTION START: 09/25/90 1300 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y283

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS ***REMARKS***

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE:
SOURCE:
STATION ID: SW-04
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1245 STOP: 00/00/00
D. NUMBER: Y285

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD. ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01 COLLECTION START: 09/25/90 0800 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y275

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS ***REMARKS***

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01 COLLECTION START: 09/25/90 0800 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y275

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
40U	ALUMINUM	3U	MANGANESE
29U	ANTIMONY	.20U	MERCURY
3U	ARSENIC	28U	NICKEL
4U	BARIUM	770U	POTASSIUM
1U	BERYLLIUM	3U	SELENIUM
4U	CADMIUM	4U	SILVER
210U	CALCIUM	90U	SODIUM
5U	CHROMIUM	2U	THALLIUM
7U	COBALT	NA	TIN
4U	COPPER	4U	VANADIUM
40U	IRON	6U	ZINC
1U	LEAD		
31U	MAGNESIUM		

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01 COLLECTION START: 09/25/90 0800 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y275 MD NO: Y275

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y279

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
130U	ALUMINUM	13	MANGANESE
29U	ANTIMONY	.20U	MERCURY
3U	ARSENIC	28U	NICKEL
22	BARIUM	1100U	POTASSIUM
1U	BERYLLIUM	3U	SELENIUM
4U	CADMIUM	4U	SILVER
2800	CALCIUM	2800	SODIUM
5U	CHROMIUM	2U	THALLIUM
7U	COBALT	NA	TIN
4U	COPPER	4U	VANADIUM
270U	IRON	8U	ZINC
3UJ	LEAD		
1300	MAGNESIUM		

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-02 COLLECTION START: 09/25/90 1050 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y281

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
120U	ALUMINUM	30	MANGANESE
29U	ANTIMONY	.20U	MERCURY
3U	ARSENIC	28U	NICKEL
19	BARIUM	1400U	POTASSIUM
1U	BERYLLIUM	3U	SELENIUM
4U	CADMIUM	4U	SILVER
2900	CALCIUM	2900	SODIUM
5U	CHROMIUM	2U	THALLIUM
7U	COBALT	NA	TIN
4U	COPPER	4U	VANADIUM
320U	IRON	6U	ZINC
2UJ	LEAD		
1400	MAGNESIUM		

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
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*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-03 COLLECTION START: 09/25/90 1300 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y283

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
200U	ALUMINUM	83	MANGANESE
29U	ANTIMONY	.20U	MERCURY
3U	ARSENIC	28U	NICKEL
16	BARIUM	5600	POTASSIUM
1U	BERYLLIUM	4U	SELENIUM
4U	CADMIUM	4U	SILVER
2600	CALCIUM	86000	SODIUM
6U	CHROMIUM	4U	THALLIUM
7U	COBALT	NA	TIN
40	COPPER	11	VANADIUM
650	IRON	110	ZINC
3UJ	LEAD		
1900	MAGNESIUM		

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-04 COLLECTION START: 09/25/90 1245 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y285

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
230U	ALUMINUM	83	MANGANESE
29U	ANTIMONY	.20U	MERCURY
3U	ARSENIC	38	NICKEL
18	BARIUM	5100	POTASSIUM
1U	BERYLLIUM	3U	SELENIUM
4U	CADMIUM	4U	SILVER
2600	CALCIUM	85000	SODIUM
5U	CHROMIUM	4U	THALLIUM
7U	COBALT	NA	TIN
39	COPPER	14	VANADIUM
750	IRON	110	ZINC
4UJ	LEAD		
1900	MAGNESIUM		

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y279 MD NO: Y279

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-02 COLLECTION START: 09/25/90 1050 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y281 MD NO: Y281

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-03 COLLECTION START: 09/25/90 1300 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y283 MD NO: Y283

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-04 COLLECTION START: 09/25/90 1245 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y285 MD NO: Y285

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

APPENDIX C

Site Inspection Report

Site Inspection Report

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 1 - SITE LOCATION AND INSPECTION INFORMATION

EPA

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCD	980558191

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site)	02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER
Old Startex, Spartanburg County Landfill	Off Finch Road near Nesbitt Road

03 CITY	04 STATE	05 ZIP CODE	06 COUNTY	07 COUNTY CODE	08 CONG. DIST.
Startex	SC	29377	Spartanburg		

09 COORDINATES LATITUDE	LONGITUDE	10 TYPE OF OWNERSHIP (Check one)
34 56 30.0	082 06 35.0	X A. PRIVATE ☐ B. FEDERAL ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL ☐ F. OTHER ☐ G. UNKNOWN

III. INSPECTION INFORMATION

01 DATE OF INSPECTION	02 SITE STATUS	03 YEARS OF OPERATION
9 25 90 (MONTH DAY YEAR)	☐ ACTIVE ☐ INACTIVE	Mid 1960's (BEGINNING YEAR) | present (ENDING YEAR) ☐ UNKNOWN

04 AGENCY PERFORMING INSPECTION (Check all that apply)

☐ A. EPA X B. EPA CONTRACTOR NUS Corp. (Name of firm) ☐ C. MUNICIPAL ☐ D. MUNICIPAL CONTRACTOR ____ (Name of firm)
☐ E. STATE ☐ F. STATE CONTRACTOR ____ (Name of firm) ☐ G. OTHER ____ (Specify)

05 CHIEF INSPECTOR	06 TITLE	07 ORGANIZATION	08 TELEPHONE NO
Terry Ryland	Geologists	NUS	(404) 938-7710
09 OTHER INSPECTORS	10 TITLE	11 ORGANIZATION	12 TELEPHONE NO
Willie Smitherman	Sample custodian	"	( ) "
Maurice Rowan	Sampler	"	( ) "
Tim Philips	"	"	( ) "
Sam McIver	"	"	( ) "
Alvin Williams	"	"	( ) "

13 SITE REPRESENTATIVES INTERVIEWED	14 TITLE	15 ADDRESS	16 TELEPHONE NO
Alan McManus	Environmentalists	Springs Ind.	( )
			( )
			( )
			( )
			( )
			( )

17 ACCESS GAINED BY (Check one)	18 TIME OF INSPECTION	19 WEATHER CONDITIONS
X PERMISSION ☐ WARRANT	8:00 AM	clear sky with light coal breeze

IV. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)	03 TELEPHONE NO
Earl Bozeman	EPA	(404) 347-5065

04 PERSON RESPONSIBLE FOR SITE INSPECTION FORM	05 AGENCY	06 ORGANIZATION	07 TELEPHONE NO.	08 DATE
Terry Ryland		NUS Corp	404 938-7710	1/17/91 (MONTH DAY YEAR)

EPA FORM 2070-13 (7-81)

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCD	980558191

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

A SOLID — E SLURRY
B POWDER, FINES — X F LIQUID
C SLUDGE — G GAS
D OTHER _____ (Specify)

02 WASTE QUANTITY AT SITE
(Measures of waste quantities must be independent)

TONS _____
CUBIC YARDS unknown
NO. OF DRUMS _____

03 WASTE CHARACTERISTICS (Check all that apply)

X A TOXIC — E SOLUBLE — X I HIGHLY VOLATILE
B CORROSIVE — F INFECTIOUS — J EXPLOSIVE
C RADIOACTIVE — X G FLAMMABLE — K REACTIVE
X D PERSISTENT — X H IGNITABLE — L INCOMPATIBLE
M NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			
OLW	OILY WASTE			
SOL	SOLVENTS	✓		amounts of wastes
PSD	PESTICIDES			disposed in landfill is
OCC	OTHER ORGANIC CHEMICALS	✓		unknown
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS	✓		

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION
SOL	Acetone	75-86-5	surface soil	630 ug/kg	
OCC	Phenanthrene		" "	520	ug/kg
	Fluoranthene		" "	1100	ug/kg
	Pyrene		" "	1100	ug/kg
	Bis(2-Ethylhexyl) Phthalate		surface + subsurface soil	900-1900	" "
MES	Barium	21109-95-5	surface soil	230	mg/kg
	Cobalt	7440-48-4	" "	240	" "
	Magnesium		" "	410-2000	" "
	Manganese		" "	65-1400	" "
	Nickel	7440-02-0	" "	7.8-30	" "

V. FEEDSTOCKS (See Appendix for CAS Numbers)

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g. state files, sample analysis, reports)

Analytical data, sampling sheets

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION
01 STATE: SC | 02 SITE NUMBER: D980558191

II. HAZARDOUS CONDITIONS AND INCIDENTS (continued)

01 ☐ J DAMAGE TO FLORA — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION
none known or observed during investigation

01 ☐ K DAMAGE TO FAUNA — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION (include name(s) of species)
none known or observed during investigation

01 ☐ L CONTAMINATION OF FOOD CHAIN — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION
unknown

01 ☐ M UNSTABLE CONTAINMENT OF WASTES (Spills, Runoff, Standing liquids, Leaking drums) — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 204 homes — 04 NARRATIVE DESCRIPTION
landfill has no known containment methods

01 ☐ N DAMAGE TO OFFSITE PROPERTY — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION
no offsite property was sampled during investigation

01 ☐ O CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION
No sewers or storm drains located near the site.

01 ☐ P ILLEGAL, UNAUTHORIZED DUMPING — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION
unknown

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS
Potential contamination of groundwater by the various organic compounds detected in the soil samples.

III. TOTAL POPULATION POTENTIALLY AFFECTED: 775

IV. COMMENTS

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)
EPA + state files

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
SCD	980558191

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 ☐ A. GROUNDWATER CONTAMINATION — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

Groundwater was not sampled because of depth to groundwater.

01 ☐ B. SURFACE WATER CONTAMINATION — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

No contaminants from the site were detected in any of the nearby surface water bodies/streams.

01 ☐ C. CONTAMINATION OF AIR — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

Air quality was not sampled.

01 ☐ D. FIRE EXPLOSIVE CONDITIONS — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

None expected due to sufficient cover on landfill.

01 ☐ E. DIRECT CONTACT — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

Some low levels of organics were detected near the edges of the landfill.

01 ☐ F. CONTAMINATION OF SOIL — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 AREA POTENTIALLY AFFECTED _____ Acres 04 NARRATIVE DESCRIPTION

Surface + Subsurface soil samples did detect various concentrations of organic and inorganic compounds.

01 ☐ G. DRINKING WATER CONTAMINATION — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

Not sampled, unknown.

01 ☐ H. WORKER EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 WORKERS POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

No workers observed at landfill except for occasional truck dumping cinders from Springs Ind.

01 ☐ I. POPULATION EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

None suspected or known of.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
SCD	980558191

VI. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE (Check one)

X A. 10^{-6} – 10^{-4} cm/sec ☐ B. 10^{-4} – 10^{-3} cm/sec ☐ C. 10^{-4} – 10^{-3} cm/sec ☐ D. GREATER THAN 10^{-3} cm/sec

02 PERMEABILITY OF BEDROCK (Check one)

☐ A. IMPERMEABLE (Less than 10^{-6} cm/sec) ☐ B. RELATIVELY IMPERMEABLE (10^{-4} – 10^{-6} cm/sec) ☐ C. RELATIVELY PERMEABLE (10^{-2} – 10^{-4} cm/sec) ☐ D. VERY PERMEABLE (Greater than 10^{-2} cm/sec)

03 DEPTH TO BEDROCK	04 DEPTH OF CONTAMINATED SOIL ZONE	05 SOIL pH	
1 - 20 (ft)	unknown (ft)		

06 NET PRECIPITATION	07 ONE YEAR 24 HOUR RAINFALL	08 SLOPE: SITE SLOPE	DIRECTION OF SITE SLOPE	TERRAIN AVERAGE SLOPE
12 (in)	3.5 (in)	20 %	west	2.0 %

09 FLOOD POTENTIAL	10
SITE IS IN _____ YEAR FLOODPLAIN	☐ SITE IS ON BARRIER ISLAND, COASTAL HIGH HAZARD AREA, RIVERINE FLOODWAY

11 DISTANCE TO WETLANDS (5 acre minimum)		12 DISTANCE TO CRITICAL HABITAT (of endangered species)
ESTUARINE	OTHER	_____ (mi)
A. _____ (mi)	B. _____ (mi)	ENDANGERED SPECIES: _____

13 LAND USE IN VICINITY

DISTANCE TO: COMMERCIAL/INDUSTRIAL	RESIDENTIAL AREAS; NATIONAL/STATE PARKS, FORESTS, OR WILDLIFE RESERVES	AGRICULTURAL LANDS: PRIME AG LAND	AG LAND
A. 1 (mi)	B. _____ (mi)	C. <1 (mi)	D. <1 (mi)

14 DESCRIPTION OF SITE IN RELATION TO SURROUNDING TOPOGRAPHY

Site located in rural area between 3 or 4 small towns. Small stream located on west side of site. Area has gentle rolling hills nearby but site is relatively level.

VII. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

NUS Field logbook

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 6 - SAMPLE AND FIELD INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCD	980558191

II. SAMPLES TAKEN

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 SAMPLES SENT TO	03 ESTIMATED DATE RESULTS AVAILABLE
GROUNDWATER	none		
SURFACE WATER	4	CLP labs	
WASTE			
AIR			
RUNOFF			
SPILL			
SOIL	14	CLP labs	
VEGETATION			
OTHER			

III. FIELD MEASUREMENTS TAKEN

01 TYPE	02 COMMENTS
surface water	4 surface water samples were collected and measured for pH, conductivity, Temp (°C). Results are shown in Table 2 of report.

IV. PHOTOGRAPHS AND MAPS

01 TYPE [X] GROUND [ ] AERIAL — 02 IN CUSTODY OF: NUS Corp. (Name of organization or individual)

03 MAPS [X] YES [ ] NO — 04 LOCATION OF MAPS: NUS Corp.

V. OTHER FIELD DATA COLLECTED (Provide narrative description)

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

NUS field logbook

EPA FORM 2070-13 (7-81)

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 7 - OWNER INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCD	980 558 191

II. CURRENT OWNER(S) | **PARENT COMPANY** (If applicable)

01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
Springs Ind.		Springs Ind.	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	12 CITY	13 STATE / 14 ZIP CODE
Startex	S.C. 29377		

01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	12 CITY	13 STATE / 14 ZIP CODE

01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	12 CITY	13 STATE / 14 ZIP CODE

01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	12 CITY	13 STATE / 14 ZIP CODE

III. PREVIOUS OWNER(S) (List most recent first) | **IV. REALTY OWNER(S)** (If applicable, list most recent first)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
Lyman Dying & Finishing			
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE
Startex			

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

EPA + State files

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 8 - OPERATOR INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCD	980558191

II. CURRENT OPERATOR (Provide if different from owner)

01 NAME	02 D+B NUMBER	04 SIC CODE
Springs Ind		

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	05 CITY	06 STATE	07 ZIP CODE
	Startex	S.C.	

08 YEARS OF OPERATION	09 NAME OF OWNER

OPERATOR'S PARENT COMPANY (if applicable)

10 NAME	11 D+B NUMBER	13 SIC CODE

12 STREET ADDRESS (P.O. Box, RFD #, etc.)	14 CITY	15 STATE	16 ZIP CODE

III. PREVIOUS OPERATOR(S) (List most recent first; provide only if different from owner)

01 NAME	02 D+B NUMBER	04 SIC CODE

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	05 CITY	06 STATE	07 ZIP CODE

08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

PREVIOUS OPERATORS' PARENT COMPANIES (if applicable)

10 NAME	11 D+B NUMBER	13 SIC CODE

12 STREET ADDRESS (P.O. Box, RFD #, etc.)	14 CITY	15 STATE	16 ZIP CODE

01 NAME	02 D+B NUMBER	04 SIC CODE

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	05 CITY	06 STATE	07 ZIP CODE

08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

10 NAME	11 D+B NUMBER	13 SIC CODE

12 STREET ADDRESS (P.O. Box, RFD #, etc.)	14 CITY	15 STATE	16 ZIP CODE

01 NAME	02 D+B NUMBER	04 SIC CODE

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	05 CITY	06 STATE	07 ZIP CODE

08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

10 NAME	11 D+B NUMBER	13 SIC CODE

12 STREET ADDRESS (P.O. Box, RFD #, etc.)	14 CITY	15 STATE	16 ZIP CODE

IV. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

EPA + state files

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 9 - GENERATOR/TRANSPORTER INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCO	980558191

II. ON-SITE GENERATOR

01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE

III. OFF-SITE GENERATOR(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE
01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE

IV. TRANSPORTER(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE
01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE

V. SOURCES OF INFORMATION *(Cite specific references, e.g., state files, sample analysis reports)*

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
SCD	980558191

II. PAST RESPONSE ACTIVITIES

01 ☐ A. WATER SUPPLY CLOSED 04 DESCRIPTION No	02 DATE	03 AGENCY
01 ☐ B. TEMPORARY WATER SUPPLY PROVIDED 04 DESCRIPTION No	02 DATE	03 AGENCY
01 ☐ C. PERMANENT WATER SUPPLY PROVIDED 04 DESCRIPTION No	02 DATE	03 AGENCY
01 ☐ D. SPILLED MATERIAL REMOVED 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ E. CONTAMINATED SOIL REMOVED 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ F. WASTE REPACKAGED 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ G. WASTE DISPOSED ELSEWHERE 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ H. ON SITE BURIAL 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ I. IN SITU CHEMICAL TREATMENT 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ J. IN SITU BIOLOGICAL TREATMENT 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ K. IN SITU PHYSICAL TREATMENT 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ L. ENCAPSULATION 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ M. EMERGENCY WASTE TREATMENT 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ N. CUTOFF WALLS 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ O. EMERGENCY DIKING SURFACE WATER DIVERSION 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ P. CUTOFF TRENCHES/SUMP 04 DESCRIPTION unknown	02 DATE	03 AGENCY
01 ☐ Q. SUBSURFACE CUTOFF WALL 04 DESCRIPTION unknown	02 DATE	03 AGENCY

F.O.I.A.
EXEMPTION 5

Approving Official Date

HAZARD RANKING SYSTEM SCORING SUMMARY

FOR

OLD STARTEX, SPARTANBURG COUNTY LANDFILL
EPA SITE NUMBER SCD980558191
STARTEX
SPARTANBURG COUNTY, SC
EPA REGION: 4

SCORE STATUS: IN PREPARATION

SCORED BY TERRY RYLAND
OF NUS CORPORATION
ON 01/31/91

DATE OF THIS REPORT: 01/31/91
DATE OF LAST MODIFICATION: 01/31/91

GROUND WATER ROUTE SCORE	:	42.45
SURFACE WATER ROUTE SCORE	:	9.45
AIR ROUTE SCORE	:	0.00
MIGRATION SCORE	:	25.14

F.O.I.A.
EXEMPTION 5

Approving Official

HRS GROUND WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
DEPTH TO WATER TABLE	20 FEET		
DEPTH TO BOTTOM OF WASTE	15 FEET		
DEPTH TO AQUIFER OF CONCERN	5 FEET	3	6
PRECIPITATION	52.0 INCHES		
EVAPORATION	40.0 INCHES		
NET PRECIPITATION	12.0 INCHES	2	2
PERMEABILITY	1.0X10-5 CM/SEC	1	1
PHYSICAL STATE		3	3
TOTAL ROUTE CHARACTERISTICS SCORE:			12
3. CONTAINMENT		3	3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:BARIUM			18
WASTE QUANTITY CUBIC YDS	2501		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	2501 CU. YDS	8	8
TOTAL WASTE CHARACTERISTICS SCORE:			26
5. TARGETS			
GROUND WATER USE		2	6
DISTANCE TO NEAREST WELL	1584 FEET		
AND	MATRIX VALUE	20	20
TOTAL POPULATION SERVED	775 PERSONS		
NUMBER OF HOUSES	204		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			26

GROUND WATER ROUTE SCORE (Sgw) = 42.45

HRS SURFACE WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
SITE LOCATED IN SURFACE WATER	NO		
SITE WITHIN CLOSED BASIN	NO		
FACILITY SLOPE	1.0 %		
INTERVENING SLOPE	4.2 %	1	1
24-HOUR RAINFALL	3.5 INCHES	3	3
DISTANCE TO DOWN-SLOPE WATER	500 FEET	3	6
PHYSICAL STATE	3		3
TOTAL ROUTE CHARACTERISTICS SCORE:			13
3. CONTAINMENT	3		3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:BARIUM			18
WASTE QUANTITY CUBIC YDS	2501		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	2501 CU. YDS	8	8
TOTAL WASTE CHARACTERISTICS SCORE:			26
5. TARGETS			
SURFACE WATER USE		2	6
DISTANCE TO SENSITIVE ENVIRONMENTS		0	0
COASTAL WETLANDS	NONE		
FRESH-WATER WETLANDS	NONE		
CRITICAL HABITAT	NONE		
DISTANCE TO STATIC WATER	> 3 MILES		
DISTANCE TO WATER SUPPLY INTAKE	> 3 MILES		
AND	MATRIX VALUE	0	0
TOTAL POPULATION SERVED	0		
NUMBER OF HOUSES	0		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			6

SURFACE WATER ROUTE SCORE (Ssw) = 9.45

HRS AIR ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0

2. WASTE CHARACTERISTICS

REACTIVITY:		MATRIX VALUE
INCOMPATIBILITY		
TOXICITY		
WASTE QUANTITY	CUBIC YARDS	
	DRUMS	
	GALLONS	
	TONS	
	TOTAL	

TOTAL WASTE CHARACTERISTICS SCORE: N/A

3. TARGETS

POPULATION WITHIN 4-MILE RADIUS
- 0 to 0.25 mile
- 0 to 0.50 mile
- 0 to 1.0 mile
- 0 to 4.0 miles

DISTANCE TO SENSITIVE ENVIRONMENTS
- COASTAL WETLANDS
- FRESH-WATER WETLANDS
- CRITICAL HABITAT

DISTANCE TO LAND USES
- COMMERCIAL/INDUSTRIAL
- PARK/FOREST/RESIDENTIAL
- AGRICULTURAL LAND
- PRIME FARMLAND
- HISTORIC SITE WITHIN VIEW?

TOTAL TARGETS SCORE: N/A

AIR ROUTE SCORE (Sa) = 0.00

HAZARD RANKING SYSTEM SCORING CALCULATIONS
FOR
SITE: CLD STARTEX, SPARTANBURG COUNTY LANDFILL
AS OF 01/31/91

GROUND WATER ROUTE SCORE

ROUTE CHARACTERISTICS		12
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	26
TARGETS	X	26

= 24336 /57,330 X 100 = 42.45 = S_{gw}

SURFACE WATER ROUTE SCORE

ROUTE CHARACTERISTICS		13
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	26
TARGETS	X	6

= 6084 /64,350 X 100 = 9.45 = S_{sw}

AIR ROUTE SCORE

OBSERVED RELEASE 0 /35,100 X 100 = 0.00 = S_{air}

SUMMARY OF MIGRATION SCORE CALCULATIONS

	S	S^2
GROUND WATER ROUTE SCORE (S_{gw})	42.45	1802.00
SURFACE WATER ROUTE SCORE (S_{sw})	9.45	89.30
AIR ROUTE SCORE (S_{air})	0.00	0.00
$S^2_{gw} + S^2_{sw} + S^2_{air}$		1891.30
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}$		43.49
$S_M = \sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}/1.73$		25.14

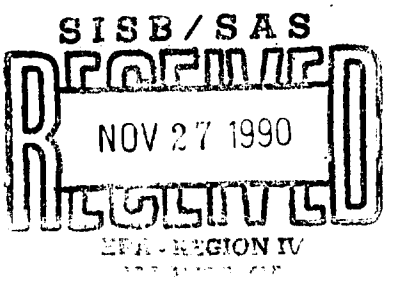
SITE OLD STARTEX/SPARTANBURG (FIT) STATE SC MANAGER ROGER FRANKLIN (NUS)
PROJECT # 90-809 SHIPWEEK 09/24/90

SOILVOA BOOKED	16	DATA RECEIVED	/ /	FOR		SAMPLES
H2OVOA BOOKED	11	DATA RECEIVED	/ /	FOR		SAMPLES
SOILEXT BOOKED	15	DATA RECEIVED	/ /	FOR		SAMPLES
H2OEXT BOOKED	11	DATA RECEIVED	/ /	FOR		SAMPLES
SOILPEST BOOKED	15	DATA RECEIVED	/ /	FOR		SAMPLES
H2OPEST BOOKED	11	DATA RECEIVED	/ /	FOR		SAMPLES
SOILMET BOOKED	15	DATA RECEIVED	11/23/90	FOR	14	SAMPLES
H2OMET BOOKED	11	DATA RECEIVED	11/23/90	FOR	5	SAMPLES
SOILCN BOOKED	15	DATA RECEIVED	11/23/90	FOR	14	SAMPLES
H2OCN BOOKED	11	DATA RECEIVED	11/23/90	FOR	5	SAMPLES

SOILOTH1 BOOKED	0	DATA RECEIVED	/ /	FOR		SAMPLES
SOILOTH2 BOOKED	0	DATA RECEIVED	/ /	FOR		SAMPLES
H2OOTH1 BOOKED	0	DATA RECEIVED	/ /	FOR		SAMPLES
H2OOTH2 BOOKED	0	DATA RECEIVED	/ /	FOR		SAMPLES
OTHER1 BOOKED	0	DATA RECEIVED	/ /	FOR		SAMPLES
OTHER2 BOOKED	0	DATA RECEIVED	/ /	FOR		SAMPLES

OV REQUESTED? N

LAB(CLP/ESD) CLP



SITE OLD STARTEX/SPARTANBURG (FIT) STATE SC MANAGER ROGER FRANKLIN (NUS)
PROJECT # 90-809 SHIPWEEK 09/24/90

SOILVOA BOOKED	16	DATA RECEIVED	12/04/90	FOR	15	SAMPLES
H2OVOA BOOKED	11	DATA RECEIVED	12/04/90	FOR	5	SAMPLES
SOILEXT BOOKED	15	DATA RECEIVED	12/04/90	FOR	14	SAMPLES
H2OEXT BOOKED	11	DATA RECEIVED	12/04/90	FOR	5	SAMPLES
SOILPEST BOOKED	15	DATA RECEIVED	12/04/90	FOR	14	SAMPLES
H2OPEST BOOKED	11	DATA RECEIVED	12/04/90	FOR	5	SAMPLES
SOILMET BOOKED	15	DATA RECEIVED	11/23/90	FOR	14	SAMPLES
H2OMET BOOKED	11	DATA RECEIVED	11/23/90	FOR	5	SAMPLES
SOILCN BOOKED	15	DATA RECEIVED	11/23/90	FOR	14	SAMPLES
H2OCN BOOKED	11	DATA RECEIVED	11/23/90	FOR	5	SAMPLES

SOILOTH1 BOOKED	0	DATA RECEIVED	/ /	FOR		SAMPLES
SOILOTH2 BOOKED	0	DATA RECEIVED	/ /	FOR		SAMPLES
H2OOTH1 BOOKED	0	DATA RECEIVED	/ /	FOR		SAMPLES
H2OOTH2 BOOKED	0	DATA RECEIVED	/ /	FOR		SAMPLES
OTHER1 BOOKED	0	DATA RECEIVED	/ /	FOR		SAMPLES
OTHER2 BOOKED	0	DATA RECEIVED	/ /	FOR		SAMPLES

QV REQUESTED? N

LAB(CLP/ESD) CLP

SISB/SAS
RECEIVED
DEC 04 1990
EPA - REGION IV
ATLANTA, GA.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region IV
Environmental Services Division
College Station Road, Athens, Ga. 30613

*****MEMORANDUM******

DATE: 11/20/90

SUBJECT: Results of Extractable Organic Analysis;
90-809 OLD STARTEX SPARTANB
STARTEX SC
CASE NO: 14949

FROM: Robert W. Knight
Chief, Laboratory Evaluation/Quality Assurance Section

TO: PHIL BLACKWELL

Attached are the results of analysis of samples collected as part of the subject project.

As a result of the Quality Assurance Review, certain data qualifiers may have been placed on the data. Attached is a DATA QUALIFIER REPORT which explains the reasons that these qualifiers were required.

If you have any questions please contact me.

ATTACHMENT

ORGANIC DATA QUALIFIER REPORT

Case Number 14949 Project Number 90-809 SAS Number

Site ID. Old Startex Spartanb, Startex, SC.

Affected Samples	Compound or Fraction	Flag Used	Reason
Volatiles			
all water samples	2-butanone	R	low response factor
Extractables			
all soil samples	pentachlorophenol	J	low QC spike recovery
	2-chloronaphthalene	R	unacceptable QC spike recovery
	bis(2-chloroisopropyl)ether	R	unacceptable QC spike recovery
	1,2,4-trichlorobenzene	R	unacceptable QC spike recovery
all water samples	di-n-butylphthalate	J	low QC spike recovery
DY285,290	all positives	J	<quantitation limit
DY288	anthracene	J	<quantitation limit
	benzo(b/k)fluoranthene	J	<quantitation limit
	indeno(1,2,3-cd)pyrene	J	<quantitation limit
	dibenz(a,h)anthracene	J	<quantitation limit
	benzo(g,h,i)perylene	J	<quantitation limit
DY292	fluoranthene	J	<quantitation limit
	pyrene	J	<quantitation limit
Pesticides			
none			

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA
SOURCE: OLD STARTEX SPARTANB
STATION ID: TB-01

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 0800 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y275

UG/L	ANALYTICAL RESULTS
10U	PHENOL
10U	BIS(2-CHLOROETHYL) ETHER
10U	2-CHLOROPHENOL
10U	1,3-DICHLOROBENZENE
10U	1,4-DICHLOROBENZENE
10U	BENZYL ALCOHOL
10U	1,2-DICHLOROBENZENE
10U	2-METHYLPHENOL
10U	BIS(2-CHLOROISOPROPYL) ETHER
10U	(3-AND/OR 4-)METHYLPHENOL
10U	N-NITROSODI-N-PROPYLAMINE
10U	HEXACHLOROETHANE
10U	NITROBENZENE
10U	ISOPHORONE
10U	2-NITROPHENOL
10U	2,4-DIMETHYLPHENOL
50U	BENZOIC ACID
10U	BIS(2-CHLOROETHOXY) METHANE
10U	2,4-DICHLOROPHENOL
10U	1,2,4-TRICHLOROBENZENE
10U	NAPHTHALENE
10U	4-CHLOROANILINE
10U	HEXACHLOROBUTADIENE
10U	4-CHLORO-3-METHYLPHENOL
10U	2-METHYLNAPHTHALENE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)
10U	2,4,6-TRICHLOROPHENOL
50U	2,4,5-TRICHLOROPHENOL
10U	2-CHLORONAPHTHALENE
50U	2-NITROANILINE
10U	DIMETHYL PHTHALATE
10U	ACENAPHTHYLENE
10U	2,6-DINITROTOLUENE
50U	3-NITROANILINE
10U	ACENAPHTHENE
50U	2,4-DINITROPHENOL
50U	4-NITROPHENOL
10U	DIBENZOFURAN
10U	2,4-DINITROTOLUENE
10U	DIETHYL PHTHALATE
10U	4-CHLOROPHENYL PHENYL ETHER
10U	FLUORENE
50U	4-NITROANILINE
50U	2-METHYL-4,6-DINITROPHENOL
10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	4-BROMOPHENYL PHENYL ETHER
10U	HEXACHLOROBENZENE (HCB)
50U	PENTACHLOROPHENOL
10U	PHENANTHRENE
10U	ANTHRACENE
10UJ	DI-N-BUTYLPHTHALATE
10U	FLUORANTHENE
10U	PYRENE
10U	BENZYL BUTYL PHTHALATE
20U	3,3'-DICHLOROBENZIDINE
10U	BENZO(A)ANTHRACENE
10U	CHRYSENE
10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	DI-N-OCTYLPHTHALATE
10U	BENZO(B AND/OR K)FLUORANTHENE
10U	BENZO-A-PYRENE
10U	INDENO (1,2,3-CD) PYRENE
10U	DIBENZO(A,H)ANTHRACENE
10U	BENZO(GHI)PERYLENE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y278

UG/KG	ANALYTICAL RESULTS
400U	PHENOL
400U	BIS(2-CHLOROETHYL) ETHER
400U	2-CHLOROPHENOL
400U	1,3-DICHLOROBENZENE
400U	1,4-DICHLOROBENZENE
400U	BENZYL ALCOHOL
400U	1,2-DICHLOROBENZENE
400U	2-METHYLPHENOL
400UR	BIS(2-CHLOROISOPROPYL) ETHER
400U	(3-AND/OR 4-)METHYLPHENOL
400U	N-NITROSODI-N-PROPYLAMINE
400U	HEXACHLOROETHANE
400U	NITROBENZENE
400U	ISOPHORONE
400U	2-NITROPHENOL
400U	2,4-DIMETHYLPHENOL
1900U	BENZOIC ACID
400U	BIS(2-CHLOROETHOXY) METHANE
400U	2,4-DICHLOROPHENOL
400UR	1,2,4-TRICHLOROBENZENE
400U	NAPHTHALENE
400U	4-CHLOROANILINE
400U	HEXACHLOROBUTADIENE
400U	4-CHLORO-3-METHYLPHENOL
400U	2-METHYLNAPHTHALENE
400U	HEXACHLOROCYCLOPENTADIENE (HCCP)
400U	2,4,6-TRICHLOROPHENOL
1900U	2,4,5-TRICHLOROPHENOL
400UR	2-CHLORONAPHTHALENE
1900U	2-NITROANILINE
400U	DIMETHYL PHTHALATE
400U	ACENAPHTHYLENE
400U	2,6-DINITROTOLUENE
1900U	3-NITROANILINE
400U	ACENAPHTHENE
1900U	2,4-DINITROPHENOL
1900U	4-NITROPHENOL
400U	DIBENZOFURAN
400U	2,4-DINITROTOLUENE
400U	DIETHYL PHTHALATE
400U	4-CHLOROPHENYL PHENYL ETHER
400U	FLUORENE
1900U	4-NITROANILINE
1900U	2-METHYL-4,6-DINITROPHENOL
400U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
400U	4-BROMOPHENYL PHENYL ETHER
400U	HEXACHLOROBENZENE (HCB)
1900UJ	PENTACHLOROPHENOL
400U	PHENANTHRENE
400U	ANTHRACENE
400U	DI-N-BUTYLPHTHALATE
400U	FLUORANTHENE
400U	PYRENE
400U	BENZYL BUTYL PHTHALATE
800U	3,3'-DICHLOROBENZIDINE
400U	BENZO(A)ANTHRACENE
400U	CHRYSENE
400U	BIS(2-ETHYLHEXYL) PHTHALATE
400U	DI-N-OCTYLPHTHALATE
400U	BENZO(B AND/OR K)FLUORANTHENE
400U	BENZO-A-PYRENE
400U	INDENO (1,2,3-CD) PYRENE
400U	DIBENZO(A,H)ANTHRACENE
400U	BENZO(GHI)PERYLENE
17	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y279

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
10U	PHENOL	50U	3-NITROANILINE
10U	BIS(2-CHLOROETHYL) ETHER	10U	ACENAPHTHENE
10U	2-CHLOROPHENOL	50U	2,4-DINITROPHENOL
10U	1,3-DICHLOROBENZENE	50U	4-NITROPHENOL
10U	1,4-DICHLOROBENZENE	10U	DIBENZOFURAN
10U	BENZYL ALCOHOL	10U	2,4-DINITROTOLUENE
10U	1,2-DICHLOROBENZENE	10U	DIETHYL PHTHALATE
10U	2-METHYLPHENOL	10U	4-CHLOROPHENYL PHENYL ETHER
10U	BIS(2-CHLOROISOPROPYL) ETHER	10U	FLUORENE
10U	(3-AND/OR 4-)METHYLPHENOL	50U	4-NITROANILINE
10U	N-NITROSODI-N-PROPYLAMINE	50U	2-METHYL-4,6-DINITROPHENOL
10U	HEXACHLOROETHANE	10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	NITROBENZENE	10U	4-BROMOPHENYL PHENYL ETHER
10U	ISOPHORONE	10U	HEXACHLOROBENZENE (HCB)
10U	2-NITROPHENOL	50U	PENTACHLOROPHENOL
10U	2,4-DIMETHYLPHENOL	10U	PHENANTHRENE
50U	BENZOIC ACID	10U	ANTHRACENE
10U	BIS(2-CHLOROETHOXY) METHANE	10UJ	DI-N-BUTYLPHTHALATE
10U	2,4-DICHLOROPHENOL	10U	FLUORANTHENE
10U	1,2,4-TRICHLOROBENZENE	10U	PYRENE
10U	NAPHTHALENE	10U	BENZYL BUTYL PHTHALATE
10U	4-CHLOROANILINE	20U	3,3'-DICHLOROBENZIDINE
10U	HEXACHLOROBUTADIENE	10U	BENZO(A)ANTHRACENE
10U	4-CHLORO-3-METHYLPHENOL	10U	CHRYSENE
10U	2-METHYLNAPHTHALENE	10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)	10U	DI-N-OCTYLPHTHALATE
10U	2,4,6-TRICHLOROPHENOL	10U	BENZO(B AND/OR K)FLUORANTHENE
50U	2,4,5-TRICHLOROPHENOL	10U	BENZO-A-PYRENE
10U	2-CHLORONAPHTHALENE	10U	INDENO (1,2,3-CD) PYRENE
50U	2-NITROANILINE	10U	DIBENZO(A,H)ANTHRACENE
10U	DIMETHYL PHTHALATE	10U	BENZO(GHI)PERYLENE
10U	ACENAPHTHYLENE		
10U	2,6-DINITROTOLUENE		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-02 COLLECTION START: 09/25/90 1040 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y280

UG/KG	ANALYTICAL RESULTS
410U	PHENOL
410U	BIS(2-CHLOROETHYL) ETHER
410U	2-CHLOROPHENOL
410U	1,3-DICHLOROBENZENE
410U	1,4-DICHLOROBENZENE
410U	BENZYL ALCOHOL
410U	1,2-DICHLOROBENZENE
410U	2-METHYLPHENOL
410UR	BIS(2-CHLOROISOPROPYL) ETHER
410U	(3-AND/OR 4-)METHYLPHENOL
410U	N-NITROSODI-N-PROPYLAMINE
410U	HEXACHLOROETHANE
410U	NITROBENZENE
410U	ISOPHORONE
410U	2-NITROPHENOL
410U	2,4-DIMETHYLPHENOL
2000U	BENZOIC ACID
410U	BIS(2-CHLOROETHOXY) METHANE
410U	2,4-DICHLOROPHENOL
410UR	1,2,4-TRICHLOROBENZENE
410U	NAPHTHALENE
410U	4-CHLOROANILINE
410U	HEXACHLOROBUTADIENE
410U	4-CHLORO-3-METHYLPHENOL
410U	2-METHYLNAPHTHALENE
410U	HEXACHLOROCYCLOPENTADIENE (HCCP)
410U	2,4,6-TRICHLOROPHENOL
2000U	2,4,5-TRICHLOROPHENOL
410UR	2-CHLORONAPHTHALENE
2000U	2-NITROANILINE
410U	DIMETHYL PHTHALATE
410U	ACENAPHTHYLENE
410U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2000U	3-NITROANILINE
410U	ACENAPHTHENE
2000U	2,4-DINITROPHENOL
2000U	4-NITROPHENOL
410U	DIBENZOFURAN
410U	2,4-DINITROTOLUENE
410U	DIETHYL PHTHALATE
410U	4-CHLOROPHENYL PHENYL ETHER
410U	FLUORENE
2000U	4-NITROANILINE
2000U	2-METHYL-4,6-DINITROPHENOL
410U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
410U	4-BROMOPHENYL PHENYL ETHER
410U	HEXACHLOROBENZENE (HCB)
2000UJ	PENTACHLOROPHENOL
410U	PHENANTHRENE
410U	ANTHRACENE
410U	DI-N-BUTYLPHTHALATE
410U	FLUORANTHENE
410U	PYRENE
410U	BENZYL BUTYL PHTHALATE
820U	3,3'-DICHLOROBENZIDINE
410U	BENZO(A)ANTHRACENE
410U	CHRYSENE
410U	BIS(2-ETHYLHEXYL) PHTHALATE
410U	DI-N-OCTYLPHTHALATE
410U	BENZO(B AND/OR K)FLUORANTHENE
410U	BENZO-A-PYRENE
410U	INDENO (1,2,3-CD) PYRENE
410U	DIBENZO(A,H)ANTHRACENE
410U	BENZO(GHI)PERYLENE
19	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE: PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: CITY: STARTEX ST: SC
STATION ID: SW-02 COLLECTION START: 09/25/90 1050 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y281

UG/L	ANALYTICAL RESULTS
10U	PHENOL
10U	BIS(2-CHLOROETHYL) ETHER
10U	2-CHLOROPHENOL
10U	1,3-DICHLOROBENZENE
10U	1,4-DICHLOROBENZENE
10U	BENZYL ALCOHOL
10U	1,2-DICHLOROBENZENE
10U	2-METHYLPHENOL
10U	BIS(2-CHLOROISOPROPYL) ETHER
10U	(3-AND/OR 4-)METHYLPHENOL
10U	N-NITROSODI-N-PROPYLAMINE
10U	HEXACHLOROETHANE
10U	NITROBENZENE
10U	ISOPHORONE
10U	2-NITROPHENOL
10U	2,4-DIMETHYLPHENOL
50U	BENZOIC ACID
10U	BIS(2-CHLOROETHOXY) METHANE
10U	2,4-DICHLOROPHENOL
10U	1,2,4-TRICHLOROBENZENE
10U	NAPHTHALENE
10U	4-CHLOROANILINE
10U	HEXACHLOROBUTADIENE
10U	4-CHLORO-3-METHYLPHENOL
10U	2-METHYLNAPHTHALENE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)
10U	2,4,6-TRICHLOROPHENOL
50U	2,4,5-TRICHLOROPHENOL
10U	2-CHLORONAPHTHALENE
50U	2-NITROANILINE
10U	DIMETHYL PHTHALATE
10U	ACENAPHTHYLENE
10U	2,6-DINITROTOLUENE

UG/L	ANALYTICAL RESULTS
50U	3-NITROANILINE
10U	ACENAPHTHENE
50U	2,4-DINITROPHENOL
50U	4-NITROPHENOL
10U	DIBENZOFURAN
10U	2,4-DINITROTOLUENE
10U	DIETHYL PHTHALATE
10U	4-CHLOROPHENYL PHENYL ETHER
10U	FLUORENE
50U	4-NITROANILINE
50U	2-METHYL-4,6-DINITROPHENOL
10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	4-BROMOPHENYL PHENYL ETHER
10U	HEXACHLOROBENZENE (HCB)
50U	PENTACHLOROPHENOL
10U	PHENANTHRENE
10U	ANTHRACENE
10UJ	DI-N-BUTYLPHTHALATE
10U	FLUORANTHENE
10U	PYRENE
10U	BENZYL BUTYL PHTHALATE
20U	3,3'-DICHLOROBENZIDINE
10U	BENZO(A)ANTHRACENE
10U	CHRYSENE
10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	DI-N-OCTYLPHTHALATE
10U	BENZO(B AND/OR K)FLUORANTHENE
10U	BENZO-A-PYRENE
10U	INDENO (1,2,3-CD) PYRENE
10U	DIBENZO(A,H)ANTHRACENE
10U	BENZO(GHI)PERYLENE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-03

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1250 STOP: 00/00/00

D. NO.: Y282

UG/KG	ANALYTICAL RESULTS
420U	PHENOL
420U	BIS(2-CHLOROETHYL) ETHER
420U	2-CHLOROPHENOL
420U	1,3-DICHLOROBENZENE
420U	1,4-DICHLOROBENZENE
420U	BENZYL ALCOHOL
420U	1,2-DICHLOROBENZENE
420U	2-METHYLPHENOL
420UR	BIS(2-CHLOROISOPROPYL) ETHER
420U	(3-AND/OR 4-)METHYLPHENOL
420U	N-NITROSODI-N-PROPYLAMINE
420U	HEXACHLOROETHANE
420U	NITROBENZENE
420U	ISOPHORONE
420U	2-NITROPHENOL
420U	2,4-DIMETHYLPHENOL
2100U	BENZOIC ACID
420U	BIS(2-CHLOROETHOXY) METHANE
420U	2,4-DICHLOROPHENOL
420UR	1,2,4-TRICHLOROBENZENE
420U	NAPHTHALENE
420U	4-CHLOROANILINE
420U	HEXACHLOROBUTADIENE
420U	4-CHLORO-3-METHYLPHENOL
420U	2-METHYLNAPHTHALENE
420U	HEXACHLOROCYCLOPENTADIENE (HCCP)
420U	2,4,6-TRICHLOROPHENOL
2100U	2,4,5-TRICHLOROPHENOL
420UR	2-CHLORONAPHTHALENE
2100U	2-NITROANILINE
420U	DIMETHYL PHTHALATE
420U	ACENAPHTHYLENE
420U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2100U	3-NITROANILINE
420U	ACENAPHTHENE
2100U	2,4-DINITROPHENOL
2100U	4-NITROPHENOL
420U	DIBENZOFURAN
420U	2,4-DINITROTOLUENE
420U	DIETHYL PHTHALATE
420U	4-CHLOROPHENYL PHENYL ETHER
420U	FLUORENE
2100U	4-NITROANILINE
2100U	2-METHYL-4,6-DINITROPHENOL
420U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
420U	4-BROMOPHENYL PHENYL ETHER
420U	HEXACHLOROBENZENE (HCB)
2100UJ	PENTACHLOROPHENOL
420U	PHENANTHRENE
420U	ANTHRACENE
420U	DI-N-BUTYLPHTHALATE
420U	FLUORANTHENE
420U	PYRENE
420U	BENZYL BUTYL PHTHALATE
850U	3,3'-DICHLOROBENZIDINE
420U	BENZO(A)ANTHRACENE
420U	CHRYSENE
420U	BIS(2-ETHYLHEXYL) PHTHALATE
420U	DI-N-OCTYLPHTHALATE
420U	BENZO(B AND/OR K)FLUORANTHENE
420U	BENZO-A-PYRENE
420U	INDENO (1,2,3-CD) PYRENE
420U	DIBENZO(A,H)ANTHRACENE
420U	BENZO(GHI)PERYLENE
22	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA
SOURCE: OLD STARTEX SPARTANB
STATION ID: SW-03

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1300 STOP: 00/00/00

D. NO.: Y283

UG/L	ANALYTICAL RESULTS
10U	PHENOL
10U	BIS(2-CHLOROETHYL) ETHER
10U	2-CHLOROPHENOL
10U	1,3-DICHLOROBENZENE
10U	1,4-DICHLOROBENZENE
10U	BENZYL ALCOHOL
10U	1,2-DICHLOROBENZENE
10U	2-METHYLPHENOL
10U	BIS(2-CHLOROISOPROPYL) ETHER
10U	(3-AND/OR 4-)METHYLPHENOL
10U	N-NITROSODI-N-PROPYLAMINE
10U	HEXACHLOROETHANE
10U	NITROBENZENE
10U	ISOPHORONE
10U	2-NITROPHENOL
10U	2,4-DIMETHYLPHENOL
50U	BENZOIC ACID
10U	BIS(2-CHLOROETHOXY) METHANE
10U	2,4-DICHLOROPHENOL
10U	1,2,4-TRICHLOROBENZENE
10U	NAPHTHALENE
10U	4-CHLOROANILINE
10U	HEXACHLOROBUTADIENE
10U	4-CHLORO-3-METHYLPHENOL
10U	2-METHYLNAPHTHALENE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)
10U	2,4,6-TRICHLOROPHENOL
50U	2,4,5-TRICHLOROPHENOL
10U	2-CHLORONAPHTHALENE
50U	2-NITROANILINE
10U	DIMETHYL PHTHALATE
10U	ACENAPHTHYLENE
10U	2,6-DINITROTOLUENE

UG/L	ANALYTICAL RESULTS
50U	3-NITROANILINE
10U	ACENAPHTHENE
50U	2,4-DINITROPHENOL
50U	4-NITROPHENOL
10U	DIBENZOFURAN
10U	2,4-DINITROTOLUENE
10U	DIETHYL PHTHALATE
10U	4-CHLOROPHENYL PHENYL ETHER
10U	FLUORENE
50U	4-NITROANILINE
50U	2-METHYL-4,6-DINITROPHENOL
10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	4-BROMOPHENYL PHENYL ETHER
10U	HEXACHLOROBENZENE (HCB)
50U	PENTACHLOROPHENOL
10U	PHENANTHRENE
10U	ANTHRACENE
10UJ	DI-N-BUTYLPHTHALATE
10U	FLUORANTHENE
10U	PYRENE
10U	BENZYL BUTYL PHTHALATE
20U	3,3'-DICHLOROBENZIDINE
10U	BENZO(A)ANTHRACENE
10U	CHRYSENE
10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	DI-N-OCTYLPHTHALATE
10U	BENZO(B AND/OR K)FLUORANTHENE
10U	BENZO-A-PYRENE
10U	INDENO (1,2,3-CD) PYRENE
10U	DIBENZO(A,H)ANTHRACENE
10U	BENZO(GHI)PERYLENE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-04 COLLECTION START: 09/25/90 1240 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y284

UG/KG	ANALYTICAL RESULTS
440U	PHENOL
440U	BIS(2-CHLOROETHYL) ETHER
440U	2-CHLOROPHENOL
440U	1,3-DICHLOROBENZENE
440U	1,4-DICHLOROBENZENE
440U	BENZYL ALCOHOL
440U	1,2-DICHLOROBENZENE
440U	2-METHYLPHENOL
440UR	BIS(2-CHLOROISOPROPYL) ETHER
440U	(3-AND/OR 4-)METHYLPHENOL
440U	N-NITROSODI-N-PROPYLAMINE
440U	HEXACHLOROETHANE
440U	NITROBENZENE
440U	ISOPHORONE
440U	2-NITROPHENOL
440U	2,4-DIMETHYLPHENOL
2100U	BENZOIC ACID
440U	BIS(2-CHLOROETHOXY) METHANE
440U	2,4-DICHLOROPHENOL
440UR	1,2,4-TRICHLOROBENZENE
440U	NAPHTHALENE
440U	4-CHLOROANILINE
440U	HEXACHLOROBUTADIENE
440U	4-CHLORO-3-METHYLPHENOL
440U	2-METHYLNAPHTHALENE
440U	HEXACHLOROCYCLOPENTADIENE (HCCP)
440U	2,4,6-TRICHLOROPHENOL
2100U	2,4,5-TRICHLOROPHENOL
440UR	2-CHLORONAPHTHALENE
2100U	2-NITROANILINE
440U	DIMETHYL PHTHALATE
440U	ACENAPHTHYLENE
440U	2,6-DINITROTOLUENE
2100U	3-NITROANILINE
440U	ACENAPHTHENE
2100U	2,4-DINITROPHENOL
2100U	4-NITROPHENOL
440U	DIBENZOFURAN
440U	2,4-DINITROTOLUENE
440U	DIETHYL PHTHALATE
440U	4-CHLOROPHENYL PHENYL ETHER
440U	FLUORENE
2100U	4-NITROANILINE
2100U	2-METHYL-4,6-DINITROPHENOL
440U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
440U	4-BROMOPHENYL PHENYL ETHER
440U	HEXACHLOROBENZENE (HCB)
2100UJ	PENTACHLOROPHENOL
440U	PHENANTHRENE
440U	ANTHRACENE
440U	DI-N-BUTYLPHTHALATE
440U	FLUORANTHENE
440U	PYRENE
440U	BENZYL BUTYL PHTHALATE
880U	3,3'-DICHLOROBENZIDINE
440U	BENZO(A)ANTHRACENE
440U	CHRYSENE
440U	BIS(2-ETHYLHEXYL) PHTHALATE
440U	DI-N-OCTYLPHTHALATE
440U	BENZO(B AND/OR K)FLUORANTHENE
440U	BENZO-A-PYRENE
440U	INDENO (1,2,3-CD) PYRENE
440U	DIBENZO(A,H)ANTHRACENE
440U	BENZO(GHI)PERYLENE
25	PERCENT MOISTURE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE:
SOURCE:
STATION ID: SW-04

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1245 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y285

UG/L	ANALYTICAL RESULTS
10U	PHENOL
10U	BIS(2-CHLOROETHYL) ETHER
10U	2-CHLOROPHENOL
10U	1,3-DICHLOROBENZENE
10U	1,4-DICHLOROBENZENE
10U	BENZYL ALCOHOL
10U	1,2-DICHLOROBENZENE
10U	2-METHYLPHENOL
10U	BIS(2-CHLOROISOPROPYL) ETHER
10U	(3-AND/OR 4-)METHYLPHENOL
10U	N-NITROSODI-N-PROPYLAMINE
10U	HEXACHLOROETHANE
10U	NITROBENZENE
10U	ISOPHORONE
10U	2-NITROPHENOL
10U	2,4-DIMETHYLPHENOL
50U	BENZOIC ACID
10U	BIS(2-CHLOROETHOXY) METHANE
10U	2,4-DICHLOROPHENOL
10U	1,2,4-TRICHLOROBENZENE
10U	NAPHTHALENE
10U	4-CHLOROANILINE
10U	HEXACHLOROBUTADIENE
10U	4-CHLORO-3-METHYLPHENOL
10U	2-METHYLNAPHTHALENE
10U	HEXACHLOROCYCLOPENTADIENE (HCCP)
10U	2,4,6-TRICHLOROPHENOL
50U	2,4,5-TRICHLOROPHENOL
10U	2-CHLORONAPHTHALENE
50U	2-NITROANILINE
10U	DIMETHYL PHTHALATE
10U	ACENAPHTHYLENE
10U	2,6-DINITROTOLUENE

UG/L	ANALYTICAL RESULTS
50U	3-NITROANILINE
10U	ACENAPHTHENE
50U	2,4-DINITROPHENOL
50U	4-NITROPHENOL
10U	DIBENZOFURAN
10U	2,4-DINITROTOLUENE
10U	DIETHYL PHTHALATE
10U	4-CHLOROPHENYL PHENYL ETHER
10U	FLUORENE
50U	4-NITROANILINE
50U	2-METHYL-4,6-DINITROPHENOL
10U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
10U	4-BROMOPHENYL PHENYL ETHER
10U	HEXACHLOROBENZENE (HCB)
50U	PENTACHLOROPHENOL
10U	PHENANTHRENE
10U	ANTHRACENE
10UJ	DI-N-BUTYLPHTHALATE
2J	FLUORANTHENE
3J	PYRENE
10U	BENZYL BUTYL PHTHALATE
20U	3,3'-DICHLOROBENZIDINE
10U	BENZO(A)ANTHRACENE
10U	CHRYSENE
10U	BIS(2-ETHYLHEXYL) PHTHALATE
10U	DI-N-OCTYLPHTHALATE
10U	BENZO(B AND/OR K)FLUORANTHENE
10U	BENZO-A-PYRENE
10U	INDENO (1,2,3-CD) PYRENE
10U	DIBENZO(A,H)ANTHRACENE
10U	BENZO(GHI)PERYLENE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-01

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 0845 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y286

UG/KG	ANALYTICAL RESULTS
380U	PHENOL
380U	BIS(2-CHLOROETHYL) ETHER
380U	2-CHLOROPHENOL
380U	1,3-DICHLOROBENZENE
380U	1,4-DICHLOROBENZENE
380U	BENZYL ALCOHOL
380U	1,2-DICHLOROBENZENE
380U	2-METHYLPHENOL
380UR	BIS(2-CHLOROISOPROPYL) ETHER
380U	(3-AND/OR 4-)METHYLPHENOL
380U	N-NITROSODI-N-PROPYLAMINE
380U	HEXACHLOROETHANE
380U	NITROBENZENE
380U	ISOPHORONE
380U	2-NITROPHENOL
380U	2,4-DIMETHYLPHENOL
1800U	BENZOIC ACID
380U	BIS(2-CHLOROETHOXY) METHANE
380U	2,4-DICHLOROPHENOL
380UR	1,2,4-TRICHLOROBENZENE
380U	NAPHTHALENE
380U	4-CHLOROANILINE
380U	HEXACHLOROBUTADIENE
380U	4-CHLORO-3-METHYLPHENOL
380U	2-METHYLNAPHTHALENE
380U	HEXACHLOROCYCLOPENTADIENE (HCCP)
380U	2,4,6-TRICHLOROPHENOL
1800U	2,4,5-TRICHLOROPHENOL
380UR	2-CHLORONAPHTHALENE
1800U	2-NITROANILINE
380U	DIMETHYL PHTHALATE
380U	ACENAPHTHYLENE
380U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1800U	3-NITROANILINE
380U	ACENAPHTHENE
1800U	2,4-DINITROPHENOL
1800U	4-NITROPHENOL
380U	DIBENZOFURAN
380U	2,4-DINITROTOLUENE
380U	DIETHYL PHTHALATE
380U	4-CHLOROPHENYL PHENYL ETHER
380U	FLUORENE
1800U	4-NITROANILINE
1800U	2-METHYL-4,6-DINITROPHENOL
380U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
380U	4-BROMOPHENYL PHENYL ETHER
380U	HEXACHLOROBENZENE (HCB)
1800UJ	PENTACHLOROPHENOL
380U	PHENANTHRENE
380U	ANTHRACENE
380U	DI-N-BUTYLPHTHALATE
380U	FLUORANTHENE
380U	PYRENE
380U	BENZYL BUTYL PHTHALATE
760U	3,3'-DICHLOROBENZIDINE
380U	BENZO(A)ANTHRACENE
380U	CHRYSENE
380U	BIS(2-ETHYLHEXYL) PHTHALATE
380U	DI-N-OCTYLPHTHALATE
380U	BENZO(B AND/OR K)FLUORANTHENE
380U	BENZO-A-PYRENE
380U	INDENO (1,2,3-CD) PYRENE
380U	DIBENZO(A,H)ANTHRACENE
380U	BENZO(GHI)PERYLENE
13	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

** PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND **
** SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC **
** STATION ID: SB-01 COLLECTION START: 09/26/90 0905 STOP: 00/00/00 **
**
** CASE NO.: 14949 SAS NO.: D. NO.: Y287 **

UG/KG	ANALYTICAL RESULTS
380U	PHENOL
380U	BIS(2-CHLOROETHYL) ETHER
380U	2-CHLOROPHENOL
380U	1,3-DICHLOROBENZENE
380U	1,4-DICHLOROBENZENE
380U	BENZYL ALCOHOL
380U	1,2-DICHLOROBENZENE
380U	2-METHYLPHENOL
380UR	BIS(2-CHLOROISOPROPYL) ETHER
380U	(3-AND/OR 4-)METHYLPHENOL
380U	N-NITROSODI-N-PROPYLAMINE
380U	HEXACHLOROETHANE
380U	NITROBENZENE
380U	ISOPHORONE
380U	2-NITROPHENOL
380U	2,4-DIMETHYLPHENOL
1900U	BENZOIC ACID
380U	BIS(2-CHLOROETHOXY) METHANE
380U	2,4-DICHLOROPHENOL
380UR	1,2,4-TRICHLOROBENZENE
380U	NAPHTHALENE
380U	4-CHLOROANILINE
380U	HEXACHLOROBUTADIENE
380U	4-CHLORO-3-METHYLPHENOL
380U	2-METHYLNAPHTHALENE
380U	HEXACHLOROCYCLOPENTADIENE (HCCP)
380U	2,4,6-TRICHLOROPHENOL
1900U	2,4,5-TRICHLOROPHENOL
380UR	2-CHLORONAPHTHALENE
1900U	2-NITROANILINE
380U	DIMETHYL PHTHALATE
380U	ACENAPHTHYLENE
380U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1900U	3-NITROANILINE
380U	ACENAPHTHENE
1900U	2,4-DINITROPHENOL
1900U	4-NITROPHENOL
380U	DIBENZOFURAN
380U	2,4-DINITROTOLUENE
380U	DIETHYL PHTHALATE
380U	4-CHLOROPHENYL PHENYL ETHER
380U	FLUORENE
1900U	4-NITROANILINE
1900U	2-METHYL-4,6-DINITROPHENOL
380U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
380U	4-BROMOPHENYL PHENYL ETHER
380U	HEXACHLOROBENZENE (HCB)
1900UJ	PENTACHLOROPHENOL
380U	PHENANTHRENE
380U	ANTHRACENE
380U	DI-N-BUTYLPHTHALATE
380U	FLUORANTHENE
380U	PYRENE
380U	BENZYL BUTYL PHTHALATE
770U	3,3'-DICHLOROBENZIDINE
380U	BENZO(A)ANTHRACENE
380U	CHRYSENE
900	BIS(2-ETHYLHEXYL) PHTHALATE
380U	DI-N-OCTYLPHTHALATE
380U	BENZO(B AND/OR K)FLUORANTHENE
380U	BENZO-A-PYRENE
380U	INDENO (1,2,3-CD) PYRENE
380U	DIBENZO(A,H)ANTHRACENE
380U	BENZO(GHI)PERYLENE
14	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-02

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 0930 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y288

UG/KG	ANALYTICAL RESULTS
380U	PHENOL
380U	BIS(2-CHLOROETHYL) ETHER
380U	2-CHLOROPHENOL
380U	1,3-DICHLOROBENZENE
380U	1,4-DICHLOROBENZENE
380U	BENZYL ALCOHOL
380U	1,2-DICHLOROBENZENE
380U	2-METHYLPHENOL
380UR	BIS(2-CHLOROISOPROPYL) ETHER
380U	(3-AND/OR 4-)METHYLPHENOL
380U	N-NITROSODI-N-PROPYLAMINE
380U	HEXACHLOROETHANE
380U	NITROBENZENE
380U	ISOPHORONE
380U	2-NITROPHENOL
380U	2,4-DIMETHYLPHENOL
1800U	BENZOIC ACID
380U	BIS(2-CHLOROETHOXY) METHANE
380U	2,4-DICHLOROPHENOL
380UR	1,2,4-TRICHLOROBENZENE
380U	NAPHTHALENE
380U	4-CHLOROANILINE
380U	HEXACHLOROBUTADIENE
380U	4-CHLORO-3-METHYLPHENOL
380U	2-METHYLNAPHTHALENE
380U	HEXACHLOROCYCLOPENTADIENE (HCCP)
380U	2,4,6-TRICHLOROPHENOL
1800U	2,4,5-TRICHLOROPHENOL
380UR	2-CHLORONAPHTHALENE
1800U	2-NITROANILINE
380U	DIMETHYL PHTHALATE
380U	ACENAPHTHYLENE
380U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1800U	3-NITROANILINE
380U	ACENAPHTHENE
1800U	2,4-DINITROPHENOL
1800U	4-NITROPHENOL
380U	DIBENZOFURAN
380U	2,4-DINITROTOLUENE
380U	DIETHYL PHTHALATE
380U	4-CHLOROPHENYL PHENYL ETHER
380U	FLUORENE
1800U	4-NITROANILINE
1800U	2-METHYL-4,6-DINITROPHENOL
380U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
380U	4-BROMOPHENYL PHENYL ETHER
380U	HEXACHLOROBENZENE (HCB)
1800UJ	PENTACHLOROPHENOL
520	PHENANTHRENE
100J	ANTHRACENE
380U	DI-N-BUTYLPHTHALATE
1100	FLUORANTHENE
1100	PYRENE
380U	BENZYL BUTYL PHTHALATE
760U	3,3'-DICHLOROBENZIDINE
430	BENZO(A)ANTHRACENE
570	CHRYSENE
380U	BIS(2-ETHYLHEXYL) PHTHALATE
380U	DI-N-OCTYLPHTHALATE
770J	BENZO(B AND/OR K)FLUORANTHENE
370J	BENZO-A-PYRENE
230J	INDENO (1,2,3-CD) PYRENE
130J	DIBENZO(A,H)ANTHRACENE
260J	BENZO(GHI)PERYLENE
12	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE: PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: CITY: STARTEX ST: SC
STATION ID: SB-02 COLLECTION START: 09/26/90 1000 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y289

UG/KG	ANALYTICAL RESULTS
390U	PHENOL
390U	BIS(2-CHLOROETHYL) ETHER
390U	2-CHLOROPHENOL
390U	1,3-DICHLOROBENZENE
390U	1,4-DICHLOROBENZENE
390U	BENZYL ALCOHOL
390U	1,2-DICHLOROBENZENE
390U	2-METHYLPHENOL
390UR	BIS(2-CHLOROISOPROPYL) ETHER
390U	(3-AND/OR 4-)METHYLPHENOL
390U	N-NITROSODI-N-PROPYLAMINE
390U	HEXACHLOROETHANE
390U	NITROBENZENE
390U	ISOPHORONE
390U	2-NITROPHENOL
390U	2,4-DIMETHYLPHENOL
1900U	BENZOIC ACID
390U	BIS(2-CHLOROETHOXY) METHANE
390U	2,4-DICHLOROPHENOL
390UR	1,2,4-TRICHLOROBENZENE
390U	NAPHTHALENE
390U	4-CHLOROANILINE
390U	HEXACHLOROBUTADIENE
390U	4-CHLORO-3-METHYLPHENOL
390U	2-METHYLNAPHTHALENE
390U	HEXACHLOROCYCLOPENTADIENE (HCCP)
390U	2,4,6-TRICHLOROPHENOL
1900U	2,4,5-TRICHLOROPHENOL
390UR	2-CHLORONAPHTHALENE
1900U	2-NITROANILINE
390U	DIMETHYL PHTHALATE
390U	ACENAPHTHYLENE
390U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1900U	3-NITROANILINE
390U	ACENAPHTHENE
1900U	2,4-DINITROPHENOL
1900U	4-NITROPHENOL
390U	DIBENZOFURAN
390U	2,4-DINITROTOLUENE
390U	DIETHYL PHTHALATE
390U	4-CHLOROPHENYL PHENYL ETHER
390U	FLUORENE
1900U	4-NITROANILINE
1900U	2-METHYL-4,6-DINITROPHENOL
390U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
390U	4-BROMOPHENYL PHENYL ETHER
390U	HEXACHLOROBENZENE (HCB)
1900UJ	PENTACHLOROPHENOL
390U	PHENANTHRENE
390U	ANTHRACENE
390U	DI-N-BUTYLPHTHALATE
390U	FLUORANTHENE
390U	PYRENE
390U	BENZYL BUTYL PHTHALATE
770U	3,3'-DICHLOROBENZIDINE
390U	BENZO(A)ANTHRACENE
390U	CHRYSENE
390U	BIS(2-ETHYLHEXYL) PHTHALATE
390U	DI-N-OCTYLPHTHALATE
390U	BENZO(B AND/OR K)FLUORANTHENE
390U	BENZO-A-PYRENE
390U	INDENO (1,2,3-CD) PYRENE
390U	DIBENZO(A,H)ANTHRACENE
390U	BENZO(GHI)PERYLENE
14	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: CITY: STARTEX ST: SC
STATION ID: SS-03 COLLECTION START: 09/26/90 1030 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y290

UG/KG	ANALYTICAL RESULTS
1600U	PHENOL
1600U	BIS(2-CHLOROETHYL) ETHER
1600U	2-CHLOROPHENOL
1600U	1,3-DICHLOROBENZENE
1600U	1,4-DICHLOROBENZENE
1600U	BENZYL ALCOHOL
1600U	1,2-DICHLOROBENZENE
1600U	2-METHYLPHENOL
1600UR	BIS(2-CHLOROISOPROPYL) ETHER
1600U	(3-AND/OR 4-)METHYLPHENOL
1600U	N-NITROSODI-N-PROPYLAMINE
1600U	HEXACHLOROETHANE
1600U	NITROBENZENE
1600U	ISOPHORONE
1600U	2-NITROPHENOL
1600U	2,4-DIMETHYLPHENOL
7600U	BENZOIC ACID
1600U	BIS(2-CHLOROETHOXY) METHANE
1600U	2,4-DICHLOROPHENOL
1600UR	1,2,4-TRICHLOROBENZENE
1600U	NAPHTHALENE
1600U	4-CHLOROANILINE
1600U	HEXACHLOROBUTADIENE
1600U	4-CHLORO-3-METHYLPHENOL
1600U	2-METHYLNAPHTHALENE
1600U	HEXACHLOROCYCLOPENTADIENE (HCCP)
1600U	2,4,6-TRICHLOROPHENOL
7600U	2,4,5-TRICHLOROPHENOL
1600UR	2-CHLORONAPHTHALENE
7600U	2-NITROANILINE
1600U	DIMETHYL PHTHALATE
1600U	ACENAPHTHYLENE
1600U	2,6-DINITROTOLUENE
7600U	3-NITROANILINE
1600U	ACENAPHTHENE
7600U	2,4-DINITROPHENOL
7600U	4-NITROPHENOL
1600U	DIBENZOFURAN
1600U	2,4-DINITROTOLUENE
600J	DIETHYL PHTHALATE
1600U	4-CHLOROPHENYL PHENYL ETHER
1600U	FLUORENE
7600U	4-NITROANILINE
7600U	2-METHYL-4,6-DINITROPHENOL
1600U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
1600U	4-BROMOPHENYL PHENYL ETHER
1600U	HEXACHLOROBENZENE (HCB)
7600UJ	PENTACHLOROPHENOL
1600U	PHENANTHRENE
1600U	ANTHRACENE
1600U	DI-N-BUTYLPHTHALATE
210J	FLUORANTHENE
380J	PYRENE
1600U	BENZYL BUTYL PHTHALATE
3100U	3,3'-DICHLOROBENZIDINE
1600U	BENZO(A)ANTHRACENE
1600U	CHRYSENE
1600U	BIS(2-ETHYLHEXYL) PHTHALATE
1600U	DI-N-OCTYLPHTHALATE
1600U	BENZO(B AND/OR K)FLUORANTHENE
1600U	BENZO-A-PYRENE
1600U	INDENO (1,2,3-CD) PYRENE
1600U	DIBENZO(A,H)ANTHRACENE
1600U	BENZO(GHI)PERYLENE
79	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-03 COLLECTION START: 09/26/90 1055 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y291

UG/KG	ANALYTICAL RESULTS
490U	PHENOL
490U	BIS(2-CHLOROETHYL) ETHER
490U	2-CHLOROPHENOL
490U	1,3-DICHLOROBENZENE
490U	1,4-DICHLOROBENZENE
490U	BENZYL ALCOHOL
490U	1,2-DICHLOROBENZENE
490U	2-METHYLPHENOL
490UR	BIS(2-CHLOROISOPROPYL) ETHER
490U	(3-AND/OR 4-)METHYLPHENOL
490U	N-NITROSODI-N-PROPYLAMINE
490U	HEXACHLOROETHANE
490U	NITROBENZENE
490U	ISOPHORONE
490U	2-NITROPHENOL
490U	2,4-DIMETHYLPHENOL
2400U	BENZOIC ACID
490U	BIS(2-CHLOROETHOXY) METHANE
490U	2,4-DICHLOROPHENOL
490UR	1,2,4-TRICHLOROBENZENE
490U	NAPHTHALENE
490U	4-CHLOROANILINE
490U	HEXACHLOROBUTADIENE
490U	4-CHLORO-3-METHYLPHENOL
490U	2-METHYLNAPHTHALENE
490U	HEXACHLOROCYCLOPENTADIENE (HCCP)
490U	2,4,6-TRICHLOROPHENOL
2400U	2,4,5-TRICHLOROPHENOL
490UR	2-CHLORONAPHTHALENE
2400U	2-NITROANILINE
490U	DIMETHYL PHTHALATE
490U	ACENAPHTHYLENE
490U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2400U	3-NITROANILINE
490U	ACENAPHTHENE
2400U	2,4-DINITROPHENOL
2400U	4-NITROPHENOL
490U	DIBENZOFURAN
490U	2,4-DINITROTOLUENE
490U	DIETHYL PHTHALATE
490U	4-CHLOROPHENYL PHENYL ETHER
490U	FLUORENE
2400U	4-NITROANILINE
2400U	2-METHYL-4,6-DINITROPHENOL
490U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
490U	4-BROMOPHENYL PHENYL ETHER
490U	HEXACHLOROBENZENE (HCB)
2400UJ	PENTACHLOROPHENOL
490U	PHENANTHRENE
490U	ANTHRACENE
490U	DI-N-BUTYLPHTHALATE
490U	FLUORANTHENE
490U	PYRENE
490U	BENZYL BUTYL PHTHALATE
990U	3,3'-DICHLOROBENZIDINE
490U	BENZO(A)ANTHRACENE
490U	CHRYSENE
490U	BIS(2-ETHYLHEXYL) PHTHALATE
490U	DI-N-OCTYLPHTHALATE
490U	BENZO(B AND/OR K)FLUORANTHENE
490U	BENZO-A-PYRENE
490U	INDENO (1,2,3-CD) PYRENE
490U	DIBENZO(A,H)ANTHRACENE
490U	BENZO(GHI)PERYLENE
33	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-04 COLLECTION START: 09/26/90 1205 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y292

UG/KG	ANALYTICAL RESULTS
410U	PHENOL
410U	BIS(2-CHLOROETHYL) ETHER
410U	2-CHLOROPHENOL
410U	1,3-DICHLOROBENZENE
410U	1,4-DICHLOROBENZENE
410U	BENZYL ALCOHOL
410U	1,2-DICHLOROBENZENE
410U	2-METHYLPHENOL
410UR	BIS(2-CHLOROISOPROPYL) ETHER
410U	(3-AND/OR 4-)METHYLPHENOL
410U	N-NITROSODI-N-PROPYLAMINE
410U	HEXACHLOROETHANE
410U	NITROBENZENE
410U	ISOPHORONE
410U	2-NITROPHENOL
410U	2,4-DIMETHYLPHENOL
2000U	BENZOIC ACID
410U	BIS(2-CHLOROETHOXY) METHANE
410U	2,4-DICHLOROPHENOL
410UR	1,2,4-TRICHLOROBENZENE
410U	NAPHTHALENE
410U	4-CHLOROANILINE
410U	HEXACHLOROBUTADIENE
410U	4-CHLORO-3-METHYLPHENOL
410U	2-METHYLNAPHTHALENE
410U	HEXACHLOROCYCLOPENTADIENE (HCCP)
410U	2,4,6-TRICHLOROPHENOL
2000U	2,4,5-TRICHLOROPHENOL
410UR	2-CHLORONAPHTHALENE
2000U	2-NITROANILINE
410U	DIMETHYL PHTHALATE
410U	ACENAPHTHYLENE
410U	2,6-DINITROTOLUENE
2000U	3-NITROANILINE
410U	ACENAPHTHENE
2000U	2,4-DINITROPHENOL
2000U	4-NITROPHENOL
410U	DIBENZOFURAN
410U	2,4-DINITROTOLUENE
410U	DIETHYL PHTHALATE
410U	4-CHLOROPHENYL PHENYL ETHER
410U	FLUORENE
2000U	4-NITROANILINE
2000U	2-METHYL-4,6-DINITROPHENOL
410U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
410U	4-BROMOPHENYL PHENYL ETHER
410U	HEXACHLOROBENZENE (HCB)
2000UJ	PENTACHLOROPHENOL
410U	PHENANTHRENE
410U	ANTHRACENE
410U	DI-N-BUTYLPHTHALATE
76J	FLUORANTHENE
110J	PYRENE
410U	BENZYL BUTYL PHTHALATE
820U	3,3'-DICHLOROBENZIDINE
410U	BENZO(A)ANTHRACENE
410U	CHRYSENE
1900	BIS(2-ETHYLHEXYL) PHTHALATE
410U	DI-N-OCTYLPHTHALATE
410U	BENZO(B AND/OR K)FLUORANTHENE
410U	BENZO-A-PYRENE
410U	INDENO (1,2,3-CD) PYRENE
410U	DIBENZO(A,H)ANTHRACENE
410U	BENZO(GHI)PERYLENE
19	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-05

CASE NO.: 14949 SAS NO.:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1225 STOP: 00/00/00

D. NO.: Y293

UG/KG	ANALYTICAL RESULTS
450U	PHENOL
450U	BIS(2-CHLOROETHYL) ETHER
450U	2-CHLOROPHENOL
450U	1,3-DICHLOROBENZENE
450U	1,4-DICHLOROBENZENE
450U	BENZYL ALCOHOL
450U	1,2-DICHLOROBENZENE
450U	2-METHYLPHENOL
450UR	BIS(2-CHLOROISOPROPYL) ETHER
450U	(3-AND/OR 4-)METHYLPHENOL
450U	N-NITROSODI-N-PROPYLAMINE
450U	HEXACHLOROETHANE
450U	NITROBENZENE
450U	ISOPHORONE
450U	2-NITROPHENOL
450U	2,4-DIMETHYLPHENOL
2200U	BENZOIC ACID
450U	BIS(2-CHLOROETHOXY) METHANE
450U	2,4-DICHLOROPHENOL
450UR	1,2,4-TRICHLOROBENZENE
450U	NAPHTHALENE
450U	4-CHLOROANILINE
450U	HEXACHLOROBUTADIENE
450U	4-CHLORO-3-METHYLPHENOL
450U	2-METHYLNAPHTHALENE
450U	HEXACHLOROCYCLOPENTADIENE (HCCP)
450U	2,4,6-TRICHLOROPHENOL
2200U	2,4,5-TRICHLOROPHENOL
450UR	2-CHLORONAPHTHALENE
2200U	2-NITROANILINE
450U	DIMETHYL PHTHALATE
450U	ACENAPHTHYLENE
450U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
2200U	3-NITROANILINE
450U	ACENAPHTHENE
2200U	2,4-DINITROPHENOL
2200U	4-NITROPHENOL
450U	DIBENZOFURAN
450U	2,4-DINITROTOLUENE
450U	DIETHYL PHTHALATE
450U	4-CHLOROPHENYL PHENYL ETHER
450U	FLUORENE
2200U	4-NITROANILINE
2200U	2-METHYL-4,6-DINITROPHENOL
450U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
450U	4-BROMOPHENYL PHENYL ETHER
450U	HEXACHLOROBENZENE (HCB)
2200UJ	PENTACHLOROPHENOL
450U	PHENANTHRENE
450U	ANTHRACENE
450U	DI-N-BUTYLPHTHALATE
450U	FLUORANTHENE
450U	PYRENE
450U	BENZYL BUTYL PHTHALATE
890U	3,3'-DICHLOROBENZIDINE
450U	BENZO(A)ANTHRACENE
450U	CHRYSENE
450U	BIS(2-ETHYLHEXYL) PHTHALATE
450U	DI-N-OCTYLPHTHALATE
450U	BENZO(B AND/OR K)FLUORANTHENE
450U	BENZO-A-PYRENE
450U	INDENO (1,2,3-CD) PYRENE
450U	DIBENZO(A,H)ANTHRACENE
450U	BENZO(GHI)PERYLENE
26	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-06

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1250 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y294

UG/KG	ANALYTICAL RESULTS
400U	PHENOL
400U	BIS(2-CHLOROETHYL) ETHER
400U	2-CHLOROPHENOL
400U	1,3-DICHLOROBENZENE
400U	1,4-DICHLOROBENZENE
400U	BENZYL ALCOHOL
400U	1,2-DICHLOROBENZENE
400U	2-METHYLPHENOL
400UR	BIS(2-CHLOROISOPROPYL) ETHER
400U	(3-AND/OR 4-)METHYLPHENOL
400U	N-NITROSODI-N-PROPYLAMINE
400U	HEXACHLOROETHANE
400U	NITROBENZENE
400U	ISOPHORONE
400U	2-NITROPHENOL
400U	2,4-DIMETHYLPHENOL
1900U	BENZOIC ACID
400U	BIS(2-CHLOROETHOXY) METHANE
400U	2,4-DICHLOROPHENOL
400UR	1,2,4-TRICHLOROBENZENE
400U	NAPHTHALENE
400U	4-CHLOROANILINE
400U	HEXACHLOROBUTADIENE
400U	4-CHLORO-3-METHYLPHENOL
400U	2-METHYLNAPHTHALENE
400U	HEXACHLOROCYCLOPENTADIENE (HCCP)
400U	2,4,6-TRICHLOROPHENOL
1900U	2,4,5-TRICHLOROPHENOL
400UR	2-CHLORONAPHTHALENE
1900U	2-NITROANILINE
400U	DIMETHYL PHTHALATE
400U	ACENAPHTHYLENE
400U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1900U	3-NITROANILINE
400U	ACENAPHTHENE
1900U	2,4-DINITROPHENOL
1900U	4-NITROPHENOL
400U	DIBENZOFURAN
400U	2,4-DINITROTOLUENE
400U	DIETHYL PHTHALATE
400U	4-CHLOROPHENYL PHENYL ETHER
400U	FLUORENE
1900U	4-NITROANILINE
1900U	2-METHYL-4,6-DINITROPHENOL
400U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
400U	4-BROMOPHENYL PHENYL ETHER
400U	HEXACHLOROBENZENE (HCB)
1900UJ	PENTACHLOROPHENOL
400U	PHENANTHRENE
400U	ANTHRACENE
400U	DI-N-BUTYLPHTHALATE
400U	FLUORANTHENE
400U	PYRENE
400U	BENZYL BUTYL PHTHALATE
800U	3,3'-DICHLOROBENZIDINE
400U	BENZO(A)ANTHRACENE
400U	CHRYSENE
400U	BIS(2-ETHYLHEXYL) PHTHALATE
400U	DI-N-OCTYLPHTHALATE
400U	BENZO(B AND/OR K)FLUORANTHENE
400U	BENZO-A-PYRENE
400U	INDENO (1,2,3-CD) PYRENE
400U	DIBENZO(A,H)ANTHRACENE
400U	BENZO(GHI)PERYLENE
17	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

EXTRACTABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-06

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1315 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y295

UG/KG	ANALYTICAL RESULTS
350U	PHENOL
350U	BIS(2-CHLOROETHYL) ETHER
350U	2-CHLOROPHENOL
350U	1,3-DICHLOROBENZENE
350U	1,4-DICHLOROBENZENE
350U	BENZYL ALCOHOL
350U	1,2-DICHLOROBENZENE
350U	2-METHYLPHENOL
350UR	BIS(2-CHLOROISOPROPYL) ETHER
350U	(3-AND/OR 4-)METHYLPHENOL
350U	N-NITROSODI-N-PROPYLAMINE
350U	HEXACHLOROETHANE
350U	NITROBENZENE
350U	ISOPHORONE
350U	2-NITROPHENOL
350U	2,4-DIMETHYLPHENOL
1700U	BENZOIC ACID
350U	BIS(2-CHLOROETHOXY) METHANE
350U	2,4-DICHLOROPHENOL
350UR	1,2,4-TRICHLOROBENZENE
350U	NAPHTHALENE
350U	4-CHLOROANILINE
350U	HEXACHLOROBUTADIENE
350U	4-CHLORO-3-METHYLPHENOL
350U	2-METHYLNAPHTHALENE
350U	HEXACHLOROCYCLOPENTADIENE (HCCP)
350U	2,4,6-TRICHLOROPHENOL
1700U	2,4,5-TRICHLOROPHENOL
350UR	2-CHLORONAPHTHALENE
1700U	2-NITROANILINE
350U	DIMETHYL PHTHALATE
350U	ACENAPHTHYLENE
350U	2,6-DINITROTOLUENE

UG/KG	ANALYTICAL RESULTS
1700U	3-NITROANILINE
350U	ACENAPHTHENE
1700U	2,4-DINITROPHENOL
1700U	4-NITROPHENOL
350U	DIBENZOFURAN
350U	2,4-DINITROTOLUENE
350U	DIETHYL PHTHALATE
350U	4-CHLOROPHENYL PHENYL ETHER
350U	FLUORENE
1700U	4-NITROANILINE
1700U	2-METHYL-4,6-DINITROPHENOL
350U	N-NITROSODIPHENYLAMINE/DIPHENYLAMINE
350U	4-BROMOPHENYL PHENYL ETHER
350U	HEXACHLOROBENZENE (HCB)
1700UJ	PENTACHLOROPHENOL
350U	PHENANTHRENE
350U	ANTHRACENE
350U	DI-N-BUTYLPHTHALATE
350U	FLUORANTHENE
350U	PYRENE
350U	BENZYL BUTYL PHTHALATE
710U	3,3'-DICHLOROBENZIDINE
350U	BENZO(A)ANTHRACENE
350U	CHRYSENE
350U	BIS(2-ETHYLHEXYL) PHTHALATE
350U	DI-N-OCTYLPHTHALATE
350U	BENZO(B AND/OR K)FLUORANTHENE
350U	BENZO-A-PYRENE
350U	INDENO (1,2,3-CD) PYRENE
350U	DIBENZO(A,H)ANTHRACENE
350U	BENZO(GHI)PERYLENE
7	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y279 MD NO: Y279

ANALYTICAL RESULTS UG/L

4JN HEXANEDIOIC ACID, ETHYLHEXYLESTER

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-02 COLLECTION START: 09/26/90 0930 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y288 MD NO: Y288

ANALYTICAL RESULTS UG/KG

200JN	BENZOFLUORANTHENE (NOT B OR K)
500JN	PINENE
400J	1 UNIDENTIFIED COMPOUND

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50970	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE:			CITY: STARTEX ST: SC
STATION ID: SS-03			COLLECTION START: 09/26/90 1030 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y290 MD NO: Y290

ANALYTICAL RESULTS UG/KG

90000J	15 UNIDENTIFIED COMPOUNDS
N	PETROLEUM PRODUCT
2000JN	BENZOTHIAZOLONE
4000JN	HEXADECANOIC ACID
3000JN	BUTOXYETHANOLPHOSPHATE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50971	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SB-03			COLLECTION START: 09/26/90 1055 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y291 MD NO: Y291

ANALYTICAL RESULTS UG/KG

2000JN	BUTOXYETHANOLPHOSPHATE
2000JN	BENZOTHIAZOLONE
10000J	14 UNIDENTIFIED COMPOUNDS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50972	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SS-04			COLLECTION START: 09/26/90 1205 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y292 MD NO: Y292

ANALYTICAL RESULTS UG/KG

3000J	6 UNIDENTIFIED COMPOUNDS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-05 COLLECTION START: 09/26/90 1225 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y293 MD NO: Y293

ANALYTICAL RESULTS UG/KG

800J 1 UNIDENTIFIED COMPOUND

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS EXTRACTABLE COMPOUNDS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-06 COLLECTION START: 09/26/90 1250 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y294 MD NO: Y294

ANALYTICAL RESULTS UG/KG

10000J	10 UNIDENTIFIED COMPOUNDS
N	PETROLEUM PRODUCT
1000JN	HEXADECANOIC ACID

FOOTNOTES
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SISB/SAS
RECEIVED
DEC 04 1990
EPA - REGION IV
ATLANTA, GA.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region IV
Environmental Services Division
College Station Road, Athens, Ga. 30613

*****MEMORANDUM******

DATE: 11/20/90

SUBJECT: Results of Pesticide/PCB Analysis;
90-809 OLD STARTEX SPARTANB
STARTEX SC
CASE NO: 14949

FROM: Robert W. Knight
Chief, Laboratory Evaluation/Quality Assurance Section

TO: PHIL BLACKWELL

Attached are the results of analysis of samples collected as part of the subject project.

As a result of the Quality Assurance Review, certain data qualifiers may have been placed on the data. Attached is a DATA QUALIFIER REPORT which explains the reasons that these qualifiers were required.

If you have any questions please contact me.

ATTACHMENT

ORGANIC DATA QUALIFIER REPORT

Case Number 14949 Project Number 90-809 SAS Number

Site ID. Old Startex Spartanb, Startex, SC.

Affected Samples	Compound or Fraction	Flag Used	Reason
Volatiles			
all water samples	2-butanone	R	low response factor
Extractables			
all soil samples	pentachlorophenol	J	low QC spike recovery
	2-chloronaphthalene	R	unacceptable QC spike recovery
	bis(2-chloroisopropyl)ether	R	unacceptable QC spike recovery
	1,2,4-trichlorobenzene	R	unacceptable QC spike recovery
all water samples	di-n-butylphthalate	J	low QC spike recovery
DY285,290	all positives	J	<quantitation limit
DY288	anthracene	J	<quantitation limit
	benzo(b/k)fluoranthene	J	<quantitation limit
	indeno(1,2,3-cd)pyrene	J	<quantitation limit
	dibenz(a,h)anthracene	J	<quantitation limit
	benzo(g,h,i)perylene	J	<quantitation limit
DY292	fluoranthene	J	<quantitation limit
	pyrene	J	<quantitation limit
Pesticides			
none			

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01 COLLECTION START: 09/25/90 0800 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y275

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-01
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 0855 STOP: 00/00/00
D. NUMBER: Y278

UG/KG	ANALYTICAL RESULTS
9.6U	ALPHA-BHC
9.6U	BETA-BHC
9.6U	DELTA-BHC
9.6U	GAMMA-BHC (LINDANE)
9.6U	HEPTACHLOR
9.6U	ALDRIN
9.6U	HEPTACHLOR EPOXIDE
9.6U	ENDOSULFAN I (ALPHA)
19U	DIELDRIN
19U	4,4'-DDE (P,P'-DDE)
19U	ENDRIN
19U	ENDOSULFAN II (BETA)
19U	4,4'-DDD (P,P'-DDD)
19U	ENDOSULFAN SULFATE
19U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
96U	METHOXYCHLOR
19U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
96U	GAMMA-CHLORDANE /2
96U	ALPHA-CHLORDANE /2
190U	TOXAPHENE
96U	PCB-1016 (AROCLOR 1016)
96U	PCB-1221 (AROCLOR 1221)
96U	PCB-1232 (AROCLOR 1232)
96U	PCB-1242 (AROCLOR 1242)
96U	PCB-1248 (AROCLOR 1248)
190U	PCB-1254 (AROCLOR 1254)
190U	PCB-1260 (AROCLOR 1260)
17	PERCENT MOISTURE

REMARKS

REMARKS

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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y279

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS

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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-02
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1040 STOP: 00/00/00
D. NUMBER: Y280

UG/KG	ANALYTICAL RESULTS
9.9U	ALPHA-BHC
9.9U	BETA-BHC
9.9U	DELTA-BHC
9.9U	GAMMA-BHC (LINDANE)
9.9U	HEPTACHLOR
9.9U	ALDRIN
9.9U	HEPTACHLOR EPOXIDE
9.9U	ENDOSULFAN I (ALPHA)
20U	DIELDRIN
20U	4,4'-DDE (P,P'-DDE)
20U	ENDRIN
20U	ENDOSULFAN II (BETA)
20U	4,4'-DDD (P,P'-DDD)
20U	ENDOSULFAN SULFATE
20U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
99U	METHOXYCHLOR
20U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
99U	GAMMA-CHLORDANE /2
99U	ALPHA-CHLORDANE /2
200U	TOXAPHENE
99U	PCB-1016 (AROCLOR 1016)
99U	PCB-1221 (AROCLOR 1221)
99U	PCB-1232 (AROCLOR 1232)
99U	PCB-1242 (AROCLOR 1242)
99U	PCB-1248 (AROCLOR 1248)
200U	PCB-1254 (AROCLOR 1254)
200U	PCB-1260 (AROCLOR 1260)
19	PERCENT MOISTURE

REMARKS

REMARKS

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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE:
SOURCE:
STATION ID: SW-02
CASE NUMBER: 14949 SAS NUMBER:
PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1050 STOP: 00/00/00
D. NUMBER: Y281

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS

REMARKS

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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-03
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1250 STOP: 00/00/00
D. NUMBER: Y282

UG/KG	ANALYTICAL RESULTS
10U	ALPHA-BHC
10U	BETA-BHC
10U	DELTA-BHC
10U	GAMMA-BHC (LINDANE)
10U	HEPTACHLOR
10U	ALDRIN
10U	HEPTACHLOR EPOXIDE
10U	ENDOSULFAN I (ALPHA)
21U	DIELDRIN
21U	4,4'-DDE (P,P'-DDE)
21U	ENDRIN
21U	ENDOSULFAN II (BETA)
21U	4,4'-DDD (P,P'-DDD)
21U	ENDOSULFAN SULFATE
21U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
100U	METHOXYCHLOR
21U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
100U	GAMMA-CHLORDANE /2
100U	ALPHA-CHLORDANE /2
210U	TOXAPHENE
100U	PCB-1016 (AROCLOR 1016)
100U	PCB-1221 (AROCLOR 1221)
100U	PCB-1232 (AROCLOR 1232)
100U	PCB-1242 (AROCLOR 1242)
100U	PCB-1248 (AROCLOR 1248)
210U	PCB-1254 (AROCLOR 1254)
210U	PCB-1260 (AROCLOR 1260)
22	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-03 COLLECTION START: 09/25/90 1300 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y283

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS

REMARKS

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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SD-04
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1240 STOP: 00/00/00
D. NUMBER: Y284

UG/KG	ANALYTICAL RESULTS
11U	ALPHA-BHC
11U	BETA-BHC
11U	DELTA-BHC
11U	GAMMA-BHC (LINDANE)
11U	HEPTACHLOR
11U	ALDRIN
11U	HEPTACHLOR EPOXIDE
11U	ENDOSULFAN I (ALPHA)
21U	DIELDRIN
21U	4,4'-DDE (P,P'-DDE)
21U	ENDRIN
21U	ENDOSULFAN II (BETA)
21U	4,4'-DDD (P,P'-DDD)
21U	ENDOSULFAN SULFATE
21U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
110U	METHOXYCHLOR
21U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
110U	GAMMA-CHLORDANE /2
110U	ALPHA-CHLORDANE /2
210U	TOXAPHENE
110U	PCB-1016 (AROCLOR 1016)
110U	PCB-1221 (AROCLOR 1221)
110U	PCB-1232 (AROCLOR 1232)
110U	PCB-1242 (AROCLOR 1242)
110U	PCB-1248 (AROCLOR 1248)
210U	PCB-1254 (AROCLOR 1254)
210U	PCB-1260 (AROCLOR 1260)
25	PERCENT MOISTURE

REMARKS

REMARKS

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*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.
*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE: PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: CITY: STARTEX ST: SC
STATION ID: SW-04 COLLECTION START: 09/25/90 1245 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y285

UG/L	ANALYTICAL RESULTS
0.050U	ALPHA-BHC
0.050U	BETA-BHC
0.050U	DELTA-BHC
0.050U	GAMMA-BHC (LINDANE)
0.050U	HEPTACHLOR
0.050U	ALDRIN
0.050U	HEPTACHLOR EPOXIDE
0.050U	ENDOSULFAN I (ALPHA)
0.10U	DIELDRIN
0.10U	4,4'-DDE (P,P'-DDE)
0.10U	ENDRIN
0.10U	ENDOSULFAN II (BETA)
0.10U	4,4'-DDD (P,P'-DDD)
0.10U	ENDOSULFAN SULFATE
0.10U	4,4'-DDT (P,P'-DDT)

UG/L	ANALYTICAL RESULTS
0.50U	METHOXYCHLOR
0.10U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
0.50U	GAMMA-CHLORDANE /2
0.50U	ALPHA-CHLORDANE /2
1.0U	TOXAPHENE
0.50U	PCB-1016 (AROCLOR 1016)
0.50U	PCB-1221 (AROCLOR 1221)
0.50U	PCB-1232 (AROCLOR 1232)
0.50U	PCB-1242 (AROCLOR 1242)
0.50U	PCB-1248 (AROCLOR 1248)
1.0U	PCB-1254 (AROCLOR 1254)
1.0U	PCB-1260 (AROCLOR 1260)

REMARKS ***REMARKS***

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

PESTICIDES/PCB'S DATA REPORT 11/19/90

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-01
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 0845 STOP: 00/00/00
D. NUMBER: Y286

UG/KG	ANALYTICAL RESULTS
9.2U	ALPHA-BHC
9.2U	BETA-BHC
9.2U	DELTA-BHC
9.2U	GAMMA-BHC (LINDANE)
9.2U	HEPTACHLOR
9.2U	ALDRIN
9.2U	HEPTACHLOR EPOXIDE
9.2U	ENDOSULFAN I (ALPHA)
18U	DIELDRIN
18U	4,4'-DDE (P,P'-DDE)
18U	ENDRIN
18U	ENDOSULFAN II (BETA)
18U	4,4'-DDD (P,P'-DDD)
18U	ENDOSULFAN SULFATE
18U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
92U	METHOXYCHLOR
18U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
92U	GAMMA-CHLORDANE /2
92U	ALPHA-CHLORDANE /2
180U	TOXAPHENE
92U	PCB-1016 (AROCLOR 1016)
92U	PCB-1221 (AROCLOR 1221)
92U	PCB-1232 (AROCLOR 1232)
92U	PCB-1242 (AROCLOR 1242)
92U	PCB-1248 (AROCLOR 1248)
180U	PCB-1254 (AROCLOR 1254)
180U	PCB-1260 (AROCLOR 1260)
13	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-01
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 0905 STOP: 00/00/00
D. NUMBER: Y287

UG/KG	ANALYTICAL RESULTS
9.3U	ALPHA-BHC
9.3U	BETA-BHC
9.3U	DELTA-BHC
9.3U	GAMMA-BHC (LINDANE)
9.3U	HEPTACHLOR
9.3U	ALDRIN
9.3U	HEPTACHLOR EPOXIDE
9.3U	ENDOSULFAN I (ALPHA)
19U	DIELDRIN
19U	4,4'-DDE (P,P'-DDE)
19U	ENDRIN
19U	ENDOSULFAN II (BETA)
19U	4,4'-DDD (P,P'-DDD)
19U	ENDOSULFAN SULFATE
19U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
93U	METHOXYCHLOR
19U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
93U	GAMMA-CHLORDANE /2
93U	ALPHA-CHLORDANE /2
190U	TOXAPHENE
93U	PCB-1016 (AROCLOR 1016)
93U	PCB-1221 (AROCLOR 1221)
93U	PCB-1232 (AROCLOR 1232)
93U	PCB-1242 (AROCLOR 1242)
93U	PCB-1248 (AROCLOR 1248)
190U	PCB-1254 (AROCLOR 1254)
190U	PCB-1260 (AROCLOR 1260)
14	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-02
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 0930 STOP: 00/00/00
D. NUMBER: Y288

UG/KG	ANALYTICAL RESULTS
9.1U	ALPHA-BHC
9.1U	BETA-BHC
9.1U	DELTA-BHC
9.1U	GAMMA-BHC (LINDANE)
9.1U	HEPTACHLOR
9.1U	ALDRIN
9.1U	HEPTACHLOR EPOXIDE
9.1U	ENDOSULFAN I (ALPHA)
18U	DIELDRIN
18U	4,4'-DDE (P,P'-DDE)
18U	ENDRIN
18U	ENDOSULFAN II (BETA)
18U	4,4'-DDD (P,P'-DDD)
18U	ENDOSULFAN SULFATE
18U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
91U	METHOXYCHLOR
18U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
91U	GAMMA-CHLORDANE /2
91U	ALPHA-CHLORDANE /2
180U	TOXAPHENE
91U	PCB-1016 (AROCLOR 1016)
91U	PCB-1221 (AROCLOR 1221)
91U	PCB-1232 (AROCLOR 1232)
91U	PCB-1242 (AROCLOR 1242)
91U	PCB-1248 (AROCLOR 1248)
180U	PCB-1254 (AROCLOR 1254)
180U	PCB-1260 (AROCLOR 1260)
12	PERCENT MOISTURE

REMARKS

REMARKS

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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE:
SOURCE:
STATION ID: SB-02
CASE NUMBER: 14949 SAS NUMBER:
PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1000 STOP: 00/00/00
D. NUMBER: Y289

UG/KG	ANALYTICAL RESULTS
9.3U	ALPHA-BHC
9.3U	BETA-BHC
9.3U	DELTA-BHC
9.3U	GAMMA-BHC (LINDANE)
9.3U	HEPTACHLOR
9.3U	ALDRIN
9.3U	HEPTACHLOR EPOXIDE
9.3U	ENDOSULFAN I (ALPHA)
19U	DIELDRIN
19U	4,4'-DDE (P,P'-DDE)
19U	ENDRIN
19U	ENDOSULFAN II (BETA)
19U	4,4'-DDD (P,P'-DDD)
19U	ENDOSULFAN SULFATE
19U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
93U	METHOXYCHLOR
19U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
93U	GAMMA-CHLORDANE /2
93U	ALPHA-CHLORDANE /2
190U	TOXAPHENE
93U	PCB-1016 (AROCLOR 1016)
93U	PCB-1221 (AROCLOR 1221)
93U	PCB-1232 (AROCLOR 1232)
93U	PCB-1242 (AROCLOR 1242)
93U	PCB-1248 (AROCLOR 1248)
190U	PCB-1254 (AROCLOR 1254)
190U	PCB-1260 (AROCLOR 1260)
14	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: CITY: STARTEX ST: SC
STATION ID: SS-03 COLLECTION START: 09/26/90 1030 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y290

UG/KG	ANALYTICAL RESULTS
38U	ALPHA-BHC
38U	BETA-BHC
38U	DELTA-BHC
38U	GAMMA-BHC (LINDANE)
38U	HEPTACHLOR
38U	ALDRIN
38U	HEPTACHLOR EPOXIDE
38U	ENDOSULFAN I (ALPHA)
76U	DIELDRIN
76U	4,4'-DDE (P,P'-DDE)
76U	ENDRIN
76U	ENDOSULFAN II (BETA)
76U	4,4'-DDD (P,P'-DDD)
76U	ENDOSULFAN SULFATE
76U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
380U	METHOXYCHLOR
76U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
380U	GAMMA-CHLORDANE /2
380U	ALPHA-CHLORDANE /2
760U	TOXAPHENE
380U	PCB-1016 (AROCLOR 1016)
380U	PCB-1221 (AROCLOR 1221)
380U	PCB-1232 (AROCLOR 1232)
380U	PCB-1242 (AROCLOR 1242)
380U	PCB-1248 (AROCLOR 1248)
760U	PCB-1254 (AROCLOR 1254)
760U	PCB-1260 (AROCLOR 1260)
79	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

PESTICIDES/PCB'S DATA REPORT 11/19/90

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-03 COLLECTION START: 09/26/90 1055 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: D. NUMBER: Y291

UG/KG	ANALYTICAL RESULTS
12U	ALPHA-BHC
12U	BETA-BHC
12U	DELTA-BHC
12U	GAMMA-BHC (LINDANE)
12U	HEPTACHLOR
12U	ALDRIN
12U	HEPTACHLOR EPOXIDE
12U	ENDOSULFAN I (ALPHA)
24U	DIELDRIN
24U	4,4'-DDE (P,P'-DDE)
24U	ENDRIN
24U	ENDOSULFAN II (BETA)
24U	4,4'-DDD (P,P'-DDD)
24U	ENDOSULFAN SULFATE
24U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
120U	METHOXYCHLOR
24U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
120U	GAMMA-CHLORDANE /2
120U	ALPHA-CHLORDANE /2
240U	TOXAPHENE
120U	PCB-1016 (AROCLOR 1016)
120U	PCB-1221 (AROCLOR 1221)
120U	PCB-1232 (AROCLOR 1232)
120U	PCB-1242 (AROCLOR 1242)
120U	PCB-1248 (AROCLOR 1248)
240U	PCB-1254 (AROCLOR 1254)
240U	PCB-1260 (AROCLOR 1260)
33	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

PESTICIDES/PCB'S DATA REPORT 11/19/90

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-04
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1205 STOP: 00/00/00
D. NUMBER: Y292

UG/KG	ANALYTICAL RESULTS
9.9U	ALPHA-BHC
9.9U	BETA-BHC
9.9U	DELTA-BHC
9.9U	GAMMA-BHC (LINDANE)
9.9U	HEPTACHLOR
9.9U	ALDRIN
9.9U	HEPTACHLOR EPOXIDE
9.9U	ENDOSULFAN I (ALPHA)
20U	DIELDRIN
20U	4,4'-DDE (P,P'-DDE)
20U	ENDRIN
20U	ENDOSULFAN II (BETA)
20U	4,4'-DDD (P,P'-DDD)
20U	ENDOSULFAN SULFATE
20U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
99U	METHOXYCHLOR
20U	ENDRIN KETONE
	CHLORDANE (TECH. MIXTURE) /1
99U	GAMMA-CHLORDANE /2
99U	ALPHA-CHLORDANE /2
200U	TOXAPHENE
99U	PCB-1016 (AROCLOR 1016)
99U	PCB-1221 (AROCLOR 1221)
99U	PCB-1232 (AROCLOR 1232)
99U	PCB-1242 (AROCLOR 1242)
99U	PCB-1248 (AROCLOR 1248)
200U	PCB-1254 (AROCLOR 1254)
200U	PCB-1260 (AROCLOR 1260)
19	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PESTICIDES/PCB'S DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-05
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1225 STOP: 00/00/00
D. NUMBER: Y293

UG/KG	ANALYTICAL RESULTS
11U	ALPHA-BHC
11U	BETA-BHC
11U	DELTA-BHC
11U	GAMMA-BHC (LINDANE)
11U	HEPTACHLOR
11U	ALDRIN
11U	HEPTACHLOR EPOXIDE
11U	ENDOSULFAN I (ALPHA)
22U	DIELDRIN
22U	4,4'-DDE (P,P'-DDE)
22U	ENDRIN
22U	ENDOSULFAN II (BETA)
22U	4,4'-DDD (P,P'-DDD)
22U	ENDOSULFAN SULFATE
22U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS
110U	METHOXYCHLOR
22U	ENDRIN KETONE
--	CHLORDANE (TECH. MIXTURE) /1
110U	GAMMA-CHLORDANE /2
110U	ALPHA-CHLORDANE /2
220U	TOXAPHENE
110U	PCB-1016 (AROCLOR 1016)
110U	PCB-1221 (AROCLOR 1221)
110U	PCB-1232 (AROCLOR 1232)
110U	PCB-1242 (AROCLOR 1242)
110U	PCB-1248 (AROCLOR 1248)
220U	PCB-1254 (AROCLOR 1254)
220U	PCB-1260 (AROCLOR 1260)
26	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

PESTICIDES/PCB'S DATA REPORT 11/19/90

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SS-06
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1250 STOP: 00/00/00
D. NUMBER: Y294

UG/KG	ANALYTICAL RESULTS
9.6U	ALPHA-BHC
9.6U	BETA-BHC
9.6U	DELTA-BHC
9.6U	GAMMA-BHC (LINDANE)
9.6U	HEPTACHLOR
9.6U	ALDRIN
9.6U	HEPTACHLOR EPOXIDE
9.6U	ENDOSULFAN I (ALPHA)
19U	DIELDRIN
19U	4,4'-DDE (P,P'-DDE)
19U	ENDRIN
19U	ENDOSULFAN II (BETA)
19U	4,4'-DDD (P,P'-DDD)
19U	ENDOSULFAN SULFATE
19U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS	
96U	METHOXYCHLOR	
19U	ENDRIN KETONE	
--	CHLORDANE (TECH. MIXTURE)	/1
96U	GAMMA-CHLORDANE	/2
96U	ALPHA-CHLORDANE	/2
190U	TOXAPHENE	
96U	PCB-1016 (AROCLOR 1016)	
96U	PCB-1221 (AROCLOR 1221)	
96U	PCB-1232 (AROCLOR 1232)	
96U	PCB-1242 (AROCLOR 1242)	
96U	PCB-1248 (AROCLOR 1248)	
190U	PCB-1254 (AROCLOR 1254)	
190U	PCB-1260 (AROCLOR 1260)	
17	PERCENT MOISTURE	

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.
*C-CONFIRMED BY GCMS 1. WHEN NO VALUE IS REPORTED, SEE CHLORDANE CONSTITUENTS.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

PESTICIDES/PCB'S DATA REPORT 11/19/90

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL
SOURCE: OLD STARTEX SPARTANB
STATION ID: SB-06
CASE NUMBER: 14949 SAS NUMBER:

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1315 STOP: 00/00/00
D. NUMBER: Y295

UG/KG	ANALYTICAL RESULTS
8.6U	ALPHA-BHC
8.6U	BETA-BHC
8.6U	DELTA-BHC
8.6U	GAMMA-BHC (LINDANE)
8.6U	HEPTACHLOR
8.6U	ALDRIN
8.6U	HEPTACHLOR EPOXIDE
8.6U	ENDOSULFAN I (ALPHA)
17U	DIELDRIN
17U	4,4'-DDE (P,P'-DDE)
17U	ENDRIN
17U	ENDOSULFAN II (BETA)
17U	4,4'-DDD (P,P'-DDD)
17U	ENDOSULFAN SULFATE
17U	4,4'-DDT (P,P'-DDT)

UG/KG	ANALYTICAL RESULTS	
86U	METHOXYCHLOR	
17U	ENDRIN KETONE	
--	CHLORDANE (TECH. MIXTURE)	/1
86U	GAMMA-CHLORDANE	/2
86U	ALPHA-CHLORDANE	/2
170U	TOXAPHENE	
86U	PCB-1016 (AROCLOR 1016)	
86U	PCB-1221 (AROCLOR 1221)	
86U	PCB-1232 (AROCLOR 1232)	
86U	PCB-1242 (AROCLOR 1242)	
86U	PCB-1248 (AROCLOR 1248)	
170U	PCB-1254 (AROCLOR 1254)	
170U	PCB-1260 (AROCLOR 1260)	
7	PERCENT MOISTURE	

REMARKS

REMARKS

FOOTNOTES
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SISB/SAS
RECEIVED
DEC 04 1990
EPA - REGION IV
ATLANTA, GA.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region IV
Environmental Services Division
College Station Road, Athens, Ga. 30613

*****MEMORANDUM******

DATE: 11/20/90

SUBJECT: Results of Purgeable Organic Analysis;
90-809 OLD STARTEX SPARTANB
STARTEX SC
CASE NO: 14949

FROM: Robert W. Knight
Chief, Laboratory Evaluation/Quality Assurance Section

TO: PHIL BLACKWELL

Attached are the results of analysis of samples collected as part of the subject project.

As a result of the Quality Assurance Review, certain data qualifiers may have been placed on the data. Attached is a DATA QUALIFIER REPORT which explains the reasons that these qualifiers were required.

If you have any questions please contact me.

ATTACHMENT

cc:

ORGANIC DATA QUALIFIER REPORT

Case Number 14949 Project Number 90-809 SAS Number

Site ID. Old Startex Spartanb, Startex, SC.

Affected Samples	Compound or Fraction	Flag Used	Reason
Volatiles			
all water samples	2-butanone	R	low response factor
Extractables			
all soil samples	pentachlorophenol	J	low QC spike recovery
	2-chloronaphthalene	R	unacceptable QC spike recovery
	bis(2-chloroisopropyl)ether	R	unacceptable QC spike recovery
	1,2,4-trichlorobenzene	R	unacceptable QC spike recovery
all water samples	di-n-butylphthalate	J	low QC spike recovery
DY285,290	all positives	J	<quantitation limit
DY288	anthracene	J	<quantitation limit
	benzo(b/k)fluoranthene	J	<quantitation limit
	indeno(1,2,3-cd)pyrene	J	<quantitation limit
	dibenz(a,h)anthracene	J	<quantitation limit
	benzo(g,h,i)perylene	J	<quantitation limit
DY292	fluoranthene	J	<quantitation limit
	pyrene	J	<quantitation limit
Pesticides			
none			

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01 COLLECTION START: 09/25/90 0800 STOP: 00/00/00
CASE NO.: 14949 SAS NO.: D. NO.: Y275

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
10U	CHLOROMETHANE	5U	1,2-DICHLOROPROPANE
10U	BROMOMETHANE	5U	CIS-1,3-DICHLOROPROPENE
10U	VINYL CHLORIDE	5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
10U	CHLOROETHANE	5U	DIBROMOCHLOROMETHANE
70U	METHYLENE CHLORIDE	5U	1,1,2-TRICHLOROETHANE
10U	ACETONE	5U	BENZENE
5U	CARBON DISULFIDE	5U	TRANS-1,3-DICHLOROPROPENE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)	5U	BROMOFORM
5U	1,1-DICHLOROETHANE	10U	METHYL ISOBUTYL KETONE
5U	1,2-DICHLOROETHENE (TOTAL)	10U	METHYL BUTYL KETONE
5U	CHLOROFORM	5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,2-DICHLOROETHANE	5U	1,1,2,2-TETRACHLOROETHANE
10UR	METHYL ETHYL KETONE	5U	TOLUENE
5U	1,1,1-TRICHLOROETHANE	5U	CHLOROBENZENE
5U	CARBON TETRACHLORIDE	5U	ETHYL BENZENE
10U	VINYL ACETATE	5U	STYRENE
5U	BROMODICHLOROMETHANE	5U	TOTAL XYLENES

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y278

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
200U	METHYLENE CHLORIDE
12U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
17	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y279

UG/L	ANALYTICAL RESULTS
10U	CHLOROMETHANE
10U	BROMOMETHANE
10U	VINYL CHLORIDE
10U	CHLOROETHANE
20U	METHYLENE CHLORIDE
100U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
10UR	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
10U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/L	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
10U	METHYL ISOBUTYL KETONE
10U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES

REMARKS

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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-02 COLLECTION START: 09/25/90 1040 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y280

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
20U	METHYLENE CHLORIDE
20U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
19	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

PURGEABLE ORGANICS DATA REPORT 11/19/90

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE:
SOURCE:
STATION ID: SW-02

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/25/90 1050 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y281

UG/L	ANALYTICAL RESULTS
10U	CHLOROMETHANE
10U	BROMOMETHANE
10U	VINYL CHLORIDE
10U	CHLOROETHANE
30U	METHYLENE CHLORIDE
30U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
10UR	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
10U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/L	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
10U	METHYL ISOBUTYL KETONE
10U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES

REMARKS

REMARKS

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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-03 COLLECTION START: 09/25/90 1250 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y282

UG/KG	ANALYTICAL RESULTS
13U	CHLOROMETHANE
13U	BROMOMETHANE
13U	VINYL CHLORIDE
13U	CHLOROETHANE
30U	METHYLENE CHLORIDE
13U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
13U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
13U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
13U	METHYL ISOBUTYL KETONE
13U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
22	PERCENT MOISTURE

REMARKS ***REMARKS***

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-03 COLLECTION START: 09/25/90 1300 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y283

UG/L	ANALYTICAL RESULTS
10U	CHLOROMETHANE
10U	BROMOMETHANE
10U	VINYL CHLORIDE
10U	CHLOROETHANE
30U	METHYLENE CHLORIDE
30U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
10UR	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
10U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/L	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
10U	METHYL ISOBUTYL KETONE
10U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES

REMARKS

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-04 COLLECTION START: 09/25/90 1240 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y284

UG/KG	ANALYTICAL RESULTS
13U	CHLOROMETHANE
13U	BROMOMETHANE
13U	VINYL CHLORIDE
13U	CHLOROETHANE
9U	METHYLENE CHLORIDE
30U	ACETONE
7U	CARBON DISULFIDE
7U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
7U	1,1-DICHLOROETHANE
7U	1,2-DICHLOROETHENE (TOTAL)
7U	CHLOROFORM
7U	1,2-DICHLOROETHANE
13U	METHYL ETHYL KETONE
7U	1,1,1-TRICHLOROETHANE
7U	CARBON TETRACHLORIDE
13U	VINYL ACETATE
7U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
7U	1,2-DICHLOROPROPANE
7U	CIS-1,3-DICHLOROPROPENE
7U	TRICHLOROETHENE(TRICHLOROETHYLENE)
7U	DIBROMOCHLOROMETHANE
7U	1,1,2-TRICHLOROETHANE
7U	BENZENE
7U	TRANS-1,3-DICHLOROPROPENE
7U	BROMOFORM
13U	METHYL ISOBUTYL KETONE
13U	METHYL BUTYL KETONE
7U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
7U	1,1,2,2-TETRACHLOROETHANE
7U	TOLUENE
7U	CHLOROBENZENE
7U	ETHYL BENZENE
7U	STYRENE
7U	TOTAL XYLENES
25	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE: PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: CITY: STARTEX ST: SC
STATION ID: SW-04 COLLECTION START: 09/25/90 1245 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y285

UG/L	ANALYTICAL RESULTS
10U	CHLOROMETHANE
10U	BROMOMETHANE
10U	VINYL CHLORIDE
10U	CHLOROETHANE
20U	METHYLENE CHLORIDE
20U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
10UR	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
10U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/L	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
10U	METHYL ISOBUTYL KETONE
10U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES

REMARKS ***REMARKS***

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-01 COLLECTION START: 09/26/90 0845 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y286

UG/KG	ANALYTICAL RESULTS
11U	CHLOROMETHANE
11U	BROMOMETHANE
11U	VINYL CHLORIDE
11U	CHLOROETHANE
9U	METHYLENE CHLORIDE
11U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
11U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
11U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
11U	METHYL ISOBUTYL KETONE
11U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
13	PERCENT MOISTURE

REMARKS ***REMARKS***

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-01 COLLECTION START: 09/26/90 0905 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y287

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
20U	METHYLENE CHLORIDE
30U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
14	PERCENT MOISTURE

REMARKS ***REMARKS***

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-02 COLLECTION START: 09/26/90 0930 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y288

UG/KG	ANALYTICAL RESULTS
11U	CHLOROMETHANE
11U	BROMOMETHANE
11U	VINYL CHLORIDE
11U	CHLOROETHANE
20U	METHYLENE CHLORIDE
11U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
11U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
11U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
11U	METHYL ISOBUTYL KETONE
11U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
12	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE: PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: CITY: STARTEX ST: SC
STATION ID: SB-02 COLLECTION START: 09/26/90 1000 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y289

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
20U	METHYLENE CHLORIDE
12U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
14	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

PURGEABLE ORGANICS DATA REPORT 11/19/90

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL
SOURCE:
STATION ID: SS-03

PROG ELEM: NSF COLLECTED BY: T RYLAND
CITY: STARTEX ST: SC
COLLECTION START: 09/26/90 1030 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y290

UG/KG	ANALYTICAL RESULTS
48U	CHLOROMETHANE
48U	BROMOMETHANE
48U	VINYL CHLORIDE
48U	CHLOROETHANE
60U	METHYLENE CHLORIDE
630	ACETONE
24U	CARBON DISULFIDE
24U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
24U	1,1-DICHLOROETHANE
24U	1,2-DICHLOROETHENE (TOTAL)
24U	CHLOROFORM
24U	1,2-DICHLOROETHANE
48U	METHYL ETHYL KETONE
24U	1,1,1-TRICHLOROETHANE
24U	CARBON TETRACHLORIDE
48U	VINYL ACETATE
24U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
24U	1,2-DICHLOROPROPANE
24U	CIS-1,3-DICHLOROPROPENE
24U	TRICHLOROETHENE(TRICHLOROETHYLENE)
24U	DIBROMOCHLOROMETHANE
24U	1,1,2-TRICHLOROETHANE
24U	BENZENE
24U	TRANS-1,3-DICHLOROPROPENE
24U	BROMOFORM
48U	METHYL ISOBUTYL KETONE
48U	METHYL BUTYL KETONE
24U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
24U	1,1,2,2-TETRACHLOROETHANE
24U	TOLUENE
29	CHLOROBENZENE
24U	ETHYL BENZENE
24U	STYRENE
24U	TOTAL XYLENES
79	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-03 COLLECTION START: 09/26/90 1055 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y291

UG/KG	ANALYTICAL RESULTS
15U	CHLOROMETHANE
15U	BROMOMETHANE
15U	VINYL CHLORIDE
15U	CHLOROETHANE
20U	METHYLENE CHLORIDE
50U	ACETONE
7U	CARBON DISULFIDE
7U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
7U	1,1-DICHLOROETHANE
7U	1,2-DICHLOROETHENE (TOTAL)
7U	CHLOROFORM
7U	1,2-DICHLOROETHANE
15U	METHYL ETHYL KETONE
7U	1,1,1-TRICHLOROETHANE
7U	CARBON TETRACHLORIDE
15U	VINYL ACETATE
7U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
7U	1,2-DICHLOROPROPANE
7U	CIS-1,3-DICHLOROPROPENE
7U	TRICHLOROETHENE(TRICHLOROETHYLENE)
7U	DIBROMOCHLOROMETHANE
7U	1,1,2-TRICHLOROETHANE
7U	BENZENE
7U	TRANS-1,3-DICHLOROPROPENE
7U	BROMOFORM
15U	METHYL ISOBUTYL KETONE
15U	METHYL BUTYL KETONE
7U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
7U	1,1,2,2-TETRACHLOROETHANE
7U	TOLUENE
19	CHLOROBENZENE
9	ETHYL BENZENE
7U	STYRENE
22	TOTAL XYLENES
33	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-04 COLLECTION START: 09/26/90 1205 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y292

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
7U	METHYLENE CHLORIDE
12U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
19	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

PURGEABLE ORGANICS DATA REPORT 11/19/90

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-05 COLLECTION START: 09/26/90 1225 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y293

UG/KG	ANALYTICAL RESULTS
14U	CHLOROMETHANE
14U	BROMOMETHANE
14U	VINYL CHLORIDE
14U	CHLOROETHANE
30U	METHYLENE CHLORIDE
14U	ACETONE
7U	CARBON DISULFIDE
7U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
7U	1,1-DICHLOROETHANE
7U	1,2-DICHLOROETHENE (TOTAL)
7U	CHLOROFORM
7U	1,2-DICHLOROETHANE
14U	METHYL ETHYL KETONE
7U	1,1,1-TRICHLOROETHANE
7U	CARBON TETRACHLORIDE
14U	VINYL ACETATE
7U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
7U	1,2-DICHLOROPROPANE
7U	CIS-1,3-DICHLOROPROPENE
7U	TRICHLOROETHENE(TRICHLOROETHYLENE)
7U	DIBROMOCHLOROMETHANE
7U	1,1,2-TRICHLOROETHANE
7U	BENZENE
7U	TRANS-1,3-DICHLOROPROPENE
7U	BROMOFORM
14U	METHYL ISOBUTYL KETONE
14U	METHYL BUTYL KETONE
7U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
7U	1,1,2,2-TETRACHLOROETHANE
7U	TOLUENE
7U	CHLOROBENZENE
7U	ETHYL BENZENE
7U	STYRENE
7U	TOTAL XYLENES
26	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

PURGEABLE ORGANICS DATA REPORT 11/19/90

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-06 COLLECTION START: 09/26/90 1250 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y294

UG/KG	ANALYTICAL RESULTS
12U	CHLOROMETHANE
12U	BROMOMETHANE
12U	VINYL CHLORIDE
12U	CHLOROETHANE
20U	METHYLENE CHLORIDE
12U	ACETONE
6U	CARBON DISULFIDE
6U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
6U	1,1-DICHLOROETHANE
6U	1,2-DICHLOROETHENE (TOTAL)
6U	CHLOROFORM
6U	1,2-DICHLOROETHANE
12U	METHYL ETHYL KETONE
6U	1,1,1-TRICHLOROETHANE
6U	CARBON TETRACHLORIDE
12U	VINYL ACETATE
6U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
6U	1,2-DICHLOROPROPANE
6U	CIS-1,3-DICHLOROPROPENE
6U	TRICHLOROETHENE(TRICHLOROETHYLENE)
6U	DIBROMOCHLOROMETHANE
6U	1,1,2-TRICHLOROETHANE
6U	BENZENE
6U	TRANS-1,3-DICHLOROPROPENE
6U	BROMOFORM
12U	METHYL ISOBUTYL KETONE
12U	METHYL BUTYL KETONE
6U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
6U	1,1,2,2-TETRACHLOROETHANE
6U	TOLUENE
6U	CHLOROBENZENE
6U	ETHYL BENZENE
6U	STYRENE
6U	TOTAL XYLENES
17	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

PURGEABLE ORGANICS DATA REPORT 11/19/90

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-06 COLLECTION START: 09/26/90 1315 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y295

UG/KG	ANALYTICAL RESULTS
11U	CHLOROMETHANE
11U	BROMOMETHANE
11U	VINYL CHLORIDE
11U	CHLOROETHANE
50U	METHYLENE CHLORIDE
11U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
11U	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
11U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
11U	METHYL ISOBUTYL KETONE
11U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES
7	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

PURGEABLE ORGANICS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50976 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01S COLLECTION START: 09/24/90 0830 STOP: 00/00/00

CASE NO.: 14949 SAS NO.: D. NO.: Y300

UG/KG	ANALYTICAL RESULTS
11U	CHLOROMETHANE
11U	BROMOMETHANE
11U	VINYL CHLORIDE
11U	CHLOROETHANE
8U	METHYLENE CHLORIDE
20U	ACETONE
5U	CARBON DISULFIDE
5U	1,1-DICHLOROETHENE(1,1-DICHLOROETHYLENE)
5U	1,1-DICHLOROETHANE
5U	1,2-DICHLOROETHENE (TOTAL)
5U	CHLOROFORM
5U	1,2-DICHLOROETHANE
11U	METHYL ETHYL KETONE
5U	1,1,1-TRICHLOROETHANE
5U	CARBON TETRACHLORIDE
11U	VINYL ACETATE
5U	BROMODICHLOROMETHANE

UG/KG	ANALYTICAL RESULTS
5U	1,2-DICHLOROPROPANE
5U	CIS-1,3-DICHLOROPROPENE
5U	TRICHLOROETHENE(TRICHLOROETHYLENE)
5U	DIBROMOCHLOROMETHANE
5U	1,1,2-TRICHLOROETHANE
5U	BENZENE
5U	TRANS-1,3-DICHLOROPROPENE
5U	BROMOFORM
11U	METHYL ISOBUTYL KETONE
11U	METHYL BUTYL KETONE
5U	TETRACHLOROETHENE(TETRACHLOROETHYLENE)
5U	1,1,2,2-TETRACHLOROETHANE
5U	TOLUENE
5U	CHLOROBENZENE
5U	ETHYL BENZENE
5U	STYRENE
5U	TOTAL XYLENES
9	PERCENT MOISTURE

REMARKS

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y278 MD NO: Y278

ANALYTICAL RESULTS UG/KG

50J 3 UNIDENTIFIED COMPOUNDS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-02 COLLECTION START: 09/25/90 1040 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y280 MD NO: Y280

ANALYTICAL RESULTS UG/KG

10JN	TETRAMETHYLBUTANE	

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-03 COLLECTION START: 09/25/90 1250 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y282 MD NO: Y282

ANALYTICAL RESULTS UG/KG

20JN	TETRAMETHYLBUTANE	

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-04 COLLECTION START: 09/25/90 1240 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y284 MD NO: Y284

ANALYTICAL RESULTS UG/KG

20JN	TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-01 COLLECTION START: 09/26/90 0845 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y286 MD NO: Y286

ANALYTICAL RESULTS UG/KG

40JN	TETRAMETHYLBUTANE	

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50967	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SB-01			COLLECTION START: 09/26/90 0905 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y287 MD NO: Y287

ANALYTICAL RESULTS UG/KG

90JN	TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-02 COLLECTION START: 09/26/90 0930 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y288 MD NO: Y288

ANALYTICAL RESULTS UG/KG

50JN TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50970	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE:			CITY: STARTEX ST: SC
STATION ID: SS-03			COLLECTION START: 09/26/90 1030 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y290 MD NO: Y290

ANALYTICAL RESULTS UG/KG

80JN	TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-03 COLLECTION START: 09/26/90 1055 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y291 MD NO: Y291

ANALYTICAL RESULTS UG/KG

10JN	TETRAMETHYLBUTANE
100JN	ETHYLMETHYBENZENE (2 ISOMERS)

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-04 COLLECTION START: 09/26/90 1205 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y292 MD NO: Y292

ANALYTICAL RESULTS UG/KG

20JN	TETRAMETHYLBUTANE	

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50973	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SS-05			COLLECTION START: 09/26/90 1225 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y293 MD NO: Y293

ANALYTICAL RESULTS UG/KG

30JN	TETRAMETHYLBUTANE
4JN	PROPADIENE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50974	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: SS-06			COLLECTION START: 09/26/90 1250 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y294 MD NO: Y294

ANALYTICAL RESULTS UG/KG

6OJN	TETRAMETHYLBUTANE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-06 COLLECTION START: 09/26/90 1315 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y295 MD NO: Y295

ANALYTICAL RESULTS UG/KG

20J 1 UNIDENTIFIED COMPOUND

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/19/90

MISCELLANEOUS PURGEABLE ORGANICS - DATA REPORT

PROJECT NO. 90-809	SAMPLE NO. 50976	SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB			CITY: STARTEX ST: SC
STATION ID: TB-01S			COLLECTION START: 09/24/90 0830 STOP: 00/00/00
CASE.NO.: 14949	SAS NO.:		D. NO.: Y300 MD NO:

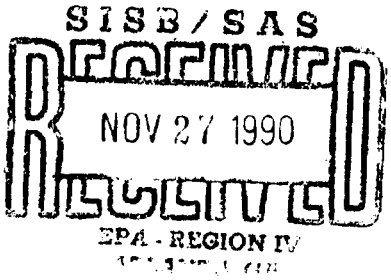
ANALYTICAL RESULTS UG/KG

20JN	TETRAMETHYLBUTANE	

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region IV
Environmental Services Division
College Station Road, Athens, Ga. 30613

*****MEMORANDUM******



DATE: 11/14/90

SUBJECT: Results of Specified Analysis;
90-809 OLD STARTEX SPARTANB
STARTEX SC
CASE NO: 14949

FROM: Robert W. Knight
Chief, Laboratory Evaluation/Quality Assurance Section

TO: PHIL BLACKWELL

Attached are the results of analysis of samples collected as part of the subject project.

As a result of the Quality Assurance Review, certain data qualifiers may have been placed on the data. Attached is a DATA QUALIFIER REPORT which explains the reasons that these qualifiers were required.

If you have any questions please contact me.

ATTACHMENT

INORGANIC DATA QUALIFIERS REPORT

Case Number: 14949
Project Number: 90-809
Site: Old Startex Spartanburg, Startex, SC

Element	Flag	Samples Affected	Reason
Water			
Cu, Se	U	All positives >IDL but <CRDL	Baseline instability
Al, Ca, Fe, K, Zn	U	All positives)IDL but <10X contaminant level	Positives in Blanks
Sb	JN	All positives with Al or Fe concentrations >200,000 ug/L in solution	Suspected positive interference as noted in the contractor ICS
Ag	JN	All positives with Fe concentrations >100,000 ug/L in solution	Suspected positive interference as noted in the contractor ICS
Pb	J	All positives	Matrix spike recovery = 137.6%
CN	J	All	Technical holding time exceeded
Soil			
Cu, Se	U	All positives >IDL but <CRDL	Baseline instability
Al, Ca, Fe, K, Zn	U	All positives)IDL but <10X contaminant level	Positives in Blanks
Sb	JN	All positives with Al or Fe concentrations >200,000 ug/L in solution	Suspected positive interference as noted in the contractor ICS
Ag	JN	All positives with Fe concentrations >100,000 ug/L in solution	Suspected positive interference as noted in the contractor ICS
As	J R	All positives All negatives	Matrix spike recovery = -103.8%
Pb	J	All	Matrix spike recovery = 144% Matrix duplicate RPD = 61.7%
Cr	J	All	Matrix duplicate RPD = 129%
Se	J	MDX286 and 289	Duplicate MSA r <.995

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01 COLLECTION START: 09/25/90 0800 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y275 MD NO: Y275

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y278 MD NO: Y278

RESULTS	UNITS	PARAMETER
1.8U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y279 MD NO: Y279

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-02 COLLECTION START: 09/25/90 1040 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y280 MD NO: Y280

RESULTS	UNITS	PARAMETER
1.5U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-02 COLLECTION START: 09/25/90 1050 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y281 MD NO: Y281

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-03 COLLECTION START: 09/25/90 1250 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y282 MD NO: Y282

RESULTS	UNITS	PARAMETER
1.3U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-03 COLLECTION START: 09/25/90 1300 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y283 MD NO: Y283

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-04 COLLECTION START: 09/25/90 1240 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y284 MD NO: Y284

RESULTS	UNITS	PARAMETER
1.3U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-04 COLLECTION START: 09/25/90 1245 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y285 MD NO: Y285

RESULTS	UNITS	PARAMETER
10UJ	UG/L	CYANIDE

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-01 COLLECTION START: 09/26/90 0845 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y286 MD NO: Y286

RESULTS UNITS PARAMETER
1.6U MG/KG CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-01 COLLECTION START: 09/26/90 0905 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y287 MD NO: Y287

RESULTS	UNITS	PARAMETER
1.2U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-02 COLLECTION START: 09/26/90 0930 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y288 MD NO: Y288

RESULTS	UNITS	PARAMETER
1.1U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-02 COLLECTION START: 09/26/90 1000 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y289 MD NO: Y289

RESULTS	UNITS	PARAMETER
1.2U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB	CITY: STARTEX ST: SC
STATION ID: SS-03	COLLECTION START: 09/26/90 1030 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.:	D. NO.: Y290 MD NO: Y290

RESULTS	UNITS	PARAMETER
4.8U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-03 COLLECTION START: 09/26/90 1055 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y291 MD NO: Y291

RESULTS	UNITS	PARAMETER
1.6U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-04 COLLECTION START: 09/26/90 1205 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y292 MD NO: Y292

RESULTS	UNITS	PARAMETER
1.4U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-05 COLLECTION START: 09/26/90 1225 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y293 MD NO: Y293

RESULTS	UNITS	PARAMETER
1.4U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-06 COLLECTION START: 09/26/90 1250 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.: D. NO.: Y294 MD NO: Y294

RESULTS	UNITS	PARAMETER
1.2U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA. 11/13/90

SPECIFIED ANALYSIS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL	PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB	CITY: STARTEX ST: SC
STATION ID: SB-06	COLLECTION START: 09/26/90 1315 STOP: 00/00/00
CASE.NO.: 14949 SAS NO.:	D. NO.: Y295 MD NO: Y295

RESULTS	UNITS	PARAMETER
1.1U	MG/KG	CYANIDE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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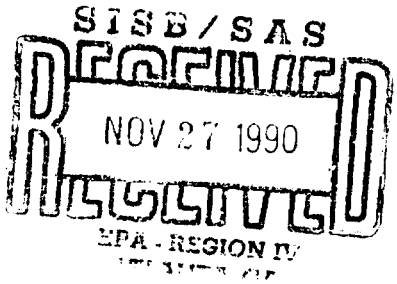
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region IV
Environmental Services Division
College Station Road, Athens, Ga. 30613

*****MEMORANDUM******



DATE: 11/14/90

SUBJECT: Results of Metals Analysis;
90-809 OLD STARTEX SPARTANB
STARTEX SC
CASE NO: 14949

FROM: Robert W. Knight
Chief, Laboratory Evaluation/Quality Assurance Section

TO: PHIL BLACKWELL

Attached are the results of analysis of samples collected as part of the subject project.

As a result of the Quality Assurance Review, certain data qualifiers may have been placed on the data. Attached is a DATA QUALIFIER REPORT which explains the reasons that these qualifiers were required.

If you have any questions please contact me.

ATTACHMENT

cc:

INORGANICS DATA QUALIFIERS REPORT

Case Number: 14949
Project Number: 90-809
Site: Old Startex Spartanburg, Startex, SC

Element	Flag	Samples Affected	Reason
Water			
Cu, Se	U	All positives >IDL but <CRDL	Baseline instability
Al, Ca, Fe, K, Zn	U	All positives)IDL but <10X contaminant level	Positives in Blanks
Sb	JN	All positives with Al or Fe concentrations >200,000 ug/L in solution	Suspected positive interference as noted in the contractor ICS
Ag	JN	All positives with Fe concentrations >100,000 ug/L in solution	Suspected positive interference as noted in the contractor ICS
Pb	J	All positives	Matrix spike recovery = 137.6%
CN	J	All	Technical holding time exceeded
Soil			
Cu, Se	U	All positives >IDL but <CRDL	Baseline instability
Al, Ca, Fe, K, Zn	U	All positives)IDL but <10X contaminant level	Positives in Blanks
Sb	JN	All positives with Al or Fe concentrations >200,000 ug/L in solution	Suspected positive interference as noted in the contractor ICS
Ag	JN	All positives with Fe concentrations >100,000 ug/L in solution	Suspected positive interference as noted in the contractor ICS
As	J R	All positives All negatives	Matrix spike recovery = -103.8%
Pb	J	All	Matrix spike recovery = 144% Matrix duplicate RPD = 61.7%
Cr	J	All	Matrix duplicate RPD = 129%
Se	J	MDX286 and 289	Duplicate MSA r <.995

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

METALS DATA REPORT 11/13/90

PROJECT NO. 90-809 SAMPLE NO. 50957 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: TB-01 COLLECTION START: 09/25/90 0800 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y275

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
40U	ALUMINUM	3U	MANGANESE
29U	ANTIMONY	.20U	MERCURY
3U	ARSENIC	28U	NICKEL
4U	BARIUM	770U	POTASSIUM
1U	BERYLLIUM	3U	SELENIUM
4U	CADMIUM	4U	SILVER
21U	CALCIUM	90U	SODIUM
5U	CHROMIUM	2U	THALLIUM
7U	COBALT	NA	TIN
4U	COPPER	4U	VANADIUM
40U	IRON	6U	ZINC
1U	LEAD		
31U	MAGNESIUM		

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

METALS DATA REPORT 11/13/90

PROJECT NO. 90-809 SAMPLE NO. 50958 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y278

MG/KG	ANALYTICAL RESULTS
6500	ALUMINUM
20U	ANTIMONY
3UJ	ARSENIC
34	BARIUM
.36U	BERYLLIUM
1.5U	CADMIUM
98	CALCIUM
46J	CHROMIUM
2.6U	COBALT
9.6	COPPER
7900	IRON
8J	LEAD
1000	MAGNESIUM
76	MANGANESE
.18U	MERCURY
20U	NICKEL
1400U	POTASSIUM
1.1U	SELENIUM
1.5U	SILVER
30U	SODIUM
.73U	THALLIUM
NA	TIN
22	VANADIUM
20U	ZINC
45	PERCENT MOISTURE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50959 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-01 COLLECTION START: 09/25/90 0855 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y279

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
130U	ALUMINUM	13	MANGANESE
29U	ANTIMONY	.20U	MERCURY
3U	ARSENIC	28U	NICKEL
22	BARIUM	1100U	POTASSIUM
1U	BERYLLIUM	3U	SELENIUM
4U	CADMIUM	4U	SILVER
2800	CALCIUM	2800	SODIUM
5U	CHROMIUM	2U	THALLIUM
7U	COBALT	NA	TIN
4U	COPPER	4U	VANADIUM
270U	IRON	8U	ZINC
3UJ	LEAD		
1300	MAGNESIUM		

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50960 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-02 COLLECTION START: 09/25/90 1040 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y280

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
6100	ALUMINUM	75	MANGANESE
8.8U	ANTIMONY	.15U	MERCURY
.91UR	ARSENIC	8.5U	NICKEL
18	BARIUM	710U	POTASSIUM
.30U	BERYLLIUM	.91U	SELENIUM
1.2U	CADMIUM	1.2U	SILVER
56	CALCIUM	30U	SODIUM
100J	CHROMIUM	.61U	THALLIUM
2.1U	COBALT	NA	TIN
6U	COPPER	84	VANADIUM
29000	IRON	8U	ZINC
5.8J	LEAD	34	PERCENT MOISTURE
380	MAGNESIUM		

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

METALS DATA REPORT 11/13/90

PROJECT NO. 90-809 SAMPLE NO. 50961 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-02 COLLECTION START: 09/25/90 1050 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y281

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
120U	ALUMINUM	30	MANGANESE
29U	ANTIMONY	.20U	MERCURY
3U	ARSENIC	28U	NICKEL
19	BARIUM	1400U	POTASSIUM
1U	BERYLLIUM	3U	SELENIUM
4U	CADMIUM	4U	SILVER
2900	CALCIUM	2900	SODIUM
5U	CHROMIUM	2U	THALLIUM
7U	COBALT	NA	TIN
4U	COPPER	4U	VANADIUM
320U	IRON	6U	ZINC
2UJ	LEAD		
1400	MAGNESIUM		

REMARKS ***REMARKS***
HOLDING TIME EXCEEDED-CN

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50962 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-03 COLLECTION START: 09/25/90 1250 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y282

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
1900	ALUMINUM	160	MANGANESE
7.5U	ANTIMONY	.13U	MERCURY
2UJ	ARSENIC	7.2U	NICKEL
9.6	BARIUM	200U	POTASSIUM
.26U	BERYLLIUM	.78U	SELENIUM
1U	CADMIUM	1U	SILVER
50U	CALCIUM	27	SODIUM
4.6J	CHROMIUM	.52U	THALLIUM
1.8U	COBALT	NA	TIN
2U	COPPER	7.1	VANADIUM
3200	IRON	9U	ZINC
2.5J	LEAD	23	PERCENT MOISTURE
130	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50963 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-03 COLLECTION START: 09/25/90 1300 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y283

UG/L	ANALYTICAL RESULTS	UG/L	ANALYTICAL RESULTS
200U	ALUMINUM	83	MANGANESE
29U	ANTIMONY	.20U	MERCURY
3U	ARSENIC	28U	NICKEL
16	BARIUM	5600	POTASSIUM
1U	BERYLLIUM	4U	SELENIUM
4U	CADMIUM	4U	SILVER
2600	CALCIUM	86000	SODIUM
6U	CHROMIUM	4U	THALLIUM
7U	COBALT	NA	TIN
40	COPPER	11	VANADIUM
650	IRON	110	ZINC
3UJ	LEAD		
1900	MAGNESIUM		

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50964 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SD-04 COLLECTION START: 09/25/90 1240 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y284

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
6600	ALUMINUM	130	MANGANESE
7.8U	ANTIMONY	.13U	MERCURY
2U	ARSENIC	7.5U	NICKEL
29	BARIUM	1000U	POTASSIUM
.27U	BERYLLIUM	.80U	SELENIUM
1.1U	CADMIUM	1.1U	SILVER
99	CALCIUM	23	SODIUM
19J	CHROMIUM	.54U	THALLIUM
2.4	COBALT	NA	TIN
8.5	COPPER	18	VANADIUM
7800	IRON	20U	ZINC
7.4J	LEAD	25	PERCENT MOISTURE
650	MAGNESIUM		

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

METALS DATA REPORT 11/13/90

PROJECT NO. 90-809 SAMPLE NO. 50965 SAMPLE TYPE: SURFACEWA PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SW-04 COLLECTION START: 09/25/90 1245 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y285

UG/L	ANALYTICAL RESULTS
230U	ALUMINUM
29U	ANTIMONY
3U	ARSENIC
18	BARIUM
1U	BERYLLIUM
4U	CADMIUM
2600	CALCIUM
5U	CHROMIUM
7U	COBALT
39	COPPER
750	IRON
4UJ	LEAD
1900	MAGNESIUM
83	MANGANESE
.20U	MERCURY
38	NICKEL
5100	POTASSIUM
3U	SELENIUM
4U	SILVER
85000	SODIUM
4U	THALLIUM
NA	TIN
14	VANADIUM
110	ZINC

REMARKS
HOLDING TIME EXCEEDED-CN

REMARKS

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50966 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-01 COLLECTION START: 09/26/90 0845 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y286

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
89000	ALUMINUM	130	MANGANESE
20U	ANTIMONY	.16U	MERCURY
13J	ARSENIC	9.1U	NICKEL
52	BARIUM	290U	POTASSIUM
.33U	BERYLLIUM	.98UJ	SELENIUM
1.3U	CADMIUM	1.3U	SILVER
430	CALCIUM	30U	SODIUM
65J	CHROMIUM	.65U	THALLIUM
2.3U	COBALT	NA	TIN
32	COPPER	220	VANADIUM
73000	IRON	29	ZINC
58J	LEAD	38	PERCENT MOISTURE
490	MAGNESIUM		

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

METALS DATA REPORT 11/13/90

PROJECT NO. 90-809 SAMPLE NO. 50967 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-01 COLLECTION START: 09/26/90 0905 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y287

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
61000	ALUMINUM	410	MANGANESE
20U	ANTIMONY	.12U	MERCURY
.70UR	ARSENIC	17	NICKEL
180	BARIUM	6800	POTASSIUM
.23U	BERYLLIUM	.70U	SELENIUM
.93U	CADMIUM	.93U	SILVER
20U	CALCIUM	20U	SODIUM
40J	CHROMIUM	.47U	THALLIUM
18	COBALT	NA	TIN
92	COPPER	170	VANADIUM
68000	IRON	87	ZINC
39J	LEAD	14	PERCENT MOISTURE
7700	MAGNESIUM		

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50968 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-02 COLLECTION START: 09/26/90 0930 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y288

MG/KG	ANALYTICAL RESULTS
21000	ALUMINUM
6.6U	ANTIMONY
2.6J	ARSENIC
54	BARIUM
.23U	BERYLLIUM
.91U	CADMIUM
480	CALCIUM
54J	CHROMIUM
5.2	COBALT
17	COPPER
24000	IRON
18J	LEAD
410	MAGNESIUM
390	MANGANESE
.11U	MERCURY
7.8	NICKEL
580U	POTASSIUM
1.9	SELENIUM
.91U	SILVER
18U	SODIUM
.46U	THALLIUM
NA	TIN
64	VANADIUM
73	ZINC
12	PERCENT MOISTURE

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50969 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-02 COLLECTION START: 09/26/90 1000 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y289

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
80000	ALUMINUM	400	MANGANESE
6.9U	ANTIMONY	.12U	MERCURY
2UJ	ARSENIC	28	NICKEL
60	BARIUM	980U	POTASSIUM
.24U	BERYLLIUM	3.7J	SELENIUM
.95U	CADMIUM	.95U	SILVER
200	CALCIUM	20U	SODIUM
130J	CHROMIUM	.47U	THALLIUM
8.5	COBALT	NA	TIN
71	COPPER	250	VANADIUM
94000	IRON	45	ZINC
24J	LEAD	16	PERCENT MOISTURE
800	MAGNESIUM		

FOOTNOTES
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50970 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-03 COLLECTION START: 09/26/90 1030 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y290

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
33000	ALUMINUM	1400	MANGANESE
30U	ANTIMONY	.48U	MERCURY
8UJ	ARSENIC	30	NICKEL
230	BARIUM	1400	POTASSIUM
.96U	BERYLLIUM	2.9U	SELENIUM
3.8U	CADMIUM	3.8U	SILVER
2000	CALCIUM	150	SODIUM
44J	CHROMIUM	1.9U	THALLIUM
240	COBALT	NA	TIN
38	COPPER	80	VANADIUM
100000	IRON	120	ZINC
51J	LEAD	79	PERCENT MOISTURE
1600	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

METALS DATA REPORT 11/13/90

PROJECT NO. 90-809 SAMPLE NO. 50971 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-03 COLLECTION START: 09/26/90 1055 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y291

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
6500	ALUMINUM	900	MANGANESE
9.2U	ANTIMONY	.16U	MERCURY
.95UR	ARSENIC	8.9U	NICKEL
52	BARIUM	250U	POTASSIUM
.32U	BERYLLIUM	.95U	SELENIUM
1.3U	CADMIUM	1.3U	SILVER
350	CALCIUM	25U	SODIUM
18J	CHROMIUM	.63U	THALLIUM
48	COBALT	NA	TIN
2.8	COPPER	16	VANADIUM
4300	IRON	7U	ZINC
9.8J	LEAD	37	PERCENT MOISTURE
290	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50972 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-04 COLLECTION START: 09/26/90 1205 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y292

MG/KG	ANALYTICAL RESULTS
61000	ALUMINUM
8.4U	ANTIMONY
.87UR	ARSENIC
110	BARIUM
.29U	BERYLLIUM
1.2U	CADMIUM
790	CALCIUM
88J	CHROMIUM
9	COBALT
40	COPPER
63000	IRON
34J	LEAD
2000	MAGNESIUM
170	MANGANESE
.14U	MERCURY
19	NICKEL
2100	POTASSIUM
.87U	SELENIUM
1.2U	SILVER
300	SODIUM
.58U	THALLIUM
NA	TIN
180	VANADIUM
33	ZINC
31	PERCENT MOISTURE

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

METALS DATA REPORT 11/13/90

PROJECT NO. 90-809 SAMPLE NO. 50973 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-05 COLLECTION START: 09/26/90 1225 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y293

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
11000	ALUMINUM	65	MANGANESE
7.8U	ANTIMONY	.14U	MERCURY
11J	ARSENIC	16	NICKEL
200	BARIUM	900U	POTASSIUM
2U	BERYLLIUM	2U	SELENIUM
1.1U	CADMIUM	1.1U	SILVER
4400	CALCIUM	190	SODIUM
13J	CHROMIUM	1U	THALLIUM
8	COBALT	NA	TIN
35	COPPER	44	VANADIUM
10000	IRON	20U	ZINC
11J	LEAD	26	PERCENT MOISTURE
760	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50974 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SS-06 COLLECTION START: 09/26/90 1250 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y294

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
26000	ALUMINUM	450	MANGANESE
7.2U	ANTIMONY	.12U	MERCURY
3UJ	ARSENIC	7U	NICKEL
140	BARIUM	1200U	POTASSIUM
.25U	BERYLLIUM	.75U	SELENIUM
1U	CADMIUM	2.9JN	SILVER
3100	CALCIUM	20U	SODIUM
44J	CHROMIUM	.50U	THALLIUM
7.4	COBALT	NA	TIN
23	COPPER	73	VANADIUM
28000	IRON	38	ZINC
33J	LEAD	20	PERCENT MOISTURE
1000	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
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*U-MATERIAL WAS ANALYZED FOR BUT NOT DETECTED. THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.
*R-QC INDICATES THAT DATA UNUSABLE. COMPOUND MAY OR MAY NOT BE PRESENT. RESAMPLING AND REANALYSIS IS NECESSARY FOR VERIFICATION.

SAMPLE AND ANALYSIS MANAGEMENT SYSTEM
EPA-REGION IV ESD, ATHENS, GA.

11/13/90

METALS DATA REPORT

PROJECT NO. 90-809 SAMPLE NO. 50975 SAMPLE TYPE: SOIL PROG ELEM: NSF COLLECTED BY: T RYLAND
SOURCE: OLD STARTEX SPARTANB CITY: STARTEX ST: SC
STATION ID: SB-06 COLLECTION START: 09/26/90 1315 STOP: 00/00/00
CASE NUMBER: 14949 SAS NUMBER: MD NUMBER: Y295

MG/KG	ANALYTICAL RESULTS	MG/KG	ANALYTICAL RESULTS
39000	ALUMINUM	290	MANGANESE
6.3U	ANTIMONY	.11U	MERCURY
2UJ	ARSENIC	7.5	NICKEL
75	BARIUM	920U	POTASSIUM
1U	BERYLLIUM	.65U	SELENIUM
.87U	CADMIUM	3.7JN	SILVER
330	CALCIUM	20U	SODIUM
140J	CHROMIUM	.44U	THALLIUM
6	COBALT	NA	TIN
29	COPPER	100	VANADIUM
37000	IRON	27	ZINC
16J	LEAD	08	PERCENT MOISTURE
880	MAGNESIUM		

FOOTNOTES
*A-AVERAGE VALUE *NA-NOT ANALYZED *NAI-INTERFERENCES *J-ESTIMATED VALUE *N-PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
*K-ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN *L-ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ENVIRONMENTAL SERVICES DIVISION
ATHENS, GEORGIA 30613

SIBE/SAS
RECEIVED
OCT 04 1990
EPA - REGION IV
ATLANTA, GA.

MEMORANDUM

DATE: October 3, 1990

SUBJECT: Screening Site Inspection Study Plans

FROM: Pat Stamp
Laboratory Quality Control Specialist
Laboratory Evaluation & Quality Assurance Section

TO: Al Hanke, Chief
Site Assessment Section
Waste Programs Branch
Waste Management Division

THRU: Wade Knight, Chief
Laboratory Evaluation & Quality Assurance Section

We have reviewed the following subject documents and have no comments:

1. Reliable Metal Products, Geneva, Alabama
2. AMAX Phosphate, Palmetto, Florida
3. Georgia Power/Plant Branch, Milledgeville, Georgia
4. Buncombe County Landfill, Asheville, North Carolina
5. 3M Greenville Plant, Greenville, South Carolina
6. Columbia Landfill, Columbia, South Carolina
7. Dart Industries, Hemingway, South Carolina
8. Duracell International Battery, Lancaster, South Carolina
9. G.B. Fermentation, Kingstree, South Carolina
10. Old Lyman Dump, Lyman, South Carolina
11. Old Startex, Spartanburg County Landfill, Startex, SC
12. Richland County Landfill, Columbia, South Carolina
13. Slater Plant Property, Slater, South Carolina

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

4WD-WPB

SEP 18 1990

Mr. Nick Odom
Spring Industries
P.O. Box 70
Ft. Mill, South Carolina 29715

SCD 980558191

Dear Mr. Odom:

Enclosed you will find a copy of the Screening Site Inspection (SSI) study plan which you requested for the Old Startex Spartanburg County Landfill. Please be advised that the SSI study plan is subject to revision based on comments from EPA and field conditions at the time of the inspection.

I sent a copy of the Old Lyman Dump SSI study plan to Mr. William Groce, since the town of Lyman is the current owner of that property.

Should you have any questions regarding this matter, please contact me at (404) 347-5065.

Sincerely yours,

Earl L. Bozeman, Jr.
Environmental Scientist

Enclosure

EB:eb:Doc Odom:Disk Bozeman (Pers):9/17/90:x5065

4WD-SAS 4WD-SAS

BOZEMAN DEIHL

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV, ATHENS, GEORGIA

SIED/SAS
RECEIVED
SEP 18 1990
EPA - REGION IV
ATLANTA, GA.

MEMORANDUM

DATE: SEP 17 1990

SUBJECT: Screening Site Inspection Study Plan,
Old Startex, Spartanburg County Landfill,
Startex, Spartanburg County, South Carolina;
ESD Project No. 90E-634

FROM: Roger E. Carlton, Environmental Engineer Roger E. Carlton
Hazardous Waste Section
Environmental Compliance Branch
Environmental Services Division

TO: Al Hanke, Chief
Site Assessment Section
Waste Programs Branch
Waste Management Division

THRU: William R. Bokey, Chief William R. Bokey
Hazardous Waste Section
Environmental Compliance Branch
Environmental Services Division

The screening site inspection study plan for Screening Site Inspection Study Plan, Old Startex, Spartanburg County Landfill, Startex, Spartanburg County, South Carolina, has been reviewed and it appears that a field reconnaissance was not performed. A figure showing the landfill, access road(s) to the landfill and the sample collection points should be shown. Any other physiographic features should be noted and included on the same figure.

If you have any questions, please contact me at (404) 546-3351 or (FTS) 250-3351.

cc: Finger/Wright
Bokey/Hall
Knight
Franklin

NUS CORPORATION
1927 LAKESIDE PARKWAY
SUITE 614
TUCKER, GEORGIA 30084
404-938-7710

SISB/SAS
RECEIVED
SEP 13 1990
EPA - REGION IV
ATLANTA, GA.

C-586-9-0-52

September 6, 1990

Mr. A.R. Hanke
Waste Programs Branch
Waste Management Division
Environmental Protection Agency
345 Courtland Street, N. E.
Atlanta, Georgia 30365

Subject: Screening Site Inspection
Study Plan - Revision 0
Old Startex, Spartanburg County Landfill
TDD No. F4-9007-22
EPA ID No. SCD980558191

Dear Mr. Hanke:

Enclosed please find one (1) copy of the Study Plan for Old Startex, Spartanburg County Landfill, Startex, Spartanburg County, South Carolina. The investigation is scheduled for the week of September 24, 1990.

If you have any questions or comments about this submittal, please contact me.

Very truly yours,

Terry Ryland
Project Manager

Approved:

TR/tb

Enclosure (1)

NUS CORPORATION
1927 LAKESIDE PARKWAY
SUITE 614
TUCKER, GEORGIA 30084
404-938-7710

Wade Knight

C-586-9-0-53

September 6, 1990

Mr. William Bokey
Environmental Protection Agency
College Station Road
Athens, Georgia 30613

SEPT 11 90

Subject: Screening Site Inspection
Study Plan - Revision 0
Old Startex, Spartanburg County Landfill
TDD No. F4-9007-22
EPA ID No. SCD980558191

Dear Mr. Bokey:

Enclosed please find two (2) copies of the Study Plan for Old Startex, Spartanburg County Landfill, Startex, Spartanburg County, South Carolina. The investigation is scheduled for the week of September 24, 1990.

If you have any questions or comments about this submittal, please contact me.

Very truly yours,

Terry Ryland
Project Manager

Approved:

TR/tb

Enclosures (2)

SEP 13 1990

STUDY PLAN
SCREENING SITE INSPECTION, PHASE II
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA
EPA ID #: SCD980558191

Prepared Under
TDD No. F4-9007-22
CONTRACT NO. 68-01-7346

Revision 0

FOR THE

WASTE MANAGEMENT DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY

SEPTEMBER 10, 1990

NUS CORPORATION
SUPERFUND DIVISION

Prepared By	Reviewed By	Approved By
Terry Ryland Project Manager	Roger Franklin Assistant Regional Project Manager	Phil Blackwell Regional Project Manager

TABLE OF CONTENTS

Section		Page
1.0	**INTRODUCTION**	**1**
1.1	Objectives	1
1.2	Scope of Work	2
1.3	Schedule	2
1.4	Personnel	2
1.5	Permits and Authorization Requirements	3
1.6	Site History and Description	3
1.7	Regional Hydrogeology	3
2.0	**SAMPLING INVESTIGATION**	**5**
2.1	Sampling Locations	5
2.2	Analytical and Container Requirements	6
2.3	Methodology	9
REFERENCES		10

FIGURES

Figure 1	Site Location Map	4

TABLES

Table 1	Sample Locations and Rationale	7

STUDY PLAN

SCREENING SITE INSPECTION, PHASE II

OLD STARTEX, SPARTANBURG COUNTY LANDFILL

STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

EPA ID #SCD980558191

TDD NO. F4-9007-22

1.0 INTRODUCTION

The NUS Corporation Region 4 Field Investigation Team (FIT) has been tasked by the U.S. Environmental Protection Agency (EPA), Waste Management Division to conduct a Screening Site Inspection (SSI) at the Old Startex, Spartanburg County Landfill facility in Spartanburg County, South Carolina. The inspection will be performed under the authority of the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). Tasks will be performed to satisfy the requirements stated in Phase II of Technical Directive Document (TDD) number F4-9007-22.

1.1 Objectives

The objectives of this Phase II inspection will be to determine the nature of contaminants present at the site and to determine if a release of these substances has occurred or may occur. Further, this inspection will seek to determine the possible pathways by which contamination could migrate from the site and the populations and environments it would potentially affect. Through these objectives, a recommendation will be made regarding future activities at the site.

Specific elements are:

- Obtain information to prepare a site-specific preliminary HRS
- Provide EPA the necessary information to make decisions on any other actions warranted at the site.

1.2 Scope of Work

The scope of this investigation will include the following activities:

- Obtain and review background materials relevant to HRS scoring of site
- Obtain aerial photographs and maps of site, if possible
- Obtain information on local water systems
- Evaluate target populations associated with the groundwater, surface water, air and onsite exposure pathways
- Conduct a survey of private wells
- Determine location and distance to nearest potable well
- Develop a site sketch
- Collect environmental samples

1.3 Schedule

The week of September 24, 1990

1.4 Personnel

Project Manager - Terry Ryland
Other personnel as required

1.5 Permits and Authorization Requirements

EPA is responsible for obtaining access to the site and permission to take photographs of site. In addition, EPA is responsible for all permits which may be required to accomplish this task.

1.6 Site History and Description

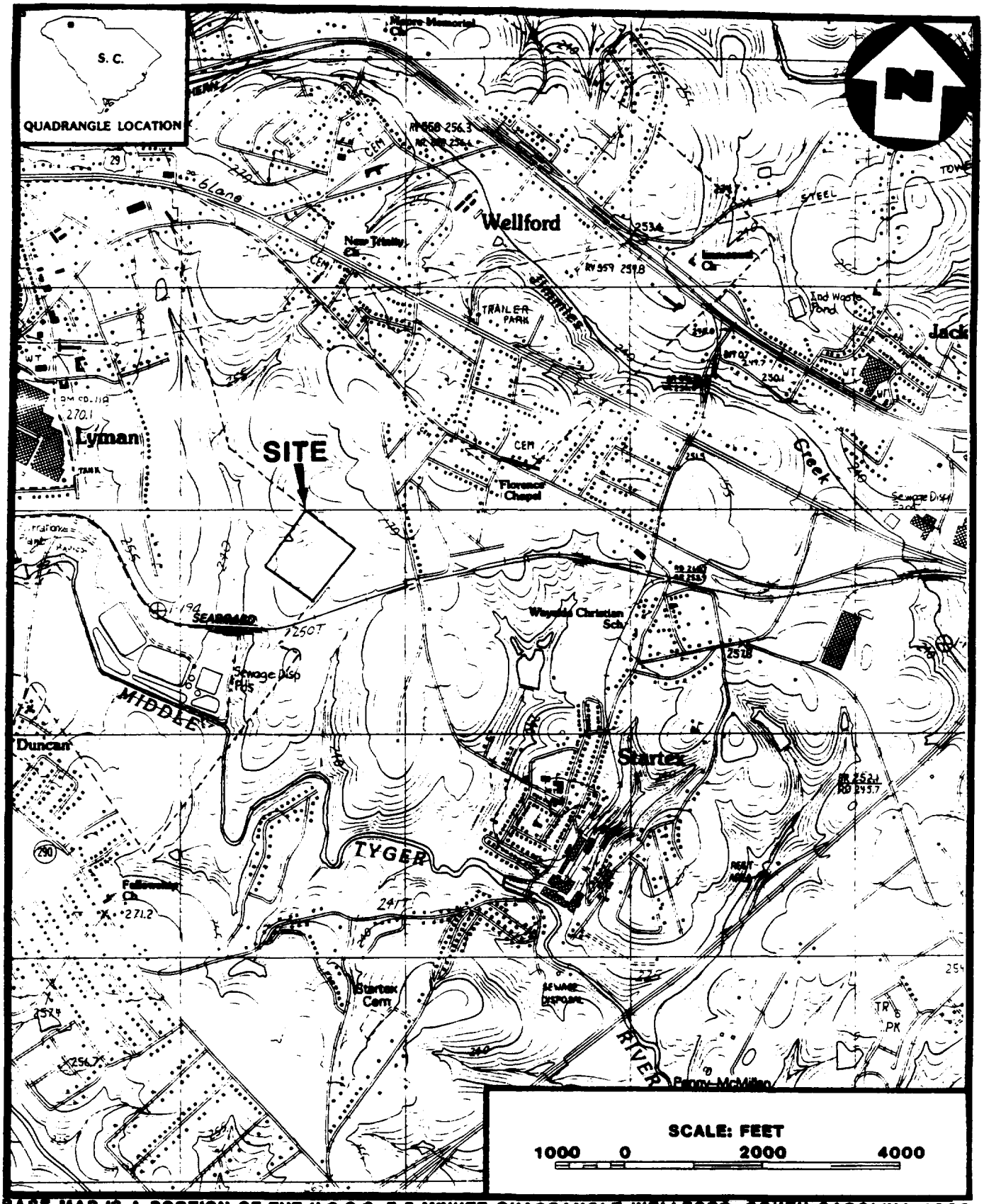
The Old Startex, Spartanburg County landfill is located off old U.S. 29 in Startex, Spartanburg County, South Carolina (Figure 1). This 35 acre landfill, although owned by Lyman Printing and Finishing Company, was operated by Spartanburg County from the middle to late 1960's through the early 1970's. During this time the landfill accepted wastes from Lyman Printing and Finishing Company, Spartanburg County and other industries for disposal of domestic and industrial wastes or refuse (Ref 1). It is thought to have received mostly inert materials and small amounts of organic and inorganic wastes (Ref. 2). When Spartanburg County ceased operations at the site, Lyman Printing and Finishing Company closed access of the site to the public and other industries. Since that time, Lyman Printing and Finishing Company has used the site for disposal of only broken wooden pallets and cinders from their boiler house until closed in 1981 (Ref. 1).

It is unknown as to the exact amount and type of waste buried in the landfill, but because of the nature of wastes generated by textile printing and finishing operations during the 1960's and 70's, it is suspected that some of the materials buried in the landfill contain hazardous substances.

Lyman Printing and Finishing changed its name to Lyman Dying and Finishing sometime before 1981. Today the facility is called Springs Industries.

1.7 Regional Hydrogeology

The Old Startex Spartanburg County landfill is located with in the Piedmont physiographic province of northwestern South Carolina, which is characterized by a series of complexly fractures and folded metamorphic rocks containing numerous igneous intrusions (Ref. 1, p. 13). The facility lies within the Inner Piedmont Belt, which is composed of highly metamorphosed gneisses and schist of Pre-Cambrian age, intruded in many areas by younger granites (Ref. 1, p. 13). The topography of the area is regionally mature, consisting of a broad plateau dissected by streams that generally trend southeast (Ref. 1, pp. 9, 10). The land surface has moderate relief, with generally subdued topographic features, such as as well-rounded hills with no prominent peaks or ridges (Ref. 1, p. 7).



BASE MAP IS A PORTION OF THE U.S.G.S. 7.5 MINUTE QUADRANGLE WELLFORD, SOUTH CAROLINA 1983.

SITE LOCATION MAP
OLD STARTEX, SPARTANBURG COUNTY LANDFIILL
STARTEX, SOUTH CAROLINA

FIGURE 1

NUS CORPORATION

The net annual precipitation for the area is 21 inches, and the 1-year, 24-hour rainfall is 3.5 inches (Refs. 2, pp. 29, 49; 3, p. 93).

The source of groundwater in the area is the unconfined crystalline rock aquifer system (Ref. 1, p. 57). Water is stored in this aquifer system within the fractures of the crystalline bedrock, and within the pore spaces of the overlying mantle of weathered rock and residual soil, or regolith (Ref. 1, p. 57). The availability of water in the aquifer is controlled primarily by the intensity of jointing and fracturing of bedrock and by the thickness and areal extent of the regolith (Ref. 1, p. 57). Within the Inner Piedmont, the regolith is usually highly permeably, allowing rainfall to infiltrate readily to recharge the bedrock fractures. Locally, the soils around the facility consist of moderately permeably sandy clay and clay loams of the Davidson series (Refs. 4, pp. 14, 64-65, sheet 28; 5, p. 2). Soils of this series are formed from the weathering of gabbro, diorite, and hornblende schists or gneisses. These soils are typically deep and well-drained (Refs. 4, pp. 14, 56). Davidson series soils are generally greater than 15 feet thick and have an estimated hydraulic conductivity of 1.0 x 10-5 to 1.0 x 10-7 cm/sec (Refs. 4, pp. 14, 4-65; 5, p. 2). Depth to groundwater at the facility is estimated to be between 10 and 20 feet below land surface, and the predominant direction of groundwater flow is to the west toward the Middle Tyger River (Refs. 5, p. 2; 6). Both water-table and artesian conditions can be found in the general area, since the regolith may locally have low permeability and act as a confining layer, but water-table conditions are most likely (Ref. 1, p. 58).

2.0 SAMPLING INVESTIGATION

The sampling investigation will include the collection of surface soil, subsurface soil sediment and groundwater samples. Samples will be analyzed for extractable and purgeable organic compounds, pesticides, PCBs, cyanides, metals, and the USEPA Target Compound List. Analyses will be performed under the Contract Laboratory Program (CLP).

A sample location map is not available at this time and will be generated during the investigation.

2.1 Sampling Locations

Twenty-four environmental samples will be collected during the investigation. Ten soil samples will be collected from five locations, these include both surface soil and subsurface soil samples. One sampling location will be for background and the others will be for possible detection of contamination (Table 1).

Five temporary wells will also be installed at the five soil sampling locations and one private well will be sampled, to determine the presence or absence of contamination in groundwater (Table 1).

Four sediment and four surface water samples will be collected. Two sediment and two surface water samples will be collected for background. The remaining samples will be collected from various locations downgradient of the landfill (Table 1).

2.2 Analytical and Container Requirements

Sample containers used will be in accordance with the requirements specified in the Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual; United States Environmental Protection Agency, Region IV, Environmental Services Division, April 1, 1986. The following is a description of the analysis and types of containers required.

Analyses	Container	Preservatives**
Ext. Organics, Water	1 gal., amber glass*	None
Volatile Organics, Water	40 ml., glass vial*	4 drops conc. HCL to pH <2
Metals, Water	1 liter, plastic	50% HNO_3 to pH <2
Cyanide, Water	1 liter, plastic	NaOH to pH >12
Ext. Organics, Soil/Sediment	8 oz., glass*	None
Volatile Organics Soil/Sediment	4 oz., glass*	None
Inorganics, Soil/Sediment	8 oz., glass*	None

* Sample container lids are lined with teflon.

** All samples will be iced to 4°C upon collection.

TABLE 1

SAMPLE LOCATIONS AND RATIONALE
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Sample Type	Location	Rationale
OS-SS-01	Surface Soil	Background	Control sample
OS-SS-02	Surface Soil	Onsite	Detection around landfill perimeter
OS-SS-03	Surface Soil	Onsite	Detection around landfill perimeter
OS-SS-04	Surface Soil	Onsite	Detection around landfill perimeter
OS-SS-05	Surface Soil	Onsite	Detection around landfill perimeter
OS-SB-01	Subsurface Soil	Background	Collected at 10 feet below land surface (bls)
OS-SB-02	Subsurface Soil	Onsite	Collected at landfill perimeter 10 feet bls to determine presence or absence of contamination
OS-SB-03	Subsurface Soil	Onsite	Collected at landfill perimeter 10 feet bls to determine presence or absence of contamination
OS-SB-04	Subsurface Soil	Onsite	Collected at landfill perimeter 10 feet bls to determine presence or absence of contamination
OS-SB-05	Subsurface Soil	Onsite	Collected at landfill perimeter 10 feet bls to determine presence or absence of contamination
OS-TW-01	Temporary Well	Background	Collected at same location as SS-01 and SB-01
OS-TW-02	Temporary Well	Onsite	Determine presence or absence of groundwater contamination

OS - Old Startex
SS - Surface Soil
SB - Subsurface Soil
TW - Temporary Well
PW - Private Well
SD - Sediment
SW - Surface Water

TABLE 1

SAMPLE LOCATIONS AND RATIONALE
OLD STARTEX, SPARTANBURG COUNTY LANDFILL
STARTEX, SPARTANBURG COUNTY, SOUTH CAROLINA

Sample Code	Sample Type	Location	Rationale
OS-TW-03	Temporary Well	Onsite	Determine presence or absence of groundwater contamination
OS-TW-04	Temporary Well	Onsite	Determine presence or absence of groundwater contamination
OS-TW-05	Temporary Well	Onsite	Determine presence or absence of groundwater contamination
OS-PW-01	Private Well	Onsite	Determine presence or absence of groundwater contamination
OS-SD-01	Sediment	Background	Control sample
OS-SD-02	Sediment	Onsite	Downgradient sediment along perennial stream
OS-SD-03	Sediment	Background	Control sample for Tyger River
OS-SD-04	Sediment	Onsite	Downgradient on Tyger River
OS-SW-01	Surface Water	Background	Control sample
OS-SW-02	Surface Water	Downgradient	Downgradient along perennial stream
OS-SW-03	Surface Water	Background	Control sample on Tyger River
OS-SW-04	Surface Water	Downgradient	Downgradient of perennial stream confluence on Tyger River

OS - Old Startex
SS - Surface Soil
SB - Subsurface Soil
TW - Temporary Well
PW - Private Well
SD - Sediment
SW - Surface Water

2.3 Methodology

All sample collection, sample preservation, and chain-of-custody procedures used during this investigation will be in accordance with the standard operating procedures as specified in Section 3 and 4 of the Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual; United States Environmental Protection Agency, Region IV, Environmental Services Division, April 1, 1986.

All laboratory analyses and laboratory quality assurance procedures used during this investigation will be in accordance with standard procedures and protocols as specified in the Analytical Support Branch Operations and Quality Assurance Manual; United States Environmental Protection Agency, Region IV, Environmental Services Division; revised June 1, 1985 or as specified by the existing United States Environmental Protection Agency standard procedures and protocols for the contract analytical laboratory program.

REFERENCES

1. EPA Notification of Hazardous Waste Site (EPA Form 8900-1) foy Lyman Dyeing and Finishing Company, Lyman, South Carolina. Filed by Lamac T. Oxford, Vice President, June 22, 1981.

2. Update Preliminary Assessment, prepared by Gerald Stewart, South Carolina Department of Health and Environmental Control, December 16, 1988.

3. W.M. Bloxham, George E. Siple, and T. Ray Cummings, Water Resources of Spartanburg County, South Carolina. South Carolina Water Resources Commission Report No. 3 (Spartanburg, S.C.: U.S. Geological Survey, Water Resources Commission, 1979).

4. U. S. Department of Commerce, Climatic Atlas of the United States, (Washington, D.C>: GPO, June 1868) Reprint: 1983, National Oceanic and Atmospheric Administration.

5. U. S. Department of Commerce, Rainfall Frequency Atlas of the United States, Technical Paper No. 40 (Washington, D.C.: GPO, June 1961).

6. Wallace J. Camp, Soil Survey, Spartanburg County, South Carolina, (United States Department of Agriculture, 1968).

7. South Carolina Department of Health and Environmental Control (SCDHEC), Division of Hydrogeology. Hydrogeologic Review of the Old Startex Spartanburg County Landfill, completed by Judy L. Canova, November 22, 1988.

8. USGS 7.5 minute Topographic Quadrangle: Wellford, S.C.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

CERTIFIED MAIL

RETURN RECEIPT REQUESTED

September 11, 1990

Mr. Alan McManus
Spring Industries
Post Office Box 70
Fort Mill, South Carolina 29715

RE: Old Startex Spartanburg County Landfill
Old U.S. Highway 29
Startex, South Carolina
SCD980558191

Dear Mr. McManus:

The United States Environmental Protection Agency (EPA), pursuant to the authority and requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act (SARA), Public Law 99-499, is planning to conduct an investigation of the above referenced site. Old Startex Spartanburg County Landfill is located on Old U.S. Highway 29, Startex, South Carolina. EPA has reason to believe that there may be a release or threat of a release of hazardous substances from the site into the surrounding environment. The purpose of the investigation is to determine the nature and extent of contamination at the site and to determine what, if any, further response action would be appropriate.

As per the telephone conversation with you on August 21, 1990, EPA was granted permission for access to your property beginning on or about September 24, 1990 and continuing through the completion of the investigation on or about September 28, 1990. Activities to be conducted during the investigation include:

1. Inspect, sketch, and photograph the premises;

2. Collect surface and subsurface soil samples;

3. Collect groundwater and subsurface water samples;

4. Collect sediment samples;

5. Conduct air monitoring;

6. Transportation of equipment onto and about the site as necessary to accomplish the activities above, including trucks and sampling equipment.

YELLOW

The above sampling activity will be conducted by personnel from EPA Region IV's Field Investigation Team (FIT). Mr. Terry Ryland of FIT will contact you prior to the actual site visit to make final arrangements and note any changes.

Split samples will be made available if requested. However, you will be required to furnish your own containers as well as your own laboratory analyses.

If you have any questions, please contact me at (404) 347-5065. Your cooperation in this matter is appreciated.

Sincerely,

Earl L. Bozeman Jr.

Earl L. Bozeman, Jr.
Environmental Scientist

ELB/gwn

Enclosure

cc: John Jenkins, NUS Corporation
John Cresswell, SCDHEC

YELLOW

ACCESS INFORMATION SHEET

Site Name: Old Stactex, Spartenburg County Landfill
Site Address: off old U.S. 29, STactex, South Cacaling
EPA ID #: SCD 980558191
FIT Project Manager: Terry Ryland
FIT State Coordinator: John Jenkins
EPA Contact: Earl Bozeman
Field Date: 9-24-90
TDD Number: F4-9007-22

	File Information	Verification
Facility Owner/Operator Address Phone No. Principal Contact	Owner: Spring Industries P.O. Box 70 Fort Mills, S.C. 29715 Operator: Spring Industries P.O. Box 2000 Lyman, S.C. 29365 (803) 433-4000)	SAME Dr. Ron Reed Contact
Landowner Address Phone No. Principal Contact (if different from above)	Above owner/operator is also: Lyman Printing & Finishing a division of Spring Ind. Pacific Street Lyman, S.C. 29365	SAME
Date of Information	Dec. 16, 1988 / phone # as of 7/27/90	7/27/90

Date Access Required (3 weeks prior to field date) 9/3/90

Date Information Submitted to EPA 7-30-90

Comments:

ACCESS INFORMATION SHEET

Site Name: Old Startex Spartanburg Co Landfill
Site Address: Old US 29
Startex, SC

FIT Project Manager: Terry Ryland
FIT State Coordinator: John Jenkins
EPA Contact: Earl Bozeman
Field Date: 9/24/90

EPA ID #: SCD980558191
TDD Number: F4-9007-22

	File Information	Verification
Facility Owner/Operator **Address** **Phone No.** **Principal Contact**	Send Study Plan	Contact - Alan McManus or Nick Odom 803-547-3601 or (3629) Spring Industries P.O. Box 70 Ft. Mill, SC 29715
Landowner **Address** **Phone No.** **Principal Contact** **(If different from above)**		
Date of Information		

Date Access Required (3 weeks prior to field date) _____

Date Information Submitted to EPA _____

Comments:

South Carolina Department of Health and Environmental Control

Received
JAN 10 1989

2600 Bull Street
Columbia, S.C. 29201

Commissioner
Michael D. Jarrett

Board
Harry M. Hallman, Jr., Chairman
Toney Graham, Jr. M.D., Vice-Chairman
John B. Pate, M.D., Secretary
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Henry S. Jordan, M.D.

Medium Priority
01/12/89
BLH

UPDATED PRELIMINARY ASSESSMENT
Old Startex Spartanburg County Landfill
SCD 980 558 191
Spartanburg County

Prepared by: Gerald Stewart
Date Completed: December 16, 1988

I. INTRODUCTION/EXECUTIVE SUMMARY

Between the late 1960's to 1981, the Old Startex Spartanburg County Landfill was utilized by Lyman Dyeing and Finishing Company and Spartanburg County to dispose of domestic and industrial wastes (Ref. 1, pg. 3). The identity and quantity of wastes disposed in the approximately thirty-five acre landfill are unknown. According to Nick Odom, Environmental Manager-Springs Industries, Inc., the site probably received mostly inert materials and a minimum amount of liquids, such as organics and inorganics (Ref. 1, pg. 4). However, as suggested in the company's Section 103(c) notification, it is impossible to know all types of wastes that were dumped at the site during the active years. Because of the nature of the wastes generated by textile printing and finishing operations in the 1960's and 70's, some of the materials disposed in the landfill probably contained hazardous substances (Ref. 1, pg. 3).

An estimated 775 people are dependent on groundwater wells located within three mile of the Old Startex Spartanburg County Landfill (Ref. 3, pg. 2). No public water supply intakes are located within fifteen miles downstream of the site (Ref. 4, pg. 176). Therefore, the migration of contaminants into the groundwater supply is the major area of concern. No groundwater monitoring has been done to assess the impact of contaminants on groundwater quality. Therefore, the Old Startex Spartanburg County Landfill is given a medium priority for a Site Screening Investigation (SSI).

II. SITE BACKGROUND AND HISTORY

A. Ownership History

Present Owner: Spring Industries, Inc.
P.O. Box 70
Fort Mills, S.C. 29715

Present Operator: Spring Industries, Inc.
P.O. Box 2000
Lyman, S.C. 29365

Previous Owner: Lyman Dyeing and Finishing Company
(presently, Spring Industries)
P.O. Box 2000
Lyman, South Carolina 29365

Previous Operators: Same as previous owner
and
(2) Spartanburg County

B. Site Location/Description

Spring Industries, Incorporated Lyman Plant is located in the Town of Lyman, South Carolina. Old Startex Spartanburg County Landfill is located approximately 3,750 feet to the east-southeast of the Springs Industries, Inc.'s plant (Ref. 2). Geographically, the site is positioned at 34^0 56' 24.3" North latitude and 082^0 06' 39.5" West longitude (Ref. 2).

Old Startex Spartanburg County Landfill is estimated to cover thirty to forty acres of land (Ref. 1, pg. 2). No additional specifications of the landfill are known.

C. Regulatory History/RCRA Status

Lyman Dyeing and Finishing Company (presently, Springs Industries) submitted Section 103(c) CERCLA notification for the Old Startex Spartanburg County Landfill to the US EPA on June 22, 1981 (Ref. 1, pg. 1-3). According to the 103(c) notification, no potentially hazardous materials were placed into the landfill after the early 1970's (Ref. 1, pg. 3). Lyman Dyeing and Finishing Company closed the landfill in 1981.

Lyman Dyeing and Finishing Company submitted a hazardous waste activity notification to SCDHEC of temporary storage of oil base and/or water base paint waste (Ref. 1, pg. 5-12). According to the state notification, the company generated approximately seventy-five pounds of paint waste per year (Ref. 1, pg. 5). Lyman Dyeing and Finishing Company is not classified as a RCRA facility of any type according to SCDHEC files. SCDHEC files indicate that the company is newly listed with the US EPA under the RCRA program.

D. Process and Waste Disposal History

According to Lyman Dyeing and Finishing Company's 103(c) notification, the Old Startex Spartanburg County Landfill received domestic and industrial wastes or refuse from Lyman Dyeing and Finishing Company, Spartanburg County and other industries from the late 1960's until the early 1970's (Ref. 1, pg. 3). The dump handled industrial waste and refuse generated by the textile printing and finishing operations at the Lyman D&F

plant and industrial waste from other companies (Ref. 1, pg. 3). Therefore, the dump site is suspected to contain hazardous waste.

Spartanburg County operated the site until the early 1970's. Afterward, Lyman D&F Company closed access to the site to the public and other industries (Ref. 1, pg. 3). From the early 1970's until 1981, Lyman D&F Company utilized the site for disposal of broken wooden pallets and cinders from their boiler house (Ref. 1, pg. 3). According to Nick Odom, Environmental Manager - Springs Industries, Inc., the landfill probably received a large amount of textile rags, cardboard, bricks, blocks and fly ash and a minimum amount of liquids, such as organics and inorganics (Ref. 1, pg. 4).

However, the composition and amount of hazardous waste disposed of in the Old Startex Spartanburg County Landfill is unknown. According to the 103(c) notification, the landfill contains between 13 and 26 million cubic feet of potentially hazardous wastes (Ref. 1, pg. 2).

E. Removal/Remedial Actions

No remedial or removal actions are known to have taken place at the site.

F. Demography/Regional Setting

Old Startex Spartanburg County Landfill is located approximately .75 mile east-southeast of Lyman, South Carolina and .75 mile northwest of Startex, South Carolina (Ref. 2). Within three miles of the site, the region is heavily populated and contains numerous villages and townships (Ref. 2).

The region is fairly hilly with numerous woodlands, creeks and rivers (Ref. 2).

III. GROUNDWATER PATHWAY

A. Regional Hydrogeology

Old Startex Spartanburg County Landfill is underlain by weathering products of bedrock containing a heterogeneous mixture of sands, silts and clays, and a mixture of igneous and metamorphic crystalline rock (Ref. 3, pg. 1). The on-site soil is composed of Davidson sandy clay loam containing an average of sixty percent clay (Ref. 3, pg. 2). Soils of this composition has a saturated hydraulic conductivity of approximately 10^{-4} to 10^{-7} cm/sec. (Ref. 3, pg. 2). The depth to groundwater is estimated to be between ten and twenty feet (Ref. 3, pg. 2).

The aquifer of concern consists of the saprolite aquifer and bedrock aquifer (Ref. 3, pg. 2). The direction of groundwater flow in the superficial unconfined aquifer (saprolite aquifer) appears to be toward the west (Ref. 3, pg. 2). No sole source aquifer or Karst topography is known to occur within four miles of the site (Ref. 3, pg. 2).

B. Groundwater Use

Ground water is used as a source of drinking water by an estimated 775 people living within three miles of the Old Startex Spartanburg County Landfill (Ref. 3, pg. 2). Approximately 204 domestic wells are sparsely distributed throughout the three-mile radius (Ref. 2 and Ref. 3, pg. 2). The nearest groundwater well is located approximately 1,584 feet east of the site (Ref. 3, pg. 2). If the area of concern is increased to four miles, the number of people depending on ground water would increase to 1,756 (Ref. 3, pg. 2).

No additional uses of the aquifer of concern are known.

C. Groundwater Impact

No groundwater monitoring is known to have taken place at the Old Startex Spartanburg County Landfill. Therefore, the impact on groundwater caused by the burial of industrial and unknown wastes at the site is unknown. However, potentially hazardous wastes buried at the site are suspected to have adversely impacted the aquifer of concern.

IV. SURFACE WATER PATHWAY

A. Regional Characteristics

Old Startex Spartanburg County Landfill is located approximately 1,000 feet northeast of a small tributary that flows to the south and empties into the Middle Tyger River (Ref. 2). The Middle Tyger River flows toward the southeast at approximately 103 cubic feet/sec. (Ref. 4, pg. 166). The site slope and intervening slope are estimated to be 2.0 percent and 7.9 percent respectively (Ref. 2).

B. Surface Water Use

No public supply or agricultural surface water intakes are located within fifteen miles downstream of the Old Startex Spartanburg County Landfill (Ref. 4, pg. 176). According to the South Carolina Heritage Trust County Program, October 12, 1987, for Spartanburg County, no federally endangered species occur within four miles of the site.

Within three miles downstream of the site, the Middle Tyger River is predominantly used for recreational boating and fishing.

C. Surface Water Impact

No surface water sampling has been conducted to determine the impact of contaminated runoff from the site on the small tributary located 1,000 feet from the site.

V. CONCLUSIONS AND RECOMMENDATIONS

Because the types and amount of hazardous waste disposed in the Old Startex Spartanburg County Landfill are unknown and 775 people may be adversely affected via the migration of contaminated leachates into the groundwater supply, the Old Startex Spartanburg County Landfill is given a medium priority for a Site Screening Investigation (SSI). The SSI is needed to more thoroughly evaluate hazardous conditions associated with the old landfill by collecting and analyzing appropriate groundwater and surface water samples for potential contaminants. Additionally, the SSI should evaluate the potential for on-site soil and air contamination (These areas were not addressed in this report). The results from the SSI should be used to determine the need for further action.

VI. REFERENCES

1. South Carolina Department of Health and Environmental Control; Files and Records of Communications.

2. U.S. Geological Survey; Wellford and Greer, South Carolina, Quadrangles. 1983 Editions.

3. SCDHEC - Division of Hydrogeology; Hydrogeologic Review of the Old Startex Spartanburg County Landfill, completed by Judy L. Canova, November 22, 1988.

4. South Carolina Water Resource Commission, S.C. State Water Assessment: Report No. 140, 1983.

...and Environmental Control
2600 Bull Street
Columbia, SC 29201
Phone: (803) 758-5681

DHEC USE ONLY:
I.D.# _/_ _ _/_ _ _ _/_
Waste Code _ _ _

Instructions for completing this Form on reverse side.

HAZARDOUS WASTE INFORMATION

(1) Name of generator: Lyman Printing & Finishing

(2) Place of generation: Lyman, South Carolina 29365

(3) General description of hazardous waste, including process producing waste:

Paint waste - maintenance and/or repair

(4) Description of the hazardous waste:

Oil base and/or water base paint waste

(5) Check the hazardous waste characteristics the waste exhibits as identified in Section C of the Emergency Hazardous Waste Regulation; or if the waste is listed as a hazardous waste, check "Listed"; or if the waste has been declared hazardous by the generator, check the hazardous waste characteristic(s) as identified in Section C of the Emergency Hazardous Waste Regulation the generator suspects the waste to exhibit.

(a)	Ignitable	☐
(b)	Corrosive	☐
(c)	Reactive	☐
(d)	Toxic	☐
(e)	Listed	XX

(6) Attach any information obtained from the testing of the waste performed to determine their hazard. If the generator declares the waste to be hazardous attach information on what basis the decision to declare the waste hazardous was made.

(7) Estimated amount of the waste produced per year in pounds (pounds/waste):

75 Lbs.

(8) Describe the method(s) by which this waste is currently being treated, stored, or disposed, including the name and address of any facility to which the waste is being sent.

Fred Bridwell - Painting Contractor - Spartanburg, S. C.

S. C. Waste Management - Commercial Waste Hauler, Spartanburg, S. C.

(9) Certification: I hereby certify (or declare) that the information provided herein is complete and correct to the best of my knowledge. I understand that all information on this Form may be made available to the public except those portions entitled to confidentiality as provided by Section 44-56-[illegible] of the South Carolina Hazardous Waste Management Act. I am authorized to sign official documents for the generator named in (1) above.

Signature — Dir., Engineering Serv. — 12/19/79
Name and Title — Date

NOTE: Additional copies of this Form may be reproduced locally as needed.

DHEC 1986(9/[illegible])

5

General Instructions

1. This Hazardous Waste Information Form is to be used when designated by the Department. A separate Form shall be completed for each hazardous waste.

2. All definitions contained in the Hazardous Waste Management Act (Section 44-56-10 et seq. of the 1976 S.C. Code of Laws) and the Emergency Hazardous Waste Regulation shall apply to this Form.

3. If a question arises as to how to complete a particular item of this Form or additional copies of this Form are needed, please contact the Solid Waste Management Division at the telephone number or address given on the front of this Form.

4. If additional space is needed to complete any item, attach a separate sheet to complete the item. Clearly identify on the separate sheet which item is being continued on that sheet.

5. Type or print in ink all items of this Form except the signature required in item (9), which must be signed in ink.

Specific Instructions

(1) Self-explanatory.
(2) Self-explanatory.
(3) Self-explanatory.
(4) A description of the hazardous waste handled by general type and specific contents using the best available information.
(5) Self-explanatory.
(6) Self-explanatory.
(7) Give estimated amount of the waste produced per year based upon the best available information. The generator may be required by the Department to produce information as to the basis of this estimation.
(8) Self-explanatory.
(9) Certification. An individual authorized to sign official documents for the organization or person identified in (1) shall enter his signature, name, title, and date. The signature shall be in ink.

South Carolina Department of Health
and Environmental Control
Solid Waste Management Division
2600 Bull Street
Columbia, SC 29201
Phone: (803) 758-5681

DHEC USE ONLY:
I.D.#__/___/____/_

Instructions for completing this Form on reverse side.

NOTIFICATION OF HAZARDOUS WASTE ACTIVITY

A. General.

(1) Identification.

(a) Name of person or organization conducting hazardous waste activities: Lyman Printing & Finishing

Lyman, S. C. 29365

(b) Mailing Address: _____

(c) Phone Number: 803/433-4000

(2) Principal technical contacts (Name(s), mailing address(es) and phone number(s)):

H. B. Bridgeman, Lyman Prt. & Finish, Lyman, S. C. 29365 433/4433 (803)

D. E. Sands, Lyman Prt. & Finishing, Lyman, S. C. 29365 433/4322 (803)

(3) Types of hazardous waste activities person or organization conducts within the State: (Check all applicable boxes.)

(a) Generation of hazardous waste [X]

(b) Transportation of hazardous waste (other than on-site of generation or on-site of treatment, storage or disposal facility) [ ]

(c) Treatment, storage, or disposal of hazardous waste at a facility owned or operated by the person or organization [XX]

(4) Certification: I hereby certify (or declare) that the information provided herein is complete and correct to the best of my knowledge. I understand that all information on this form may be made available to the public unless otherwise noted as provided under (5) below. I am authorized to sign official documents for the organization or person identified in (1) (a) above.

Edward S. Bridgeman — Dir., Engineering Serv. — 12/19/79

Signature — Name and Title — Date

(5) Confidentiality.

Information reported to the Department in this Notification may be claimed as confidential, and therefore exempt from public disclosure under Section 6B of the South Carolina Hazardous Waste Management Act, which reads:

> Information obtained by the department under this chapter shall be available to the public, unless the department certifies such information as being proprietary. The department may make such certification where any person shows, to the satisfaction of the department, that the information, or parts thereof, if made public, would divulge methods, production rates, processes, or other confidential information entitled to protection. Nothing in this subsection shall be construed as limiting the disclosure of information by the department to any officer, employee or authorized representative of the State concerned with effecting this chapter, providing such person respects the proprietary nature of the information.

In order for information to be considered for confidentiality, the Department must be supplied with a detailed list of exactly what information is claimed as confidential and on what basis the claim of confidentiality is made, including facts and information to support such claim. Upon receiving such claim, the Department will make a determination as to whether or not the information is entitled to confidentiality. A determination by the Department that a portion of the Notification will be considered confidential does not serve as a determination that the entire Notification will be considered confidential.

(6) Warning: Section 12 of the Hazardous Waste Management Act provided for significant penalties for violations of the Act; the rules and regulations promulgated pursuant to the Act; or orders issued by the Board, Commissioner, or the Department. No hazardous waste as defined under Section C , shall be generated, stored, transported, or disposed within the State unless

General Instructions

(1) This Notification Form is to be used by all persons required to file a Notification Form with the Department by Section D of the Emergency Hazardous Waste Regulation.

(2) All definitions contained in the Hazardous Waste Management Act (Section 44-56-10 et seq. of the 1976 S.C. Code of Laws) and Section A of the Emergency Hazardous Waste Regulation shall apply to this Form.

(3) Generators of hazardous waste shall complete Parts A and B of this Form. A separate Notification Form shall be completed for each place of generation if the generator produces hazardous waste at more than one location within the State.

(4) Transporters of hazardous waste shall complete Parts A and C of this Form. A person who transports hazardous waste solely on the site of generation or solely on the site of a hazardous waste facility is not considered a transporter for this Notification.

(5) Owner(s)/Operator(s) of hazardous waste treatment, storage, or disposal facilities shall complete Parts A and D of this Form. A separate Notification Form shall be completed for each separate facility (if the owner/operator has more than one location within the State at which hazardous waste is treated, stored, or disposed.)

(6) If a question arises as to how to complete a particular item of this Form or additional copies of this Form are needed, please contact the Solid Waste Management Division at the telephone number or address given on the front of this Form.

(7) If additional space is needed to complete any item, attach a separate sheet to complete the item. Clearly identify on the separate sheet which item is being continued on that sheet.

(8) Type or print in ink all items of this Form except the signature in item A(4), which must be signed in ink.

Specific Instructions

A. General.
(1) Self-explanatory.
(2) Principal Technical Contacts. Enter the name, address, and telephone number of an individual or individuals whom the Department may contact for clarification of information submitted on this Form.
(3) Self-explanatory.
(4) Certification. An individual authorized to sign official documents for the organization or person identified in A(1)(a) shall enter his signature, name, title, and date. The signature shall be in ink.
(5) Self-explanatory.
(6) Self-explanatory.

B. Generator
(1) Self-explanatory.
(2) Self-explanatory.
(3) Self-explanatory.
(4) Give the county in which place of generation is located. If place of generation is located in more than one county, give the county in which the place of generation is primarily located.
(5) Self-explanatory.
(6) Types of hazardous waste(s) generated at location:
(a) Ignitable waste - the waste meets the ignitable characteristics of Section C of the Emergency Hazardous Waste Regulation.
(b) Corrosive waste - the waste meets the corrosive characteristics of Section C of the Emergency Hazardous Waste Regulation.
(c) Reactive waste - the waste meets the reactive characteristics of Section C of the Emergency Hazardous Waste Regulation.
(d) Toxic waste - the waste meets the toxic characteristics of Section C of the Emergency Hazardous Waste Regulation.

notification of hazardous waste activity has been submitted to the Department according to the regulations promulgated under the Act.

B. Generator.

(1) Mailing address of place of generation: Lyman Printing & Finishing, Lyman, S. C. 29365

(2) Location of place of generation: Lyman, S. C.

(3) Phone number at place of generation: 803/433-4000

(4) County in which place of generation is located: Spartanburg

(5) General Description of generator's operations at the location of generation: Textile Printing/Finishing Operation

(6) Types of hazardous waste(s) generated at location: (Check all applicable boxes.)

(a) Ignitable ☐
(b) Corrosive ☐
(c) Reactive ☐
(d) Toxic ☐
(e) Listed ☒

(7) Estimated amount of hazardous waste generated at location annually in pounds (pounds/year): 75 Lbs.

(8) For each hazardous waste produced at the location submit a completed Hazardous Waste Information Form (DHEC Form No. 1986).

C. Transporter.

(1) General description of kind of transportation transporter is engaged in:

(2) State and county in which the transporter has his principal place of business: _____ State _____ County

(3) Location, mailing address, and phone number of all terminals or other transportation facilities the transporter maintains within the State:

(4) Identification code(s) if transporter has previously been assigned a hazardous waste identification code by the Federal Environmental Protection Agency or any other state. Also include source of I.D. Code and by whom such codes were assigned:

(5) Interstate Commerce Commission Number or South Carolina Public Service Commission Number (state whether number is ICC or PSC):

(6) Types of hazardous wastes handled by the transporter: (Check all applicable boxes.)

(a) Ignitable ☐
(b) Corrosive ☐
(c) Reactive ☐
(d) Toxic ☐
(e) Listed ☒

(e) Listed waste - the waste is listed as a hazardous waste under Section C of the Emergency Hazardous Waste Regulation.
(7) Give estimated amount of hazardous waste producted per year at the location based upon the best available information. The generator may be required by the Department to produce information as to the basis of this estimation.
(8) Self-explanatory.

C. Transporter.
(1) Self-explanatory.
(2) Self-explanatory.
(3) Self-explanatory.
(4) Self-explanatory.
(5) If transporter has not been assigned either a ICC or PSC number, state "None".
(6) Types of hazardous wastes handled by the transporter:
(a) Ignitable waste - the waste meets the ignitable characteristics of Section C of the Emergency Hazardous Waste Regulation.
(b) Corrosive waste - the waste meets the corrosive characteristics of Section C of the Emergency Hazardous Waste Regulation.
(c) Reactive waste - the waste meets the reactive characteristics of Section C of the Emergency Hazardous Waste Regulation.
(d) Toxic waste - the waste meets the toxic characteristics of Section C of the Emergency Hazardous Waste Regulation.
(e) Listed waste - the waste is listed as a hazardous waste under Section C of the Emergency Hazardous Waste Regulation.
(7) Give estimated amount of hazardous waste transported by the transporter annually based upon the best available information. The transporter may be required by the Department to produce information as to the basis of this estimation.

D. Hazardous Waste Facilities.
(1) Self-explanatory.
(2) Self-explanatory.
(3) Self-explanatory.
(4) Self-explanatory.
(5) Give the county in which the facility is located. If the facility is located in more than one county give the county in which the facility is primarily located.
(6) Before answering this question, be sure to read the definitions of "treatment", "storage", and "disposal" contained in the Emergency Hazardous Waste Regulation.
(7) Self-explanatory.
(8) Types of hazardous wastes handled by facility:
(a) Ignitable waste - the waste meets the ignitable characteristics of Section C of the Emergency Hazardous Waste Regulation.
(b) Corrosive waste - the waste meets the corrosive characteristics of Section C of the Emergency Hazardous Waste Regulation.
(c) Reactive waste - the waste meets the reactive characteristics of Section C of the Emergency Hazardous Waste Regulation.
(d) Toxic waste - the waste meets the toxic characteristics of Section C of the Emergency Hazardous Waste Regulation.
(e) Listed waste - the waste is listed as a hazardous waste under Section C of the Emergency Hazardous Waste Regulation.
(9) Give estimated amount of hazardous waste handled by the facility annually based upon the best available information. The generator may be required by the Department to produce information as to the basis of this estimation.

(7) Estimat amount of hazardous wastes handled annually by transporter in pounds (pounds/year): 75 Lbs.

D. Hazardous Waste Facilities.

(1) Name of facility: Lyman Printing & Finishing

(2) Mailing address of facility: Lyman, S. C. 29365

(3) Location of facility: Lyman, S. C.

(4) Phone number of facility: 803/433-4000

(5) County in which facility is located: Spartanburg

(6) Type of operations conducted at the facility: (Check all applicable boxes).

(a) Treatment of hazardous waste ☐
(b) Storage of hazardous waste ☒ Temporary storage until treated or disposed.
(c) Disposal of hazardous waste ☐

(7) Submit on a separate sheet of paper a description of the hazardous waste activities conducted at the facility. See Item 8 DHEC Form 1986

(8) Types of hazardous wastes handled at the facility: (Check all applicable boxes.)

(a) Ignitable ☐
(b) Corrosive ☐
(c) Reactive ☐
(d) Toxic ☐
(e) Listed ☒

(9) Estimated amount of hazardous waste treated, stored, or disposed annually at the facility in pounds (pounds/year): 75 Lbs.

//

EPA Notification of Hazardous Waste Site

United States Environmental Protection Agency Washington DC 20460

This initial notification information is required by Section 103(c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and must be mailed by June 9, 1981.

Please type or print in ink. If you need additional space, use separate sheets of paper. Indicate the letter of the item which applies.

810609

SCS000001103

I Person Required to Notify:

Enter the name and address of the person or organization required to notify.

Name: Lyman Dyeing and Finishing Co.

Street: Pacific Street

City: Lyman State: S.C. Zip Code: 29365

II Site Location:

Enter the common name (if known) and actual location of the site.

SC D980558191

Name of Site: Old Startex Spartanburg County Landfill

Street: End of road going south off old US 29 at Walt Moore's Stor

City: Startex County: Spartanburg State: S. C. Zip Code: 29377

III Person to Contact:

Enter the name, title (if applicable), and business telephone number of the person to contact regarding information submitted on this form.

Name (Last, First and Title): Holsten, John - Director of Regulatory Affairs

Phone: 803/433-4113

IV Dates of Waste Handling:

Enter the years that you estimate waste treatment, storage, or disposal began and ended at the site.

From (Year): 1966-68 To (Year): ~~present~~ 1981

V Waste Type: Choose the option you prefer to complete

Option 1: Select general waste types and source categories. If you do not know the general waste types or sources, you are encouraged to describe the site in Item I—Description of Site.

General Type of Waste:
Place an X in the appropriate boxes. The categories listed overlap. Check each applicable category.

1. ☒ Organics
2. ☒ Inorganics
3. ☐ Solvents
4. ☐ Pesticides
5. ☐ Heavy metals
6. ☐ Acids
7. ☐ Bases
8. ☐ PCBs
9. ☒ Mixed Municipal Waste
10. ☒ Unknown
11. ☐ Other (Specify)

Source of Waste:
Place an X in the appropriate boxes.

1. ☐ Mining
2. ☐ Construction
3. ☒ Textiles
4. ☐ Fertilizer
5. ☐ Paper/Printing
6. ☐ Leather Tanning
7. ☐ Iron/Steel Foundry
8. ☐ Chemical, General
9. ☐ Plating/Polishing
10. ☐ Military/Ammunition
11. ☐ Electrical Conductors
12. ☐ Transformers
13. ☐ Utility Companies
14. ☒ Sanitary/Refuse
15. ☐ Photofinish
16. ☐ Lab/Hospital
17. ☒ Unknown
18. ☐ Other (Specify)

Option 2: This option is available to persons familiar with the Resource Conservation and Recovery Act (RCRA) Section 3001 regulations (40 CFR Part 261).

Specific Type of Waste:
EPA has assigned a four-digit number to each hazardous waste listed in the regulations under Section 3001 of RCRA. Enter the appropriate four-digit number in the boxes provided. A copy of the list of hazardous wastes and codes can be obtained by contacting the EPA Region serving the State in which the site is located.

0 0 1 7 6 0 0 0 3 1 1

RECEIVED EPA/REGION IV JUN 8 12 32 PM '81 ENVIRONMENTAL PROTECTION DIVISION

RECEIVED EPA/REGION IV JUN 8 11 11 AM '81 ENVIRONMENTAL PROTECTION DIVISION

Form Approved
OMB No. 2000-0138

EPA Form 8900-1

1

Notification of Hazardous Wa Site Side Two

Waste Quantity:

Place an X in the appropriate boxes to indicate the facility types found at the site.

In the "total facility waste amount" space give the estimated combined quantity (volume) of hazardous wastes at the site using cubic feet or gallons.

In the "total facility area" space, give the estimated area size which the facilities occupy using square feet or acres.

Facility Type

1. ☐ Piles
2. ☐ Land Treatment
3. ☒ Landfill
4. ☐ Tanks
5. ☐ Impoundment
6. ☐ Underground Injection
7. ☐ Drums, Above Ground
8. ☐ Drums, Below Ground
9. ☐ Other (Specify) _____

Total Facility Waste Amount

cubic feet 13—2C million

gallons

Total Facility Area

square feet

acres 30—40 +/-

G Known, Suspected or Likely Releases to the Environment:

Place an X in the appropriate boxes to indicate any known, suspected, or likely releases of wastes to the environment.

☐ Known ☒ Suspected ☐ Likely ☐ Non

Note: Items H and I are optional. Completing these items will assist EPA and State and local governments in locating and assessir hazardous waste sites. Although completing the items is not required, you are encouraged to do so.

H Sketch Map of Site Location: (Optional)

Sketch a map showing streets, highways, routes or other prominent landmarks near the site. Place an X on the map to indicate the site location. Draw an arrow showing the direction north. You may substitute a publishing map showing the site location.

I Description of Site: (Optional)

Describe the history and present conditions of the site. Give directions to the site and describe any nearby wells, springs, lakes, or housing. Include such information as how waste was disposed and where the waste came from. Provide any other information or comments which may help describe the site conditions.

(see attachment)

J Signature and Title:

The person or authorized representative (such as plant managers, superintendents, trustees or attorneys) of persons required to notify must sign the form and provide a mailing address (if different than address in item A). For other persons providing notification, the signature is optional. Check the boxes which best describe the relationship to the site of the person required to notify. If you are not required

Lamar T. Oxford

Name Lamar T. Oxford, Vice President

Street

City State Zip Code

Signature Date 6/22/81

- ☒ Owner, Present
- ☐ Owner, Past
- ☐ Transporter
- ☐ Operator, Preser
- ☐ Operator, Past
- ☐ Other

I. The Old Startex Spartanburg County Landfill was opened in the middle-to-late 1960's, probably some time between 1966-1968. This land was and is owned by Lyman Printing & Finishing Company but was operated for several years by Spartanburg County with the understanding that Lyman P&F Co. could use the dump at no charge. Spartanburg County operated the dump site from its opening until some time in the early 1970's. During county operation the site was used for landfill disposal of domestic and industrial wastes or refuse. Industrial wastes were not limited to those originating from Lyman P&F Co. The identity and quantity of industrial wastes disposed of at this dump by Lyman P&F Co. during county operation are not known, but it is possible, because of the nature of the wastes generated by textile printing and finishing operations of that time, that some of those wastes would be classified as "hazardous" under current definitions. When Spartanburg County ceased operations at the site, Lyman P&F Co. closed access to the site to the public and other industries. Since that time, Lyman P&F Co. (now Lyman D&F Co.) has used the site as a disposal site for only broken wooden pallets and cinders from their boiler house.

We are reporting this site strictly because we do not know what all was dumped at the site during its active years. We know of no adverse environmental effects or of any health hazards posed by this dump.

RECORD OF COMMUNICATION

_X_ Phone Call
_X_ Discussion
____ Field Trip
____ Conference
____ Other (Specify)

TO: Nick Odom, Env. Manager
Spring Industries Inc.

FROM: Gerald Stewart

DATE: November 28, 1988

TIME: 4:15 PM

SUBJECT: Ownership History and waste disposal practies at the Old Startex Spartanburg County Landfill and Old Lyman Dump.

SUMMARY OF COMMUNICATION

According to Nick Odom, Environmental Manager - Springs Industries Inc., Springs Industries operated the Old Lyman Dump, but the property is owned by the Town of Lyman. The Old Statex Spartanburg County Landfill is owned by Springs Industries Incorporated. Mr. Odom stated that Lyman Dyeing and Finishing Company is now owned and operated by Springs.

Historically, landfill of these types received textile rags, cardboard, brick, blocks, fly ash and a minimum amount of liquid waste, such as organics and inorganics. Most chemical waste (liquids) were drained into the wastewater treatment system.

CONCLUSIONS, ACTION TAKEN OR REQUIRED

The above information was gathered from a phone conversation with Nick Odom and Marshall Bright. Contact Address: Spring Industries Inc.; P.O. Box 70; Fort Mills, SC 29715 - ATTN: Nick Odom.

INFORMATION COPIES
TO: Old Lyman Dump File
Old Startex Spartanburg County File

OVERSIZED

DOCUMENT

Ref 3

South Carolina Department of Health and Environmental Control

2600 Bull Street
Columbia, S.C. 29201

Commissioner
Michael D. Jarrett

Board
Harry M. Hallman, Jr., Chairman
Toney Graham, Jr. M.D., Vice-Chairman
John B. Pate, M.D., Secretary
Oren L. Brady, Jr.
Moses H. Clarkson, Jr.
Euta M. Colvin, M.D.
Henry S. Jordan, M.D.

MEMORANDUM

TO: John Cresswell, Manager
Site Screening Section
Bureau of Solid and Hazardous Waste Management

FROM: Judy Canova, Hydrologist JC
Superfund and Solid Waste Section
Division of Hydrogeology
Bureau of Solid and Hazardous Waste Management

DATE: November 22, 1988

RE: Old Startex Spartanburg County Landfill
SCD 980 558 191
Spartanburg County
Preliminary Assessment - Hydrogeologic Review

A hydrogeologic review of the referenced site has been conducted to assist in completing a preliminary assessment for the Superfund program. The purpose of the hydrogeologic review is to provide information regarding the ground-water migration route of potential contaminants. It includes information obtained from South Carolina Water Resources Commission well tabulations, available site specific information from state files, a target survey using United States Geological Survey topographic quadrangles, and a literature review.

According to Bloxham et al. (1970), the following geologic units underlie the site:

Name	Description	Depth of Occurrence
Saprolite	Weathering products of bedrock containing a heterogeneous mixture of sands, silts, and clays	From ground surface to variable depths
Bedrock	Igneous and metamorphic crystalline rock	Variable

The aquifer of concern includes the bedrock and saprolite. The aquifer does not appear to be the sole source of potable water in the area. The referenced facility is not in an area of karst topography.

The 1968 Soil Survey of Spartanburg County classifies soils on site as Davidson sandy clay loam containing an average of sixty percent clay. Soils of this composition have an approximate saturated hydraulic conductivity of 10^{-4} to 10^{-7} cm/sec. Based on topographic relief and surface drainage, the depth to ground-water is estimated to be between ten and twenty feet. The predominant ground-water flow direction appears to be towards the west in the surficial unconfined aquifer.

A well inventory within a radius of four miles of the site reveals the following uses of ground-water from the aquifer of concern: domestic water supply.

From available information, it appears that the nearest domestic well developed within the aquifer of concern is Ø.3 miles to the east of the site.

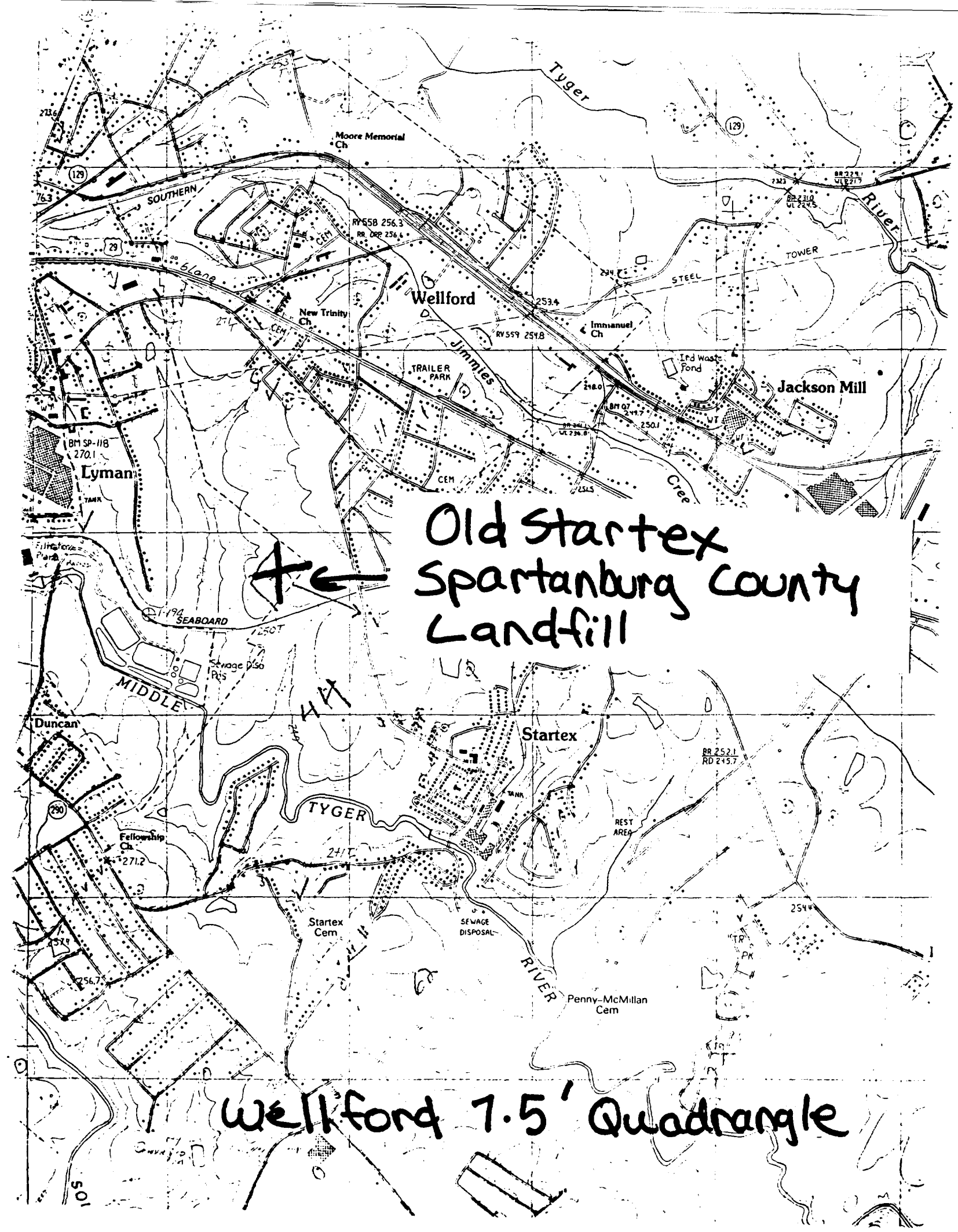
The number of homes within a four mile radius of the site not located on a public water supply line (therefore assumed to utilize domestic wells), as identified from topographic quadrangles, are as follows:

Radius	Number of Houses
1 Mile	49
2 Miles	62
3 Miles	93
4 Miles	257
Total	461

References Cited:

Bloxham, W., Siple, G., and Cummings, T., 1970, Water Resources of Spartanburg County, South Carolina: S. C. Water Resources Commission Report #3, 112 p.

United States Department of Agriculture, 1968, Soil Survey of Spartanburg County, South Carolina.


Old Startex
Spartanburg County
Landfill
Wellford 7.5' Quadrangle
Tyger
Moore Memorial Ch
SOUTHERN
Wellford
New Trinity Ch
Immanuel Ch
Jimmies
TRAILER PARK
Jackson Mill
Ind Waste Pond
TOWER
STEEL
River
Lyman
Cree
SEABOARD
MIDDLE
Duncan
Startex
TYGER
Fellowship Ch
Startex Cem
SEWAGE DISPOSAL
REST AREA
Penny-McMillan Cem
RIVER

Ref. # 4

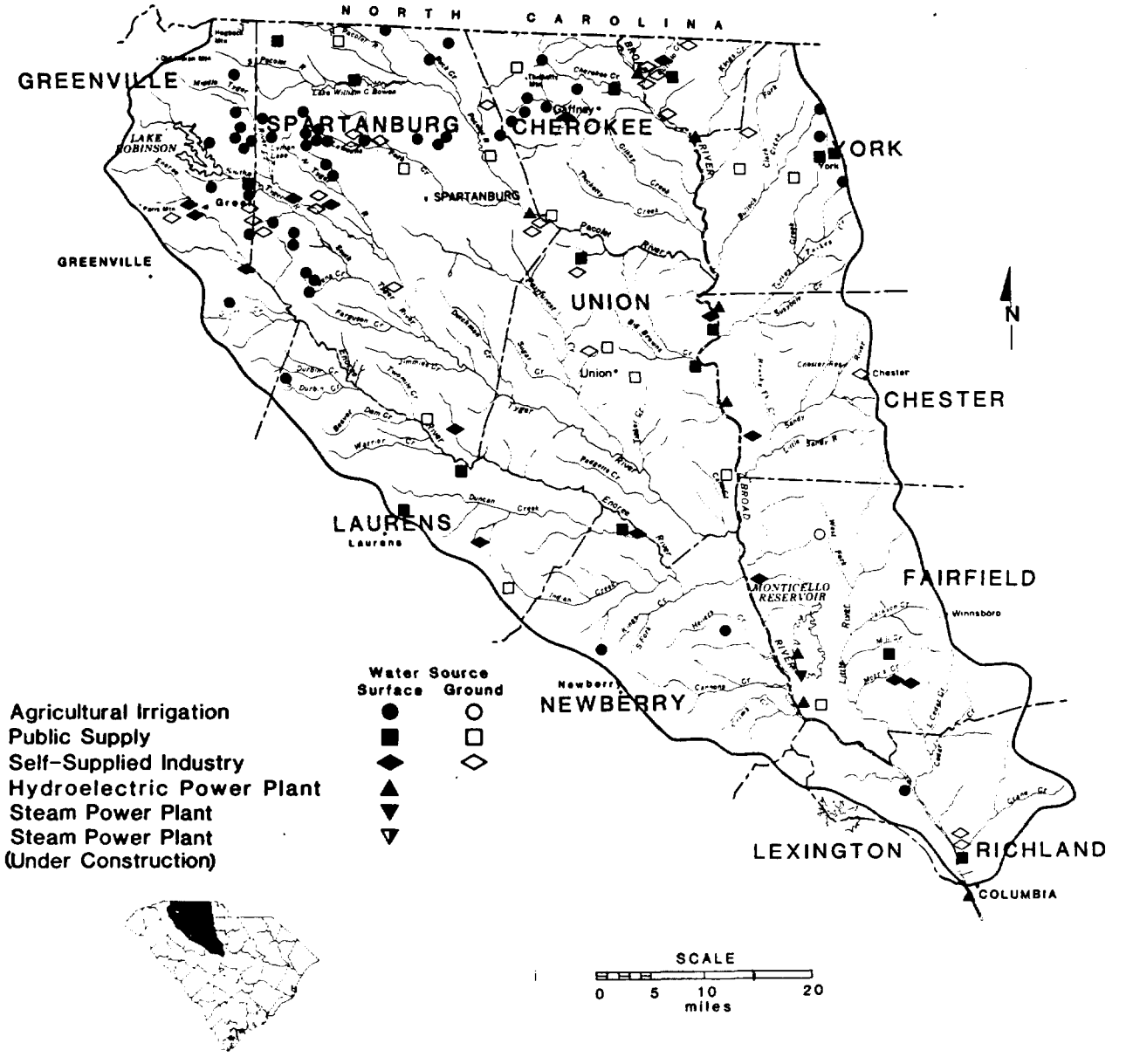


Figure 75.
Location, type, and supply source of water users in the Broad River Sub-basin, South Carolina.

PRELIMINARY ASSESSMENT
HAZARDOUS RANKING SYSTEM SCORING SUMMARY

FOR

SCD980558191
OLD STARTEX SPARTANBURG CO LANDFILL

EPA REGION: IV

SCORE STATUS: In preparation

SCORED BY: GERALD STEWART
EMPLOYED BY: SCDHEC

DATE OF THIS REPORT:	12/12/88
DATE OF LAST MODIFICATION:	12/12/88

GROUND WATER ROUTE SCORE:	47.35
SURFACE WATER ROUTE SCORE:	0.00
AIR ROUTE SCORE:	0.00
MIGRATION SCORE:	27.37

COMMENTS

SITE NAME: OLD STARTEX SPARTANBURG CO LANDFILL

HRS GROUND WATER ROUTE SCORE

CATAGORY/FACTOR	RAW DATA	ASN. VALUE		SCORE
1. Observed release	N	0		0
Comments: No groundwater sampling has taking place at the site. Therefore, the impact of contaminates on ground water is unknown.				
2. Route Characteristics:				
Depth to Water Table	15 feet			
Comments: Hydrogeological report indicates that the depth to ground water ranges from 10 to 20 feet.				
Depth to Bottom of Waste	6 feet			
Comments: Assumed depth				
Depth to Aquifer of Concern	9 feet	3	X 2	6
Precipitation	48.0 inches			
Evaporation	40.0 inches			
Net Precipitation	8.0 inches	2		2
Permeability	1.0 x 10^{-5} cm/sec	1		1
Comments: See hydrogeological report.				
Physical State		3		3
Comments: Unknown. Liquids are highly suspected.				
TOTAL ROUTE CHARACTERISTICS SCORE:				12
3. Containment		3		3
Comments: None known				
4. Waste Characteristics:				
Toxicity/Persistence Matrix Value		18		18
Substance scored: UNKNOWN WASTE - ASSUMED WORST CASE				
Comments: Worst possible case is assumed.				

SITE NAME: OLD STARTEX SPARTANBURG CO LANDFILL

HRS GROUND WATER ROUTE SCORE (Continued)

CATAGORY/FACTOR	RAW DATA	ASN. VALUE		SCORE
4. Waste Characteristics: (Continued)				
Other substances present:				
Waste Quantity:				
Cubic Yds	99999999			
Drums	0			
Gallons	0			
Tons	0			
Total	99999999 Cu. yds.	8		8
Comments: Worst possible case is assumed.				
TOTAL WASTE CHARACTERISTICS SCORE:				26
5. Targets:				
Ground Water Use (Three mile radius)	3	x 3		9
Comments: Ground water is used for drinking purposes with three miles of the site.				
Distance to nearest well	1584 feet	4		
Population Within 3 Miles:				
Number of Houses	204 x 3.8			
Number of Persons	0			
Number of Connections	0 x 3.8			
Number Irrigated Acres	0 x 1.5			
Total Population Served	775.2	2		
Distance to Well/Population Served Matrix		20		20
TOTAL TARGETS SCORE:				29

6. If line 1 is 45, multiply 1 x 4 x 5, & divide by 57.33 or if line 1 is 0, multiply 2 x 3 x 4 x 5, & divide by 57.33 to get Sgw

GROUND WATER ROUTE SCORE (Sgw) = 47.35

SITE NAME: OLD STARTEX SPARTANBURG CO LANDFILL

HRS SURFACE WATER ROUTE SCORE

CATAGORY/FACTOR	RAW DATA	ASN. VALUE		SCORE
1. Observed release	X	0		0
Comments: Not scored.				
2. Route Characteristics:				
Site Located in S/W	.F.			
Site Within Closed Basin	.F.			
Facility Slope	0.0 %			
Intervening Slope	0.0 %			
Facility slope and intervening terrain		0		0
24-Hour Rainfall	0.0 inches	0		0
Distance to Nearest S/W	99999 feet	0	x 2	0
Physical State of Waste		0		0
Comments:				
TOTAL ROUTE CHARACTERISTICS SCORE:				0
3. Containment		0		0
Comments:				
4. Waste Characteristics:				
Toxicity/Persistence Matrix Value		0		0
Substance scored:				
Comments:				
Other substances present:				

SITE NAME: OLD STARTEX SPARTANBURG CO LANDFILL

HRS SURFACE WATER ROUTE SCORE (Continued)

CATAGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
4. Waste Characteristics: (Continued)			
Waste Quantity:			
Cubic Yds	0		
Drums	0		
Gallons	0		
Tons	0		
Total	0 Cu. yds.	0	0
Comments:			
TOTAL WASTE CHARACTERISTICS SCORE:			0
5. Targets:			
Surface Water Use (Three miles Downstream)		0 x 3	0
Comments:			
Distance to:			
Coastal Wetlands	99999 feet		
Fresh-water Wetlands	99999 feet		
Critical Habitat	99999 feet		
Species Evaluated:			
Sensitive Environments Score		0 x 2	0
Distance on Static Water	0 feet		
Distance Water Supply Intake	99999 feet		
Number of Houses	0 x 3.8		
Number of Persons	0		
Number of Connections	0 x 3.8		
Number of Irrigated Acres	0 x 1.5		
Total Population Served	0		
Distance Water Intake/Population Matrix		0	0
TOTAL TARGETS SCORE:			0

SITE NAME: OLD STARTEX SPARTANBURG CO LANDFILL

HRS SURFACE WATER ROUTE SCORE (Continued)

6. If line 1 is 45, multiply 1 x 4 x 5, & divide by 64.35 or
   if line 1 is 0, multiply 2 x 3 x 4 x 5, & divide by 64.35 to get Ssw

---

SURFACE WATER ROUTE SCORE (Ssw) = 0.00

SITE NAME: OLD STARTEX SPARTANBURG CO LANDFILL

HRS AIR ROUTE SCORE

CATAGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. Observed release	X	0	0

Comments:

2. Waste Characteristics:

Reactivity
Comments:

Incompatibility
Comments:

Toxicity:

Waste Quanity:
- Cubic Yds
- Drums
- Gallons
- Tons

Total _____ Cu. yds.

TOTAL WASTE CHARACTERISTICS SCORE:

3. Targets

Population Within 4-mile Radius
- 0 to 0.25 mile
- 0 to 0.50 mile
- 0 to 1.00 mile
- 0 to 4.0 miles

Distance to Sensitive Environments:
- Coastal Wetlands feet
- Fresh-Water Wetlands feet
- Critical Habitat feet

Distance to Land Uses:
- Commercial/Industrial feet
- Park/Forest/Residential feet
- Agricultural Land feet
- Prime Farmland feet
- Historic Site Within View?

SITE NAME: OLD STARTEX SPARTANBURG CO LANDFILL

HRS AIR ROUTE SCORE (Continued)

CATAGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
TOTAL TARGETS SCORE:			

4. Multiply 1 x 2 x 3

5. Divide line 4 by 35,100 and multiply by 100 to get Sa

AIR ROUTE SCORE Sa = 0.00

HAZARDOUS RANKING SYSTEM SCORING CALCULATIONS

Á FOR

OLD STARTEX SPARTANBURG CO LANDFILL
AS OF: 12/12/88

Ground Water Route Score

Observed Release	0
Route Characteristics	12
Containment	3
Waste Characteristics	26
Targets	29

27144 / 57,330 x 100 = 47.35 Sgw

Surface Water Route Score

Observed Release	0
Route Characteristics	0
Containment	0
Waste Characteristics	0
Targets	0

0 / 64,350 x 100 = 0.00 Ssw

Air Route Score

Observed Release	0
Waste Characteristics	
Targets	

0 / 35,100 x 100 = 0.00 Sa

Summary of Migration Score Calculations

	S	S^2
Ground Water Route Score (Sgw)	47.35	2242.02
Surface Water Route Score (Ssw)	0.00	0.00
Air Route Score (Sa)	0.00	0.00
$Sgw^2 + Ssw^2 + Sa^2$		2242.02
Square Route of $[Sgw^2 + Ssw^2 + Sa^2]$		47.35
$\frac{\text{Square Route of } [Sgw^2 + Ssw^2 + Sa^2]}{1.73}$	= Sm	27.37

M.2 - SITE MAINTENANCE FORM

ACTION: _

EPA ID : SCD980558191

SITE NAME: OLD STARTEX SPARTANBURG CO LDFL SOURCE: N

STREET : OFF OLD US 29 CONG DIST: 04

CITY : STARTEX ZIP: 29377

CNTY NAME: SPARTANBURG CNTY CODE : 083

LATITUDE : 34/54/30.0 LONGITUDE : 082/06/00.0

LL-SOURCE: R LL-ACCURACY:

SMSA : 3160 HYDRO UNIT: 03050107

INVENTORY IND: Y REMEDIAL IND: Y REMOVAL IND: N FED FAC IND: N

NPL IND: N NPL LISTING DATE: NPL DELISTING DATE:

SITE/SPILL IDS:

RPM NAME: RPM PHONE: - -

SITE CLASSIFICATION: SITE APPROACH:

DIOXIN TIER: REG FLD1: REG FLD2:

RESP TERM: PENDING ( ) NO FURTHER ACTION (X)

PENDING (_) NO FURTHER ACTION (_)

ENF DISP: NO VIABLE RESP PARTY ( ) VOLUNTARY RESPONSE ( )
ENFORCED RESPONSE ( ) COST RECOVERY ( )

SITE DESCRIPTION:

M.2 - PROGRAM MAINTENANCE FORM

* ACTION: _ *

SITE: OLD STARTEX SPARTANBURG CO LDFL

EPA ID: SCD980558191 PROGRAM CODE: H01 PROGRAM TYPE: * _ *

PROGRAM QUALIFIER: ALIAS LINK : * ___ __ *

PROGRAM NAME: SITE EVALUATION * _____ *

DESCRIPTION:

* _____ *

* _____ *

* _____ *

* _____ *

M.2 - EVENT MAINTENANCE FORM

* ACTION: _ *

SITE: OLD STARTEX SPARTANBURG CO LDFL
PROGRAM: SITE EVALUATION

EPA ID: SCD980558191 PROGRAM CODE: H01 EVENT TYPE: DS1

FMS CODE: EVENT QUALIFIER : EVENT LEAD: E * _ ___ _ *

EVENT NAME: DISCOVERY STATUS: * _____ _ *

DESCRIPTION:

* _____ *
* _____ *
* _____ *
* _____ *

ORIGINAL	CURRENT	ACTUAL			
START:	START:	START:	* __/__/__	__/__/__	__/__/__ *
COMP :	COMP :	COMP : 06/01/81	* __/__/__	__/__/__	__/__/__ *

HQ COMMENT:

* _____ *

RG COMMENT:

* _____ *

COOP AGR #	AMENDMENT #	STATUS	STATE %				
			0	* _____	_____	__	___ *

M.2 - EVENT MAINTENANCE FORM

* ACTION: _ *

SITE: OLD STARTEX SPARTANBURG CO LDFL
PROGRAM: SITE EVALUATION

EPA ID: SCD980558191 PROGRAM CODE: H01 EVENT TYPE: PA1

FMS CODE: EVENT QUALIFIER : EVENT LEAD: * _ ___ _ *

EVENT NAME: PRELIMINARY ASSESSMENT STATUS: * _____ _ *

DESCRIPTION:

* _____ *
* _____ *
* _____ *
* _____ *

ORIGINAL	CURRENT	ACTUAL			
START:	START:	START:	__/__/__	__/__/__	__/__/__
COMP :	COMP :	COMP : 09/01/82	__/__/__	__/__/__	__/__/__

HQ COMMENT:

* _____ *

RG COMMENT:

* _____ *

COOP AGR #	AMENDMENT #	STATUS	STATE %			
			0	_____	_____	___

M.2 - COMMENT MAINTENANCE FORM

SITE: OLD STARTEX SPARTANBURG CO LDFL

EPA ID: SCD980558191

COM NO	COMMENT	ACTION
001	SCS000001103 -SEE ATTACHMENT.	_
002	CONTACT: JOHN HOLSTEN, DIR. OF REGU	_
	LATORY AFFAIRS. (803) 433-4113.	

EPA Notification of Hazardous Waste Site

R

United States Environmental Protection Agency Washington DC 20460

This initial notification information is required by Section 103(c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and must be mailed by June 9, 1981.

Please type or print in ink. If you need additional space, use separate sheets of paper. Indicate the letter of the item which applies.

810609

SCS0000001103

A Person Required to Notify:

Enter the name and address of the person or organization required to notify.

Name: Lyman Dyeing and Finishing Co.

Street: Pacific Street

City: Lyman State: S.C. Zip Code: 29365

B Site Location:

Enter the common name (if known) and actual location of the site.

SC D980558191

Name of Site: Old Startex Spartanburg County Landfill

Street: End of road going south off old US 29 at Walt Moore's Store

City: Startex County: Spartanburg State: S. C. Zip Code: 29377

C Person to Contact:

Enter the name, title (if applicable), and business telephone number of the person to contact regarding information submitted on this form.

Name (Last, First and Title): Holsten, John - Director of Regulatory Affairs

Phone: 803/433-4113

D Dates of Waste Handling:

Enter the years that you estimate waste treatment, storage, or disposal began and ended at the site.

From (Year): 1966-68 To (Year): 1981 ~~present~~

E Waste Type: Choose the option you prefer to complete

Option 1: Select general waste types and source categories. If you do not know the general waste types or sources, you are encouraged to describe the site in Item I—Description of Site.

General Type of Waste:
Place an X in the appropriate boxes. The categories listed overlap. Check each applicable category.

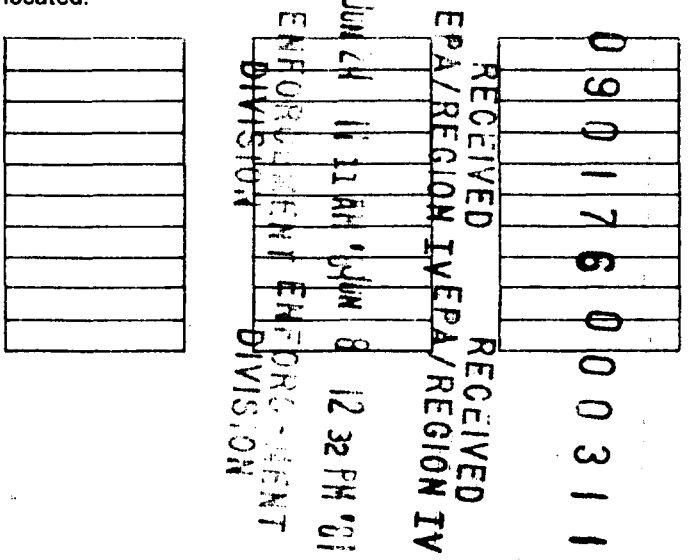
1. ☒ Organics
2. ☒ Inorganics
3. ☐ Solvents
4. ☐ Pesticides
5. ☐ Heavy metals
6. ☐ Acids
7. ☐ Bases
8. ☐ PCBs
9. ☒ Mixed Municipal Waste
10. ☒ Unknown
11. ☐ Other (Specify)

Source of Waste:
Place an X in the appropriate boxes.

1. ☐ Mining
2. ☐ Construction
3. ☒ Textiles
4. ☐ Fertilizer
5. ☐ Paper/Printing
6. ☐ Leather Tanning
7. ☐ Iron/Steel Foundry
8. ☐ Chemical, General
9. ☐ Plating/Polishing
10. ☐ Military/Ammunition
11. ☐ Electrical Conductors
12. ☐ Transformers
13. ☐ Utility Companies
14. ☒ Sanitary/Refuse
15. ☐ Photofinish
16. ☐ Lab/Hospital
17. ☒ Unknown
18. ☐ Other (Specify)

Option 2: This option is available to persons familiar with the Resource Conservation and Recovery Act (RCRA) Section 3001 regulations (40 CFR Part 261).

Specific Type of Waste:
EPA has assigned a four-digit number to each hazardous waste listed in the regulations under Section 3001 of RCRA. Enter the appropriate four-digit number in the boxes provided. A copy of the list of hazardous wastes and codes can be obtained by contacting the EPA Region serving the State in which the site is located.



Form Approved
OMB No. 2000-0138

EPA Form 8900-1

Notification of Hazardous Waste [illegible] Side Two

F Waste Quantity:

Place an X in the appropriate boxes to indicate the facility types found at the site.

In the "total facility waste amount" space give the estimated combined quantity (volume) of hazardous wastes at the site using cubic feet or gallons.

In the "total facility area" space, give the estimated area size which the facilities occupy using square feet or acres.

Facility Type

1. ☐ Piles
2. ☐ Land Treatment
3. ☒ Landfill
4. ☐ Tanks
5. ☐ Impoundment
6. ☐ Underground Injection
7. ☐ Drums, Above Ground
8. ☐ Drums, Below Ground
9. ☐ Other (Specify) _____

Total Facility Waste Amount C

cubic feet ~~13~~ 26 million

gallons _____

Total Facility Area

square feet _____

acres ~~30~~ 40 A

G Known, Suspected or Likely Releases to the Environment:

Place an X in the appropriate boxes to indicate any known, suspected, or likely releases of wastes to the environment.

☐ Known ☒ Suspected ☐ Likely ☐ None

Note: Items H and I are optional. Completing these items will assist EPA and State and local governments in locating and assessing hazardous waste sites. Although completing the items is not required, you are encouraged to do so.

H Sketch Map of Site Location: (Optional)

Sketch a map showing streets, highways, routes or other prominent landmarks near the site. Place an X on the map to indicate the site location. Draw an arrow showing the direction north. You may substitute a publishing map showing the site location.

I Description of Site: (Optional)

Describe the history and present conditions of the site. Give directions to the site and describe any nearby wells, springs, lakes, or housing. Include such information as how waste was disposed and where the waste came from. Provide any other information or comments which may help describe the site conditions.

(see attachment)

J Signature and Title:

The person or authorized representative (such as plant managers, superintendents, trustees or attorneys) of persons required to notify must sign the form and provide a mailing address (if different than address in item A). For other persons providing notification, the signature is optional. Check the boxes which best describe the relationship to the site of the person required to notify. If you are not required to notify check "Other".

Lamar T. Oxford

Name Lamar T. Oxford, Vice President

Street _____

City _____ State _____ Zip Code _____

Signature _____ Date 6/22/81

☒ Owner, Present
☐ Owner, Past
☐ Transporter
☐ Operator, Present
☐ Operator, Past
☐ Other

I. The Old Startex Spartanburg County Landfill was opened in the middle-to-late 1960's, probably some time between 1966-1968. This land was and is owned by Lyman Printing & Finishing Company but was operated for several years by Spartanburg County with the understanding that Lyman P&F Co. could use the dump at no charge. Spartanburg County operated the dump site from its opening until some time in the early 1970's. During county operation the site was used for landfill disposal.of domestic and industrial wastes or refuse. Industrial wastes were not limited to those originating from Lyman P&F Co. The identity and quantity of industrial wastes disposed of at this dump by Lyman P&F Co. during county operation are not known, but it is possible, because of the nature of the wastes generated by textile printing and finishing operations of that time, that some of those wastes would be classified as "hazardous" under current definitions. When Spartanburg County ceased operations at the site, Lyman P&F Co. closed access to the site to the public and other industries. Since that time, Lyman P&F Co. (now Lyman D&F Co.) has used the site as a disposal site for only broken wooden pallets and cinders from their boiler house.

We are reporting this site strictly because we do not know what all was dumped at the site during its active years. We know of no adverse environmental effects or of any health hazards posed by this dump.

SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.

Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.

1. ☐ Show to whom delivered, date, and addressee's address. *(Extra charge)*
2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to:
MR ALAN McMANUS
SPRING INDUSTRIES
POST OFFICE BOX 70
FORT MILL, SC 29715

4. Article Number
44962417

Type of Service:
- ☐ Registered
- ☒ Certified
- ☐ Express Mail
- ☐ Insured
- ☐ COD
- ☐ Return Receipt for Merchandise

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature — Addressee
X Johnny Hayfield

6. Signature — Agent
X

7. Date of Delivery

8. Addressee's Address *(ONLY if requested and fee paid)*

PS Form 3811, Apr. 1989 *U.S.G.P.O. 1989-238-815 DOMESTIC RETURN RECEIPT